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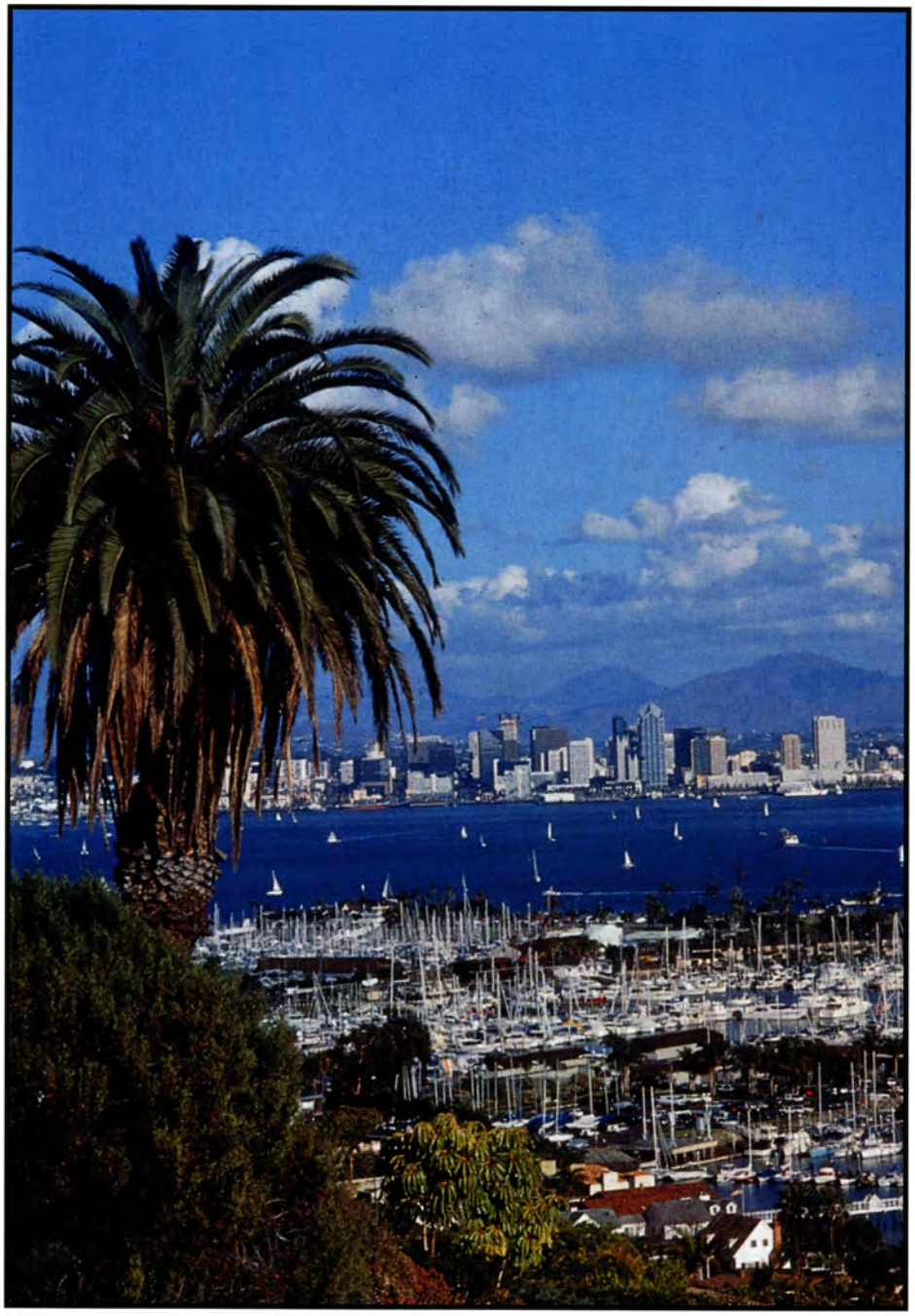

Skyline, San Diego, California (see page 967)

AMERICAN MATHEMATICAL SOCIETY

New Titles from the AMS

Stochastic Analysis on Manifolds

Elton P. Hsu, *Northwestern University, Evanston, IL*

Probability theory has become a convenient language and a useful tool in many areas of modern analysis. The main purpose of this book is to explore part of this connection concerning the relations between Brownian motion on a manifold and analytical aspects of differential geometry. A dominant theme of the book is the probabilistic interpretation of the curvature of a manifold.

Graduate Studies in Mathematics, Volume 38; 2002; approximately 273 pages; Hardcover; ISBN 0-8218-0802-8; List $44; All AMS members $35; Order code GSM/38NT110

Independent Study

Mathematics of Information and Coding

Te Sun Han and **Kingo Kobayashi**, *The University of Electro-Communications, Tokyo, Japan*

This book is intended to provide engineering and/or statistics students, communications engineers, and mathematicians with the firm theoretic basis of *source coding* (or *data compression*) in information theory. It will also serve as an excellent introductory text for advanced-level and graduate students taking elementary or advanced courses in telecommunications, electrical engineering, statistics, mathematics, and computer science.

Translations of Mathematical Monographs; 2001; approximately 296 pages; Hardcover; ISBN 0-8218-0534-7; List $99; Individual member $59; Order code MMONO-HANNT110

Recommended Text

Geometry of Manifolds

Richard L. Bishop, *University of Illinois, Urbana,* and **Richard J. Crittenden**, *University of Alabama, Birmingham*

From a review for the First Edition:

This book represents an excellent treatment of a wide section of modern differential geometry ... The style is elegant and at the same time considerate for the needs of a beginner ... a great number of well chosen problems with pertinent references ... anybody who chooses to base his course on differential geometry at the graduate level on this book could do no better.

—Mathematical Reviews

The first edition of this book was the origin of a modern treatment of global Riemannian geometry, using the carefully conceived notation that has withstood the test of time. The primary source material for the book were the papers and course notes of brilliant geometers, including É. Cartan, C. Ehresmann, I. M. Singer, and W. Ambrose. It is tightly organized, uniformly very precise, and amazingly comprehensive for its length.

AMS Chelsea Publishing; 2001; 273 pages; Hardcover; ISBN 0-8218-2923-8; List $39; All AMS members $35; Order code CHEL/344.HNT110

Independent Study

Oscillating Patterns in Image Processing and Nonlinear Evolution Equations

The Fifteenth Dean Jacqueline B. Lewis Memorial Lectures

Yves Meyer, *École Normale Supérieure de Cachan, France*

Image compression, the Navier-Stokes equations, and detection of gravitational waves are three seemingly unrelated scientific problems that, remarkably, can be studied from one perspective. The notion that unifies the three problems is that of "oscillating patterns", which are present in many natural images, help to explain nonlinear equations, and are pivotal in studying chirps and frequency-modulated signals.

University Lecture Series, Volume 22; 2001; approximately 136 pages; Softcover; ISBN 0-8218-2920-3; List $25; All AMS members $20; Order code ULECT/22NT110

The Concentration of Measure Phenomenon

Michel Ledoux, *Université Paul-Sabatier, Toulouse, France*

The observation of the concentration of measure phenomenon is inspired by isoperimetric inequalities. A familiar example is the way the uniform measure on the standard sphere S^n becomes concentrated around the equator as the dimension gets large. This property may be interpreted in terms of functions on the sphere with small oscillations, an idea going back to Lévy. The phenomenon also occurs in probability, as a version of the law of large numbers, due to Emil Borel. This book offers the basic techniques and examples of the concentration of measure phenomenon. The concentration of measure phenomenon was put forward in the early seventies by V. Milman in the asymptotic geometry of Banach spaces. It is of powerful interest in applications in various areas, such as geometry, functional analysis and infinite-dimensional integration, discrete mathematics and complexity theory, and probability theory. Particular emphasis is on geometric, functional, and probabilistic tools to reach and describe measure concentration in a number of settings.

Mathematical Surveys and Monographs; 2001; approximately 192 pages; Hardcover; ISBN 0-8218-2864-9; List $59; Individual member $35; Order code SURV/89NT110

Lebesgue's Theory of Integration: Its Origins and Development

Thomas Hawkins, *Boston University, MA*

From reviews for the original edition:

Thomas Hawkins has set out to place Lebesgue's early work on integration theory ... within its proper historical context ... He has succeeded brilliantly ... [He] has been able to convey the excitement of discovery and groping that must attend the birth of any fundamental theory ... [He] has written a book that is the epitome of what a mathematical history should be.

—Science

Lebesgue integration is one of the great success stories of modern mathematics, and Hawkins tells it very well. An introductory chapter sets the scene, describing how the first rigorous theory of integration took shape at the hands of Cauchy and Riemann. The book then plunges into fifty years of ferment, as researchers struggle to deal with "assumptionless" functions which will not fit the theory. Differentiable functions turn up with bounded derivatives which are not (Riemann) integrable; do they satisfy the fundamental theorem of calculus? Rectificable curves are defined without assuming differentiability; must we give up the integral formula for length? To prove uniqueness for trigonometric series, we need a term-by-term integration of a series not converging uniformly; can it be justified? [One] falls into traps through not understanding the complexity of nowhere-dense sets, and through confusing them with the sets negligible in integration. The valid theorems have complicated hypotheses and even more complicated proofs. At the end of the century Hermite exclaims, "I turn away with fright and horror from this lamentable plague of functions which do not have derivatives." And then the key idea enters from a quite unexpected source.

—Bulletin of the AMS

In this book, Hawkins elegantly places Lebesgue's early work on integration theory within in proper historical context by relating it to the developments during the nineteenth century that motivated it and gave it significance and also to the contributions made in this field by Lebesgue's contemporaries.

Hawkins was awarded the 1997 MAA Chauvenet Prize and the 2001 AMS Albert Leon Whiteman Memorial Prize for notable exposition and exceptional scholarship in the history of mathematics.

AMS Chelsea Publishing; 1979; 227 pages; Hardcover; ISBN 0-8218-2963-7; List $29; All AMS members $26; Order code CHEL/282.HNT110

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Forthcoming!

H. Sinaceur, *CNRS, Paris, France and* **F. Bourgoin,** *Univ. of California, Berkeley (Translator)*

Fields and Models

This unique work is a fascinating chapter in the history of mathematics, bringing together algebra, logic and geometry with a stretch to topology. It traces the history of the following intertwined developments: Sturm's theorem on the location of roots of real polynomials; the work of Artin and Schrier on real-closed fields, and its application by Artin to the solution of Hilbert's 17th problem; the development of model-theoretic algebra by Tarski, Robinson, and others; and Tarski's decision procedure for the field of real numbers and real algebraic geometry.The exposition is clear, self-contained, and should attract an audience of graduate students and researchers in mathematics and mathematical logic, both for general interest and as an introduction to such current areas of study as model theory and real algebraic geometry.

The French edition of Sinaceur's *Corps et Modeles* upon which this translation is based has been enthusiastically received and reviewed.

FEBRUARY 2002/APPROX. 432 PP./HARDCOVER
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W.D. Wallis, *Southern Illinois University, Carbondale, IL*

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This introduction to discrete mathematics is aimed primarily at undergraduates in mathematics and computer science at the freshmen and sophomore levels. The text has a distinctly applied orientation and begins with a survey of number systems and elementary set theory. Included are discussions of scientific notation and the representation of numbers in computers. Good examples occur throughout. At the end of every section there are two problem sets of equal difficulty. References and index conclude the work.

A math course at the college level is required to handle this text. College algebra would be the most helpful.

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Also by Wallis

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Alberto Guzman, *The City College of New York, CUNY, New York, NY*

Continuous Functions of Vector Variables

This text is an axiomatic treatment of the properties of continuous multivariable functions and related results from topology. Viewing multiple real variables as members of vector spaces, the author covers boundedness, extreme values, and uniform continuity of functions, along with the connections between continuity and topological concepts such as connectedness and compactness.

Continuous Functions of Vector Variables is suitable for advanced undergraduates preparing for graduate programs in pure mathematics. Required background includes a course in the theory of one-variable calculus and the elements of linear algebra.

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Piotr Mikusinski *and* **Michael D. Taylor,** *both, University of Central Florida, Orlando, FL*

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This book takes the reader on a journey through the core topics in multivariable analysis that are basic for senior undergraduate and graduate studies in differential geometry, and for analysis in N-dimensions and on manifolds. The book may be used for self-study to anyone working in the areas of dynamical systems, control theory and optimization, general relativity and electromagnetic phenomena. Aside from mathematical maturity, prerequisites are a one-semester undergraduate course in advanced calculus or analysis, and linear algebra.

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—Proceedings of the Edinburgh Mathematical Society

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—Mathematical Reviews

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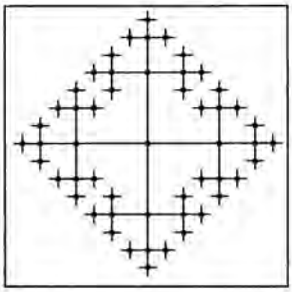
of the American Mathematical Society

October 2001

Feature Articles



Communications

Commentary

Notices

of the American Mathematical Society

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Departments

From the AMS Secretary

Reference Lists and Citations in the Mathematical Reviews Database

Mathematicians have long been accustomed to studying a given area of mathematics by using the reference list in a paper of interest to go from that paper to related papers, and then to papers in the reference lists of those related papers, and so on, thereby navigating back through the antecedents of a particular topic or result. The new release of MathSciNet in fall 2001 contains a major enhancement to the underlying Mathematical Reviews (MR) Database that builds on this idea: in the MathSciNet entry for a paper the inclusion of the *full* reference list from the original paper with links from the references to reviews. The addition of linked reference lists also enables *forward* citations in MathSciNet: for each item, links to (MathSciNet entries for) papers in which the given item is cited in the reference list.

This kind of navigation, which has in the past been done in the library by going from a paper in one journal to a related paper in another journal, is now possible in MathSciNet: locate an item of potential interest (and use the review to help decide whether it really is of interest); scan the reference list of the item, which follows the review on MathSciNet, to locate a reference of particular interest; click on the link in the reference to reach the MathSciNet entry for it; once again, investigate whether the item is of interest by reading the review; and so on. For an increasing number of items in MathSciNet there are not only links internal to MathSciNet but also a link to the original paper; such links greatly enhance the kind of navigation through MathSciNet enabled by linked references. The AMS is committed to expanding the number of links from MathSciNet entries to the original article or book online, so that researchers will increasingly be able to search back through MathSciNet and thence right to the original documents of interest, all from the desktop.

Citation indexing is familiar to all scientists, and MathSciNet users have often asked whether it is possible to include this feature in MathSciNet. The forward reference citations that are now listed for each entry provide a start to full citation indexing by providing a (partial) list of articles and books in which the item is cited. Just as the reference lists themselves can be used to trace mathematical ideas back through the literature, so the reference citations given for each MathSciNet item can be used to trace the development of mathematical ideas forward through the literature. It is also possible on MathSciNet to search for a given author name in the reference lists and thus find where books and papers (including preprints and other items not in the MR Database) by that author appear in the reference lists on MathSciNet.

The kind of backward and forward navigation that linked references make possible is not new in MathSciNet. Since its inception in 1940, MR has included references in reviews. Review references that have an MR entry are identified by the corresponding MR number. In MathSciNet the review reference is directly linked via the MR identifier to the full MathSciNet entry. The MR identifiers of references in reviews have also been used in MathSciNet to provide forward links: for each item, there is a list of those reviews that cite the item, "review citations". However, the number of review references has intentionally been limited (less than two per review on average), and some reviews contain no references at all. The addition of full reference lists vastly increases the number of links among related items on MathSciNet.

The project of gathering and adding reference lists (together with the links, generated by a sophisticated matching algorithm) to the MR Database began in early 2001. Initially, lists from sixty-five journals are being added, for published issues from 2000 on. New issues of these journals are treated on receipt at the MR office on an ongoing basis. Later, other journals and possibly earlier time periods also will be covered. Thus, the numbers of both the MR Database items with full reference lists and the corresponding forward citations will grow over time, making MathSciNet an increasingly powerful tool with which to explore the interconnections among the literature.

The addition of reference lists and the associated forward citations represent the most significant change in the structure and content of the MR Database in the over sixty years since it was founded. The enhanced MathSciNet is undoubtedly an indispensable adjunct to the mathematical literature.

—*Jane Kister*
Executive Editor
Mathematical Reviews

Letters to the Editor

The Longest Waiting Time for Print in Modern Mathematics

Hala Pflugfelder is well familiar with the history of loop theory since the 1920s when it began, as evidenced (i) from her books that significantly contributed to the history of loop theory [*Quasigroups and Loops: Theory and Applications*, edited with O. Chein and J. D. H. Smith, Heldermann Verlag, Berlin, 1990; and *Quasigroups and Loops: Introduction*, Heldermann Verlag, Berlin, 1990] and (ii) from the historical notes she presented to the first international conference on loop theory, Prague, July 28–August 1, 1999 [Historical notes on loop theory, *Comment. Math. Univ. Carolin.* **41** (2000), no. 2, 359–370]. I was therefore delighted to read in her review for *Mathematical Reviews* [MR 2000j:20131]:

> In incidence geometry, H. Karzel, also in the 1960s, introduced K-loops as additive systems of his near-domains, with an emphasis not on identities but on special automorphisms. In print, the term "K-loop" appeared only in 1989 in a paper by A. A. Ungar, who was the first to discover that the addition of relativistic velocities is a loop with Thomas gyrations playing the role of special automorphisms. He named this system a complete weakly associative-commutative group(oid), but later switched to his gyrolanguage.

I realized from Pflugfelder's review that H. Karzel waited 20–30 years for me to bring the term "K-loop" into print! Certainly, this is the longest waiting time for print in the history of loop theory. Unfortunately, however, I could not figure out the exact waiting time of H. Karzel, since it depends on the undisclosed exact time "in the 1960s" when he "introduced K-loops" into some undisclosed media.

As Hala Pflugfelder noted in her review, my introduction of the notion of the K-loop in 1989 (which later became known as the gyrocommutative gyrogroup) enabled, for the first time, loop theory to be applied in physics. Unlike H. Karzel, readers of the *Notices* need not wait 20–30 years for my publication. The story of the K-loop that I introduced in 1989, now known as the "gyrocommutative gyrogroup" that has sprung from the soil of Einstein's special theory of relativity, is told in my recent book: *Beyond the Einstein Addition Law and Its Gyroscopic Thomas Precession: The Theory of Gyrogroups and Gyrovector Spaces* (Kluwer Academic, 2001).

—Abraham A. Ungar
North Dakota State University

(Received May 6, 2001)

Segal's Cosmology

I strongly disagree with the suggestion in the article by Daigneault and Sangalli [*Notices*, January 2001, pp. 9–16] that the late Irving Segal's chronometric cosmology (CC) is a viable scientific theory, that Segal "has refuted all published criticism of CC." Readers of the *Notices* would get a better understanding of the status of CC from Segal's obituary by Baez et al. [June/July 1999, pp. 659–668].

My own experience, when I published a critique of CC [*Astrophys. J.* **313** (1987), 551–555], was that Segal's "refutation" missed the point. I examined for $S_1 < S_2$ a ratio $E(S_1, S_2)$ defined as $(S_1/S_2)^{1.5} N(S_1)/N(S_2)$, where $N(S)$ denotes the number of sources per steradian brighter than the flux S. I showed that CC predicts, for any homogeneous distribution of sources and for any fluxes $S_1 < S_2$, that $E(S_1, S_2)$ is bounded above by $3\pi/2$, a bound incompatible with an observed value that exceeds 17. Segal's published reply [*Astrophys. J.* **320** (1987), 135–138] states that I am wrong because $E(S_1, S_2) \to \infty$ as $S_2 \to 0$ with fixed positive S_1. But in this case the inequality $S_1 < S_2$ is violated, so Segal's response is simply irrelevant.

The chronometric cosmology did not fit the data when it was published in 1976, and this disagreement became more extreme as the data on the redshift-magnitude law improved. Riess, Press, and Kirshner [*Astrophys. J.* **473** (1996), 88–109] used data for Type Ia supernovae to show that

$$\log(z) = \text{const} - (0.5025 \pm 0.0088)\log(S),$$

where z is the redshift and S is the observed flux. This result supports the Hubble Law prediction $\log(z) = \text{const} - 0.5\log(S)$, but it cannot be reconciled with the prediction $\log(z) = \text{const} - \log(S)$ of CC. Consequently, it is not surprising that most cosmologists ignored Segal's theory for the last years of his life.

The test of a physical theory is whether its predictions agree with observation. Segal's chronometric cosmology fails the test.

—Edward L. Wright
UCLA

(Received June 13, 2001)

Big Bang Cosmology

Greg Kuperberg argues in his February 19, 2001, letter that Segal's theory is useless because it disagrees with Big Bang cosmology. He seems unaware that there is a growing dissident faction of cosmologists who find that the Big Bang theory has been overthrown by observational evidence. The chief proponent of this idea is Halton Arp, whose recent book *Seeing Red* summarizes this evidence. Arp's strongest argument is the observation of high redshift quasars which are physically connected to low redshift galaxies. Pairs of high redshift quasars that are symmetrically arranged to a "foreground" galaxy occur far more often than chance alone would permit, suggesting ejection.

Big Bang cosmology depends on the redshift-distance relationship. If that relationship does not hold, then we may not live in an expanding universe after all. Theoretical cosmology should keep an open mind.

—Rochus Boerner
Arizona State University

(Received June 23, 2001)

Revolutionary Dirk Struik

In 1951, I was a junior at M.I.T. and was fortunate to be enrolled in the differential geometry class taught by Dirk Struik. It was around the time that he was indicted by the Commonwealth of Massachusetts for various allegedly subversive activities, but in class he did not seem to be under any strain and maintained his good humor through it all. When we got to the portion of the course that was about surfaces of revolution, he said to us, absolutely deadpan, that he was going to call them "surfaces of rotation", because his perilous legal position vis-à-vis the state would not allow him any more to utter the word "revolution".

—Herbert S. Wilf
University of Pennsylvania

(Received July 3, 2001)

Prizes

Andy Magid makes a good case for increased and improved prize giving. Would it also be better to have more Fields Medals, perhaps two every year so that the number will match what goes on with Nobels? We could greatly improve publicity by having the announcement of the winners and the giving of the prizes at two separate times, with two chances for publicity, and that is twice every year. The public relations work on prizes in mathematics, in general, is primitive by comparison with other areas.

Of course, mathematics—and, in particular, very much so pure mathematics—is quite different from all other disciplines in that evaluations usually agree and secondary ratings like prizes are not needed. There are not many conflicts about methods, just a concentration on results in evaluations. We don't need prize givers to tell us who is doing great things!

And, also, prizes can have negative effects, as strange as this seems (and not just the consequences of the many unfair ways things are awarded). I was on a committee in my university years ago, screening nominations for honorary degrees, and the math department had submitted one for a Fields Medalist. The university policy of trying to honor people who have yet to receive significant honors was brought up as possible grounds for turning down the recommendation, but I saved the day by pointing out that Fields Medalists, as compared to Nobelists, received neither fame nor money.

This suggests also a nice tactic in departmental politics of downgrading a suggested appointment because the case is full of mention of prizes, all of secondary interest! That would be ironic.

—Jon Alperin
University of Chicago

(Received July 19, 2001)

Correction

Due to a typographical error, David George Crighton's first name was incorrect on the cover of the September 2001 *Notices*.

About the Cover

The cover image shows the San Diego skyline, San Diego, California. San Diego is the site of the 2002 Joint Mathematics Meetings, January 6-9, 2002.

Photograph © James Blank for the San Diego Convention & Visitors Bureau.

Probability on Groups: Random Walks and Invariant Diffusions

Laurent Saloff-Coste

What do card shuffling, volume growth, and Harnack inequalities have to do with each other? They all arise in the study of random walks on groups. Probability on groups is concerned with probability measures and random processes whose properties are dictated in part by an underlying group structure. It is a diverse area where one finds both sophisticated theories and the analysis of concrete problems. Although there are many other fascinating examples, we will focus on random walks and invariant diffusions, which both are processes with independent stationary increments. Random walks proceed by jumps, whereas diffusions have continuous paths. The two share important properties but differ in some aspects, including the nature of the typical underlying group: finitely generated for random walks, connected for diffusions. We will focus on very basic properties of these processes and leave out many developments, some of which can be found in [V+], [W].

Our aim is to present the theory of random walks and invariant diffusions on general groups, with an emphasis on the relations with algebra, analysis, and geometry. By studying these processes we hope to learn something about the underlying group and related objects. For instance, certain properties of the solutions of the Laplace and heat diffusion equations on the universal cover of a compact manifold relate to the behavior of random walks on the fundamental group. From this viewpoint, understanding the basic properties of random walks on large classes of groups is more important than the detailed study of specific examples. The accumulated knowledge concerning the example of d-dimensional Brownian motion (including the beautiful recent advances by Lawler, Schramm, and Werner) serves as a remote, perhaps unreachable, ideal. It provides natural questions, ideas, and insights, but one may have to settle for much less on general groups.

This article has two parts: one treating random walks, the other diffusions. The two parts are related in many ways—at the level of ideas as well as on firmer mathematical ground—and more so than this article can possibly convey. Behind the difference in settings, ranging from the symmetric group S_n to the Lie group $SL_n(\mathbb{R})$ to the infinite dimensional torus $\mathbb{T}^\infty$, there is unity in the problems that are discussed, and any substantial progress in one particular context sheds light on the entire subject.

Laurent Saloff-Coste is professor of mathematics at Cornell University, currently on leave from the Centre National de la Recherche Scientifique (Toulouse, France). His e-mail address is lsc@math.cornell.edu.

Research for this article was supported in part by NSF grants DMS 9802855 and DMS 0102126.

Random Walks

Let G be a group generated by a finite symmetric set S. That is, $s \in S$ implies $s^{-1} \in S$, and $G = \cup_{n=0}^{\infty} S^n$. The *Cayley graph* (G, S) has vertex set G and an edge from x to y if and only if $y = xs$ for some $s \in S$. To capture the basic idea of *random walk*, imagine a walker whose position is a vertex of this graph. At each stage the walker takes a step along one of the adjacent edges, choosing uniformly at random from the possibilities. Where will the walker be after n steps?

More generally, given a probability measure p on G, the associated random walk $(X_n)_{n\geq 0}$ proceeds at each step by picking s in G with probability $p(s)$ and moving to $X_{n+1} = X_n s$. The distribution after n steps is the convolution power $p^{(n)}$, where $p * q(x) = \sum_y p(y)q(y^{-1}x)$.

Shuffling Cards

Why would anyone want to study random walks on groups? Maybe simply because everyone uses random walks, just as Molière's Monsieur Jourdain uses prose without realizing it. Indeed, most card-shuffling methods can be modeled as random walks on the symmetric group S_n ($n = 52$), where the shuffling mechanism is interpreted as choosing at random among a certain set of permutations. A single question obviously takes center stage: how many shuffles are needed to mix up the cards? Bayer and Diaconis made the *New York Times* for proving that seven riffle shuffles are necessary and sufficient. Not only is the question broadly appealing, but the mathematics of riffle shuffles is surprisingly rich and beautiful. That such a precise answer can be given is in itself an interesting fact which has been studied and publicized by Diaconis under the name of cut-off phenomenon.

Card shuffling was discussed much earlier in mathematics: for instance, by Poincaré, Borel, and others (see [Ho]). However, the first quantitative theorem is the following result due to Diaconis and Shahshahani concerning random transposition. To describe this process, we imagine the cards laid out neatly in a row on a table. Two cards are picked independently and uniformly at random, and the cards are switched. For random transposition, a sudden convergence to the uniform distribution occurs after about $\frac{1}{2}n\log n$ repetitions, an example of the cut-off phenomenon. For a standard deck of 52 cards this means that about 100 random transpositions are appropriate to mix up the deck. To state a precise result, we consider the *total variation distance* between two probability measures p and q given by $\|p - q\|_{\mathrm{TV}} = \sup |p(A) - q(A)|$, where the supremum is over all subsets A of G.

Theorem 1. *For random transposition on the symmetric group S_n, let $p^{(k)}$ be the law after k steps. Let $k(n,c) = \frac{1}{2}n(c + \log n)$. Then there exists a constant A such that for all n and for all $c > 0$,*

$$\|p^{(k(n,c))} - u_n\|_{\mathrm{TV}} \leq Ae^{-c},$$

where u_n denotes the uniform probability measure on S_n. Moreover, there exist a constant B and a positive function f satisfying $\lim_{c\to 0} f(c) = 0$ such that for all n and for all $c < 0$,

$$\|p^{(k(n,c))} - u_n\|_{\mathrm{TV}} \geq 1 - f(c) - Bn^{-1}\log n.$$

Adjacent transposition (adjacent cards are transposed) and random insertion (a card is picked at random and inserted at an independent random position) are two other simple examples of shuffling mechanisms that have been studied. To mix up the cards uniformly takes order $n^3 \log n$ shuffles for adjacent transposition and order $n \log n$ shuffles for random insertion. In both cases the exact multiplicative constant is not known, and the existence of a precise cut-off time is an open question. Educated guesses are that it takes about 30,000 adjacent transpositions and a few hundred random insertions to mix 52 cards.

For large n, about three of every four pairs of permutations generate the symmetric group, but one has no clue how many shuffles are typically needed to mix up the cards using such a pair of permutations. Varied techniques have been used in the last twenty years by Aldous, Diaconis, and their many collaborators and followers to understand random walks on the symmetric groups and other finite groups. We will now describe two very different approaches in some detail. For more, see [D].

Fix a given shuffling mechanism. In the probabilistic method known as "coupling", two dependent copies (X_n, Y_n) of the process—the first stationary, the second started from a fixed arbitrary state—are constructed with the property that they agree with higher and higher probability as time evolves. Let T be the random time equal to the smallest n at which X_n and Y_n coincide. This T is called the coupling time, and the total variation distance between the law $p^{(n)}$ of Y_n and the stationary measure u (i.e., the law of X_n) can be bounded by

$$\|p^{(n)} - u\|_{\mathrm{TV}} \leq \mathrm{Prob}(T > n).$$

Thus the problem becomes that of constructing a good coupling for which $\mathrm{Prob}(T > n)$ can be estimated. This method has the advantage of not being restricted to random walks on finite groups and is used widely in other contexts.

Representation theory (e.g., of the symmetric group) offers great possibilities when the walk possesses extra symmetries. Studying a random walk on a large finite group can be viewed as the manipulation of a large matrix, namely, the transition probability matrix of the walk. Representation theory helps reduce the size of the problem by providing a partial diagonalization of the matrix into blocks. But the blocks can still have large dimension. For instance, for the symmetric group S_n, the starting matrix has size $n! \times n!$, and after the breakup according to irreducible representations, the largest blocks are still of order $\sqrt{n!} \times \sqrt{n!}$. However, if the walk is invariant under inner automorphisms (i.e., $x \mapsto axa^{-1}$, a typical example of the extra symmetries alluded to above), then each block is a scalar matrix, and refined results can be obtained, as in the case of random transposition. Another very useful approach

involves comparisons of different random walks and elementary combinatoric considerations, including the geometry of paths in the corresponding finite Cayley graphs. For instance, Diaconis and the author have used comparison with random transposition to bound efficiently the number of shuffles needed for adjacent transposition, random insertion, and many other examples.

Nonetheless, results such as Theorem 1 exist only for a small number of specific examples. Although there are satisfactory weaker results for a few larger classes of random walks on finite groups, there is no real global understanding of the behavior of random walks on finite groups, especially for walks based on small sets of generators.

Thus, there are many challenging questions and open problems. One is as follows. In any given graph, the *boundary* ∂A of a set A is the set of all edges connecting A to its complement A^c. A *family of* (k, c)*-expanders* is an infinite collection of finite graphs for which any vertex has at most k neighbors, and for any subset A,

$$\min\{\#A, \#A^c\} \le c\#\partial A.$$

These graphs have very good connectivity properties. They are of practical interest as models for communication networks. Random walks on expanders have few local moves but converge rapidly to equilibrium. The first examples of expanders were produced by Margulis using the representation theory of the infinite group $SL_n(\mathbb{Z})$ in the form of Kazhdan's property (T) (see [L]). Whether or not the symmetric groups can yield a family of (k, c)-expanders is an open question.

Before we leap to infinite groups, let us emphasize that random walks on finite and finitely generated groups are related in many ways. Results concerning specific infinite groups (e.g., Kazhdan's property (T)) can lead to interesting results concerning finite quotients; conversely, many infinite groups can be approximated by finite groups. After all, a short-sighted random walker walking on a large finite cyclic group $\mathbb{Z}/N\mathbb{Z}$ will not immediately realize that the group is not $\mathbb{Z}$. A recent success story which illustrates this point is the computation by Grigorchuk and Żuk of the spectral measure (i.e., the measure μ on $[-1, 1]$ such that $p^{(n)}(e) = \int_{-1}^{1} \lambda^n d\mu(\lambda)$) of a random walk on the wreath product $\mathbb{Z}_2 \wr \mathbb{Z}$ (this group is described below in the section on solvable groups). They proceed by approximation by random walks on finite groups. With Linnel and Schick they show that this computation provides a negative answer to a question of Atiyah concerning divisibility properties of the L^2-Betti numbers of coverings of compact manifolds.

The Birth of Random Walks on Groups

For any random walk on a finitely generated group, let $\phi(n)$ denote the probability of being back at the starting point after $2n$ steps. Thus, if p denotes the probability measure driving the walk, we have $\phi(n) = p^{(2n)}(e)$. We assume throughout that the support of p generates the group and that p is finitely supported and symmetric, i.e., satisfies $p(x) = p(x^{-1})$. Because of the symmetry assumption, $\phi(n) = p^{(2n)}(e)$ is a decreasing function of n (the behavior of $p^{(2n+1)}(e)$ is less interesting: for the simple random walk on the integers, $p^{(2n+1)}(e) = 0$ for all n).

A random walk is *recurrent* if, with probability 1, it comes back to its starting point infinitely often. Around 1920 Pólya proved that the simple random walk on the square lattice is recurrent in dimensions 1 and 2 and not in dimensions 3 and higher. Indeed, elementary results from probability theory show that recurrence is equivalent to $\sum_n \phi(n) = +\infty$, and for the d-dimensional square lattice, $\phi(n) \sim c(d)n^{-d/2}$. Understanding the behavior of $\phi(n)$ is the most basic question in random walk theory from our viewpoint.

In 1958, in his Ph.D. thesis, Kesten—guided by a question of Kac concerning the product of random 2×2 matrices—created the subject of random walks on finitely generated groups. In a sequel to his thesis he proved that $\phi(n)$ decays exponentially fast with n if and only if the group is *nonamenable*. A topological group G is *amenable* if there exists a continuous linear functional ν defined on the space of all Borel measurable bounded functions and such that $\nu(f) \ge 0$ when $f \ge 0$, $\nu(\mathbf{1}) = 1$, and $\nu(f_x) = \nu(f)$ where $f_x(y) = f(xy)$. Such a linear functional is called a left-invariant mean. Although amenability relates to the algebraic structure of the group, there is no satisfactory algebraic description of the dichotomy between amenable and nonamenable groups. Just before Kesten's work, Følner characterized amenability in terms of isoperimetry and proved that a group is nonamenable if and only if there is a constant C such that $\#A \le C\#\partial A$ for any finite set $A \subset G$. These early results well illustrate how random walk theory relates to algebraic and geometric notions.

All Abelian groups and, more generally, all solvable groups are amenable. See Figure 3 below. The free group $\mathbb{F}_k$ on $k \ge 2$ generators and the fundamental group of a two-dimensional orientable surface of genus $g \ge 2$ are nonamenable. Surprising examples of nonamenable groups include some groups all of whose elements have the same finite order (these deep examples are due to Adyan, and the proof uses the co-growth criterion of Grigorchuk). The natural simple random walk on the free group $\mathbb{F}_k$ $(k \ge 2)$ has

$$\phi(n) \sim c(k)n^{-3/2}(2\sqrt{k}/(k+1))^{2n} \text{ as } n \to \infty,$$

but for most random walks on nonamenable groups the exact rate of exponential decay of ϕ, i.e., the spectral radius $\rho = \lim_{n\to\infty} \phi(n)^{1/2n}$, is hard to compute and is not known.

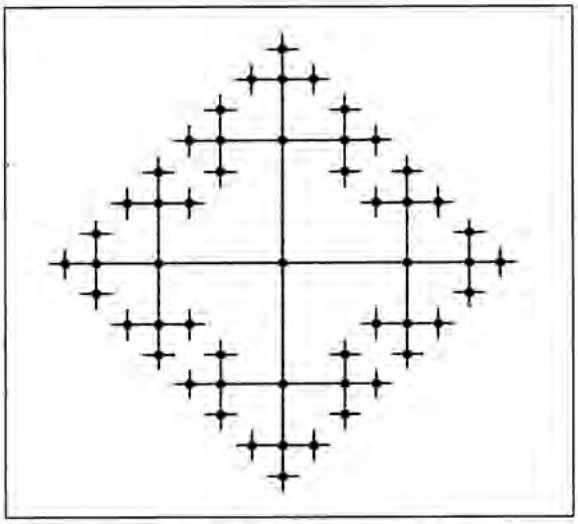

Figure 1. The ball of radius 4 in the free group $\mathbb{F}_2$ on two generators.

For twenty years after Kesten's thesis little progress was made concerning the basic behavior of random walks on finitely generated groups. The conjecture that the only infinite groups that carry recurrent random walks are the finite extensions of $\mathbb{Z}$ and $\mathbb{Z}^2$ became known as Kesten's conjecture. As we shall see, it was solved positively by Varopoulos in the mid 1980s [V+], [W]. An analogous conjecture for connected Lie groups was solved in 1977 by Baldi, Lohoué, and Peyrière using work of Guivarc'h, Keane, and Roynette, but because of the structure theory of Lie groups, this is a rather different story.

Quasi-isometric Invariants

In the 1980s Gromov popularized the notion of *quasi-isometry* between metric spaces and the idea of looking at Cayley graphs of groups as basic geometric objects in their own right. Quasi-isometries are maps that do not distort large distances too much while imposing no restriction on small distances and local topology. For instance, the universal cover of a compact Riemannian manifold and its fundamental group are quasi-isometric objects. Two Cayley graphs corresponding to two different finite generating sets of the same group G are quasi-isometric. A finitely generated group is quasi-isometric to any of its finite index subgroups.

Given a Cayley graph (G, S), the *volume growth function* $V(n)$ is the number of elements in the ball of radius n around the identity element e, that is, the number of elements of the group that can be written as a product of at most n generators. The *isoperimetric profile* is the function

$$I(n) = \inf\{\#\partial A : A \subset G,\ \#A \geq n\}.$$

The behavior at infinity of the volume growth function V and of the isoperimetric profile I are quasi-isometric invariants. A much less obvious example of a quasi-isometric invariant is the behavior of the random walk function ϕ (see [W]). Looking at random walks from this viewpoint turns out to be very fruitful. A natural question that arises is whether or not these three invariants, V, I, and ϕ, all carry the same information about the group G.

It is plain that the volume growth function does not determine either I or ϕ: all nonamenable groups have exponential volume growth, but there are also many amenable groups with such volume growth. We shall see that, even among amenable groups, the function V does not determine the behavior of I or ϕ and that the relation between the isoperimetric profile I and the probability of return function ϕ is not completely understood. The difficulty in attacking this kind of question comes from the diversity and complexity of the algebraic structures of arbitrary finitely generated groups. This is why Gromov's celebrated theorem asserting that any group whose volume growth is bounded above by a polynomial contains a nilpotent subgroup of finite index is remarkable. For random walks the breakthrough came from the following theorem of Varopoulos. See [V+].

Theorem 2. *Assume that there exists a positive constant c such that $V(n) \geq cn^d$ for all n. Then there are positive constants C_1 and c_1 such that $\phi(n) \leq C_1 n^{-d/2}$ and $I(n) \geq c_1 n^{1-1/d}$ for all n.*

Observe that the hypothesis of this theorem puts very little constraint on the group. On the one hand, this means that one cannot use sophisticated tools to prove such a result. On the other hand, the group structure is essential since there are regular graphs—not arising as Cayley graphs—that have exponential growth from any base point even though the simple random walk is recurrent. The key to both Varopoulos's original proof and the argument outlined below is a simple calculus-type inequality. On any Cayley graph (G, S), for any $y \in G$ and any finitely supported function f,

$$\sum_{x \in G} |f(xy) - f(x)| \leq |y| \sum_{x \in G} |df(x)|,$$

where $|y|$ is the word length of y (the smallest k such that $y = s_1 \cdots s_k$ with $s_i \in S$), and $|df(x)| = \sum_{s \in S} |f(xs) - f(x)|$ is the discrete analog of the gradient. This inequality can be used to prove the following functional inequality involving the inverse function $w(t) = \inf\{n : V(n) > t\}$ of V. Setting $\Psi(t) = Cw^2(8t)$, we have

$$\text{(N)} \qquad \|f\|_2^2 \leq \Psi(\|f\|_1^2 / \|f\|_2^2)\ \|df\|_2^2$$

for any finitely supported function f on G, where ℓ^p-norms are with respect to the counting measure. If $V(n) \geq cn^d$, we find that $\Psi(t) \leq Ct^{2/d}$, and inequality (N) is then analogous to an inequality on $\mathbb{R}^d$ introduced by Nash in his celebrated paper concerning the Hölder continuity of solutions of parabolic equations. Nash used his inequality to control the behavior of certain heat diffusion

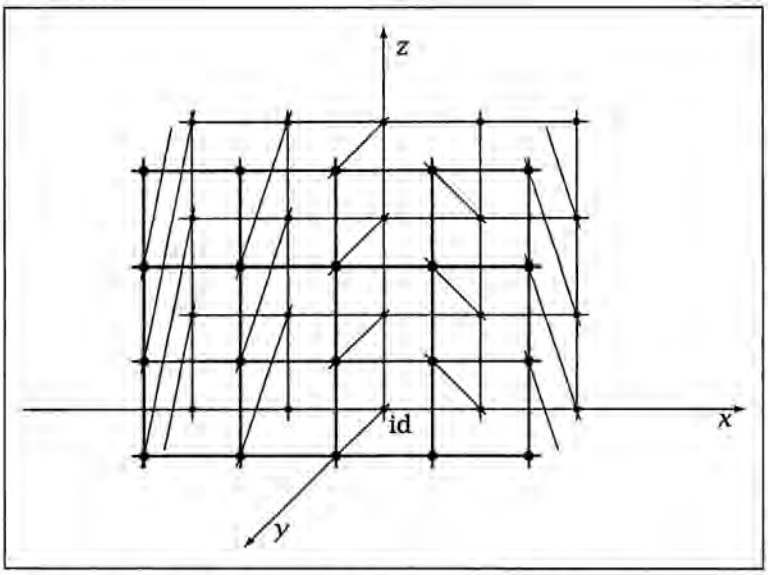

Figure 2. A piece of the Cayley graph of the Heisenberg group.

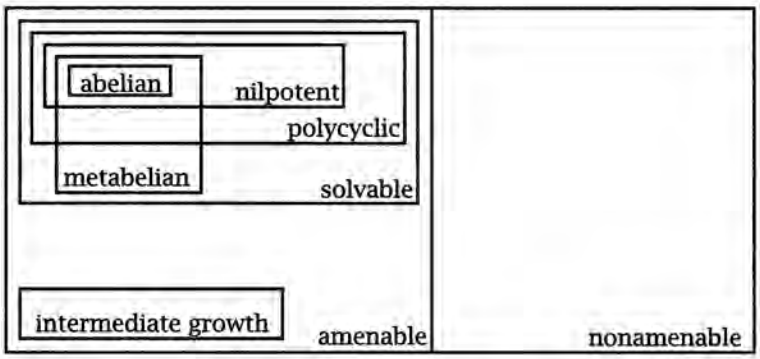

Figure 3. A schematic diagram of the inclusion relations between various classes of finitely generated groups.

semigroups. In the present context, (N) leads to the conclusion of Theorem 2 concerning ϕ.

The Polynomial Realm

With a little work, Gromov's polynomial growth theorem and Theorem 2 give a positive solution of Kesten's conjecture: the only finitely generated groups that admit a recurrent random walk are the finite extensions of $\{0\}$, $\mathbb{Z}$, and $\mathbb{Z}^2$. The works of Gromov and Varopoulos are also the main ingredients for the more precise results described below, where for two positive functions, $f(n) \approx g(n)$ means that there are constants c and C such that $0 < c \le f(n)/g(n) \le C < +\infty$.

Theorem 3. *For a finitely generated group G, the following are equivalent properties: (1) $V(n) \approx n^d$; (2) $I(n) \approx n^{1-1/d}$; (3) $\phi(n) \approx n^{-d/2}$; (4) G contains a nilpotent subgroup N of finite index, and $d = \sum_i i r_i$, where r_i is the torsion-free rank of the abelian group N_i/N_{i+1}, and (N_i) is the lower central series of N defined by $N_1 = N$, $N_{i+1} = [N, N_i]$.*

Thus, in the polynomial/nilpotent realm, V, I, and ϕ contain essentially the same information. The simplest non-abelian group with polynomial growth is the countable Heisenberg group

$$\mathbb{H} = \left\{ \begin{pmatrix} 1 & y & z \\ 0 & 1 & x \\ 0 & 0 & 1 \end{pmatrix} : x, y, z \in \mathbb{Z} \right\}.$$

It is generated by the four matrices obtained by setting $x = \pm 1$ with $y = z = 0$ and $y = \pm 1$ with $x = z = 0$. The corresponding Cayley graph is shown in Figure 2. It has $V(n) \approx n^4$, $I(n) \approx n^{3/4}$, $\phi(n) \approx n^{-2}$.

Superpolynomial Growth

There are many groups whose volume grows faster than any polynomial. In fact, most groups have this property, even among amenable groups. Hence the following result is a useful complement to Theorem 2.

Theorem 4. *Fix $\alpha \in [0, 1]$. Assume that there exists a positive constant c such that $\log V(n) \ge cn^\alpha$ for all n. Then there are positive constants c_1 and c_2 such that $\log \phi(n) \le -c_1 n^{\alpha/(\alpha+2)}$ and $I(n) \ge c_2 n/[\log n]^{1/\alpha}$ for all n.*

The bound on ϕ is due to Varopoulos; the isoperimetric bound, to Coulhon and the author. This theorem says that any group with exponential growth has $\log \phi(n) \le -c_1 n^{1/3}$ and $I(n) \ge c_2 n/\log n$. We shall see below that these bounds are sharp for some groups but not for all. Theorem 4 is also useful for groups of *intermediate growth* whose volume grows faster than any polynomial but slower than any exponential. The existence of such groups was discovered by Grigorchuk in the mid 1980s. Little is known about random walks on these groups, but there is a growing body of work on the structure of a large class of examples (see [BGS]).

Solvable Groups

By a result of Milnor and Wolf, solvable groups have either polynomial or exponential growth. See Figure 3. We start with a very satisfactory result concerning *polycyclic* groups. By a deep structure theorem, polycyclic groups are, up to finite extension, the amenable discrete subgroups of connected Lie groups. Here discrete refers to the topology inherited by the subgroup from the ambient group. Because of their specific algebraic structure, polycyclic groups can be understood quite well, and this yields the following satisfactory result.

Theorem 5. *Let G be an amenable discrete subgroup of a connected Lie group. Then G is finitely generated, and either there exists an integer d such that $V(n) \approx n^d$ or $V(n)$ grows exponentially. In the latter case, $I(n) \approx n/\log n$ and $\log \phi(n) \approx -n^{1/3}$.*

The lower bound on $\log \phi$ is due to Alexopoulos and the upper bound on I to Pittet. The other bounds follow from Theorem 4. One of the simplest examples of a polycyclic group with exponential growth is the semidirect product $\mathbb{Z} \ltimes \mathbb{Z}^2$, whose group operation is defined for $(x,u),(y,v) \in \mathbb{Z} \times \mathbb{Z}^2$ by

$$(x,u)\cdot(y,v) = (x+y, u+A^x v) \text{ with } A = \begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}.$$

It is a discrete version of the Lie group Sol, which gives one of the eight geometries used to describe 3-manifolds in Thurston's geometrization program.

Things are different for general solvable groups of exponential volume growth. Among solvable groups the simplest are the *metabelian* groups, the ones whose commutator group is abelian. Even in this class of groups, the behavior of the functions I and ϕ can vary widely. For $\lambda > 1$, let $\mathbb{A}_\lambda$ be the subgroup of the affine group $ax+b$ generated by $u_\pm(x) = x \pm 1$ and $v_\pm^\lambda(x) = \lambda^{\pm 1}x$. These groups are metabelian and have exponential volume growth. They are not discrete in $ax+b$, and most are not polycyclic. When λ is an integer, $\mathbb{A}_\lambda$ can be presented as $\langle a,b : aba^{-1} = b^\lambda \rangle$ with $a = v_+$ and $b = u_+$ (these are also known as Baumslag-Solitar groups).

Figures 4 and 5 describe the Cayley graph of $\mathbb{A}_2$. When λ is algebraic, $\mathbb{A}_\lambda$ has $I(n) \approx n/\log n$ and $\log \phi(n) \approx -n^{1/3}$. When λ is transcendental, $\mathbb{A}_\lambda$ is isomorphic to the wreath product $\mathbb{Z} \wr \mathbb{Z}$ and has $\log \phi(n) \approx -n^{1/3}(\log n)^{2/3}$.

In the study of metabelian groups the wreath products $\mathbb{Z}_2 \wr \mathbb{Z}$ play an important role. These are also known as "lamplighter groups". Imagine $\mathbb{Z}^d$ as the map of a (multidimensional and infinite) American city. At each street crossing there is a lamp which can be on or off (only finitely many lamps can be on). In addition, a lamplighter is wandering around the city turning lamps on or off. An element of $\mathbb{Z}_2 \wr \mathbb{Z}^d$ can be thought of as a "scenery" formed by the lamps and the lamplighter, standing somewhere. See Figure 6. Note that this picturesque description fails to capture how two elements are multiplied. Nevertheless, the basic moves of a natural random walk on $\mathbb{Z}_2 \wr \mathbb{Z}^d$ can be described as the $2d$ possible steps of the lamplighter to adjacent nodes together with the action of turning on or off the lamp at the current node. A theorem of Donsker and Varadhan asserts that N_n, the number of points visited by the simple random walk on $\mathbb{Z}^d$ up to time n, satisfies $\log \mathbb{E}\left(e^{-\lambda N_n}\right) \sim -c(\lambda,d)n^{d/(d+2)}$ as $n \to \infty$, where $\mathbb{E}$ denotes the expectation. It turns out that this is just what one needs to prove that $\log \phi(n) \approx -n^{d/(d+2)}$ on the lamplighter group $\mathbb{Z}_2 \wr \mathbb{Z}^d$ [PSa].

The examples above show that for finitely generated (in fact, with additional arguments, for finitely presented) metabelian groups of

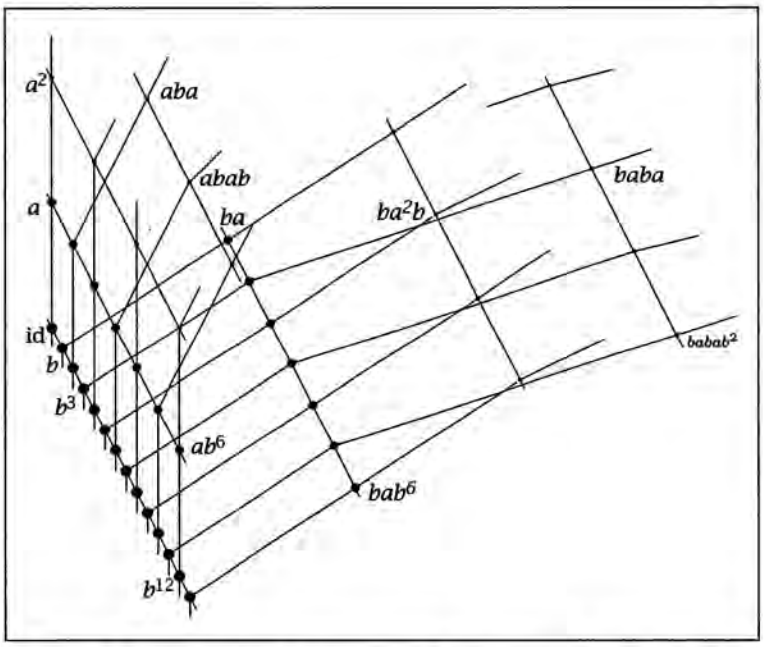

Figure 4. A piece of the Cayley graph of $\mathbb{A}_2 = \langle a,b : aba^{-1} = b^2 \rangle$. This Cayley graph has $\log \phi(n) \approx -n^{1/3}$, $I(n) \approx n/\log n$.

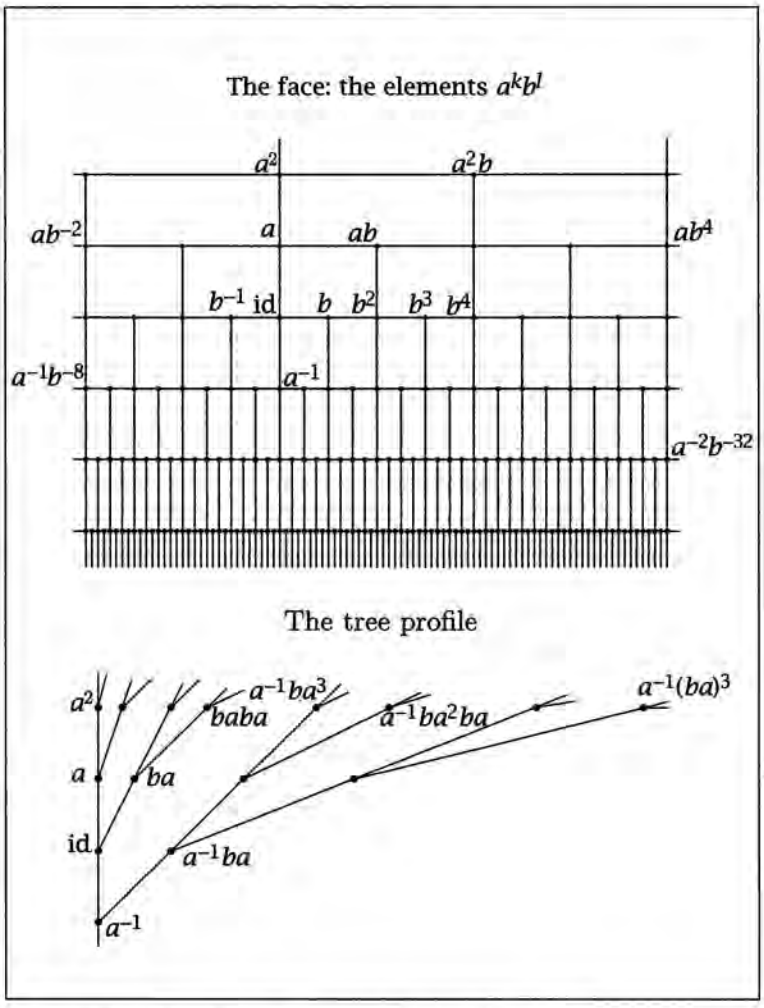

Figure 5. Face and profile of $\mathbb{A}_2 = \langle a,b : aba^{-1} = b^2 \rangle$.

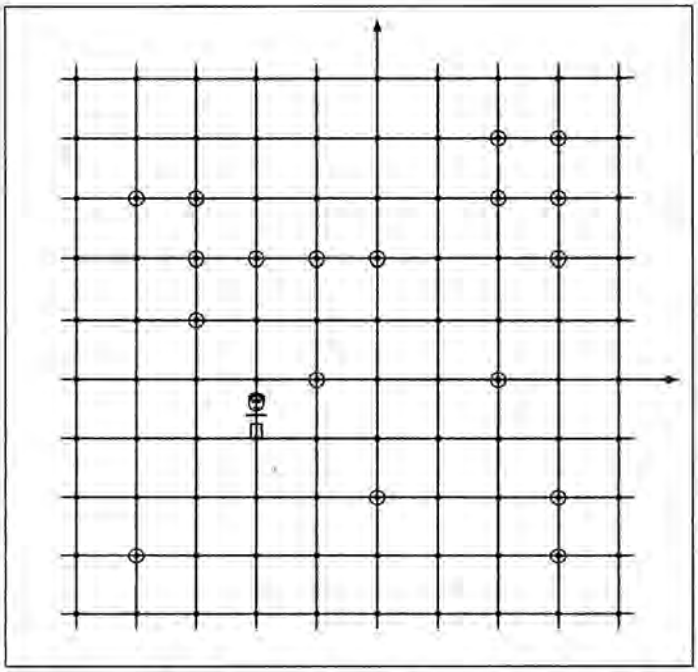

Figure 6. An element of the 2-dimensional lamplighter group $\mathbb{Z}_2 \wr \mathbb{Z}^2$.

exponential growth, there are infinitely many different behaviors for ϕ. The same is true for the isoperimetric profile I, and Erschler(Dyubina) is developing new precise isoperimetric bounds for wreath products in a promising work in progress. Two related challenging open problems concerning finitely generated metabelian groups are: (a) classify all the possible behaviors of ϕ and I; (b) does the behavior of ϕ determine the behavior of I and vice versa? Thus, despite some remarkable achievements, a complete understanding of the behavior of random walks and isoperimetry on finitely generated groups is still very much out of reach, even for solvable groups. This contrasts with the results we are about to describe concerning invariant diffusions on connected Lie groups, where thanks to the existence of a simpler and more satisfactory structure theory, a complete picture has emerged.

Invariant Diffusion Processes

Let us now change the setting and consider left-invariant diffusion processes on locally compact connected groups. Brownian motion on $\mathbb{R}^d$ is the classical and most studied example. These processes can be characterized in different ways, but they have the crucial properties of having independent stationary increments and continuous paths. Equivalently, by a theorem of Hunt their infinitesimal generators are second-order differential operators that can be written in the form

$$L = \sum_i X_i^2 + X_0,$$

where the X_i's are left-invariant vector fields and can thus be viewed as elements of the Lie algebra. This makes sense even if G is not a Lie group, because locally compact connected groups are projective limits of Lie groups (see, e.g., [H]). The parallel with random walks is striking, the role of the generators being played now by the X_i's.

A family of probability measures $(\mu_t)_{t>0}$ forms a *convolution semigroup* if $\mu_t * \mu_s = \mu_{t+s}$ and $\mu_t \to \delta_e$ as $t \to 0$. Such a semigroup is *Gaussian* if $t^{-1}\mu_t(G \setminus U) \to 0$ as $t \to 0$ for each neighborhood U of e. This last property is equivalent to the continuity of the sample paths of the associated stochastic process. For a left-invariant diffusion process $Z = (Z_t)$ on a group G, the laws μ_t of Z_t, $t > 0$, form a Gaussian convolution semigroup such that the function $u(t,x) = \int_G f(x,y)d\mu_t(y)$ solves the heat diffusion equation $(\partial_t - L)u = 0$, $u(0,x) = f(x)$.

To complete this picture with a geometric perspective, one introduces a natural "distance function" $d(x,y)$ (allowing the value ∞) called the *intrinsic distance* or *Carnot-Carathéodory distance* and defined by

$$d(x,y) = \sup\{f(x) - f(y) : f \in C^\infty(G), \Gamma(f,f) \le 1\},$$

where $\Gamma(f,f) = \frac{1}{2}(Lf^2 - 2fLf) = \sum_i |X_i f|^2$ is the "carré du champs". This definition is more general but essentially equivalent to others based on suitable notions of length of paths. In particular, if G is a Lie group and L is the Laplace-Beltrami operator of a left-invariant Riemannian structure, then d equals the Riemannian distance. The corresponding volume growth function $V(t)$ is defined as the volume of any metric ball of radius t with respect to the left-invariant Haar measure on G.

The main questions concerning these diffusions are: Does μ_t have a smooth density with respect to Haar measure? And if it does, what is the behavior of this density? How does this behavior relate to properties of the distance function d, to the volume growth function, to the family of vector fields (X_i)? How does this relate to the algebraic structure of the group G? Assuming that $(\mu_t)_{t>0}$ admits a continuous density $x \mapsto \mu_t(x)$, the value $\mu_t(e)$ at the origin is the exact analog of the probability of return $\phi(n)$ in the first part of the article, and the most basic question concerns the behavior of $\mu_t(e)$ as t tends either to zero or to infinity.

For brevity we will concentrate on the case where $L = \sum X_i^2$, i.e., $X_0 = 0$. The case where $X_0 \neq 0$ is interesting and requires both additional arguments and some different ideas, but this is more of a technical matter.

Local Theory

Let G be a connected Lie group of dimension n. The natural hypothesis in this context is that the family (X_i) generates the Lie algebra of G. This means that the X_i's, together with their commutators of

all orders, linearly span the Lie algebra. We always make this hypothesis. For the second-order differential operator L, it corresponds to the celebrated subellipticity condition of Hörmander. The local theory that we are about to describe can (and should) be viewed as a model for the deeper and more difficult study of general subelliptic second-order differential operators. The geometry of the distance d is an area of research in its own right under the name of sub-Riemannian geometry and is closely related to control theory. In some sense, the group structure is irrelevant here, although it leads to significant simplifications (see [V+]).

Under Hörmander's condition, μ_t has a smooth positive density for all $t > 0$, the distance d is Hölder continuous with respect to any fixed locally Euclidean distance, and the operator L is hypoelliptic. There exists an integer $m \in [n, 1 + \binom{n}{2}]$, depending on the family (X_i), such that $\mu_t(e) \sim ct^{-m/2}$ as $t \to 0$. This m is also characterized by the fact that $V(t) \sim bt^m$ as $t \to 0$. Much like for harmonic functions in Euclidean space, there exists a constant $C = C_L$ such that, for any $r \in (0,1)$ and for any positive solution of $Lu = 0$ in the d-ball $B(x,r)$, we have

$$\text{(GH)} \qquad \sup_{B(x,r/2)} u \le C \inf_{B(x,r/2)} u.$$

The geometric nature of this *Harnack inequality* makes it a powerful tool and illustrates the role played by the distance d.

Thus, under Hörmander's condition, symmetric Gaussian semigroups on Lie groups are very well behaved. Before discussing their large-scale and long-time behavior, we briefly consider what happens locally when G is not a Lie group. This case illustrates in a highly nontrivial way the general theory of analysis and geometry on Dirichlet spaces. Simple-minded but already interesting examples are the product of countably many circle groups and the product of countably many orthogonal groups in different dimensions. In such cases, can $(\mu_t)_{t>0}$ have a nice continuous density for all $t > 0$? Although the theory of such Gaussian semigroups is developed in [H], this question is not answered there. It is natural to focus (at least at first) on bi-invariant, i.e., central, Gaussian semigroups on compact groups. In fact, there are many interesting and challenging open questions already in the case of the infinite-dimensional torus $\mathbb{T}^\infty$, where the infinitesimal generator can simply be written $L = \sum_{i,j} a_{i,j} \partial_i \partial_j$, and this infinite sum is easily interpreted as acting on functions depending only on finitely many coordinates.

A recent result of Bendikov and the author is that any compact, connected, locally connected, metrizable group G carries a host of central Gaussian semigroups having a smooth continuous positive density with respect to Haar measure. The quantity $\mu_t(e)$ can explode in many different ways as t tends to zero, including behaviors such as $e^{[\log 1/t]^{1+\lambda}}$, $e^{t^{-\lambda}}$, $e^{e^{t^{-\lambda}}}$, etc., with $\lambda > 0$.

A sufficient but far-from-necessary condition for $(\mu_t)_{t>0}$ to have a continuous density is that the associated intrinsic distance be continuous. This condition also implies an elliptic Harnack inequality. Namely, if d is continuous, then for any domain Ω and any compact set K in Ω, there exists a constant $C(\Omega, K)$ such that any positive continuous solution of $Lu = 0$ in Ω satisfies

$$\text{(H)} \qquad \sup_K u \le C(\Omega, K) \inf_K u.$$

Observe that the geometric nature of the inequality has been lost here in the sense that one does not know how to make the constant $C(\Omega, K)$ scale invariant by choosing the pair (Ω, K) to be suitable concentric balls as in (GH). The surprising fact that such a Harnack inequality can hold in infinite dimensions was discovered in the mid-1970s by Bendikov and Berg independently in their Ph.D. theses. Remarkably, inequality (H) can be characterized in terms of the behavior of $\mu_t(e)$.

Theorem 6. *Let L be the infinitesimal generator of a central symmetric Gaussian semigroup $(\mu_t)_{t>0}$ on a compact connected group G. Then L satisfies the elliptic Harnack inequality (H) if and only if $\log \mu_t(e) = o(1/t)$ as $t \to 0$* [BS].

One of the crucial ingredients in the proof of Theorem 6 is a study of bi-invariant diffusions on compact simple *Lie* groups that brings out the role played by the dimension and that involves small-, medium-, and large-time behaviors.

Long-Time Behavior on Lie Groups

We now turn to noncompact connected Lie groups and discuss the long-time behavior of $\mu_t(e)$ as t tends to infinity, under the standing condition that the family (X_i) generates the Lie algebra. This long-time behavior is really the heart of the matter, since it is where the group structure plays the most significant part.

To start, the behavior of the volume growth function V at infinity is independent of the choice of the family (X_i). Guivarc'h proved in the early 1970s that the volume growth at infinity is either exponential or comparable to a power function whose exponent D is an integer depending only on the underlying group. The groups for which V has a polynomial behavior are called groups of type (R), for rigid. The *adjoint representation* of G is obtained by lifting the action of the inner automorphisms $x \mapsto axa^{-1}$ to the Lie algebra. Groups of type (R) can be characterized algebraically in terms of the adjoint representation, whose eigenvalues must be purely imaginary. The group $U(m)$ of all $m \times m$ unipotent upper-triangular real matrices is of type (R) and has $V(t) \approx t^D$ with $D = \frac{1}{6}(m-1)m(m+1)$.

Groups of type (R) are amenable and unimodular, that is, have bi-invariant Haar measures, but there are many amenable unimodular Lie groups of exponential growth (hence, not of type (R)). The simplest such group is the group Sol mentioned above in the section on random walks on solvable groups. Sol can be described as the semidirect product of $\mathbb{R}^2$ by $\mathbb{R}$ with the action given by multiplication by $\begin{pmatrix} e^t & 0 \\ 0 & e^{-t} \end{pmatrix}$.

The behavior of $\mu_t(e)$ on amenable unimodular Lie groups is described by the following theorem.

Theorem 7. *For any amenable unimodular connected Lie group, if $V(t) \approx t^D$ as $t \to \infty$, then $\mu_t(e) \approx t^{-D/2}$ as $t \to \infty$. If V is exponential, then $\log \mu_t(e) \approx -t^{1/3}$ as $t \to \infty$.*

The two-sided bound under polynomial growth is due to Varopoulos. In the exponential growth case the lower bound is due to Alexopoulos and the upper bound to Varopoulos, with independent distinct proofs of the latter by Hebisch and Robinson. See [V+]. Theorem 7 is analogous to Theorem 5 and can be complemented by a statement concerning the isoperimetric profile, as in Theorem 5 (see [P], [V+]). The two results, for random walks and for diffusions, emerged simultaneously and can be proved by similar methods. A recent work of Alexopoulos [A] complements Theorem 7 with long-time asymptotics on groups with polynomial volume growth, i.e., groups of type (R). Alexopoulos's approach, which is tightly connected to the algebraic structure of type (R) groups, is adapted from techniques and ideas of the area of PDE known as homogenization theory, which deals with the large-scale behavior of differential operators having periodic coefficients in $\mathbb{R}^n$.

Of course, for nonamenable groups, $\mu_t(e)$ decays exponentially fast at a rate described by the *spectral gap* λ of $L = \sum X_i^2$, which is defined as the infimum of the Raleigh quotient

$$\frac{\int_G \sum |X_i f|^2 d\nu}{\int_G |f|^2 d\nu}, \quad f \neq 0,\ f \in L^2(G, \nu),$$

where ν is a right-invariant Haar measure on G. The spectral gap λ vanishes if and only if G is amenable. It should be noted that, in sharp contrast with the case of finitely generated groups, there exists a satisfactory structure theory that distinguishes between amenable and nonamenable groups in the class of connected locally compact groups [Pa]. Typical nonamenable connected Lie groups are all the semisimple noncompact Lie groups such as $SL_n(\mathbb{R})$, and the connected component of the identity in $SO(p, q)$. One of the early results concerning diffusions on Lie groups is the local central limit theorem of Bougerol, which gives, for semisimple Lie groups, a precise asymptotic result of the form $\mu_t(e) \sim ct^{-a/2}e^{-\lambda t}$ as $t \to +\infty$ for some integer $a \geq 3$ and $\lambda > 0$ as above. In general, such a precise result is hard to obtain. In either the commutative or the semisimple case, representation theory is the tool of choice for this purpose, but for other groups, including nilpotent and solvable groups, representation theory fails to a large extent to provide useful information about the behavior of $\mu_t(e)$.

For many years precisely understanding the long-time behavior of $\mu_t(e)$ in full generality seemed hopeless, despite the structure theory of Lie groups. However, in the last ten years Varopoulos has developed a theory that describes what happens for any symmetric Gaussian semigroup on any connected real Lie group, amenable or not, unimodular or not. The form of the main result is similar to Theorem 7, but the proofs are quite different. The proof of Theorem 7 is mostly analytic in nature, whereas the proof of Theorem 8 below also involves probability, algebra, and geometry.

Varopoulos [Vb] separates real connected Lie groups into two classes, (B) and (NB). This algebraic classification is too involved to describe here precisely. All (noncompact) semisimple groups, e.g., $SL_n(\mathbb{R})$, are in (NB). In the case of amenable groups, this classification reduces to a simpler one, (C) versus (NC), which can be understood in terms of the adjoint representation and the geometry of (generalized) roots [Va]. The class (R) of rigid groups coincides exactly with the class of those (NC) groups that are unimodular. Further examples of (NC) groups are the groups AN coming from the KAN Iwasawa decomposition of semisimple groups, for instance the group $ax + b$. To describe the simplest family of examples where both (C) and (NC) groups arise, let $\mathbb{S}_\ell = \mathbb{R} \ltimes_\ell \mathbb{R}^2$, where $\ell = (\ell_1, \ell_2) \in \mathbb{R}^2$ and the product is given by

$$(x, u) \cdot (y, v) = (x + y, u + A_\ell^x v)$$
$$\text{where } A_\ell = \begin{pmatrix} e^{\ell_1} & 0 \\ 0 & e^{\ell_2} \end{pmatrix}.$$

Then $\mathbb{S}_\ell$ is of type (C) if $\ell_1\ell_2 < 0$ and of type (NC) if $\ell_1\ell_2 > 0$.

Varopoulos's main result describes the classes (B) and (NB) (hence also the classes (C) and (NC)) in terms of the long-time behavior of $\mu_t(e)$ and classifies all the possible behaviors.

Theorem 8. *(1) For groups of type (NB), for each $L = \sum X_i^2$ there exists a nonnegative real number a (which may depend on L) such that $\mu_t(e) \approx t^{-a}e^{-t\lambda}$ as $t \to \infty$. (2) For groups of type (B), $\log(e^{t\lambda}\mu_t(e)) \approx -t^{1/3}$ as $t \to \infty$. Here λ denotes the spectral gap of the corresponding operator L.*

The factors t^{-a} and $e^{-t^{1/3}}$ appearing respectively in the (NB) and (B) cases can be interpreted in terms of the probability that a certain Euclidean Brownian motion stays in a certain convex region up to time t. The exact nature of the Brownian motion (i.e., its covariance matrix) is determined

by the algebraic structure of the group and by L. The convex region is determined by the geometry of the roots. It is compact or not depending on whether the group is (B) or (NB), and this accounts for the $e^{-t^{1/3}}$ versus polynomial behavior. A precise knowledge of the covariance matrix of the Brownian motion and of the convex region above are necessary to determine the constant a in the (NB) case. In fact, typically, the exact value of a is very hard to compute and can vary continuously with L.

These results extend to give a description of the behavior of the convolution powers of any continuous compactly supported symmetric nonnegative function f. This behavior precisely mimics the behavior of symmetric Gaussian convolution semigroups depending on whether the group is (B) or (NB). When expressed in terms of convolution powers, the result can be formulated in a straightforward way in the setting of locally compact connected groups. The restriction that G be connected is essential, as shown by the finitely generated groups $\mathbb{Z}_2 \wr \mathbb{Z}^d$ discussed in the section on solvable groups.

To conclude, there is a geometric description of the classes (B) and (NB) which adds a final touch to this remarkable classification [Vc]. It involves *filling invariants*. These have been considered in various contexts, in particular by Gromov. The 2-dimensional filling invariant $\psi_2(t)$ of a simply connected Riemannian manifold is defined as follows. For any given loop of length at most t, consider all immersed disks having this loop as their boundary, and find the infimum of the areas of all such disks. Then $\psi_2(t)$ is the supremum of these infimal areas over all such loops. For each dimension $k = 2, \ldots, n-1$, where n is the topological dimension of the manifold, there is a k-filling invariant. In particular, $\psi_{n-1}(t)$ gives the largest possible volume of a compact set with smooth boundary of $(n-1)$-volume at most t and is closely related to the isoperimetric profile. Essentially, a group is (NB) if and only if all its filling invariants are bounded above polynomially, whereas a group is a (B) group if and only if at least one of its filling invariants is growing faster than any polynomial. Thus, for connected real Lie groups, one has three equivalent classifications: the analytic/probabilistic classification according to the long-time behavior of symmetric Gaussian semigroups, the geometric classification in terms of filling invariants, and the (B) versus (NB) algebraic classification. There is no doubt that these fundamental results will lead to further progress concerning invariant diffusions, harmonic analysis, and geometry on Lie groups.

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Addition and Counting: The Arithmetic of Partitions

Scott Ahlgren and Ken Ono

At first glance the stuff of partitions seems like child's play:

$$4 = 3+1 = 2+2 = 2+1+1 = 1+1+1+1.$$

Therefore, there are 5 partitions of the number 4. But (as happens in number theory) the seemingly simple business of counting the ways to break a number into parts leads quickly to some difficult and beautiful problems. Partitions play important roles in such diverse areas of mathematics as combinatorics, Lie theory, representation theory, mathematical physics, and the theory of special functions, but we shall concentrate here on their role in number theory (for which [A] is the standard reference).

In the Beginning, There Was Euler...

A *partition* of the natural number n is any nonincreasing sequence of natural numbers whose sum is n (by convention, we agree that $p(0) = 1$). The number of partitions of n is denoted by $p(n)$. Eighty years ago Percy Alexander MacMahon, a major in the British Royal Artillery and a master calculator, computed the values of $p(n)$ for all n up to 200. He found that

$$p(200) = 3,972,999,029,388,$$

and he did not count the partitions one-by-one:

$$200 = 199+1 = 198+2$$
$$= 198+1+1 = 197+3 = \ldots\ldots\ldots\ldots\ldots .$$

Instead, MacMahon employed classical formal power series identities due to Euler.

To develop Euler's recurrence, we begin with the elementary fact that if $|x| < 1$, then

$$\frac{1}{1-x} = 1+x+x^2+x^3+x^4+\ldots .$$

Using this, Euler noticed that when we expand the infinite product

$$\prod_{n=1}^{\infty}\frac{1}{1-x^n} = (1+x+x^2+x^3+\ldots)$$
$$\times(1+x^2+x^4+\ldots)$$
$$\times(1+x^3+x^6+\ldots)\ldots,$$

the coefficient of x^n is equal to $p(n)$ (think of the first factor as counting the number of 1's in a partition, the second as counting the number of 2's, and so on). In other words, we have the generating function

$$\sum_{n=0}^{\infty}p(n)x^n = \prod_{n=1}^{\infty}\frac{1}{1-x^n}$$
$$= 1+x+2x^2+3x^3+5x^4+\ldots .$$

Moreover, Euler observed that the reciprocal of this infinite product satisfies a beautiful identity

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(also known as Euler's Pentagonal Number Theorem):

$$\prod_{n=1}^{\infty}(1-x^n) = \sum_{k=-\infty}^{\infty}(-1)^k x^{(3k^2+k)/2}$$
$$= 1 - x - x^2 + x^5 + x^7 - x^{12} - \dots .$$

These two identities show that

$$\left(\sum_{n=0}^{\infty} p(n)x^n\right) \times \left(1 - x - x^2 + x^5 + x^7 - x^{12} - \dots\right) = 1,$$

which in turn implies, for positive integers n, that

$$p(n) = p(n-1) + p(n-2) - p(n-5) - p(n-7) + p(n-12) + \dots .$$

This recurrence enabled MacMahon to perform his massive calculation.

Hardy-Ramanujan-Rademacher Asymptotic Formula for $p(n)$

It is natural to ask about the size of $p(n)$. The answer to this question is given by a remarkable asymptotic formula, discovered by G. H. Hardy and Ramanujan in 1917 and perfected by Hans Rademacher two decades later. This formula is so accurate that it can actually be used to compute individual values of $p(n)$; Hardy called it "one of the rare formulae which are both asymptotic and exact." It stands out further in importance since it marks the birth of the *circle method*, which has grown into one of the most powerful tools in analytic number theory.

Here we introduce Rademacher's result. He defined explicit functions $T_q(n)$ such that for all n we have

$$p(n) = \sum_{q=1}^{\infty} T_q(n).$$

The functions $T_q(n)$ are too complicated to write down here, but we mention that $T_1(n)$ alone yields the asymptotic formula

$$p(n) \sim \frac{1}{4n\sqrt{3}} e^{\pi\sqrt{2n/3}}.$$

(In their original work, Hardy and Ramanujan used slightly different functions in place of the $T_q(n)$. As a result, their analogue of the series $\sum_{q=1}^{\infty} T_q(n)$ was divergent, although still useful.) Moreover, Rademacher computed precisely the error incurred by truncating this series after Q terms. In particular, there exist explicit constants A and B such that

$$\left| p(n) - \sum_{q=1}^{A\sqrt{n}} T_q(n) \right| < \frac{B}{n^{1/4}}.$$

Since $p(n)$ is an integer, this determines the exact value of $p(n)$ for large n. The rate at which Rademacher's series converges is remarkable; for example, the first eight terms give the approximation

$$p(200) \approx 3,972,999,029,388.004$$

(compare with the exact value computed by MacMahon).

To implement the circle method requires a detailed study of the analytic behavior of the generating function for $p(n)$. Recall that we have

$$F(x) := \sum_{n=0}^{\infty} p(n)x^n = \frac{1}{(1-x)(1-x^2)(1-x^3)\dots}.$$

This is an analytic function on the domain $|x| < 1$. A natural starting point is Cauchy's Theorem, which gives

$$p(n) = \frac{1}{2\pi i}\int_C \frac{F(x)}{x^{n+1}}\,dx,$$

where C is any simple closed counterclockwise contour around the origin. One would hope to adjust the contour in relation to the singularities of $F(x)$ in order to obtain as much information as possible about the integral. But consider for a moment these singularities; they occur at *every* root of unity, forming an impenetrable barrier on the unit circle. In our favor, however, it can be shown that the size of $F(x)$ near a primitive q-th root of unity diminishes rapidly as q increases; moreover the behavior of $F(x)$ near each root of unity can be described with precision. Indeed, with an appropriate choice of C, the contribution to the integral from all of the primitive q-th roots of unity can be calculated quite precisely. The main contribution is the function $T_q(n)$; a detailed analysis of the errors involved yields the complete formula.

The circle method has been of extraordinary importance over the last eighty years. It has played a fundamental role in additive number theory (in Waring type problems, for instance), analysis, and even the computation of black hole entropies.

Ramanujan's Congruences

After a moment's reflection on the combinatorial definition of the partition function, we have no particular reason to believe that it possesses any interesting arithmetic properties (the analytic formula of the last section certainly does nothing to change this opinion). There is nothing, for example, which would lead us to think that $p(n)$ should exhibit a preference to be even rather than odd. A natural suspicion, therefore, might be that the values of $p(n)$ are distributed evenly modulo 2. A quick computation of the first 10,000 values confirms this suspicion: of these 10,000 values, exactly 4,996 are even and 5,004 are odd. This pattern continues with 2 replaced by 3: of the first 10,000 values, 3,313; 3,325; and 3,362 (in each case almost exactly

one-third) are congruent respectively to 0, 1, and 2 modulo 3. When we replace 3 by 5, however, something quite different happens: we discover that 3,611 (many more than the expected one-fifth) of the first 10,000 values of $p(n)$ are divisible by 5. What is the explanation for this aberration?

The answer must have been clear to Ramanujan when he saw MacMahon's table of values of $p(n)$. So Ramanujan would have seen something like the following.

1	1	2	3	5
7	11	15	22	30
42	56	77	101	135
176	231	297	385	490
627	792	1002	1255	1575
1958	2436	3010	3718	4565

What is striking, of course, is that every entry in the last column is a multiple of 5. This phenomenon, which persists, explains the apparent aberration above and was the first of Ramanujan's ground-breaking discoveries on the arithmetic of $p(n)$. Here is his own account.

> *I have proved a number of arithmetic properties of $p(n)$...in particular that*
>
> $$p(5n+4) \equiv 0 \pmod 5,$$
> $$p(7n+5) \equiv 0 \pmod 7.$$
>
> *...I have since found another method which enables me to prove all of these properties and a variety of others, of which the most striking is*
>
> $$p(11n+6) \equiv 0 \pmod{11}.$$
>
> *There are corresponding properties in which the moduli are powers of* 5, 7, *or* 11.... *It appears that there are no equally simple properties for any moduli involving primes other than these three.*

Ramanujan proved these congruences in a series of papers (the proofs of the congruences modulo 5 and 7 are quite ingenious but are not terribly difficult, while the proof of the congruence modulo 11 is much harder). In these same papers he sketched proofs of extensions of these congruences. For example, we have

$$p(25n+24) \equiv 0 \pmod{25},$$
$$p(49n+47) \equiv 0 \pmod{49}.$$

Ramanujan noticed the beginnings of other patterns in these first 200 values:

$$p(116) \equiv 0 \pmod{121}, \quad p(99) \equiv 0 \pmod{125}.$$

From such scant evidence he made the following conjecture:

$$\text{If } \delta = 5^a 7^b 11^c \text{ and } 24\lambda \equiv 1 \pmod{\delta},$$
$$\text{then } p(\delta n + \lambda) \equiv 0 \pmod{\delta}.$$

When $\delta = 125$, for example, we have $\lambda = 99$. So Ramanujan's conjecture is that

$$p(125n+99) \equiv 0 \pmod{125}.$$

We note that the general conjecture follows easily from the cases when the moduli are powers of 5, 7, or 11.

It is remarkable that Ramanujan was able to formulate a general conjecture based on such little evidence and therefore unsurprising that the conjecture was not quite correct (in the 1930s Chowla and Gupta discovered the counterexample $p(243) \not\equiv 0 \pmod{7^3}$). Much to Ramanujan's credit, however, a slightly modified version of his conjecture is indeed true; in particular, we now know the following:

$$\text{If } \delta = 5^a 7^b 11^c \text{ and } 24\lambda \equiv 1 \pmod{\delta},$$
$$\text{then } p(\delta n + \lambda) \equiv 0 \pmod{5^a 7^{\lfloor \frac{b}{2} \rfloor + 1} 11^c}.$$

The task of assigning credit for the proofs of these conjectures when the modulus is a power of 5 or 7 poses an interesting historical challenge. Typically, the proofs have been attributed to G. N. Watson. Recently, however, the nature of Ramanujan's own contributions [R] has been greatly clarified. Indeed, a complete outline of the proof modulo powers of 5 and a much rougher sketch for powers of 7 (so rough that it did not yet reveal his error in the statement of the conjecture) are given by Ramanujan in a long manuscript which he wrote in the three years preceding his


Hardy


Ramanujan


Rademacher

death. In typical fashion, Ramanujan provides in neither case complete details for all of his assertions. This manuscript was apparently in Watson's possession from 1928 until his death in 1965. Indeed, a copy of the manuscript in Watson's handwriting (the whereabouts of the original is unknown) resides in the library of Oxford's Mathematical Institute. In any event, it seems clear that Ramanujan deserves more credit than he has historically been granted for these cases. By contrast, the case of powers of 11 is much more difficult; the first published proof of Ramanujan's conjectures in this case was given by A. O. L. Atkin in 1967.

Dyson's Rank and Crank

The celebrated physicist Freeman Dyson, when he was a college student in 1944, initiated an important subject in partition theory by discovering a delightfully simple phenomenon which appeared to explain why

$$p(5n+4) \equiv 0 \pmod 5$$

and

$$p(7n+5) \equiv 0 \pmod 7.$$

Dyson defined the *rank* of a partition to be the largest summand minus the number of summands. Here, for example, are the partitions of 4 and their ranks:

Partition	Rank
4	$4-1 \equiv 3 \pmod 5$,
$3+1$	$3-2 \equiv 1 \pmod 5$,
$2+2$	$2-2 \equiv 0 \pmod 5$,
$2+1+1$	$2-3 \equiv 4 \pmod 5$,
$1+1+1+1$	$1-4 \equiv 2 \pmod 5$.

Notice that the ranks of these partitions represent each residue class modulo 5 exactly once. After computing many more examples, Dyson observed that, without exception, numbers of the form $5n+4$ (respectively $7n+5$) have the property that their ranks modulo 5 (respectively modulo 7) are equally distributed. More precisely, if $0 \le m < M$ are integers and $R(N,m,M)$ denotes the number of partitions of N with rank congruent to $m \pmod M$, then Dyson conjectured that

$$R(5n+4,m,5) = \frac{1}{5} \cdot p(5n+4) \quad \text{for } 0 \le m \le 4,$$

$$R(7n+5,m,7) = \frac{1}{7} \cdot p(7n+5) \quad \text{for } 0 \le m \le 6.$$

The truth of these conjectures would provide a simple and elegant combinatorial explanation for Ramanujan's congruences. Dyson's speculation was confirmed ten years later by Atkin and H. P. F. Swinnerton-Dyer in a wonderful paper which combines classical combinatorial arguments with techniques from the theory of modular functions.

Unfortunately, Dyson's rank does not seem to enjoy such simple properties for primes other than 5 and 7. However, he conjectured the existence of another natural statistic, the *crank*, which explains the congruence

$$p(11n+6) \equiv 0 \pmod{11}.$$

In the late 1980s George E. Andrews and Frank Garvan found such a crank [A-G], [G]. Further work of Garvan, Dongsu Kim, and Dennis Stanton [G-K-S] has produced, for the congruences with moduli 5, 7, 11, and 25, combinatorial interpretations which are rooted in the modular representation theory of the symmetric group.

Atkin's Examples

We return to Ramanujan's intuition that there are no simple arithmetic properties for $p(n)$ when the modulus involves primes greater than 11. Ramanujan seems to have been correct in this claim; no new congruence as simple as the originals has ever been found (although it has not been proved that none exists). The 1960s, however, witnessed tantalizing discoveries of further examples (notably by Atkin, Newman, and O'Brien). Atkin, for example, found elegant infinite families of congruences modulo 5, 7, and 13 which are quite different from those previously known. A simple example of these is the congruence

$$p(11^3 \cdot 13n + 237) \equiv 0 \pmod{13}.$$

Atkin also gave more examples, though not so systematic, with moduli 17, 19, 23, 29, and 31.

Atkin obtains these results via a detailed study of modular functions. Since these lie at the heart of the proofs of the congruences we have

seen so far, we will give a brief description here. Let $SL_2(\mathbb{Z})$ be the set of 2×2 integer matrices with determinant equal to 1. Then, if N is an integer, define the *congruence subgroup* $\Gamma_0(N)$ by

$$\Gamma_0(N) := \left\{ \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in SL_2(\mathbb{Z}) : c \equiv 0 \pmod{N} \right\}.$$

An element $\gamma = \left(\begin{smallmatrix} a & b \\ c & d \end{smallmatrix}\right)$ acts on the upper half-plane $\mathbb{H}$ of complex numbers via the linear fractional transformation $\gamma z = \frac{az+b}{cz+d}$. By definition, a *modular function* on $\Gamma_0(N)$ is a function f on $\mathbb{H}$ which satisfies $f(\gamma z) = f(z)$ for all $\gamma \in \Gamma_0(N)$ and which in addition is meromorphic on $\mathbb{H}$ and "at the cusps". When N is small, the field of these functions is relatively simple; therefore, given several functions in such a field, one expects to find nontrivial relations among them. If the right functions are involved, then such a relation may give information about values of $p(n)$. For Atkin's examples when $\ell = 5$, 7, or 13, the relevant function fields have a single generator; this is responsible for the infinite families of congruences. As ℓ increases, however, things rapidly become more complicated. Atkin's work is interesting for another reason: it marks an early use of sophisticated computers in mathematics. As he says, "It is often more difficult to discover results in this subject than to prove them, and an informed search on the machine may enable one to find out precisely what happens."

A Problem of Erdős

Even after all of the beautiful discoveries described above, the general arithmetic properties of $p(n)$ must seem rather mysterious. Indeed, we have said nothing for any prime modulus ℓ greater than 31, let alone for a general prime modulus. In this context we mention a conjecture of Erdős from the 1980s.

If ℓ is a prime, then there exists an n such that $p(n) \equiv 0 \pmod{\ell}$.

If we reflect on this conjecture for a moment, we are struck by its weakness: it asserts only that every prime divides at least *one* value of the partition function. On the other hand, (until very recently) the known results were even weaker; the best was a theorem of Schinzel and Wirsing, who proved the existence of a constant c such that, for large X, the number of primes $\ell < X$ for which Erdős's conjecture is true is $\geq c \log\log X$.

Recent Developments

In the past several years our understanding of the arithmetic of $p(n)$ has increased dramatically. All of the advances have arisen from a single source: the fact that values of the partition function are intimately related to the arithmetic of modular forms. Modular forms have historically played a large role in number theory; their importance, of course, has been underscored by their central position in the proof of Fermat's Last Theorem. The crux of Wiles' proof is to show that elliptic curves are "modular"; in other words, their arithmetic is dictated in part by certain modular forms to which they are related. What has been learned recently is that the partition function does not escape the web of modularity; its arithmetic, too, is intimately connected to the behavior of a certain family of modular forms. This connection has allowed the application of deep methods of Deligne, Serre, and Shimura to the study of $p(n)$. These theories (some of the most powerful of the last half-century) have important ramifications for $p(n)$; in particular, properly applied, they imply that $p(n)$ satisfies linear congruences for *every* prime $\ell \geq 5$. We shall discuss in more detail how modular forms enter the picture in the next section; let us first indicate what they enable us to prove.

The second author (inspired by some formulae of Ramanujan) was the first to notice these connections; as a result [O] he proved the following:

For any prime $\ell \geq 5$, there exist infinitely many congruences of the form

$$p(An + B) \equiv 0 \pmod{\ell}.$$

(We note that if the arithmetic progression $An + B$ gives rise to such a congruence, then so do any of its infinitely many subprogressions; we do not count these as new when we speak of "infinitely many congruences".) Shortly thereafter the first author [Ahl] extended this result by showing that the prime ℓ may in fact be replaced by an arbitrary prime power ℓ^k; from this it can be shown that ℓ may in fact be replaced by any modulus M which is coprime to 6. An immediate consequence of these results is the following:

If $\ell \geq 5$ is prime, then a positive proportion of natural numbers n have $p(n) \equiv 0 \pmod{\ell}$.

This provides a very convincing proof of the conjecture of Erdős mentioned above.

More recently, the two authors [Ahl-O] have shown that congruences for $p(n)$ are even more widespread than these theorems indicate. To explain this, let us return to Ramanujan's original results:

$$p(5n+4) \equiv 0 \pmod{5},$$
$$p(7n+5) \equiv 0 \pmod{7},$$
$$p(11n+6) \equiv 0 \pmod{11}.$$

As Ramanujan's conjectures indicate, these results may be written in a unified way. Namely, let λ_ℓ denote the inverse of 24 modulo ℓ (in other words, $24\lambda_\ell \equiv 1 \pmod{\ell}$). Then they assume the following form:

If $\ell = 5, 7, or\ 11$, then $p(\ell n + \lambda_\ell) \equiv 0 \pmod{\ell}$.

Now, for any prime $\ell \geq 5$ and any exponent k, the results above guarantee the existence of infinitely many progressions $An + B$ such that $p(An + B) \equiv 0 \pmod{\ell^k}$. An important feature of the method used to prove the theorems above is that in every case, the progression $An + B$ which it produces is a subprogression of $\ell n + \lambda_\ell$ (in other words, $\ell \mid A$ and $B \equiv \lambda_\ell \pmod{\ell}$). As an example, one of the simplest congruences guaranteed by this theorem is

$$p(59^4 \cdot 13n + 111247) \equiv 0 \pmod{13};$$

in this case we have $111247 \equiv 1/24 \pmod{13}$.

What the authors have shown recently is that congruences are not confined to this single progression modulo ℓ. In fact, we now know that if $\ell \geq 5$ is prime and k is any exponent, then infinitely many congruences $p(An + B) \equiv 0 \pmod{\ell^k}$ exist within each of $(\ell + 1)/2$ progressions modulo ℓ. In other words, for each prime, slightly more than half of such progressions contain congruences. When $\ell = 11$, for example, the relevant progressions are

$$11n + 1,\ 11n + 2,\ 11n + 3,$$
$$11n + 5,\ 11n + 6,\ 11n + 8.$$

Of these, only Ramanujan's own $11n + 6$ had been distinguished by the previous theory. The latest result provides a theoretical framework which explains every known partition function congruence.

Modular Forms

We will try to indicate briefly how the theory of modular forms can be applied to the study of $p(n)$ in order to yield the results of the preceding section. At the heart of the matter are the generating function

$$\sum_{n=0}^{\infty} p(n)x^n = \prod_{n=1}^{\infty} \frac{1}{1 - x^n}$$

and Dedekind's eta function

$$\eta(z) = x^{1/24} \prod_{n=1}^{\infty} (1 - x^n) \quad (\text{here } x := e^{2\pi i z}).$$

Combining the last two formulae gives

$$1/\eta(24z) = \sum_{n=-1}^{\infty} p\left(\frac{n+1}{24}\right) x^n = x^{-1} + x^{23} + \dots .$$

Loosely speaking, a *modular form* of weight k on the subgroup $\Gamma_0(N)$ is a function f on the upper half-plane $\mathbb{H}$ which satisfies a transformation property of the form

$$f\left(\frac{az + b}{cz + d}\right) = (cz + d)^k f(z) \quad \text{for all } \begin{pmatrix} a & b \\ c & d \end{pmatrix} \in \Gamma_0(N).$$

In addition, f is required to be meromorphic on $\mathbb{H}$ and at the cusps; if f is also holomorphic on $\mathbb{H}$ and vanishes at the cusps, then we call f a *cusp form*. We allow k to be an integer or half an integer (extra care must be taken in the latter case); note that the modular functions introduced above are just modular forms of weight zero. Every modular form $f(z)$ has a Fourier expansion in powers of $x = e^{2\pi i z}$; if f is a cusp form, then this expansion takes the form

$$f(z) = \sum_{n=1}^{\infty} a_f(n) x^n.$$

When the weight k of a cusp form is integral, then the theory of Deligne and Serre is available for the study of the Fourier coefficients a_f. In particular, there is a natural family of operators (the so-called Hecke operators) that act on spaces of modular forms. If f is a normalized eigenform for this family, then Serre conjectured and Deligne proved the existence of a representation

$$\rho_f : \mathrm{Gal}(\overline{\mathbb{Q}}/\mathbb{Q}) \to \mathrm{GL}_2(K)$$

(for some field K) such that for all but finitely many primes Q we have

$$\mathrm{Trace}(\rho_f(\mathrm{Frob}_Q)) = a_f(Q).$$

Here Frob_Q denotes a Frobenius element at the prime Q. This result is extraordinarily powerful; it allows us to study the Fourier coefficients of modular forms using the structure of Galois groups.

If the weight k of a cusp form is half-integral, then we do not have the results of Deligne and Serre at our disposal. There is, however, a correspondence due to Shimura between cusp forms of half integral weight and certain forms of integral weight; the Shimura correspondence is quite explicit and commutes in the best possible way with the action of the Hecke operators on the respective spaces.

We saw above that the expansion

$$1/\eta(24z) = \sum_{n=-1}^{\infty} p\left(\frac{n+1}{24}\right) x^n = x^{-1} + x^{23} + \dots$$

contains every value of the partition function. Now $1/\eta(24z)$ is a modular form on $\Gamma_0(576)$. However, it has two major deficiencies: the weight is $-1/2$, and it has a pole at every cusp. So none of the theories above seem to apply. It turns out, however, that starting with this expansion, one can construct half-integral weight cusp forms which still preserve much information about the values of $p(n)$ modulo powers of primes. From these cusp forms the theory of Deligne and Serre, filtered through Shimura's correspondence, yields the results of the preceding section.

L-Functions and Arithmetic

Since modular forms play such an important role in partition congruences, it is natural to suspect

that there may be deeper connections between partitions and "modular" objects. As it turns out, this is indeed the case.

To motivate the connection, consider the following classical Diophantine question (already of interest to ancient Greek and Arab scholars):

Which integers D are areas of right triangles with rational number sidelengths?

Such numbers D are known as *congruent numbers*. Simple arguments show that a number D is congruent precisely when there are infinitely many rational points (x, y) on the elliptic curve

$$E_D : y^2 = x^3 - D^2 x.$$

How does one determine whether such a curve has infinitely many points? The Birch and Swinnerton-Dyer Conjecture, one of the main outstanding conjectures in number theory (and a million-dollar Clay Mathematics Institute problem), provides the solution.

Let $L(E_D, s)$ denote the Hasse-Weil L-function attached to E_D; this is an analytic function whose definition depends on the behavior of E_D modulo primes p. For the congruent number problem the conjecture implies that

$$L(E_D, 1) = 0 \iff D \text{ is congruent.}$$

In addition, the conjecture gives a precise formula dictating the analytic behavior of $L(E_D, s)$ at $s = 1$. For instance, if $L(E_D, 1) \neq 0$, then the conjecture asserts that

$$L(E_D, 1) = \Omega_D \cdot \#Ш(E_D).$$

Here Ω_D is an explicit transcendental number, and $Ш(E_D)$ is the Tate-Shafarevich group of E_D. (The Tate-Shafarevich group is a certain Galois cohomology group which measures the extent to which the local-global principle fails for E_D.)

In the early 1980s Jerrold Tunnell, using the works of Shimura and Waldspurger (see [K] for a good account), constructed two modular forms of weight 3/2 whose coefficients "interpolate" the square roots of the $L(E_D, 1)$. Together with the Birch and Swinnerton-Dyer Conjecture, these modular forms provide a complete solution to the congruent number problem.

Recently, Li Guo and the second author [G-O] have shown that if $13 \leq \ell \leq 31$ is prime, then certain half-integral weight modular forms whose coefficients interpolate values of $p(n)$ modulo ℓ behave in a manner somewhat similar to Tunnell's modular forms. In particular, they showed that there are *modular motives* $M_{D,\ell}$ (these may be viewed as analogs of elliptic curves) whose L-functions $L(M_{D,\ell}, s)$ have the property that the square roots of $L(M_{D,\ell}, (\ell - 3)/2)$ are related in a predictable way to the coefficients of these modular forms. The truth of the Bloch-Kato Conjecture (a vast generalization of the Birch and Swinnerton-Dyer Conjecture) then implies that

$$L(M_{D,\ell}, (\ell - 3)/2) = \Omega_{D,\ell} \cdot \#Ш(M_{D,\ell}).$$

Assuming the Bloch-Kato Conjecture, it can be shown, for many n, that

$$p(n) \equiv 0 \pmod{\ell} \implies \#Ш(M_{D,\ell}) \equiv 0 \pmod{\ell},$$

where D depends on n. These two conditions are probably equivalent, and so it is likely that the divisibility of $p(n)$ often dictates the presence of elements of order ℓ in these Tate-Shafarevich groups. So, perhaps surprisingly, it seems that congruences like Ramanujan's are connected to some highly abstract creations of modern number theory.

The Future?

The beginnings of the partition function are extraordinarily humble; after all, what could be simpler than addition and counting? Despite its humble start, the history of the partition function includes connections to many central areas of number theory, from the work of Euler to the birth of the circle method to the modern theory of modular forms and L-functions. It will be quite interesting to see what further connections the future will reveal.

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Note: Photograph of L. Euler courtesy of the Institut Mittag-Leffler. The photograph of H. Rademacher was provided by Bruce Berndt.

Two Reactions to *The Mathematical Education of Teachers*

In August 2001 the Conference Board of the Mathematical Sciences (CBMS) issued the report *The Mathematical Education of Teachers* (MET). The aim of the report is to set forth recommendations for bringing about significant improvement in the mathematical education of future teachers. The project to produce the report was supported by a grant from the U.S. Department of Education.

The members of the Steering Committee for the report were: James Lewis (chair), Richelle Blair, Gail Burrill, Joan Ferrini-Mundy (advisor), Roger Howe, Mary Lindquist, Carolyn Mahoney, Dale Oliver, Ronald Rosier (ex-officio), and Richard Scheaffer. The members of the Writing Team were: Alan Tucker (lead writer), James Fey, Deborah Schifter, and Judith Sowder. The members of the Editing Team were: Cathy Kessel (lead editor), Judith Epstein, and Michael Keynes.

Other *Notices* articles on teacher education include "Spotlight on Teachers" by James Lewis, April 2001, pages 396–403; and a review of Liping Ma's book, *Knowing and Teaching Elementary Mathematics*, reviewed by Roger Howe, September 1999, pages 881–7.

The *Notices* invited two individuals to give their reactions to the MET report. Their commentary follows.

—Allyn Jackson

Amy Cohen

We mathematicians at colleges and universities have a natural interest in mathematics education in elementary and secondary schools and therefore an interest in the education of school teachers. Admittedly, our efforts alone cannot guarantee that mathematics teachers will be effective. Nonetheless, we play a crucial role in educating not only teachers but also the faculty who educate teachers. It will not help for mathematics faculty simply to complain about the preparation of undergraduates; faculty should actually work to improve the education of prospective teachers.

The report *The Mathematical Education of Teachers* (MET) challenges mathematics faculty, their academic leadership, and particularly those engaged in designing programs and delivering courses to modify what they teach prospective teachers and how they teach it. In the first fifteen pages the report makes eleven numbered recommendations and provides a brief context for them. Further chapters lay out five strands of subject matter knowledge that are developed throughout grades 1–12, discuss the mathematical understanding essential to teach this material effectively, and suggest changes in content and delivery of the undergraduate education of prospective teachers to help them obtain that essential understanding.

This report, especially its first two chapters, deserves careful reading and consideration by all mathematicians, especially those who will take

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The Mathematical Education of Teachers

The AMS is publishing the full 145-page report in cooperation with the Mathematical Association of America (MAA). The MAA is also producing a shorter, 50-page form of the report. The CBMS is distributing about 3,000 free copies of the full report (to departments of mathematics and other organizations) and will distribute about 10,000 free copies of the short form in response to requests. The report is also available on the Web at `http://www.maa.org/cbms/`.

The full report is available for sale from the AMS (item code CBMATH/11) or the MAA (ISBN 0-8218-2899-1). Further information may be obtained by telephoning the AMS at 800-321-4267 or by visiting the AMS Bookstore at `http://www.ams.org/bookstore/`.

part in the discussion of educational issues. The later chapters are essential reading for those engaged in the education of teachers, either in policymaking or in classroom instruction, and will repay careful reading by those who want a deeper understanding of the mathematics involved in precollege grades. It may be more fun to try to derive one's account of reality from pure reason, but it is more useful in effecting change to work from fact.

The recommendations of this report can be the basis for productive change, provided that the necessary resources can be found to implement them. Money is not the only rare resource; so are time, energy, and wisdom to change teaching habits and requirements for graduation and certification. To improve the education of teachers, the various stakeholders must generate the political will to find and use these resources.

Most mathematicians will probably agree with many statements in the MET report, starting with the assertion in the preface that "teachers need a solid understanding of mathematics so that they can teach it as a coherent, reasoned activity and communicate its elegance and power." Repeatedly the report stresses that teachers should acquire "mathematical common sense", that the language of mathematics has meaning, and that students need both facts and understanding to make use of mathematical reasoning. The report argues that, in order to teach effectively and to develop professionally, teachers need fluent mastery of mathematics with intellectual substance and subtlety. Thus the report repeatedly suggests that at least some of the undergraduate courses taken by prospective teachers include explicit attention to connections between the material taught in schools and the material taught in college. Finally, since people teach as they were taught, the report argues that instructors of mathematics courses for prospective teachers should use a variety of effective teaching styles and should engage students in active modes of learning.

Many colleagues will, I hope, be a bit skeptical of the assertion that the "mathematical knowledge needed for teaching is *quite different* (emphasis added) from that required [for] other professions." Over the last year, members of the Committee on the Undergraduate Program in Mathematics of the Mathematical Association of America (MAA) have met with mathematicians (and others) who hire and supervise B.A./B.S. mathematics majors in the private sector to inquire what knowledge and "habits of mind" they see in productive staff and therefore seek when hiring. Their responses describe qualities remarkably like those MET lists as important for effective teaching: seeing the mathematical content in mathematically unsophisticated questions, seeing underlying similarity of structure in apparently different problems, facility in drawing on different mathematical representations of a problem, communicating mathematics meaningfully to diverse audiences, facility in selecting and using appropriate modes of analysis ("mental", paper-and-pencil, or technological), and willingness to keep learning new material and techniques.

The MET report, at least as I read it, suggests implicitly that prospective teachers take courses that are different from those taken by other mathematics students. How many courses should be different is ambiguous; should some courses, or most courses, or all courses be different? Separating prospective teachers from other mathematics students might help develop an esprit de corps and a more professional attitude among future teachers, especially those aiming at K–8 certification. On the other hand, it seems ironic that the community of mathematics educators, which so often argues against tracking in middle and secondary grades, appears here to propose something like tracking for prospective teachers. It seems to me likely that for prospective teachers of elementary and middle grades most courses should be different. Prospective high school teachers might need only some courses that are different.

A larger related question is how to offer courses that lead to substantial learning by students not headed for doctoral programs while still meeting the needs of the very few who will follow in our footsteps as university professors. Perhaps once it was sufficient simply to present material, assign homework, give exams, and report which students learned well. But today it is not enough merely to inspire and identify those few students who will become our future research colleagues, regardless of how we treat them. The continued flow of resources to support basic research in mathematics depends in large part on the ability of mathematicians to prepare students who can use mathematical techniques and reasoning in many roles, including teaching in the schools.

Teaching is no longer a lifelong vocation. Teachers often move on to other employment. College graduates initially pursuing other employment sometimes return for postbaccalaureate certification programs. The education of teachers should not be limited to preparation for teaching. Finally, one might hope that well-conceived general education courses in mathematics could help recruit undecided majors for teaching careers at the elementary and middle grades. In some departments there is already evidence that mathematics majors with satisfying experiences as tutors or peer mentors sometimes decide rather late in their undergraduate years to enter teaching careers.

Each of the eleven numbered recommendations of the MET report should attract interest and discussion. Some will draw more immediate agreement than others will. Here are my reactions, formulated primarily with the intent of eliciting discussion.

Recommendations 1 and 5. These recommendations say that prospective teachers should develop a deep understanding of the mathematics they will teach and should also master mathematics that comes both before and after their own intended teaching level. The courses they take should connect college content to school content. These recommendations also say that mathematicians who teach these courses should "have a serious interest in teacher education" and should "cooperate with education faculty."

The later chapters of the MET report give arguments and examples to defend these recommendations. A university mathematician reading these chapters with a reasonably open mind is likely to gain both information about and insight into the challenges of teaching mathematics in American schools.

These recommendations pose cultural problems for departments in research universities and for departments staffed by faculty trained at research universities. Such faculty probably learned school mathematics easily. Ideas they have always found clear require time and effort to communicate to students who have never experienced mathematical clarity. It may be harder for a faculty member to explain an idea that has always seemed obvious than an idea that has not yet been fully understood. Will faculty invest the necessary time and effort? Will that investment command respect from peers and reward from chairs and deans?

Many university faculty have come through national educational systems where the job of a research department was purely to produce research results and research mathematicians. In such systems prospective teachers, like prospective economists or engineers, studied with entirely different faculties at the postsecondary level. Faculty with such backgrounds may find it hard to accept teaching nonmathematics majors as a respectable use of their talents. It may be hard for those with such backgrounds to enlarge their concept of the proper use of their talent in order to come to believe that it is respectable to work with nonmathematics majors. Even many mathematicians trained in the U.S. are influenced by a value system that rewards the "best" faculty with a reduced teaching load concentrated in courses for graduate or prospective graduate students.

How might U.S. universities convince faculty that it is a mark of respect to be asked to apply one's insights to the enthusiastic teaching of often unenthusiastic students, especially in courses for elementary or middle school teachers? Or, failing that, should we convince senior faculty and deans to appoint and promote some faculty on criteria counting teaching and research equally rather than to judge primarily on research? Should we consider reverting to a pattern of separate graduate and undergraduate departments of mathematics?

The committee producing the MET report was charged with offering recommendations, not with guiding implementation. Faculty sympathetic to the goals will have to work on implementation within the *Realpolitik* of their departments and universities. It is easier to say "the entire mathematics faculty [should] actively support teacher education efforts" than to figure out how to create such support. My experience with promoting educational change suggests that it is often better to enlist a respected cadre of supporters within a broad population of nonobjectors than to provoke overt opposition by insisting that everyone agree.

I would suggest further that innovators offer plausible benefits not only for students but also for faculty members and the department as a whole. One of my colleagues, who was initially dubious about a pedagogical initiative he was talked into trying, remarked midsemester that "It's more fun to teach when the students learn." This remark made it easier to recruit other colleagues to try the same innovation. If our state governments and university administrations are serious about increasing the number and quality of the teachers we educate, they must be willing to supply resources and rewards. Asking a department to steal resources from valued ongoing projects to fund new ones is a sure way to generate hostility. This last concern is especially important in departments that have typically used the same courses for the mathematical education of K–8 teachers and for the general education of students whose intended majors do not require calculus.

Recommendations 2, 3, and 4. These recommendations present specifics on the amount of mathematics instruction prospective teachers should receive: 9 semester-hours for teachers of grades 1–4, 21 semester-hours for teachers of grades 5–8, and at least the equivalent of a full mathematics major for high school mathematics

teachers. The recommendations say that this coursework should convey both mathematical knowledge and habits of mathematical common sense and reasoning so that teachers can ask good questions, investigate problems, communicate understanding, and lead their students to do the same.

For many institutions, these three recommendations carry staggering implications for the allocation of resources and the construction of graduation requirements. It is not surprising that later recommendations discuss the need for cooperation among faculty members, various academic units, and public policy groups in implementing this increased coursework wisely. The MET report suggests in Chapter 9 a 6-credit-hour capstone course for future high school teachers to bring coherence to previous coursework in content and pedagogy. I am unsure whether this course is envisioned as an intense one-semester undertaking or a full-year sequence. I was intimidated by the sheer volume of topics suggested for inclusion in the capstone course. Nonetheless, this suggestion is worthy of careful attention and possible adaptation.

In my own institution we might pursue the goals of this suggestion in the preparation of high school teachers by adding 1-credit companion seminars to each of the two core courses in our major (advanced calculus, which is really an introduction to real analysis; and abstract algebra, which is really a fairly concrete introduction to rings before groups). These 4-credit courses already include a weekly workshop in which students work in groups on problems connecting various topics before writing up solutions individually. The goal is to develop communication skills. A seminar for prospective teachers, team-taught by faculty from mathematics and mathematics education, could discuss connections to high school content and pedagogy without totally segregating teachers from other majors.

Carrying out the report's recommendation that prospective teachers of grades 5–8 should have 21 credit hours of mathematical content and making sure that pedagogical issues are appropriately addressed would require substantial attention from mathematics faculty and substantial resources from university administrators, especially in those states that currently require only 3 credit hours each in mathematics, science, and technology. The traditional Ph.D. in mathematics does little to prepare college faculty for teaching such courses. The suggestion of optional minors within a Ph.D. program to address this issue is intriguing but not obviously compatible with calls to speed progress of graduate students to the doctoral degree. Would fellowships for postdoctoral training programs be a practical alternative? Or should some mathematicians pursue postdoctoral master's degrees in mathematics education as others now do in computer science or finance?

Recommendations 6 through 11. Recommendations 6, 7, and 8 call for cooperation between mathematics departments and mathematics education departments, between 2- and 4-year institutions, and between working teachers and instructors of prospective teachers. Recommendations 9 through 11 address policies supporting high-quality teaching in the schools. They call for the participation of college and university faculty in the accreditation and certification processes, for the participation of teachers throughout their careers in activities designed to enhance their understanding of mathematics and ways to teach it, and the use of mathematics specialists in the middle grades.

Prospective teachers often face disparate lists of requirements for general education, academic majors, and teacher certification—each set by a different authority inside or outside the university. Lengthening these lists won't help. Making them more coherent will help. To make room in students' programs for more mathematics will require tact lest other departments will complain of lack of respect for their contributions to the education of teachers and fight the potential loss of their resources to mathematics.

Efforts to coordinate the mathematics programs of 2- and 4-year institutions can build on the collegiality developed within the MAA and the American Mathematical Association of Two-Year Colleges. Articulation agreements (compacts negotiated between institutions to specify transfer-credit policy) can cause problems if faculty have insufficient input. The mission of a 2-year school often extends well beyond preparing students for transfer to 4-year schools. There may be pressures that make it harder for faculty at 2-year schools than for those at 4-year schools to develop in students the facility in reasoning and communication as well as in calculation needed for upper-level courses.

In summary, I recommend that my colleagues read this report looking for ideas to adopt (or at least adapt) rather than looking for excerpts to disparage. What I like best is the report's underlying assumption that we need an alliance of *content* and *process*, not a victory of one over the other. I hope we can agree that students and their teachers must understand as well as remember mathematics in order to use it well. It would follow that education for prospective teachers, like all college-level education, should aim for deep understanding not just coverage of material. I hope that the ideas and arguments of the MET report will both spur and assist the mathematical community to improve the mathematical education of teachers and thus to improve the status of mathematics in twenty-first-century America.

Steven G. Krantz

I had a dream last night. I dreamed that I was teaching a class on pseudodifferential operators. On the first day I asked the class what they thought a pseudodifferential operator should be. No good. I got nothing but blank stares. I then said, "OK. Who can tell us what a singular integral should be? *Hint:* Think Calderón and Zygmund." Still I got no response.

Undaunted, I smiled and said, "I'll make it easy for you. What is the concept of a distribution?" One young fellow finally raised his hand and described the idea of a probability distribution. "Good answer!" I cried. "In fact, in this course we instead use the distribution theory of Laurent Schwartz."

We spent the rest of the class time discussing how we felt about mathematical analysis, about the role of the mathematician in society at large, and about what kind of teacher David Hilbert was. It was a rewarding hour.

The reader who has stuck with me so far is probably thinking that old Steve Krantz has finally gone around the bend. But no, I am portraying a teaching process that is being purveyed by well-meaning individuals who have set themselves up as the arbiters of teaching standards for the next generation of school mathematics teachers. Students are supposed to cogitate and interact with each other and generate—hit or miss—the ideas for themselves. The volume under review is an instance of this new *Weltanschauung*.

Consider now a scene in the third grade: We want to teach the kids how to multiply two 2-digit numbers together. One way to do this would be to just *tell them how it is done.* But that would be crass indeed. In the words of the report under review (which I shall refer to hereinafter as MET),

> First, she [the teacher] must believe that mathematics is about ideas that make sense, rather than a collection of motiveless rules, and that her students have mathematical ideas that can be built upon; next, that there are many ways to solve a problem.

This is a commendable sentiment. Understanding cannot come without motivation. We must link up new ideas to what the student already knows. But the teacher must play a *dynamic* role in making those connections.

I like to think of the analogy of learning to play the piano. When the (young) student sits down on the first day with his or her teacher, it is unlikely that the teacher will say, "Now, how do you think you should hold your hands? What do these symbols on the sheet music likely stand for? And what song would you like to play first?" In fact, what the teacher does instead is *to show the student how to play the piano.* As the student learns finger exercises and scales and elementary tunes and ultimately Chopin études, he or she also develops an appreciation for why things are done the way they are, why the traditional hand positions are effective, and finally how music is structured and why it works.

Why can't we teach mathematics in the same way? It is, frankly, a waste of time to try to get students to "invent" the mathematics that it took us hundreds of years to develop. What can they accomplish in just one hour?

I certainly think that students (of any age) should be encouraged to contribute their ideas, and the teacher should be sufficiently well trained so that he or she can respond thoughtfully and meaningfully to any and all student questions. I thank God every day that I have the intelligence and training always to have useful and stimulating responses for most any comment or query that my students might formulate. Our K–12 teachers should, ideally, be able to do the same.

Certainly the teacher should at some point say to the students, "Why do we multiply in this fashion? Why do we carry in this fashion? What does the operation of 'carrying' actually mean? How would we do things if we were working in some number system other than base 10?" In this way the students can turn the methods over in their minds, can find hooks on which to hang the ideas, and (one hopes) can finally say, "Aha! Now I understand." This *must* be the goal of all teaching. The process that I have described in these last two paragraphs contains all the elements of the self-discovery/group-learning paradigm that MET and other new-age texts are promoting. But it builds *atop* a foundation of basic skills and concepts. It uses time more wisely, and it makes much more didactic sense. My "traditionalist" approach allows the teacher to play a more proactive role and to *guide* the students to the right ideas.

I once read an article in *UME Trends* in which an educator said, "I can no longer teach my students calculus. What I can do is teach them *about calculus.*" It took me a moment to understand what was being said; after that, I felt as though I had gaped into the pits of hell. The message is that bona fide calculus—taking limits and calculating derivatives and computing integrals and applying these ideas to physics—is just too recondite. What is better is just to chat about these things, more or less along the lines of *A Tour of the Calculus* by David Berlinski [BER]. Is this the state to which our concept of education has devolved?

If you read pages 33–35 of MET, then you might conclude that the answer is "yes". Instead of seventh- and eighth-grade teachers being told to show their students the rudiments of Euclidean

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geometry, it is suggested that they treat their students to the software The Geometer's Sketchpad.[1] Instead of these teachers being advised to introduce their students to symmetry and congruence and angle, they are being led to books on the occurrence of geometric shapes in primitive cave paintings and folk artifacts.

Chapter 5, page 41, considers the high school treatment of geometry. As the reader may know, this subject has been trivialized in the past twenty years. Gone are the days when students were presented with a few definitions (line, point, betweenness, etc.), presented with Euclid's five axioms, and then sent off to fight the forces of darkness armed with only the two-column proof. Many high school geometry texts in recent years present fifteen new axioms in each chapter. Why? So that they can avoid doing any proofs. In other words, Euclidean geometry has been turned into a phenomenological subject: point and click; look at the pretty triangle. The most modern texts go even a step further: they have no axioms and instead engage in an anecdotal description of various pictures, including much ado about fractals.

Unfortunately, MET does not inveigh against the downgrading of geometry that I have just described. It instead takes the position of "Let a thousand flowers bloom" and advocates the use of the software The Geometer's Sketchpad to facilitate the process.

To pile the ridiculous on top of the sublime, page 42 advocates that "future teachers should also be exposed to twentieth-century developments in geometry." Just what do these authors have in mind? Chern's version of the Gauss-Bonnet theorem? The proof of the Calabi conjecture? Perhaps Gelfand-Fuks cohomology? Everybody wants to be current and hip. But we would be better off if our high school teachers were well versed in mathematics *up to and including the time of Weierstrass*—nothing more.

Let me stress that MET, at its outset, enunciates a number of lofty and commendable goals—eleven of them in fact. Some of these are:

1. Prospective teachers need mathematics courses that develop a deep understanding of the mathematics they will teach.
2. Along with building mathematical knowledge, mathematics courses for prospective teachers should develop the habits of mind of a mathematical thinker and demonstrate flexible, interactive styles of teaching.
3. The mathematical education of teachers should be seen as a partnership between mathematics faculty and mathematics education faculty.
4. Teachers need the opportunity to develop their understanding of mathematics and its teaching throughout their careers, through both self-directed and collegial study, and through formal coursework.

These goals are splendid, and their actualization is sure to improve the quality of mathematics teaching at every level in the K–12 curriculum. But the methods recommended in this report for actually implementing many of these goals are too vague and too much oriented towards self-esteem and empowerment to actually have the intended effect. As an instance, page 35 contains the admonition

> Prospective teachers need experience with designing simple experiments, collecting, displaying, and analyzing data, and using software that helps them understand how to display and interpret data. *Fathom* can be used to enhance teachers' learning; *Datascope* and *ProbSim* are available for Macs for use in the middle grades.

Is this useful teacher-training information? Do we need a nationally recognized and touted report to bring us to this level of understanding?

We also must bear in mind that there are significant societal factors that impact on, and often hinder, our efforts to improve school education. In the mid-nineteenth century most school teachers were not paid at all, at least not in hard currency. They were given food to eat by the local farmers, clothes to wear by the local seamstresses, and a place to sleep thanks to the largesse of some pigs and cows with a spare manger. The way that we train and compensate school teachers in 2001 is a throwback to a slightly more recent time when many teachers were unmarried women. The feeling was that they needed little more than a subsistence living; after a few years they would marry and that would be the end of that. Starting salaries for school teachers today have remained dreadful, and even the salaries of the most senior and experienced teachers are mediocre.

Perhaps most important of all is that teachers get so little parental and societal support. They are actually beleaguered in their efforts to teach anything of substance. Teachers are among the most important and influential members of our society, and I think that they should be paid as well as a dentist or an engineer. We should aid them in every way that we can. And paying our teachers properly would give us some clout: we could expect more of them, demand that they be better trained, and also attract much higher-quality people to the profession.

[1] *The Geometer's Sketchpad is a popular software product that allows the user to render pictures of triangles and rectangles and parallelograms and other geometric figures and to move them around and fit them together.*

Hyman Bass likes to point out that you do not learn gourmet cooking by eating out in fancy restaurants, you do not learn how to sing opera by attending performances at the Met, and you do not learn how to play tennis by watching the U.S. Open on TV. You learn by doing. You get an education by beating your head against the ideas. You develop your intellect by forcing your brain to do isometrics. And so we come to the use of the computer in education (Chapter 6 of MET). My view is that the computer should be used to illustrate and to reinforce ideas. It can also be used to try things. *A computer cannot teach* any more effectively than an oscilloscope can bring about world peace.

MET drops the ball on the crucial topic of computers in mathematics education. It once again extols the virtues of The Geometer's Sketchpad and like software packages. It takes an attitude of "Different strokes for different folks". This is a topic on which MET could really have provided some guidance. Instead, it presents a mere two pages of fluff. This treatment typifies an inbred flaw of any work like MET. It is the work of a committee rather than of an individual. It has no voice, and it has no soul. It is afraid to say anything and therefore errs on the side of vapidity. Or else it says nothing.

Chapter 7 provides a detailed treatment of the training of elementary school teachers. The authors of MET identify a number of desiderata for such a teacher:

1. understanding how place value permits efficient representation of number;
2. seeing how the operations of addition, multiplication, and exponentiation are used in representing numbers;
3. recognizing the relative magnitude of numbers;
4. recognizing how the base-10 structure of number is used in multidigit computations.

There are many more. And they are all worthwhile. Much of the chapter is devoted to detailed and lengthy vignettes of classroom scenes in which young children consider mathematical ideas (in fact all parts of the report are laced with these devices). One such vignette depicts a group of kids measuring each other's heights and manipulating the data. Another has students putting shirts into drawers. A third involves counting mouse legs [sic].

I must confess that, after the first two vignettes, I had had enough. I was no longer entertained, and I was not learning anything. I also fail to see what these stories have to do with teacher education. They may illustrate ways in which teachers put ideas before the class. But if I were writing a book or report about teacher education, I would concentrate my efforts on specific units of mathematics that teachers ought to know, how we can train the teachers to know them, and *how we can test and confirm that they actually master these ideas and can use them flexibly in the classroom.* The device of the vignette is indicative of a rather dreary nonspecificity, a lame attempt to entertain, and an almost deliberate fogginess that marks the entire approach of MET to the task of teacher training.

One good feature of MET is that it stresses the (potential) importance of the schools of education. These entities *must* coordinate more closely with the math departments at our colleges and universities, and vice versa. Mathematics departments and their high-flown denizens must take an active interest in educational issues, and they must play a genuine role in seeking solutions. It seems to me that the most important function of a school of education is to show its students precisely how their mathematical knowledge plays a role in teaching, how the ideas from different courses fit together, and how everything they know can be applied in the classroom. Surely a symbiosis with the local department of mathematics can only help in this process.

The most important contribution of the teaching reform movement is that it has sensitized us all to teaching issues. The report MET is a contribution to this new educational dialogue, and I am happy that it was written. However, I hope that it will be but one contribution of many yet to come. The authors of this volume have a certain *Gestalt* that is well worth considering. But theirs is not the final word. Although MET espouses the importance of content and of ideas, it does not provide much hard information about how to imbue our school-teachers-in-training with these ideas. The MET report frequently makes facile reference to Liping Ma's remarkable book *Knowing and Teaching Elementary Mathematics* [LMA]. But the authors of MET seem to have none of Ma's insight or grace, and they are unable to follow her model.

I hope that MET is widely distributed and will generate useful discussions. The goal should be that the next-generation work on this subject will be more specific, more candid, more realistic, and—in the end—more useful.

References

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Exploring Randomness and *The Unknowable*

Reviewed by Panu Raatikainen

Exploring Randomness
Gregory Chaitin
Springer-Verlag, 2000
ISBN 1-85233-417-7
176 pages, $34.95

The Unknowable
Gregory Chaitin
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ISBN 9-814-02172-5
122 pages, $29.00

In the early twentieth century two extremely influential research programs aimed to establish solid foundations for mathematics with the help of new formal logic. The logicism of Gottlob Frege and Bertrand Russell claimed that all mathematics can be shown to be reducible to logic. David Hilbert and his school in turn intended to demonstrate, using logical formalization, that the use of infinistic, set-theoretical methods in mathematics—viewed with suspicion by many—can never lead to finitistically meaningful but false statements and is thus safe. This came to be known as Hilbert's program.

These grand aims were shown to be impossible by applying the exact methods of logic to itself: the limitative results of Kurt Gödel, Alonzo Church, and Alan Turing in the 1930s revolutionized the whole understanding of logic and mathematics (the key papers are reprinted in [5]).

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What Gödel proved in 1931 is that in any finitely presented system of mathematical axioms there are sentences that are true but that cannot be proved to be true in the system. Church showed in 1936 that there is no general mechanical method for deciding whether a given sentence is logically valid or not and, similarly, that there is no method for deciding whether a given sentence is a theorem of a given axiomatized mathematical theory. Such an impossibility proof required an exact mathematical substitute for the informal, intuitive notion of a mechanical procedure; Church used his own λ-definable functions. Turing arrived independently at the same results at the same time. Moreover, he gave a superior philosophical explication of the concept of mechanical procedure in terms of abstract imaginary machines, known today as Turing machines; this advance made it possible to prove absolute unsolvability results and to develop Gödel's incompleteness theorem in its full generality. This identification of the intuitive notion of mechanical method and an exact mathematical notion is usually called Church's thesis or, more properly, the Church-Turing thesis. It is the fundamental basis of all proofs of absolute unsolvability.

One of the greatest achievements of modern mathematical logic was certainly the proof by Yuri Matiyasevich in 1970, based on earlier work by Julia Robinson, Martin Davis, and Hilary Putnam, that the tenth problem of Hilbert's famous list of open mathematical problems from 1900 is in fact unsolvable; i.e., there is no general method for deciding whether a given Diophantine equation has a solution or not [11]. This result implies that in any axiomatized theory there exist Diophantine

equations that have no solution but cannot be proved in the theory to have no solution.

However, it is now a widespread view, especially in computer science circles, that certain variants of incompleteness and unsolvability results by the American computer scientist Gregory Chaitin are the last word in this field. These variants are claimed to both explain the true reason for Gödel's incompleteness theorem and to be the ultimate, or the strongest possible, incompleteness results. Chaitin's results emerge from the theory of algorithmic complexity or program-size complexity (also known as "Kolmogorov complexity"); Chaitin himself was, in fact, one of the founders of the theory.

The classical work on unsolvability dealt solely with solvability in principle: one abstracted from the practical limits of space and time and required only finiteness. From the late 1950s onward, however, more and more attention has been paid to different kinds of complexity questions—at least in part because of the emergence of computing machines and the practical resource problems that accompanied them. In logic and computer science various different notions of complexity have been studied intensively. First, *computational complexity* measures the complexity of a problem in terms of resources, such as space and time, required to solve the problem relative to a given machine model of computation. Second, *descriptive complexity* analyzes the complexity of a problem in terms of logical resources, such as the number of variables, the kinds of quantifiers, or the length of a formula required to define the problem. And finally, by the *algorithmic complexity*, or the *program-size complexity* (or Kolmogorov complexity), of a number or a string, one means the size of the shortest program that computes as output that number or string.

Theory of Algorithmic Complexity

The basic idea of the theory of algorithmic complexity was suggested in the 1960s independently by Ray J. Solomonoff, Andrei N. Kolmogorov, and Gregory Chaitin. Solomonoff used it in his computational approach to scientific inference, Kolmogorov aimed initially to give a satisfactory definition for the problematic notion of a random sequence in probability theory, and Chaitin first studied the program-size complexity of Turing machines for its own sake. Kolmogorov went on to suggest that this notion also provides a good explication of the concept of the information content of a string of symbols. Later Chaitin followed him in this interpretation. Consequently, the name "algorithmic information content" has frequently been used for program-size complexity, and the whole field of study is very often called "algorithmic information theory" ([10] is a comprehensive survey of the theory and its applications).

Chaitin was active in developing this approach into a systematic theory (although one should not ignore the important contributions by many others). From the 1970s onwards Chaitin's interest has focused more and more on incompleteness and unsolvability phenomena related to the notion of program-size complexity. Indeed, he now says that "the most fundamental application" of the theory is in "the new light that it sheds on the incompleteness phenomenon" (*The Unknowable*, pp. 86–7).

It was known from the beginning that program-size complexity is unsolvable. Chaitin, however, made in the early 1970s an interesting observation: Although there are strings with arbitrarily large program-size complexity, for any mathematical axiom system there is a finite limit c such that in that system one cannot prove that any particular string has a program-size complexity larger than c [1]. Later Chaitin attempted to extend his "information-theoretic" approach to incompleteness theorems in order to obtain "the strongest possible version of Gödel's incompleteness theorem" ([3], p. v). For this purpose he has defined a specific infinite "random" sequence Ω.

As was noted, one of the major sources that originally motivated the development of the theory of program-size complexity, especially in Kolmogorov's case, was a problem in the theory of probability, viz. that of giving a precise and plausible definition for the notion of a random string. The problem is related to the paradox of randomness, which may be explained as follows: Assume we are given two binary strings of 20 digits each, and we are informed that they were both obtained by flipping a coin. Let these two strings be:

$$x = 00000000000000000000$$

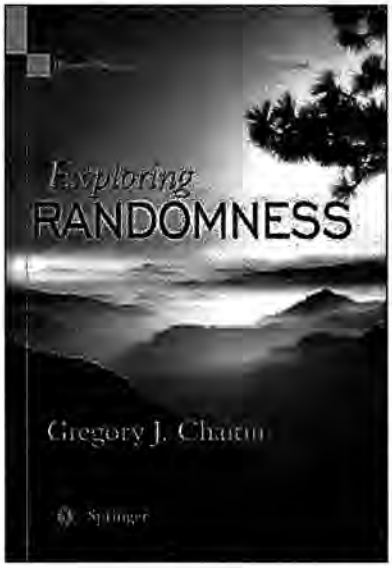
and

$$y = 01001110100111101000.$$

Now according to the standard theory of probability, these strings are equally probable. And yet intuitively one tends to think that x cannot possibly be a randomly generated string—there is too much regularity in it—whereas y appears to be genuinely irregular and random and may well be the result of a toss of a coin. The algorithmic theory of randomness explicates this idea of regularity with the help of Turing machine programs. One considers a finite string as regular, or nonrandom, if it can be generated by a simple program, i.e., if its program-size complexity is considerably smaller than its length. Accordingly, a finite string is defined to be random if its program-size complexity is roughly equal to its

length, i.e., if it cannot be compressed to a shorter program. (Note that this notion is relative to a chosen programming language or coding system; a finite string may be random in one but nonrandom in another.)

Extending this approach to infinite strings turned out to be, however, more difficult than was thought. Kolmogorov's first idea was that an infinite string be considered random if all of its finite initial segments are random. But Per Martin-Löf showed that this definition does not work and then gave a more satisfactory definition in measure-theoretic terms. In 1975 Chaitin presented a definition (which is equivalent to Martin-Löf's definition) in terms of program-size complexity: An infinite string is defined to be random if the program-size complexity of an initial segment of length n does not drop arbitrarily far below n [2]. One should add that it is not indisputable that this really provides in all respects an unproblematic explication of the notion of randomness.



Also in 1975 Chaitin presented for the first time his (since then much-advertised) number Ω: it is the halting probability of the universal Turing machine U, i.e., the probability that U halts when its binary input is chosen randomly bit by bit, such as by flipping a coin. The infinite string Ω is, according to the above definition, random [2]. Somewhat analogously to his earlier incompleteness result, Chaitin has demonstrated that no axiomatic mathematical theory enables one to determine infinitely many digits of Ω ([3], [4]; cf. [6], [8]).

Chaitin's New Approach via LISP Programs

This is the general theoretical background of the books under review. How do these two new books by Chaitin relate to these older works? In terms of results there is hardly anything new compared to the older work by Chaitin and others reviewed above. Rather, these books aim to popularize that work. In *The Unknowable* the emphasis is on the incompleteness phenomena related to program-size complexity. *Exploring Randomness* aims to explain the program-size complexity approach to randomness.

What is new is Chaitin's approach via LISP-programming; he has "translated" his own earlier work, which was in terms of abstract, idealized Turing machines, into actual programs in the LISP computer language. Well, not exactly: according to Chaitin, no existing programming language provides exactly what is needed, so he invented a new version of LISP. Chaitin begins *The Unknowable* by saying that what is new in the book is the following: "I compare and contrast Gödel's, Turing's and my work in a very simple and straightforward manner using LISP" (p. v). According to Chaitin this book is a "prequel" to his previous book, *The Limits of Mathematics* (Springer-Verlag, 1998), and is an easier introduction to his work on incompleteness. In *Exploring Randomness* Chaitin in turn writes that "[t]he purpose of this book is to show how to program the proofs of the main theorems about program-size complexity, so that we can see the algorithms in these proofs running on the computer" (p. 29).

Such an approach may be attractive for programming enthusiasts and engineers, but for the rest of us its value is less clear. It is quite doubtful whether it manages to increase the understanding of the basic notions and results and whether it really makes the fundamental issues, which are rather theoretical and conceptual, more accessible. All these can be, and have been, explained quite easily and elegantly in terms of simply describable Turing machines, and it is questionable that it is really easier to understand them by first learning Chaitin's specially modified LISP and then programming them. And after all, the key point here is that there is no program for deciding the basic properties—that they are not programmable. In *The Unknowable* (p. 27) Chaitin says that "[r]eaders who hate computer programming should skip directly to Chapter VI"—that is, should skip half of the book (and similarly with *Exploring Randomness*). What is left is two popular surveys of the field.

What is totally missing from Chaitin's accounts is the link between his particular programming language and the intuitive notion of mechanical procedure, that is, an analogue of the Church-Turing thesis. Turing's conceptual analysis of what a mechanical procedure is and the resulting Church-Turing thesis are indispensable for the proper understanding of the fundamental unsolvability results: only the thesis gives them their absolute character (in contradistinction to unsolvability by some fixed, restricted methods). Consequently, without some extra knowledge, the theoretical relevance of the limitations of the LISP programs that Chaitin demonstrates may remain unclear to the reader: one may wonder whether perhaps some other programming language would do better. This is a serious weakness of these presentations as first introductions to the unsolvability phenomena.

Problematic Philosophical Conclusions

The most controversial parts of Chaitin's work are certainly the highly ambitious philosophical conclusions he has drawn from his mathematical

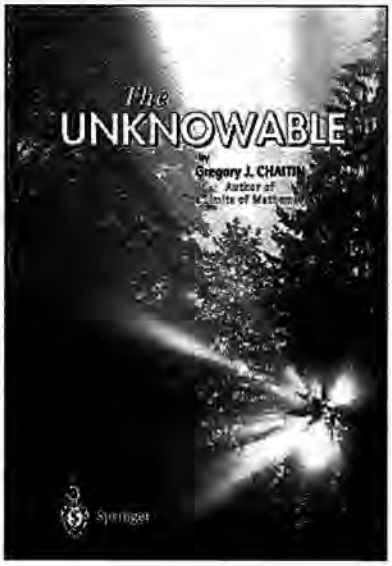
work. Recall that according to Chaitin the most fundamental application of the theory is in the new light that it sheds on the incompleteness phenomenon. He writes: "Gödel and Turing were only the tip of the iceberg. AIT [algorithmic information theory] provides a much deeper analysis of the limits of the formal axiomatic method. It provides a deeper source of incompleteness, a more natural explanation for the reason that no finite set of axioms is complete" (*Exploring Randomness*, p. 163).

But why does Chaitin think so? It is because he interprets his own variants of incompleteness theorems as follows: "The general flavor of my work is like this. You compare the complexity of the axioms with the complexity of the result you're trying to derive, and if the result is more complex than the axioms, then you can't get it from those axioms" (*The Unknowable*, p. 24). Or, in other words: "my approach makes incompleteness more natural, because you see how what you can do depends on the axioms. The more complex the axioms, the better you can do" (*The Unknowable*, p. 26).

But appearances notwithstanding, this is simply wrong. In fact, there is no direct dependence between the complexity of an axiom system and its power to prove theorems. On the one hand, there are extremely complex systems of axioms that are very weak and enable one to prove only trivial theorems. Consider, for example, an enormously complex finite collection of axioms with the form $n < n+1$; even the simple theory consisting of the single generalization "for all x, $x < x+1$" can prove more. On the other hand, there exist very simple and compact axiom systems that are sufficient for the development of all known mathematics (e.g., the axioms of set theory) and that can in particular decide many more cases of program-size complexity than some extremely complex but weak axiom systems (such as the one above). Moreover, it is possible for two theories to differ considerably in strength or complexity but nevertheless be able to decide exactly the same facts about program-size complexity and have the same Chaitinian finite limit c [12]. Analogously, Chaitin's claim with respect to Ω that "an N-bit formal axiomatic system can determine at most N bits of Ω" (*The Unknowable*, p. 90) is again not true for related reasons [13].

It has been shown conclusively (see [9], [12], [13]) that Chaitin's philosophical interpretations of his work are unfounded and false; they are based on various fatal confusions. And thus we have all the more reason for doubting the claim that his approach can explain the true source of the incompleteness and unsolvability theorems. As his philosophical interpretations fall, so does this claim. Chaitin's findings are not without interest, but their relevance for the foundations of mathematics has been greatly exaggerated.

Further, Chaitin has often stated that he has shown that mathematical truth is random: "But the bits of this number Ω, whether they're 0 or 1, are mathematical truths that are true by accident! ...they're true by no reason...there is no reason that individual bits are 0 or 1!" (*Exploring Randomness*, pp. 23–4) This is false too. The individual bits of Ω are 0 or 1 depending on whether certain Turing machines halt or not—that is the reason. It is an objective matter of fact; the truth here is completely determined, and Chaitin's interpretation of the situation is quite misleading.



Chaitin also claims that Ω is "maximally unknowable" and that in his setting one gets incompleteness and unsolvability "in the worst possible way" (*Exploring Randomness*, p. 19). But contrary to what Chaitin's own interpretations suggest, his results can in fact be derived as quite easy corollaries of Turing's classical unsolvability result and are not essentially stronger than it. Moreover, there are many incompleteness and unsolvability results in the literature of mathematical logic that are in various ways stronger than Chaitin's results; many of them also have a much more natural mathematical content [13].

Chaitin, however, seems to be quite indifferent to all such criticism. Instead of trying to seriously answer it in any way, he sweeps all such problems under the carpet with rather cheap rhetoric: "AIT is tremendously revolutionary; it is a major paradigm shift, which is why so many people find the philosophical conclusions that I draw from my theory to be either incomprehensible or unpalatable" (*Exploring Randomness*, p. 161). Or: "AIT is a drastic paradigm shift, and as such, obeys Max Planck's dictum that major new scientific ideas never convince their opponents, but instead are adopted naturally by a new generation that grows up with them and takes them for granted and that have no personal stake nor have built careers on older, obsolete viewpoints" (*Exploring Randomness*, p. 163).

But wouldn't it be conceivable that the true reason for some resistance is not dogmatic prejudice but that his conclusions are untenable because they are very weakly justified and even contradict various logico-mathematical facts? Creative and original as Chaitin has been, it is sometimes quite disturbing that he seems totally ignorant of large parts of mathematical logic relevant to the issues

he is dealing with. It is regrettable that Chaitin does not respond to criticism of his work but simply evades difficult questions and keeps on writing as if they did not exist. Chaitin's own attitude begins to resemble the dogmatism he accuses his opponents of.

At worst, Chaitin's claims are nearly megalomaniacal. What else can one think of statements such as the following?: "AIT will lead to the major breakthrough of 21st century mathematics, which will be information-theoretic and complexity based characterizations and analyses of what is life, what is mind, what is intelligence, what is consciousness, of why life has to appear spontaneously and then to evolve" (*Exploring Randomness*, p. 163).

Problems of Popularization

The historical surveys of the theory of program-size complexity that Chaitin gives are sometimes rather distorted. Some have even complained that Chaitin is "rewriting the history of the field" and "presenting himself as the sole inventor of its main concepts and results" [7]. This complaint also fits to a considerable degree the present books. They are quite idiosyncratic.

The style of these books is very loose and popular. Large parts of the text are directly transcribed from oral lectures and include asides like "Thanks very much, Manuel! It's a great pleasure to be here!" It is perhaps a matter of taste whether one finds this entertaining or annoying. Personally, I don't think that this is a proper style for books in a scientific series. It certainly does not decrease the sloppiness of the text.

The books bring together popular and introductory talks given on different occasions, and some of this material has already appeared elsewhere. There is also a lot of redundancy and overlap between the books. Both books (as well as the earlier *The Limits of Mathematics*) start with a loose and not very reliable historical survey—Chaitin himself calls it "a cartoon summary"—beginning with Cantor's set theory, going through Gödel's and Turing's path-breaking results, and culminating, unsurprisingly, in Chaitin's own work. All three books then present an introduction to LISP and Chaitin's modification of it. Both *The Unknowable* and *Exploring Randomness* contain a more theoretical section on algorithmic information theory and randomness. And finally, both books end with rather speculative remarks on the future of mathematics. Would it have been better to do some editing and publish just one book instead of three?

To a considerable degree, *Exploring Randomness* and *The Unknowable* just recycle the same old ideas. Consequently, for those with some knowledge of this field, these books do not offer anything really new. For those with no previous knowledge of these matters, it is questionable whether these books are really a good place to start.

(There is an errata for *Exploring Randomness* on Chaitin's home page: `http://www.cs.auckland.ac.nz/CDMTCS/chaitin/`).

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AMERICAN MATHEMATICAL SOCIETY

Electronic Research Announcements OF THE AMERICAN MATHEMATICAL SOCIETY

Volume 7, 2001 (Most Recent Articles)

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AMERICAN MATHEMATICAL SOCIETY

Mathematics People

Lempert and Webster Receive 2001 Bergman Prize

László Lempert and Sidney Webster have been awarded the 2001 Stefan Bergman Prize. Established in 1988, the prize recognizes mathematical accomplishments in the areas of research in which Stefan Bergman worked. For two years each awardee will receive half of the income from the prize fund. Currently this income is about $26,000 per year.

The previous Bergman Prize winners are: David W. Catlin (1989), Steven R. Bell and Ewa Ligocka (1991), Charles Fefferman (1992), Yum Tong Siu (1993), John Erik Fornæss (1994), Harold P. Boas and Emil J. Straube (1995), David E. Barrett and Michael Christ (1997), John P. D'Angelo (1999), and Masatake Kuranishi (2000). On the selection committee for the 2001 prize were Frederick Gehring, J. J. Kohn (chair), and Yum Tong Siu.

László Lempert

Sidney Webster

László Lempert

Citation

Lempert's work has contributed to both the geometric and analytic aspects of the subject, and his techniques include those from partial differential equations, complex analysis, real and complex geometry, and topology. One of his important contributions is his analysis of the complex Monge-Ampère equation. This fundamental equation is written in terms of holomorphic coordinates as

$$\det(u_{z_i \bar{z}_j}) = f.$$

It is an example of a fully nonlinear equation, and it arises in many geometrical situations such as the Calabi conjecture. The Dirichlet problem for this equation on domains in $\mathbf{C}^n$ is of special geometric significance when f vanishes near the boundary. In that case the equation is not elliptic and has defied any of the general methods that have been developed. Lempert has been able to treat such problems on convex domains; this work is a major contribution both to complex geometry and to nonlinear partial differential equations.

Lempert has introduced the notions of extremal and stationary analytic discs; these have become important tools in the study of analytic continuation. He has proved that the Carathéodory and Kobayashi distances coincide on convex domains.

Lempert's work also includes precise theorems on boundary regularity of biholomorphic mappings and several deep results on imbeddings of CR manifolds. He discovered new techniques in the study of CR manifolds and proved that a large class of 3-dimensional CR manifolds can be imbedded in some $\mathbf{C}^n$. Another striking result he obtained is that a compact strictly pseudoconvex real analytic hypersurface can be imbedded into the unit sphere of a Hilbert space.

Most recently his work has turned to infinite-dimensional holomorphy. He has made a systematic study of the Cauchy-Riemann equations and Dolbeault cohomology in the Banach space setting.

Biography

László Lempert was born in Budapest, Hungary, on June 4, 1952. He received the Diploma (1975), University Doctorate (1979), and Candidate of Sciences (1984) degrees, all from Eötvös University in Budapest. He was on the faculty there from 1977 until 1988, when he assumed his present position as professor of mathematics at Purdue University. He was a visiting research fellow at the Université de Paris VII (1979–80), a visiting lecturer at Princeton University (1984–85), and a visiting professor at Eötvös University (1994–95).

In 1981 Lempert received the Grünwald Prize of the Hungarian Mathematical Society, and in 1985 he received the Alexits Prize of the Hungarian Academy of Sciences. He was an invited speaker at the International Congress of Mathematicians in Berkeley in 1986.

Sidney Webster

Citation

One of Webster's seminal contributions bears directly on the Bergman kernel function. In 1974 Fefferman proved that a biholomorphic mapping between two strictly pseudoconvex domains extends to be a C^∞ mapping of the boundaries. Webster took the first crucial steps to extend this theorem to weakly pseudoconvex domains. He formulated three conditions related to the boundary behavior of the Bergman kernel of a smoothly bounded domain and proved that these conditions implied boundary smoothness. This work led to the results of Bell and Ligocka.

Webster is an expert on Chern-Moser invariants and has used them very effectively in his work on CR geometry. For example, Webster studied CR mappings between spheres in different dimensions. In this work he discovered that proper holomorphic mappings from the unit ball $\mathbf{B}_n$ to the unit ball $\mathbf{B}_{n+1}$ (where $n \geq 3$), when sufficiently smooth on the sphere, are conjugate via automorphisms to the imbedding $z \to (z, 0)$. Many authors have extended this work in diverse directions. Webster was also an early contributor to the study of biholomorphic mappings between algebraic hypersurfaces. He proved that biholomorphic mappings between ellipsoids must be linear.

Webster has made an impressive contribution to the understanding of the local embedding problem of strongly pseudoconvex CR manifolds; in particular he modified the Kuranishi method by using integral formulas for inverting the Cauchy-Riemann operator $\overline{\partial}$.

Biography

Sidney Webster was born on November 12, 1945, in Danville, Illinois. After a period of military service, he attended the University of California at Berkeley as an undergraduate and then as a graduate student, receiving the Ph.D. degree in 1975 under the direction of S. S. Chern. Webster spent five years at Princeton University and then went to the University of Minnesota. In 1989 he took his present position as professor of mathematics at the University of Chicago. He has held visiting positions at the Gesamthochschule Wuppertal in Germany, Rice University, and the Eidgenössische Technische Hochschule in Zürich. He was an Alfred P. Sloan Fellow in the early 1980s.

About the Prize

The Bergman Prize honors the memory of Stefan Bergman, best known for his research in several complex variables, as well as the Bergman projection and the Bergman kernel function that bear his name. A native of Poland, he taught at Stanford University for many years and died in 1977 at the age of eighty-two. He was an AMS member for thirty-five years. When his wife died, the terms of her will stipulated that funds should go toward a special prize in her husband's honor.

The AMS was asked by Wells Fargo Bank of California, the managers of the Bergman Trust, to assemble a committee to select recipients of the prize. In addition, the Society assisted Wells Fargo in interpreting the terms of the will to assure sufficient breadth in the mathematical areas in which the prize may be given. Awards are made every year, in the case of a single recipient, or every other year, in the case of two joint recipients who share the prize funds over two consecutive years. The Bergman Prize is given in the following areas: (1) the theory of the kernel function and its applications in real and complex analysis, and (2) function-theoretic methods in the theory of partial differential equations of elliptic type with attention to Bergman's operator method.

—Allyn Jackson

Peres Receives 2001 Loève Prize

YUVAL PERES of the University of California at Berkeley has been awarded the 2001 Line and Michel Loève International Prize in Probability. The prize, which carries a monetary award of $30,000, will be presented at Berkeley in fall 2001.

Biographical Sketch

Yuval Peres was born in Jerusalem in 1963. He obtained his Ph.D. in 1990 from the Hebrew University in Jerusalem, working under Hillel Furstenberg. In 1993 Peres was appointed to the faculty of the statistics department at UC Berkeley, where he is currently a professor in the mathematics and statistics departments.

The Work of Peres

Peres's research is extraordinarily prolific and mostly collaborative, encompassing a broad range of topics in theoretical probability with numerous coauthors. A central theme of his research might be called "probability on infinite discrete structures where geometry plays a role". This includes, for instance, the study of random percolation on infinite Cayley graphs, where (in contrast to the usual d-dimensional lattice setting) one has the possibility of coexistence of infinitely many infinite components. Infinite trees appear often in his work. An early result gave non-computational proofs of classical theorems of Kesten-Stigum and others for branching processes; subsequent work studied tree-indexed random walks and the speed of random walks on random trees. In recent years he has contributed to the study of uniform random spanning trees and forests in infinite graphs, which has emerged as a pivotal topic. This work has connections to random walks, algorithms, domino tilings, electrical networks, potential theory, amenability, percolation, and hyperbolic spaces. In another direction, a key breakthrough was the observation that certain (hard to prove) intersection properties for Brownian motion and random walks are in

fact equivalent to (easier to prove) survival properties of branching processes. This led ultimately to deep work on sample path properties of Brownian motion; for instance, on the fractal dimension of the frontier of 2-dimensional Brownian motion and precise study of its thick and thin points and cover times. Fractal dimension questions appear in other aspects of his work, on affine maps and expanding maps for instance.

Peres is widely acknowledged as leader of a diffuse group of younger and peer researchers; his work illustrates and delineates active and exciting areas where probability meets other areas of pure mathematics.

About the Prize

The prize commemorates Michel Loève, professor at the University of California at Berkeley from 1948 until his untimely death in 1979. The prize was established by his widow, Line Loève, shortly before her death in 1992. Awarded every two years, it is intended to recognize outstanding contributions by researchers in probability who are under forty-five years of age.

—David Aldous, Department of Statistics, UC Berkeley

Zhang Receives Third World Academy of Sciences Award

The Third World Academy of Sciences (TWAS) has presented its 2000 Award in Mathematics to WEIPING ZHANG of the Nankai Institute of Mathematics, Nankai University, Tianjin, China, for various contributions to index theory, including work on Ray-Singer analytic torsions and the geometric quantization conjecture, and for his recent work on the Kervaire semi-characteristic.

The TWAS annually awards five prizes of $10,000 each to scientists from developing countries who have made outstanding contributions to the advancement of basic sciences: biology, chemistry, mathematics, physics, and basic medical sciences.

—From a TWAS announcement

Wasilkowski Receives Information-Based Complexity Prize

GRZEGORZ W. WASILKOWSKI of the University of Kentucky has been awarded the Prize for Achievement in Information-Based Complexity for 2001. The prize consists of $3,000 and a plaque.

The Prize Committee consisted of Erich Novak, Sergei Pereverzev, Joseph F. Traub, and Henryk Wozniakowski.

—Joseph F. Traub, Columbia University

Witten and Smirnov Receive Clay Awards

The Clay Mathematics Institute has presented its Clay Research Awards for 2001 to EDWARD WITTEN of the Institute for Advanced Study and STANISLAV SMIRNOV of Yale University. According to the prize citations, Witten was selected for "a lifetime of achievement, especially for pointing the way to unify apparently disparate fields of mathematics and to discover their elegant simplicity through links with the physical world." Smirnov was chosen "for establishing the existence of the scaling limit of two-dimensional percolation and for verifying John Cardy's conjectured relation."

The awards were presented on July 13, 2001, at the closing ceremonies of the International Mathematical Olympiad in Washington, DC.

—From a Clay Institute announcement

LMS Prizes Awarded

The London Mathematical Society (LMS) has awarded a number of prizes for 2001.

J. A. (SANDY) GREEN received the De Morgan Medal for his fundamental contributions to group representation theory.

DEREK W. MOORE received the Senior Whitehead Prize for his leading role in the application of scientific computing and computational applied mathematics to the solution of problems in many areas of theoretical fluid mechanics.

MARCUS DU SAUTOY received the Berwick Prize for work that completely transformed the study of zeta functions associated to infinite groups.

Four Whitehead Prizes were awarded. JOHN R. KING was recognized for his contributions to applied mathematics, particularly through his work on nonlinear diffusion equations and free-boundary problems. MICHAEL MCQUILLAN was recognized for his work on diophantine and complex analytic geometry. ALEXEI N. SKOROBOGATOV was recognized for work that is based on algebraic geometry and ranges from number theory to combinatorics and the theory of error-correcting codes. VALERY SMYSHLYAEV was recognized for deploying his distinctive combination of powerful analytical technique and deep physical insight in applied mathematics.

—From the LMS Newsletter

NSF Postdoctoral Fellowships Awarded

The Mathematical Sciences Postdoctoral Research Fellowship program of the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) has announced the names of fellowship recipients for 2001. These fellowships are awarded each year for research in pure

mathematics, applied mathematics and operations research, and statistics. The following lists the names of the fellows, their Ph.D. institutions (in parentheses), and the institutions at which they will use their fellowships:

PRAMOD N. ACHAR (Massachusetts Institute of Technology) University of Chicago; DOROTHY E. BUCK (University of Texas, Austin) Mount Sinai School of Medicine, New York University; PETER P. CALABRESE (Cornell University) University of Southern California; ERIK D. DEMAINE (University of Waterloo) State University of New York, Stony Brook; ALEXANDER GAMBURD (Princeton University) Stanford University; FREDERIC G. GIBOU (University of California, Los Angeles) Stanford University; SEAN J. HALLGREN (University of California, Berkeley) California Institute of Technology; BENDEK B. HANSEN (University of California, Berkeley) University of Pennsylvania; ANTHONY A. HARKIN (Boston University) Harvard University; DAVID J. HEMMER (University of Chicago) Utah State University; PATRICIA L. HERSH (Massachusetts Institute of Technology) University of Michigan, Ann Arbor; BENJAMIN S. JOSEPH (Massachusetts Institute of Technology) University of Michigan, Ann Arbor; ADAM KALAI (Carnegie Mellon University) Massachusetts Institute of Technology; ANTON MALKIN (Yale University) Harvard University; WILLIAM R. MANN (Harvard University) University of Michigan, Ann Arbor; JAMES E. MIHALISIN (University of Washington) University of California, Berkeley; THOMAS A. NEVINS (University of Chicago) University of Michigan, Ann Arbor; MARTIN C. OLSSON (University of California, Berkeley) Massachusetts Institute of Technology; SCOTT T. PARSELL (University of Michigan, Ann Arbor) Pennsylvania State University; SEAN T. PAUL (Princeton University) Columbia University; ROBERT J. POLLACK (Harvard University) University of Washington; SEAN M. SATHER-WAGSTAFF (University of Utah) University of Illinois, Urbana-Champaign; SAUL D. SCHLEIMER (University of California, Berkeley) University of Illinois, Chicago; ROBERT R. SCHNEIDERMAN (University of California, Berkeley) University of California, San Diego; JASON R. SCHWEINSBERG (University of California, Berkeley) Cornell University; ROCCO A. SERVEDIO (Harvard University) Harvard University; ROMYAR T. SHARIFI (University of Chicago) Harvard University; SHANNON L. STARR (University of California, Davis) Princeton University; ALEXANDER B. VLADIMIRSKY (University of California, Berkeley) Cornell University; MAXIM VYBORNOV (Yale University) University of Massachusetts, Amherst; JESSICA M. YOUNG (Massachusetts Institute of Technology) Massachusetts Institute of Technology; and WENDY W. ZHANG (Harvard University) University of Chicago.

—From an NSF announcement

China Finishes First in International Mathematical Olympiad

The team from China has won six gold medals at the 42nd International Mathematical Olympiad (IMO), held in Washington, DC, July 1–14, 2001. Russia finished with five gold and one silver medal, and the United States followed closely with four gold and two silver medals.

The six members of the U.S. team, all high school students, were REID BARTON (Arlington, Massachusetts), gold medalist; GABRIEL CARROLL (Oakland, California), gold medalist; IAN LE (Princeton Junction, New Jersey), gold medalist; TIANKAI LIU (San Jose, California), gold medalist; OAZ NIR, (Cupertino, California), silver medalist; and DONG SHIN (West Orange, New Jersey), silver medalist. Barton, the first contestant with four IMO gold medals, and Carroll both received perfect scores on this year's exam.

The team was chosen on the basis of the students' performance in the 30th USA Mathematical Olympiad. The students attended a four-week Mathematical Olympiad Summer Program at Georgetown University in Washington, DC, over the past summer under the leadership of Titu Andreescu (Illinois Mathematics and Science Academy), director of the American Mathematics Competitions. The USA Mathematical Olympiad is a program of the Mathematical Association of America. More information is available on the official scoring site of the IMO at `http://imo.wolfram.com/`.

The four who had perfect scores—Liang Xiao and Zhiqiang Zhang from China, and Reid Barton and Gabriel Carroll from the United States—received the CMI-IMO Award from the Clay Mathematics Institute. The award consists of a state-of-the-art notebook computer.

—Elaine Kehoe

American Academy of Arts and Sciences Elections

Six mathematicians have been elected to membership in the American Academy of Arts and Sciences in 2001. They are: DEMETRIOS CHRISTODOULOU (Princeton University), CONSTANTINE M. DAFERMOS (Brown University), RONALD A. DEVORE (University of South Carolina), ANDREI A. SUSLIN (Northwestern University), MARGARET H. WRIGHT (Bell Laboratories-Lucent Technologies), and HORNG-TZER YAU (New York University). OLGA A. LADYZHENSKAYA (Steklov Institute, Russia) was elected a foreign honorary member.

The American Academy of Arts and Sciences was founded in 1780 to foster the development of knowledge as a means of promoting the public interest and social progress. The membership of the academy is elected and represents distinction and achievement in a range of intellectual disciplines: mathematical and physical sciences, biological sciences, social arts and sciences, and humanities and fine arts.

—From an American Academy announcement

Mathematics Opportunities

NSF Competition in Mathematical Biology

The Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) is now soliciting proposals for a competition in mathematical biology. This competition is being held jointly with the National Institute for General Medical Sciences at the National Institutes of Health (NIH). The competition is designed to support research on mathematical problems related to biological research. A direct relationship between a biological application and mathematics is expected. Research teams that include scientists from both the life sciences community and the mathematical sciences community are encouraged to submit proposals. Both new and existing collaborations will be supported. Individual investigators who have expertise in both areas may also submit proposals.

The full program announcement is available at `http://www.nsf.gov/cgi-bin/getpub?nsf01128/`. The deadline for submission of proposals is **October 5, 2001**.

—From an NSF announcement

ONR Young Investigator Program

The Office of Naval Research (ONR) sponsors a Young Investigator Program to support academic scientists and engineers who have recently received Ph.D. or equivalent degrees and who show exceptional promise for doing creative research.

During fiscal year 2002 it is expected that at least twenty-four awards will be made for proposals within an area of naval research interest. The basic award is $100,000 per year for three years, and additional funds may be provided based on need. The program is open to United States citizens, nationals (native residents of a U.S. possession), and permanent residents who hold tenure-track or permanent faculty positions at U.S. universities. Applicants must have received their graduate degrees on or after November 1, 1996.

Proposals in mathematical, computer, and information sciences should be sent to: Andre M. Van Tilborg, Director, Mathematical, Computer, and Information Sciences Division, Office of Naval Research, 800 N. Quincy Street, Arlington, VA 22217-5660; telephone 703-696-4312; e-mail: `vantila@onr.navy.mil`. Proposals must be received by 4:00 p.m. on **November 1, 2001**. For further information and instructions for proposal preparation, see the ONR website, `http://www.onr.navy.mil/sci_tech/special/complete.htm`.

—From an ONR announcement

NSF International Research Fellow Awards

The International Research Fellow Awards Program of the National Science Foundation provides support for postdoctoral and junior investigators to do research in basic science and engineering for 3 to 24 months in any country in the world. The goal of the program is to establish productive, long-term relationships between U.S. and foreign science and engineering communities. Applicants must be U.S. citizens or permanent residents who have earned their doctoral degrees within six years before the date of application or who expect to receive their degrees by the date of award.

The deadline for applying is **October 22, 2001**. For further information contact the program officer, Susan Parris, 703-292-8711, `sparris@nsf.gov`; or visit the website `http://www.nsf.gov/sbe/int/fellows/start.htm`.

—From an NSF announcement

Grants to Support Attendance at ICM2002

Mathematicians from developing countries and mathematicians residing in Eastern European countries and independent states of the former Soviet Union are eligible to apply for support to attend the International Congress of Mathematicians (ICM) 2002 in Beijing, China, August 20–28, 2002.

To secure participation of as many people as possible, support is available only for local costs (registration and lodging) in Beijing. Travel grants are not available. Those applying are expected to cover travel expenses from other sources. The grants are provided by the Chinese Mathematical Society and the ICM-2002 Organizing Committee.

The deadline for submission of applications is **January 1, 2002**. Decisions will be announced immediately after May 1, 2002. More information and application forms can be found on the World Wide Web at http://www.icm2002.org.cn/. Or write to: Shanzhen Lu, Department of Mathematics, Beijing Normal University, 100875 Beijing, China; e-mail: icm@bnu.edu.cn.

—From an ICM-2002 announcement

Call for Applications for AMS Epsilon Fund

The AMS Epsilon Fund awards grants to summer mathematics programs that support and nurture mathematically talented high school students in the United States. The deadline for application for funding for summer 2002 programs is **December 15, 2001**. Application materials are available at http://www.ams.org/careers-edu/epsilon.html or by mail: Professional Services Department, AMS, 201 Charles Street, Providence, RI 02904; telephone 800-321-4267, ext. 4105; e-mail: prof-serv@ams.org.

—Diane M. Boumenot, AMS Professional Services Department

Humboldt Foundation Offers Fellowships

The Alexander von Humboldt Foundation awards annual fellowships to foreign scholars holding doctorates to support research projects of their own choosing in Germany. The fellowships are offered for research visits of between six and twelve months.

Applicants from all countries and in all academic disciplines may apply. The fellowships are awarded to scholars under forty years of age. Approximately 500 research fellowships are available each year. Decisions are based primarily on the quality and feasibility of the proposed research projects and on the applicants' international publications.

For more information on application requirements and procedure, consult the Foundation's website at http://www.avh.de/en/programme/stip_aus/index.htm.

—From a Humboldt Foundation announcement

Call for Nominations for Waterman Award

Congress established the Alan T. Waterman Award in August 1975 to mark the twenty-fifth anniversary of the National Science Foundation (NSF) and to honor its first director. The annual award recognizes an outstanding young researcher in any field of science or engineering supported by the NSF. In addition to a medal the awardee receives a grant of $500,000 over a three-year period for scientific research or advanced study in the mathematical, physical, medical, biological, engineering, social, or other sciences at the institution of the recipient's choice.

Candidates must be U.S. citizens or permanent residents and must be thirty-five years of age or younger or not more than seven years beyond receipt of the Ph.D. degree by December 31 of the year in which they are nominated. Candidates should have demonstrated exceptional individual achievements in scientific or engineering research of sufficient quality to place them at the forefront of their peers. Criteria include originality, innovation, and significant impact on the field.

Nominations for the award and supporting references must be postmarked by **December 31, 2001**. For more detailed information concerning the nomination procedures or to receive a nomination form, contact Susan E. Fannoney, telephone: 703-292-8096, or e-mail: sfannone@nsf.gov.

—From an NSF announcement

Call for Nominations for TWAS Awards

The Third World Academy of Sciences (TWAS) Awards in Basic Sciences were instituted in 1985 to recognize and support outstanding achievements made by scientists from developing countries. Five awards are given each year in the fields of mathematics, basic medical sciences, biology, chemistry, and physics. Each award consists of a prize of US$10,000 and a plaque. Candidates for the awards must be nationals of developing countries and, as a rule, must be living and working in those countries.

Nominations for the 2002 awards are due on **March 1, 2002**. Completed nomination forms should be sent to: Helen Grant, TWAS Awards, Third World Academy of Sciences (TWAS), c/o The Abdus Salam International Centre for Theoretical Physics (ICTP), 34014 Trieste, Italy; fax: +39-040-224559. Further information is available on the World Wide Web at http://www.ictp.trieste.it/~twas/Awards_Info.html.

—From a TWAS announcement

News from MSRI

The Mathematical Sciences Research Institute (MSRI) has announced its programs for fall and spring 2001–02. Following are dates, titles, brief descriptions, and names of organizers of the programs.

August 13–December 14, 2001: Integral Geometry. This program will cover recent advances in integral geometry, with a focus on the interrelationships between integral geometry and the theory of representations (Penrose transform in flag domains, horospherical transforms), complex geometry, symplectic geometry, algebraic analysis, and

nonlinear differential equations. An introductory workshop in inverse problems and integral geometry will be held August 13–24. Organizers: L. Barchini, S. Gindikin, A. Goncharov, and J. Wolf.

August 13–December 14, 2001: Inverse Problems. The main topics of this program will be developments in inverse boundary value problems and inverse scattering problems. An introductory workshop in inverse problems and integral geometry will be held August 13–24. Organizers: D. Colton, J. McLaughlin, W. Symes, and G. Uhlmann.

January 7–May 17, 2002: Infinite-Dimensional Algebras and Mathematical Physics. This program will discuss recent progress in the representation theory of infinite-dimensional algebras and superalgebras and their applications to other fields. Organizers: E. Frenkel, V. Kac, I. Penkov, V. Serganova, and G. Zuckerman.

January 7–May 17, 2002: Algebraic Stacks, Intersection Theory, and Non-Abelian Hodge Theory. Algebraic stacks originally arose as solutions to moduli problems in which they were used to parametrize geometric objects in families. They have also arisen in studying homological properties of quotient singularities, non-Abelian Hodge theory, string theory, and so forth. This program will focus on intersection theory on stacks, non-Abelian Hodge theory and geometric n-stacks, perverse sheaves on stacks and the geometric Langlands program, D-brane charges in string theory, and moduli of gerbes and mirror symmetry. Organizers: W. Fulton, L. Katzarkov, M. Kontsevich, Y. Manin, R. Pandharipande, T. Pantev, C. Simpson, and A. Vistoli.

In addition to these programs MSRI has three award programs that offer support for work in mathematics at MSRI. Research Professorships provide partial salary support for at least three months and are intended for mathematicians with Ph.D.'s awarded in 1996 or earlier. Deadline for application is **September 28, 2001**. Postdoctoral Fellowships provide support for five or ten months for mathematicians with Ph.D.'s awarded in 1997 or later. There will be several one-semester awards for participants in half-year programs; this could be extended to a full year in special cases. Deadline for application is **November 16, 2001**. General Memberships provide partial support toward living and travel expenses. It is generally expected that general members will obtain partial or full support from other sources. Deadline for application is **November 16, 2001**.

Further information on these programs and application forms are available at `http://www.msri.org/` or from MSRI, 1000 Centennial Drive, Berkeley, CA 94720-5070.

—From an MSRI announcement

Mathematics Research Center Launched at Banff

The Banff International Research Station (BIRS) for Mathematical Innovation and Discovery is a cooperative venture of the United States and Canada to provide a conference center for mathematics similar to the ones in Oberwolfach, Germany, and in Luminy, France. The first meetings at BIRS will be held in 2003.

BIRS is located in a self-contained facility on the site of the Banff Centre, an international learning center dedicated to the arts, leadership development, and mountain culture, and located in Banff, Alberta, Canada. The objective of BIRS is to support research and innovation, dissemination, and educational activities in all areas of science and technology involved with the mathematical and statistical sciences. BIRS programs will include: 5-day workshops for up to 40 participants (and perhaps a few smaller workshops with up to 20 people); 2-day meetings for up to 40 people; "Research in Teams" and "Focused Research Groups", in which groups work together at BIRS for 2-4 weeks; and "Summer Schools and Training Camps" serving any educational level.

The U.S. participation in BIRS is led by the Mathematical Sciences Research Institute in Berkeley, and the Canadian participation is led by the Pacific Institute of Mathematical Sciences in Vancouver. Funding for BIRS will be provided by the Natural Science and Engineering Research Council of Canada, the U.S. National Science Foundation, and the Alberta Science Research Authority.

The 2003 operating year for BIRS will run from March to December, 2003. The deadline for proposals for 5-day workshops and summer schools is **October 1, 2001**. Proposals for research groups and teams and for 2-day meetings are also requested by October 1, 2001, but BIRS will consider proposals that arrive after that date, on a space-available basis.

For further information, visit the web site `http://www.pims.math.ca/birs/`.

—Allyn Jackson

Correction: NSA Grants

The September issue of the *Notices* carried an announcement about submitting grant proposals to the Mathematical Sciences Program of the National Security Agency (NSA). The announcement stated incorrectly that proposals for small grants for conferences, workshops, and special academic endeavors may be submitted at any time. These proposals, like all other proposals to the NSA program, must be submitted by the **October 15** deadline and will be funded the following fall.

Further information about the NSA Mathematical Sciences Program may be obtained from the NSA's web site, `http://www.nsa.gov/programs/msp/grants.html`. The telephone number is 301-688-0400, the e-mail address is `msp@math.umbc.edu`, and the postal address is: Mathematical Sciences Program, National Security Agency, Suite 6557, Ft. George G. Meade, MD 20755-6557.

—Allyn Jackson

For Your Information

Board on Mathematical Sciences Chairs' Colloquium

Department heads from the mathematical sciences are invited to attend the 16th Annual Chairs' Colloquium, sponsored by the Board on Mathematical Sciences of the National Research Council, November 9–10, 2001. The colloquium will be held at the National Academy of Sciences in Washington, DC. As in past years this meeting provides an opportunity for chairs of college and university mathematics and statistics departments to share experiences and ideas for addressing challenges, and for them to learn more about federal programs and policies that affect their departments.

Bruce Alberts, president of the National Academy of Sciences and a leader in both science and education policy, will give the keynote address on the morning of November 10. The remainder of the meeting includes a mix of plenary and break-out sessions aimed at sharing insights on a variety of topics, including: departmental management issues, assessment of student learning, increasing the number of undergraduate majors, professional development for graduate students and junior faculty, maintaining a commitment to core mathematics in an applied world, selected research opportunities from the biomedical sciences, overviews of some specific departmental innovations, working with the demands of an engineering school, working with the demands of a school of education, fundraising for your department, and comparisons of K–12 teacher training in Japan and the U.S.

As is traditional at the Chairs' Colloquia, there will be one plenary lecture on a scientific subject. This year Charles Peskin of New York University will speak about mathematical modeling of the human heart. There will also be a panel discussion of grant opportunities from federal agencies and foundations, and program officers from those organizations have been asked to attend at least a full afternoon of the colloquium to enable more off-line conversations.

The program committee for this year's colloquium consists of Deanna Caveny of the College of Charleston (chair), Jim Calvin of Texas A&M University, and Patrick Fitzpatrick of the University of Maryland.

A brochure with registration form was mailed in August 2001 to each four-year U.S. mathematics and statistics department. The agenda and a registration form (which must be mailed in) are available online at `www.nas.edu/bms/`. The registration fee for the colloquium is $185. For further information contact the Board on Mathematical Sciences at 202-334-2421 or at `bms@nas.edu`.

—BMS announcement

Inside the AMS

Fan and Caldwell Scholarships Awarded

The AMS awarded six scholarships to students attending programs for mathematically talented high school students held in summer 2001. Five Ky and Yu-Fen Fan Scholarships and one Roderick P. C. Caldwell Scholarship were awarded. The scholarships are intended to cover the tuition for the programs.

The names of the students receiving Fan Scholarships, their high schools, their hometowns, and the programs they attended (in parentheses) are: DINA SHAPIRO, Milton High School, Milton, Massachusetts (PROMYS at Boston University); BETTY LUAN, Stuyvesant High School, Woodhaven, New York (Hampshire College Summer Studies in Math); EKIN KOSEOGLU, American Robert College, Istanbul, Turkey (Mathcamp 2001); EVELINA SHPOLYANSKAYA, Bronx High School of Science, Bronx, New York (Ross Summer Mathematics Program, Ohio State University); and ERIC KIEFT, Rockford High School, Rockford, Michigan (Michigan Math and Science Scholars, University of Michigan, Ann Arbor). Receiving the Caldwell Scholarship was SVETLANA YEGOROVA, Ann Arbor, Michigan (Michigan Math and Science Scholars, University of Michigan, Ann Arbor).

In the fall of 1999, Ky Fan and his wife, Yu-Fen Fan, made a gift of approximately $1 million to the AMS. The funds were used to establish the Ky and Yu-Fen Fan Endowment. Income from the endowment supports mathematics in China and mathematically talented high school students in the U.S.

Ky Fan is an emeritus professor of mathematics at the University of California, Santa Barbara. Born on September 19, 1914, in Hangchow, China, he received his B.S. degree from Peking University (1936) and his D.Sc. degree from the University of Paris (1941). He was a member of the Institute for Advanced Study in Princeton from 1945 to 1947 and held positions at the University of Notre Dame, Wayne State University, and Northwestern University before going to Santa Barbara in 1965. Elected a member of the Academia Sinica in 1964, Fan served as the director of the Institute of Mathematics there from 1978 to 1984. The author of approximately 130 papers, Fan made fundamental contributions to operator and matrix theory, convex analysis and inequalities, linear and nonlinear programming, topology and fixed point theory, and topological groups. His work in fixed point theory, in addition to influencing nonlinear functional analysis, has found wide application in mathematical economics and game theory, potential theory, calculus of variations, and differential equations.

In December 1999 Winifred A. Caldwell endowed the Roderick P. C. Caldwell Scholarship within the AMS Epsilon Fund. The scholarship will be given each year to support at least one student of demonstrated needs to participate in a program for mathematically talented high school students.

Roderick P. C. Caldwell was professor of mathematics at the University of Rhode Island for over twenty-two years. A graduate of Harvard University, he received his master's and doctoral degrees from the University of Illinois. After his retirement Caldwell continued teaching for several years and contributed his salary to establish an endowment within the URI Foundation for needy and promising URI mathematics students. His students particularly appreciated the fact that he shared with them his personal library, which contained many rare mathematical books. Winifred A. Caldwell endowed the scholarship to keep alive her husband's wish to instill a love of mathematics in his students.

—Allyn Jackson

MathJobs.Org: Job Application Database for Mathematics

The AMS has undertaken a project to make more widely available a high-quality job application database system developed by the mathematics department at Duke University. The system, called MathJobs.Org, provides the capacity to carry out every step of the employment application process in a paperless, online environment. The system can be used by job seekers and mathematics departments alike.

For the past few years Yunliang Yu, senior systems programmer in the mathematics department at Duke University, developed and refined the system for the department. After using it successfully for a year, the department shared the system with around twenty other mathematics departments in the U.S. It was clear that MathJobs.Org could be used even more widely, so Duke asked the AMS to become a sponsor of the system. As a first step the Society is encouraging mathematics departments and applicants to use the system for postdoctoral positions to be filled in the 2001–02 hiring season.

For job seekers MathJobs.Org is simple and easy to use but sophisticated enough to offer adaptability and privacy. To register in the system, a job seeker must submit an online version of the AMS Standard Cover Sheet (this form appears in every issue of the *Notices*). After receiving a password, the job seeker can create a personal portfolio on the system by uploading cover letters, résumés, teaching and research statements, lists of publications, etc. The system accepts a wide variety of document formats (PDF, Word, PostScript, DVI, GIF, JPEG, LaTeX, and TeX, among others) and converts the documents into PDF files, which the job seeker can view to check the conversion.

A job seeker can browse through listings of open positions and create tailored applications by selecting the appropriate documents from his or her portfolio. The applications can then be submitted directly on the system. When applying for a specific job, the job seeker can indicate the names of people who will be asked to write letters of reference. The system automatically sends an e-mail message to each referee, confirming that he or she has been asked to write a letter and providing a password to enter the system to submit the letter.

MathJobs.Org offers an option whereby a job seeker can make his or her cover sheet data available in a "job wanted" area, where employers can browse for potential applicants. But otherwise the job seeker controls access to the documents in his or her portfolio. Those documents can be made available only by the job seeker and only in response to specific job advertisements.

For employers the system offers a flexible and efficient way to organize the application process. To register to use the system, a department must designate one individual as the departmental administator. The administrator then registers other members in the department as needed and assigns them passwords. The administrator has the capacity to control which departmental users can view which parts of the applicant database.

For each department advertising jobs, the system automatically prepares a table listing all applicants for those jobs. This table indicates the date when each application was received, when it was last updated, basic information about the applicant's educational background and research area, and the position he or she is applying for. Clicking on an applicant's name brings one to a page providing further details, such as the applicant's contact information and the list of referees asked to write about the applicant. Check boxes indicate whether various items, such as reference letters or curriculum vitae, have been received or not, and there is an area where departmental users can enter notes about the applicant. Equal Employment Opportunity forms can also be submitted through MathJobs.Org, and the system can automatically generate a report about the pool of applicants. Departments can use the system to automatically send e-mail messages to applicants to inform them of the progress of the search process. MathJobs.Org can manage the entire job application process without paper, but it also offers many useful and timesaving features when used in conjunction with a paper folder system.

The AMS believes that the power, flexibility, and security of this system could greatly increase the efficiency of the job application process. Information about the system will initially be sent to all Ph.D.-granting departments in the U.S. Those interested in trying out the system can use a demo available at the website `http://www.mathjobs.org/`. Further information is available through the AMS Professional Services Department, AMS, 201 Charles Street, Providence, RI 02904; telephone 800-321-4267, ext. 4105; e-mail: `prof-serv@ams.org`.

—Allyn Jackson

Deaths of AMS Members

OSCAR R. AINSWORTH, professor emeritus, University of Alabama, Tuscaloosa, died on June 1, 2001. Born on July 28, 1922, he was a member of the Society for 50 years.

EBON E. BETZ, of Annapolis, MD, died on October 14, 2000. Born on September 3, 1914, he was a member of the Society for 63 years.

GEORGE COPP, professor emeritus, University of North Texas at Denton, died on May 28, 2001. Born on October 11, 1912, he was a member of the Society for 52 years.

DUANE E. DEAL, associate professor emeritus, Ball State University, Muncie, IN, died on May 20, 2001. Born on May 17, 1924, he was a member of the Society for 39 years.

WILLIAM DURFEE, professor emeritus, Mt. Holyoke College, South Hadley, MA, died on April 18, 2001. Born on April 12, 1915, he was a member of the Society for 59 years.

SAMUEL I. GOLDBERG, professor, University of Illinois, Urbana-Champaign, died on March 22, 2001. Born on August 15, 1923, he was a member of the Society for 49 years.

ROBERT GRAY, aerospace engineer, USAF, Wright-Patterson AFB, OH, died on April 14, 2001. Born on December 7, 1941, he was a member of the Society for 26 years.

CARROLL GUILLORY, associate professor, University of Louisiana at Lafayette, died on March 18, 2001. Born on July 17, 1945, he was a member of the Society for 21 years.

JOHN G. MEILER, of Cleveland, TN, died on October 10, 2000. Born on January 8, 1904, he was a member of the Society for 51 years.

ERHARD MEISTER, professor, Tech. Universität Darmstadt, Germany, died on July 5, 2001. Born on February 12, 1930, he was a member of the Society for 37 years.

CALVIN H. WILCOX, professor emeritus, Salt Lake City, UT, died on June 7, 2001. Born on January 29, 1924, he was a member of the Society for 49 years.

Reference and Book List

*The **Reference** section of the* Notices *is intended to provide the reader with frequently sought information in an easily accessible manner. New information is printed as it becomes available and is referenced after the first printing. As soon as information is updated or otherwise changed, it will be noted in this section.*

Contacting the *Notices*

The preferred method for contacting the *Notices* is electronic mail. The editor is the person to whom to send articles and letters for consideration. Articles include feature articles, memorial articles, communications, opinion pieces, and book reviews. The editor is also the person to whom to send news of unusual interest about other people's mathematics research.

The managing editor is the person to whom to send items for "Mathematics People", "Mathematics Opportunities", "For Your Information", "Reference and Book List", and "Mathematics Calendar". Requests for permissions, as well as all other inquiries, go to the managing editor.

The electronic-mail addresses are notices@math.tamu.edu in the case of the editor and notices@ams.org in the case of the managing editor. The fax numbers are 979-845-6028 for the editor and 401-331-3842 for the managing editor. Postal addresses may be found in the masthead.

Upcoming Deadlines

September 1, 2001: Applications for AWM Workshops for Women Graduate Students and Postdocs. See http://www.awm-math.org/, or contact Workshop Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; telephone 301-405-7892; e-mail: awm@math.umd.edu.

September 15, 2001: Nominations for Alfred P. Sloan Research Fellowships. Contact Sloan Research Fellowships, Alfred P. Sloan Foundation, 630 Fifth Avenue, Suite 2550, New York, NY 10111; or see http://www.sloan.org/.

September 28, 2001: Applications for MSRI Research Professorships. See "Mathematics Opportunities" in this issue.

Where to Find It

A brief index to information that appears in this and previous issues of the *Notices*.

October 1, 2001: Nominations for the Louise Hay and Alice T. Schafer awards of the AWM. Contact Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; telephone 301-405-7892; e-mail: awm@math.umd.edu; World Wide Web http://www.awm-math.org/.

October 1, 2001: Nominations for the Emanuel and Carol Parzen Prize. Submit nominations to J. H. Matis, Department of Statistics, Texas A&M University, College Station, TX 77873-3143.

October 1, 2001: Applications for NSF/AWM Travel Grants for Women. See http://www.awm-math.org/travelgrants.html; telephone 301-405-7892; e-mail: awm@math.umd.edu.

October 1, 2001: Proposals for 2003 5-day workshops and summer schools for the Banff International Research Station (BIRS). See "Mathematics Opportunities" in this issue.

October 5, 2001: Proposals for the NSF Competition in Mathematical Biology. See "Mathematics Opportunities" in this issue.

October 15, 2001: Applications for NSA Grant and Sabbatical Programs. See http://www.nsa.gov/programs/msp/grants.html, or write to: NSA Mathematical Sciences Program, National Security Agency, ATTN:R51A, Ft. George G. Meade, MD 20755-6000.

October 17, 2001: Applications for NSF Postdoctoral Research Fellowships. See http://www.fastlane.nsf.gov/.

October 22, 2001: Applications for NSF International Research Fellow Awards. See "Mathematics Opportunities" in this issue.

October 31, 2001: Applications for AMS Travel Grants for ICM 2002. See http://www.ams.org/careers-edu/icmapp.html; e-mail: ICM02@ams.org; telephone 800-321-4267, ext. 4105, or 401-455-4105.

November 1, 2001: Proposals for ONR Young Investigator Program. See "Mathematics Opportunities" in this issue.

November 1, 2001: Applications for Fulbright Scholar international education and academic administrator seminars. Contact the Council for International Exchange of Scholars (CIES), 3007 Tilden Street, NW, Suite 5L, Washington, DC 20008-3009; telephone 202-686-7877; World Wide Web http://www.cies.org/cies/pr_competit_02.htm.

November 16, 2001: Applications for MSRI Postdoctoral Fellowships and General Memberships. See "Mathematics Opportunities" in this issue.

December 15, 2001: Applications for AMS Epsilon Fund. See "Mathematics Opportunities" in this issue.

December 31, 2001: Nominations for NSF Alan T. Waterman Award. See "Mathematics Opportunities" in this issue.

December 31, 2001: Submissions for undergraduate paper contest in *Cryptologia*. See http://www.dean.usma.edu/math/resource/pubs/crypto/index.htm.

January 1, 2002: Applications for grants for ICM 2002, from the Chinese Mathematical Society and the ICM 2002 Organizing Committee. See "Mathematics Opportunities" in this issue.

January 31, 2002: Applications for IMU travel grants for ICM 2002. See http://elib.zib.de/IMU/.

February 1, May 1, October 1, 2002: Applications for NSF/AWM Travel Grants for Women. See http://www.awm-math.org/travelgrants.html; telephone 301-405-7892; e-mail: awm@math.umd.edu.

February 1, 2002: Applications for NSF/AWM Mentoring Travel Grants. See http://www.awm-math.org/travelgrants.html; telephone 301-405-7892; e-mail: awm@math.umd.edu.

March 1, 2002: Nominations for Third World Academy of Sciences (TWAS) Awards in Basic Sciences. See "Mathematics Opportunities" in this issue.

DoD Mathematics Staff

Five agencies of the Department of Defense fund research in the mathematical sciences. The names, addresses, and telephone numbers of the pertinent staff members are listed below.

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http://www.darpa.mil/

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Air Force Office of Scientific Research
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Book List

*The **Book List** highlights books that have mathematical themes and hold appeal for a wide audience, including mathematicians, students, and a significant portion of the general public. When a book has been reviewed in the* Notices, *a reference is given to the review. Generally the list will contain only books published within the last two years, though exceptions may be made in cases where current events (e.g., the death of a prominent mathematician, coverage of a certain piece of mathematics in the news) warrant drawing readers' attention to older books. Suggestions for books to include on the list may be sent to the managing editor, e-mail:* notices@ams.org.

Angles of Reflection: Logic and a Mother's Love, by Joan L. Richards. W. H. Freeman, May 2000. ISBN 0-716-73831-7.

Battle of Wits: The Complete Story of Codebreaking in World War II, by Stephen Budiansky. Free Press, October 2000. ISBN 0-684-85932-7.

The Bit and the Pendulum: How the New Physics of Information Is Revolutionizing Science, by Tom Siegfried. John Wiley & Sons, February 2000. ISBN 0-47132-174-5.

The Book of Nothing: Vacuums, Voids, and the Latest Ideas about the Origins of the Universe, by John D. Barrow. Pantheon Books, April 2001. ISBN 0-375-42099-1.

The Brain: Unraveling the Mystery of How It Works (The Neural Network Process), by Thomas L. Saaty. RWS Publications, 2000. ISBN 1-888603-02-X.

Chaotic Elections! A Mathematician Looks at Voting, by Donald G. Saari. AMS, April 2001. ISBN 0-8218-2847-9.

* *The Colossal Book of Mathematics: Classic Puzzles, Paradoxes, and Problems*, by Martin Gardner. W.W. Norton & Company, August 2001. ISBN 0-393-02023-1.

Computers Ltd.: What They Really Can't Do, by David Harel. Oxford University Press, November 2000. ISBN 0-198-50555-8.

A Concise History of Mathematics, by Dirk J. Struik. Dover Publications, 1987. ISBN 0-486-60255-9. (Reviewed June/July 2001.)

Conned Again, Watson! Cautionary Tales of Logic, Math, and Probability, by Colin Bruce. Perseus Publishing, January 2001. ISBN 0-7382-0345-9.

Creators of Mathematics: The Irish Connection, by Ken Houston. University College Dublin Press, September 2000. ISBN 1-900-62149-5.

The Crest of the Peacock: The Non-European Roots of Mathematics, by George Gheverghese Joseph. Princeton University Press, October 2000 (new edition). ISBN 0-691-00659-8.

Crypto: How the Code Rebels Beat the Government—Saving Privacy in the Digital Age, by Steven Levy. Viking Press, January 2001. ISBN 0-67085-950-8.

* *Damned Lies and Statistics: Untangling Numbers from the Media, Politicians, and Activists*, by Joel Best. University of California Press, May 2001. ISBN 0-520-21978-3.

Divine Harmony: The Life and Teachings of Pythagoras, by John Strohmeier and Peter Westbrook. Berkeley Hills Books, November 1999. ISBN 0-965-37745-8.

The Dots and Boxes Game, by Elwyn Berlekamp. A K Peters, July 2000. ISBN 1-568-81129-2.

Duelling Idiots and Other Probability Puzzlers, by Paul J. Nahin. Princeton University Press, October 2000. ISBN 0-691-00979-1.

Education of a Mathematician, by Philip J. Davis. A K Peters, August 2000. ISBN 1-568-81116-0. (Reviewed January 2001.)

Einstein in Love: A Scientific Romance, by Dennis Overbye. Viking Press, October 2000. ISBN 0-670-89430-3.

Euclid's Window: The Story of Geometry from Parallel Lines to Hyperspace, by Leonard Mlodinow. Free Press, April 2001. ISBN 0-684-86523-8.

Exploring Randomness, by Gregory J. Chaitin. Springer, December 2000. ISBN 1-852-33-417-7. (Reviewed in this issue.)

Finite vs. Infinite, Contributions to an Eternal Dilemma, Cristian S. Calude and Gheorghe Paun, editors. Springer, March 2000. ISBN 1-852-33251-4.

Flatterland: Like Flatland, Only More So, by Ian Stewart. Perseus Publishing, May 2001. ISBN 0-7382-0442-0.

The Fractal Murders, by Mark Cohen. E-book published by Southern Cross Review, 2001. World Wide Web: www.southerncrossreview.org/.

Geometry from Africa: Mathematical and Educational Explorations, by Paulus Gerdes. Mathematical Association of America, April 1999. ISBN 0-88385-715-4.

Gödel: A Life of Logic, by John L. Casti and Werner DePauli. Perseus, August 2000. ISBN 0-7382-0274-6. (Reviewed September 2001.)

Gödel Meets Einstein: Time Travel in the Gödel Universe, by Palle Yourgrau. Open Court, November 1999. ISBN 0-812-69408-2.

Hex Strategy: Making the Right Connections, by Cameron Browne. A K Peters, May 2000. ISBN 1-568-81117-9.

* *The Hilbert Challenge*, by Jeremy J. Gray. Oxford University Press, 2000. ISBN 0-198-50651-1.

The Hole in the Universe: How Scientists Peered over the Edge of Emptiness and Found Everything, by K. C. Cole. Harcourt Brace, January 2001. ISBN 0-151-00398-X.

How the Other Half Thinks: Adventures in Mathematical Reasoning, by Sherman Stein. McGraw-Hill, July 2001. ISBN 0-071-37339-X.

How to Solve It: Modern Heuristics, by Zbigniew Michalewicz and David B. Fogel. Springer, December 1999. ISBN 3-540-66061-5.

The Kingdom of Infinite Number: A Field Guide, by Bryan Bunch. W. H.

Freeman, January 2000. ISBN 0-716-73388-9.

Logical Dilemmas: The Life and Work of Kurt Gödel, by John Dawson. A K Peters, December 1997. ISBN 1-56881-025-3. (Reviewed September 2001.)

The Math Gene: How Mathematical Thinking Evolved and Why Numbers Are Like Gossip, by Keith Devlin. Basic Books, August 2000. ISBN 0-465-01618-9. (Reviewed February 2001.)

Mathematics As Sign: Writing, Imagining, Counting, by Brian Rotman. Stanford University Press, September 2000. ISBN 0-804-73684-7.

Mathematics: Frontiers and Perspectives, V. Arnold, M. Atiyah, P. Lax, and B. Mazur, editors. AMS, December 1999. ISBN 0-8218-2697-2.

* *Mathematics Galore: Masterclasses, Workshops, and Team Projects in Mathematics and Its Applications*, by C. J. Budd and C. J. Sangwin. Oxford University Press, June 2001. ISBN 0-198-50769-0 (hardcover), 0-198-50770-4 (paperback).

My Numbers, My Friends: Popular Lectures on Number Theory, by Paulo Ribenboim. Springer, February 2000. ISBN 0-387-98911-0.

The Mystery of the Aleph: Mathematics, the Kabbalah, and the Search for Infinity, by Amir D. Aczel. Four Walls Eight Windows, November 2000. ISBN 1-568-58105-X.

Newton's Gift: How Sir Isaac Newton Unlocked the System of the World, by David Berlinski. Free Press, October 2000. ISBN 0-684-84392-7.

Newton's Tyranny: The Suppressed Scientific Discoveries of John Flamsteed and Stephen Gray, by David H. Clark and Stephen P. H. Clark. W. H. Freeman, October 2000. ISBN 0-716-74215-2.

Niels Hendrik Abel and His Times: Called Too Soon by Flames Afar, by Arild Stubhaug, translated by R. Daly. Springer, May 2000. ISBN 3-540-66834-9.

Number: From Ahmes to Cantor, by Midhat Gazalé. Princeton University Press, March 2000. ISBN 0-691-00515-X. (Reviewed August 2001.)

The Parrot's Theorem, by Denis Guedj. Weidenfeld & Nicolson, June 2000. ISBN 0-297-64578-1. (To be published in the U.S. by St. Martin's Press, September 2001, ISBN 0-312-28055-6.) (Reviewed March 2001.)

Proofs from the Book, by M. Aigner and G. M. Ziegler. Revised and expanded second edition, Springer, January 2001. ISBN 3-540-67865-4. (First edition reviewed August 1999.)

Ptolemy's Geography, translated by J. Lennart Berggren and Alexander Jones. Princeton University Press, November 2000. ISBN 0-691-01042-0.

The Pursuit of Perfect Packing, by Tomaso Aste and Denis Weaire. Institute of Physics Publishing, July 2000. ISBN 0-750-30648-3.

Radical Equations: Math Literacy and Civil Rights, by Robert P. Moses and Charles E. Cobb Jr. Beacon Press, February 2001. ISBN 0-807-03126-7.

Sacred Geometry, by Miranda Lundy. Walker & Company, April 2001. ISBN 0-802-71382-3.

The Search for Mathematical Roots, 1870-1940: Logics, Set Theories, and the Foundations of Mathematics from Cantor through Russell to Gödel, by I. Grattan-Guinness. Princeton University Press, February 2001. ISBN 0-691-0587-1.

The Story of Mathematics, by Richard Mankiewicz. Princeton University Press, February 2001. ISBN 0-691-08808-X.

Surfing through Hyperspace: Understanding Higher Universes in Six Easy Lessons, by Clifford A. Pickover. Oxford University Press, September 1999. ISBN 0-195-13006-5.

The Symbolic Universe: Geometry and Physics 1890–1930, edited by Jeremy Gray. Oxford University Press, September 1999. ISBN 0-198-50088-2.

Triangle of Thoughts, by Alain Connes, André Lichnerowicz, and Marcel Paul Schützenberger. AMS, July 2001. ISBN 0-8218-2614-X.

Two Millennia of Mathematics: From Archimedes to Gauss, by George M. Phillips. Springer, July 2000. ISBN 0-387-95022-2.

The Universal Computer: The Road from Leibniz to Turing, by Martin Davis. W.W. Norton & Company, October 2000. ISBN 0-393-04785-7. (Reviewed May 2001.)

The Universal History of Computing: From the Abacus to the Quantum Computer, by Georges Ifrah; translated from the French and with notes by E. F. Harding, assisted by Sophie Wood, Ian Monk, Elizabeth Clegg, and Guido Waldman. John Wiley & Sons, November 2000. ISBN 0-471-39671-0.

The Universal History of Numbers: From Prehistory to the Invention of the Computer, by Georges Ifrah; translated from the French by David Bellos, E. F. Harding, Sophie Wood, and Ian Monk. John Wiley & Sons, December 1999. ISBN 0-471-37568-3.

The Unknowable, by Gregory J. Chaitin. Springer, August 1999. ISBN 9-814-02172-5. (Reviewed in this issue.)

What Is Mathematics? An Elementary Approach to Ideas and Methods, by Richard Courant and Herbert Robbins; second edition, revised by Ian Stewart. Oxford University Press, August 1996. ISBN 0-195-10519-2.

Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being, by George Lakoff and Rafael Núñez. Basic Books, October 2000. ISBN 0-465-03770-4.

White Light, by Rudy Rucker. Four Walls Eight Windows, April 2001. ISBN 1-56858-198-X.

Women Becoming Mathematicians: Creating a Professional Identity in Post-World War II America, by Margaret A. M. Murray. MIT Press, September 2000. ISBN 0-262-13369-5. (Reviewed August 2001.)

Wonders of Numbers: Adventures in Math, Mind, and Meaning, by Clifford A. Pickover. Oxford University Press, September 2000. ISBN 0-195-13342-0.

Stipends for Study and Travel

Graduate Support

American Association for the Advancement of Science

Summer Fellowship

Description: Fellows will work for radio and television stations, newspapers, magazines, and online sites and will have their travel expenses and stipends paid by the AAAS. Fellows will have the opportunity to: observe and participate in the process by which events and ideas become news, improve their communication skills by learning to describe complex technical subjects in a manner understandable by the public, and increase their understanding of editorial decision making and the manner in which information is effectively disseminated. Each fellow will: attend an orientation and evaluation session in Washington, DC; begin the internship in mid-June; and submit an interim and final report to AAAS to help evaluate the program.
Eligibility: Provides support for 20–30 outstanding graduate students in mathematics, the natural and social sciences, and engineering as reporters, researchers, and production assistants in the mass media. (Exceptional undergraduate or postdoctoral students will also be considered.)
Grant amount: $450/week stipend for ten weeks.
Deadline: January 15, 2002.
Application information: Katrina Malloy, Program Coordinator, Mass Media Science and Engineering Fellows Program, American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005.

American Association of University Women (AAUW) Educational Foundation

American Fellowships

Description: Postdoctoral, dissertation, and summer postdoctoral faculty fellowships for women fulfilling eligibility requirement. Applicants for the postdoctoral fellowships must hold a doctoral degree by the application deadline. An applicant must have completed all course work, passed all examinations, and have had the dissertation proposal or plan approved by the application deadline.
Eligibility: Women who are citizens or permanent residents of the U.S.
Grant amount: The postdoctoral fellowships provide $30,000. The summer postdoctoral faculty fellowships provide stipends of $6,000. The dissertation fellowships provide stipends of $20,000 for the final year of writing the dissertation. Dissertation fellowships have some disciplinary restrictions.
Deadline: November 15 (postmark).
Application information: AAUW Educational Foundation, American Fellowships, c/o Customer Service Center, 2201 N. Dodge St., Iowa City, IA 52243-4030; telephone: 319-337-1716; fax: 319-337-1204.

American Association of University Women (AAUW) Educational Foundation

Selected Professions Fellowships

Description: These fellowships are awarded to women of outstanding academic ability who are citizens or permanent residents of the U.S. for full-time graduate study in designated fields where women's participation has traditionally been low. Eligible fields currently include mathematics and statistics.
Eligibility: Fellowships are for the final year of the master's degree. Fellowship year is July 1–June 30. Degree must be earned at the end of the fellowship year.
Grant amount: $5,000–$12,000.
Deadline: Must be postmarked by January 10 (applications are available August 1–December 20).
Application information: For more information contact: AAUW Educational Foundation, 2201 Dodge Street, Iowa City, IA 52243-4030; telephone: 319-337-1716; or visit our Web site at `http://www.aauw.org/`.

Associated Western Universities, Inc.

Description: AWU, in partnership with federal laboratories, industry, and other cooperating facilities, provides

fellowships for science and engineering research Participation. Fellowship participants are hosted by nearly sixty federal and industrial facilities.

Eligibility: Faculty, advanced-degree graduates, graduate and undergraduate students in discipline areas including the physical and biological sciences, mathematics, computer science, engineering, and technology.

Application information: Associated Western Universities, Inc., 4190 S. Highland Drive, Suite 211, Salt Lake City, UT 84124; tel: 801-273-8900; fax: 801-277-5632; e-mail: info@awu.org; home page: http://www.awu.org/.

Bunting-Cobb Graduate Residential Fellowships for Women

Description: Douglass College, the largest women's college in the nation, offers the Bunting-Cobb Graduate Residential Fellowship program. Bunting-Cobb Fellows serve as mentors to the undergraduates in the residence hall. The hall is equipped with a microcomputer room and a resource library.

Eligibility: Women graduate students enrolled in math, science, or engineering programs at Rutgers University's Graduate School on its New Brunswick campus.

Grant amount: $3,000 to $4,000, depending on duties, as well as room and board for the academic year in the Bunting-Cobb Math, Science, and Engineering Hall.

Application information: For information about the Bunting-Cobb Fellowship, please contact Dr. Terri Boyer Tillbrook, Director, Douglass Project for Rutgers Women in Math, Science, and Engineering at 732-932-9197, ext. 10; or e-mail at dougproj.rutgers.edu. For information about graduate study at Rutgers, please contact Beverly Tarter at 732-932-7711.

Florida Education Fund

The McKnight Doctoral Fellowship Program

Description: A McKnight Doctoral Fellowship provides funds for up to twenty-five African American citizens to pursue Ph.D. degrees at participating Florida universities. Contingent upon successful academic progress, the maximum length of the award is five years. The Florida Education Fund provides the first three years, and the student's university continues funding at the same level of support for an additional two years.

Eligibility: Applicants must hold or be receiving a bachelor's degree from a regionally accredited college or university.

Grant amount: Up to $5,000 in tuition and fees plus an annual stipend of $12,000.

Deadline: The deadline for applications for fall 2002 is January 15, 2002.

Application information: Detailed information and application packets can be obtained by writing or calling: The Florida Education Fund, 201 E. Kennedy Boulevard, Suite #1525, Tampa, FL 33602; 813-272-2772; or mdf@fl-educ-fd.org; or visit our Web site at: http://www.fl-educ-fd.org/.

Ford Foundation Predoctoral and Dissertation Fellowships for Minorities

Description: Approximately 60 predoctoral and 40 dissertation fellowships will be awarded in a national competition administered by the National Research Council (NRC) of the National Academies for the Ford Foundation. The awards will be made to those individuals who, in the judgment of the review panels, have demonstrated superior scholarship and show the greatest promise for future achievement as scholars, researchers, and teachers in institutions of higher education.

Eligibility: Available to minorities enrolled in research-based doctoral programs in mathematics, engineering, and other fields. The fellowships will be offered on a competitive basis to individuals who are citizens or nationals of the U.S. and who are members of the following groups: Alaskan Natives (Eskimo or Aleut), Native American Indians, Black/African Americans, Mexican Americans/Chicanas/Chicanos, Native Pacific Islanders (Polynesian or Micronesian), or Puerto Ricans.

Grant amount: Annual stipends of $15,500 and $24,000, respectively. The predoctoral awards also include an allowance of $8,500 to the awardee's university in lieu of tuition and fees.

Deadline: Deadline for the predoctoral fellowships is early December. For the dissertation fellowships, early November.

Application information: For more information, contact: Fellowship Office/FF, TJ 2041, National Research Council, 2101 Constitution Avenue, Washington, DC 20418; telephone: 202-334-2872; e-mail: infofell@nas.edu; Web site: http://national-academies.org/osep/fo/.

Georgia Institute of Technology

President's Fellowships

Description: These stipends are awarded to a selected number of highly qualified U.S. nationals who intend to pursue doctoral degrees. The fellowships are intended to supplement other forms of support and can be extended for three additional years based on academic performance and research potential.

Eligibility: The awards are highly competitive; selection is based on academic criteria and evidence of scholarship. Participants are expected to maintain high academic standing.

Grant amount: $5,500 for twelve months.

Graduate Research/Teaching Assistantships

Eligibility: Appointments are based primarily on scholarship and ability to contribute to ongoing programs of the college.

Assistantship amount: $17,547 per twelve months, plus waiver of most tuition and fees.

Application information: Prospective students should write to the Ph.D. Coordinator, College of Computing, Georgia Institute of Technology, Atlanta, GA 30332-0280; or e-mail to phd-info@cc.gatech.edu. For additional information: http://www.cc.gatech.edu/.

Fannie and John Hertz Foundation Fellowships

Application information: Available on the Web site http://www.hertzfoundation.org/.

National Academies

Christine Mirzayan Internship Program

Description: The Christine Mirzayan Internship Program of the National Academies is designed to engage graduate and postdoctoral science, engineering, medical, veterinary, business, and law students in science and technology policy and to familiarize them with the interactions between science, technology, and government. As a result, students develop essential skills different from those attained in academia and make the transition from being a graduate student to a professional.
Eligibility: Applications for the internships are invited from graduate students through postdoctoral candidates in any physical, biological, or social science field or any field of engineering, medicine/health, or veterinary medicine, as well as business and law students.
Grant amount: The stipend for the 12-week January program is $4,800. The stipend for the 10-week June program is $4,000. In addition, travel expenses of up to $500 will be provided.
Deadline: Deadline for the receipt of materials is November 1 for the January program and March 1 for the June program.
Application information: For more information, e-mail: internship@nas.edu (preferred); fax: 202-334-1667; telephone: 202-334-2455; or write to: The National Academies Internship Program, 2101 Constitution Ave., NW, Suite FO-2050, Washington, DC 20418.The Web site is http://national-academies.org/; then click on Internships & Careers.

National Science Foundation

Graduate Research Fellowships

Description: Three-year awards available to U.S. citizens or nationals, or permanent resident aliens of the U.S. Fellowships are awarded for graduate study leading to research-based master's or doctoral degree in the fields of science, mathematics, and engineering supported by the NSF. Women in Engineering and Computer and Information Science: Additional awards will be offered to encourage women to undertake graduate study in engineering and computer and information science.
Eligibility: Fellowships are intended for individuals in the early stages of their graduate study in science, mathematics, or engineering.
Grant amount: $18,000 stipend for twelve-month tenure. A one-time research travel allowance of $1,000. No dependency allowances. A cost-of-education allowance of $10,500 is paid to the fellowship institution.
Deadline: Application deadline is early November.
Application information: Apply to NSF Graduate Research Fellowship Program, Oak Ridge Associated Universities, P. O. Box 3010, Oak Ridge, TN 37831-3010; tel. 423-241-4300; fax: 423-241-4513; e-mail: nsfgrfp@orau.gov; Web site: http://www.orau.org/nsf/nsffel.htm.

State of California

Graduate Assumption Program of Loans for Education

Eligibility: Residents of California who attend accredited graduate or professional schools in program leading to a graduate degree with the intent to become college or university faculty members in California.
Assumption benefits: May assume up to $6,000 in loan balances in return for teaching service at a college or university in California.
Priority filing date: June 30, 2001, or until all awards are filled.
Deadline: March 1, 2002.
Application information: California Student Aid Commission, P. O. Box 419029, Rancho Cordova, CA 95741-9029; phone: 916-526-7599; e-mail: custsvcs@csac.ca.gov.

Zonta International Foundation

Amelia Earhart Fellowship Awards

Description: Established in 1938 in honor of Amelia Earhart, famed pilot and member of Zonta International. The awards are granted annually to women pursuing graduate degrees in aerospace-related sciences and aerospace-related engineering.
Eligibility: Women of any nationality are eligible. To apply for the fellowship, a woman must meet the following minimum requirements: (1) have completed a bachelor's degree in a qualifying area of science or engineering related to advanced studies in aerospace-related science or aerospace-related engineering; (2) demonstrate a superior academic record with evidence of potential at a recognized university or college as verified by transcripts, recommendations, and acceptance or verification by an institution of higher education with accredited courses in aerospace-related studies; (3) provide evidence of a well-defined research program in aerospace-related science or aerospace-related engineering as described in your application essay, research, and publications. *Clearly demonstrate the relationship* of your research to aerospace and verify your research program with at least one letter of recommendation. (4) By the time the fellowship grant is awarded, have completed one year of aerospace-related graduate studies at a well-recognized institution of higher education.
Grant amount: The scholarship award of US$6,000 may be used for tuition, books and fees, or living expenses. The award may be used at any university or college offering accredited graduate courses and degrees in aerospace studies.
Deadline: Application forms must be received by November 15, 2001.
Application information: All applicants will be notified by mid-May. For more information: Zonta International Foundation, 557 W. Randolph St., Chicago, IL 60661-2206; tel: 312-930-5848; fax: 312-930-0951; e-mail: Zontafdtn@Zonta.org; http://www.Zonta.org/.

Postdoctoral Support

Air Force Office of Scientific Research

Research Contracts and Grants

Description: Mathematicians and computer scientists are encouraged to submit proposals for research support through their organizations. Research areas include mathematics of dynamics and control, physical mathematics and applied analysis, computational mathematics, optimization and discrete mathematics, signal processing, probability and statistics, software and systems, intelligent software agents, and electromagnetics.
Application information: Research proposals should be forwarded to the Mathematics and Space Sciences Directorate, Air Force Office of Scientific Research (AFOSR NM), 801 N. Randolph Street, Room 732, Arlington, VA 22203-1977.

American Association of University Women (AAUW) Educational Foundation

American Fellowships

Application information: See the listing in the "Graduate Support" section for information.

American Mathematical Society Centennial Fellowships

Postdoctoral Fellowships

Description: The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Trustees have arranged a matching program from general funds in such a way that funds for at least one fellowship are guaranteed. Due to a change in eligibility criteria and an increase in the stipend beginning in 2002–03, it is expected that three fellowships will be awarded.
Eligibility: Recently the AMS Council approved changes in the rules for the fellowships. The eligibility rules are as follows. The primary selection criterion for the Centennial Fellowship is the excellence of the candidate's research. Preference will be given to candidates who have not had extensive fellowship support in the past. Recipients may not hold the Centennial Fellowship concurrently with another research fellowship such as a Sloan or NSF Postdoctoral Fellowship. Under normal circumstances the fellowship cannot be deferred. A recipient of the fellowship shall have held his or her doctoral degree for at least three years and not more than twelve years at the inception of the award. Applications will be accepted from those currently holding a tenured, tenure-track, postdoctoral, or comparable (at the discretion of the selection committee) position at an institution in North America. Applications should include a cogent plan indicating how the fellowship will be used. The plan should include travel to at least one other institution and should demonstrate that the fellowship will be used for more than reduction of teaching at the candidate's home institution. The selection committee will consider the plan in addition to the quality of the candidate's research and will try to award the fellowship to those for whom the award would make a real difference in the development of their research careers. Work in all areas of mathematics, including interdisciplinary work, is eligible.
Grant amount: The stipend for fellowships awarded for 2002–03 is expected to be approximately $55,000, with an additional expense allowance of about $1,650. Acceptance of the fellowship cannot be postponed.
Deadline: The deadline for receipt of applications is December 1, 2001. Awards will be announced in February 2002 or earlier if possible.
Application information: For application forms, write to the Executive Director, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294, or send electronic mail to `ams@ams.org`, or call 401-455-4106. Application forms are also available via the Internet at `http://www.ams.org/employment/`. Please note that completed applications and references should not be sent to the AMS, but to the address given on the forms.

American Philosophical Society

Description: Postdoctoral research grants to aid specific research projects. The purpose of the program is to connect scholars with the objects of their research. Tenable abroad and in the U.S. The Committee on Research meets in January.
Eligibility: For candidates with Ph.D. for at least one year.
Grant amount: Up to $6,000 for one year, up to $12,000 for two years. Grants contribute toward travel expenses, food and lodging, and photoduplication. No funds are available for attending conferences or consulting with colleagues.
Deadline: October 1.
Application information: For application forms please consult the Web site at `http://www.amphilsoc.org/` . If electronic access is denied, briefly describe your project and proposed budget in a letter to: Committee on Research, American Philosophical Society, 104 South Fifth Street, Philadelphia, PA 19106. Include self-addressed mailing label.

The Bunting Institute at Radcliffe

Description: The Radcliffe Institute for Advanced Study at Harvard University awards over 50 funded postdoctoral fellowships each year to scholars, professionals, writers, and artists from around the world. Fellows at the Radcliffe Institute, women and men, are traditionally affiliated with one of Radcliffe's four centers for learning and scholarship: the Bunting Fellowship Program, the Schlesinger Library, the Murray Research Center, and the Radcliffe Public Policy Center.
Eligibility: Scholars, scientists, artists, or writers in any field with the receipt of a doctorate or appropriate terminal degree at least two years prior to appointment (September 2002) or comparable professional achievement. Those at a critical juncture in their careers and

those who have experienced detours and constraints on their professional path are encouraged to apply.
Deadline: The deadline to apply for a 2002–03 fellowship is October 15.
Application information: To learn more about Radcliffe fellowships or to receive an application, please call 617-496-1324; e-mail: fellowships@radcliffe; write to Applications Office, 34 Concord Avenue, Cambridge, MA 02138; or visit the Radcliffe Institute online at http://www.radcliffe.edu/.

California Institute of Technology

Harry Bateman Research Instructorships

Description: Offered by The division of Physics, Mathematics, and Astronomy at the California Institute of Technology. Appointments are for one year and are renewable for one additional year.
Eligibility: Open to persons who have recently received their doctorate in mathematics.
Grant amount: The annual salary for academic year 2002–03 is $48,200. Duties include teaching one course for the full academic year.
Deadline: January 1, 2002.
Application information: Please send applications to Instructorship Search Committee, 253–37 Sloan Laboratory, Pasadena, CA 91125. Include c.v. and a statement of anticipated research. The candidate is requested to ensure that at least three letters of recommendation are sent to Caltech. To avoid duplication of paperwork, your application may also be considered for an Olga Taussky and John Todd Instructorship. Caltech is an Affirmative Action/Equal Opportunity Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

California Institute of Technology

Olga Taussky and John Todd Instructorships in Mathematics

Description: Initial appointments are for two years, with a one-year terminal extension expected. There are three terms in the Caltech academic year, and instructors are expected to teach one course in all but two terms of the total appointment.
Eligibility: Offered to recent Ph.D. recipients who show strong research promise in one of the areas in which Caltech's mathematics faculty is currently active.
Grant amount: The annual salary for 2002–03 is $51,200 per year plus a $2,000 per year research fund.
Deadline: January 1, 2002.
Application information: Apply to the Instructorship Search Committee, 253–37 Sloan Laboratory, Pasadena, CA 91125. Include c.v. and a statement of anticipated research. The candidate is requested to ensure that at least three letters of recommendation are sent directly to Caltech. To avoid duplication of paperwork, your application may also be considered for a Harry Bateman Research Instructorship. Caltech is an Affirmative Action/Equal Opportunity Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

Dartmouth College

John Wesley Young Research Instructorships

Description: Two instructorships are normally awarded by Dartmouth College each year. Teaching duties are one course for two quarters and two courses for one quarter (or two courses for two quarters) and are of a varied and nonroutine nature. Appointments are for two years and are not renewable.
Grant amount: The academic-year salary of $43,000 is supplemented by a two-month resident research stipend of $9,555, for a total of $52,555.
Deadline: Applicants are advised to apply promptly and no later than January 5, 2002.
Application information: Applicants should write to Department of Mathematics, Dartmouth College, Hanover, NH 03755-3551 (Attention: Recruiting).

Ford Foundation Postdoctoral Fellowships for Minorities

Description: Administered by the National Research Council, these fellowships are sponsored by the Ford Foundation. Tenure of the one-year fellowship provides postdoctoral research experience at an appropriate nonprofit institution of the fellow's choice.
Eligibility: Applicants must be U.S. citizens who are members of one of the designated minority groups: Alaskan Natives (Eskimo or Aleut), Native American Indians, Black/African Americans, Mexican Americans/Chicanas/Chicanos, Native Pacific Islanders (Polynesian or Micronesian), or Puerto Ricans who are engaged in college or university teaching and research (or planning such a career) and hold a doctoral degree. Supported fields include: behavioral and social sciences, humanities, engineering, mathematics, physical sciences, life sciences, education, and interdisciplinary programs composed of two or more eligible research-based disciplines.
Grant amount: The annual stipend is $35,000, with a travel and relocation allowance of $3,000. No dependency allowance is available. The program will also provide a cost-of-research allowance of $2,000 intended to provide support for the fellow's study and research program. An employing institution allowance of $2,500 will be forwarded to the fellow's employing institution after fellowship tenure is completed.
Deadline: Deadline for the submission of the application and accompanying materials is early January.
Application information: For more information contact: Fellowship Office/FF, TJ 2041, National Research Council, 2101 Constitution Avenue, Washington, DC 20418; telephone: 202-334-2860; e-mail: infofell@nas.edu; Web site: http://national-academies.org/osep/fo/.

Institute for Advanced Study Memberships

Description: The School of Mathematics will grant a limited number of memberships, some with financial support, for research in mathematics at the Institute during the academic year 2002–03.

Eligibility: Candidates must give evidence of ability in research comparable at least with that expected for the Ph.D. degree.
Deadline: December 1, 2001.
Application information: Application blanks may be obtained from The School of Mathematics, Institute for Advanced Study, Princeton, NJ 08540, and should be returned (whether or not funds are expected from some other source) by December 1. Forms may also be downloaded but not submitted via Web connection at `http://www/math.ias.edu/`. An Equal Opportunity/Affirmative Action Employer.

Institute for Mathematics and its Applications (IMA)

Postdoctoral Memberships

Senior Visiting Memberships

Optimization

Description: The IMA announces two-year postdoctoral research memberships effective September 3, 2002. The postdoctoral terms will include the academic-year program on **Optimization 2002–2003**, and the second year of the appointment will provide a variety of options to enhance career development, including participation in the 2003–04 annual program on *Probability and Statistics in Complex Systems: Genomics, Networks, and Financial Engineering.*
Eligibility: All requirements for a doctorate should be completed by September 3, 2002. Applicants must show evidence of mathematical excellence, but they do not need to be a specialist in the field. The following materials must be submitted: (1) personal statement of scientific interest, research plans, and reasons for wishing to participate in the **Optimization** program (this is an essential part of the application); (2) curriculum vitae and a list of publications; (3) three letters of recommendation, to be sent directly to the IMA; (4) the official IMA application form located at `http://www.ima.umn.edu/docs/genapp.html`. **Senior memberships** are also available. Preference will be given to supplementary support for persons with sabbatical leaves, fellowships, or other stipends.
Deadline: All material should arrive by January 15, 2002.
Application information: All correspondence should be sent to: Visiting Membership Committee, Institute for Mathematics and its Applications, University of Minnesota, 400 Lind Hall, 207 Church Street SE, Minneapolis, MN 55455-0436. The University of Minnesota is an Equal Opportunity Educator and Employer. See Web site `http://www.ima.umn.edu/`.

Institute for Mathematics and its Applications (IMA)

Postdoctorates in **Industrial** *Mathematics*

Description: The IMA announces two-year positions in industrial mathematics effective September 3, 2002. These appointments are in addition to the regular IMA 2002–03 postdoctoral program on **Optimization** and are funded jointly by NSF and industry. They are designed to prepare mathematicians for research careers involving industrial interaction.
Eligibility: Applicants should have received their Ph.D. in mathematics, applied mathematics, or statistics by September 3, 2002. Postdoctorates will spend 50% effort in the IMA program and 50% effort working with scientists from industry. The following materials must be submitted: (1) personal statement of scientific interests, research plans, and reasons for wishing to participate in the Industrial Mathematics program (this is an essential part of the application); (2) curriculum vitae and a list of publications; (3) three letters of recommendation, to be sent directly to the IMA; (4) the official IMA application form located at `http://www.ima.umn.edu/docs/genapp.html`.
Deadline: All material should arrive by January 15, 2002.
Application information: All correspondence should be sent to: Industrial Mathematics Postdoctorate Membership Committee, Institute for Mathematics and its Applications, University of Minnesota, 400 Lind Hall, 207 Church Street SE, Minneapolis, MN 55455-0436. The University of Minnesota is an Equal Opportunity Educator and Employer. See Web site `http://www.ima.umn.edu/`.

Los Alamos National Laboratory

Postdoctoral Appointments

Description: Research opportunities are granted in many areas of chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Appointments are available for two years, subject to renewal for a third year. A postdoctoral committee meets to review candidates for postdoctoral appointments in February, May, August, and December.
Eligibility: Candidates must be recipients of a doctoral degree within the past three years.
Grant amount: Starting salary: $54,100–$58,300.
Application information: Los Alamos National Laboratory is an Equal Opportunity Employer. For more information: e-mail: `postdoc-info@lanl.gov`; phone: 505-667-0872; fax: 505-665-4562; see details at: `http://www.hr.lanl.gov/postdoc/`.

Los Alamos National Laboratory

J. Robert Oppenheimer, Richard P. Feynman, and Frederick Reines Fellowships

Description: Research opportunities are granted in many areas of chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Appointments are for three years.
Eligibility: Candidates must be recipients of a doctoral degree within the past five years and must show clear and definite promise of becoming outstanding leaders in scientific research.
Grant amount: Starting salary: $83,000.
Deadline: Application deadline: mid-November each year.
Application information: Los Alamos National Laboratory is an Equal Opportunity Employer. For initial

consideration send résumé with publication listing to Postdoctoral Program Office, Mail Stop P-290, Los Alamos National Laboratory, Los Alamos, NM 87545; for further details see: http://www.hr.lanl.gov/postdoc/.

Mathematical Sciences Research Institute (MSRI)

General Memberships

Description: The Institute will invite an undetermined number of general members for stays of 1 month or more during 2002–03, when one full-year program and two half-year programs will be featured: *Commutative Algebra* (August 19, 2002, to May 16, 2003), *Quantum Computation* (August 19 to December 20, 2002), and *Semi-Classical Analysis* (January 2 to May 16, 2003). Some invitations will be made in other areas, so applications from candidates in all fields are welcome.
Eligibility: For mathematicians postdoctoral and above.
Grant amount: While there is no stipend for general members, MSRI may offer partial expense reimbursement of up to $2,350/month and may offer travel expense reimbursement. General members are expected to visit with at least some outside financial support.
Deadline: Files must be complete by November 16, 2001.
Application information: Please complete online application form at: http://www.msri.org/applications/applying/.

Mathematical Sciences Research Institute (MSRI)

Hewlett-Packard and Microsoft Research Postdoctoral Grants

Description: The Mathematical Sciences Research Institute announces the availability of several postdoctoral fellowhips combined with internships at Hewlett-Packard Laboratories (HPL) in Palo Alto, California, and with Microsoft Research (MSR) in Redmond, Washington. HP Labs and Microsoft Research pursue a wide range of mathematical work. Because of the variety of work done at these facilities, no particular fields of mathematics have been specified. However, an essential prerequisite is a strong interest in the applications of mathematics as well as in the research environment at MSRI. **HPL postdocs** will join an active research group at the HP Labs for two months prior to the start of their time at MSRI and will consult three days a month with that group during their tenure at MSRI. Two further months at HP Labs at the end of their time at MSRI is possible. HPL postdocs receive compensation for their work at HP Labs in addition to the standard MSRI Postdoctoral Fellowship. **MSR postdoctoral fellowships** are normally a two-year award, with the recipient spending one year at MSRI and the second year at Microsoft Research.
Eligibility: For new and recent Ph.D.'s (Ph.D. earned in 1997 or later). Applicants should apply through the usual process for MSRI Postdoctoral Fellowships, indicating their interest in these internships/fellowships and adding relevant documentation. Applications indicating interest in the internship program will be reviewed by Hewlett-Packard and/or Microsoft Research as well as by MSRI.
Deadline: Files must be completed by November 16, 2001.
Application information: Please complete online application form at: http://www.msri.org/applications/applying/.

Mathematical Sciences Research Institute (MSRI)

Postdoctoral Fellowships

Description: The Institute will award about 18 postdoctoral fellowships during 2002–03, when one full-year program and two half-year programs will be featured: *Commutative Algebra* (August 19, 2002, to May 16, 2003), *Quantum Computation* (August 19 to December 20, 2002), and *Semi-Classical Analysis* (January 2 to May 16, 2003). Some awards will be made in other areas, so applications from candidates in all fields are welcome.
Eligibility: For new and recent Ph.D.'s (Ph.D. earned in 1997 or later).
Grant amount: The stipend will be $3,500/month for 5 months for semester programs and for 10 months for full-year programs.
Deadline: Files must be complete by November 16, 2001.
Application information: Please complete online application form at: http://www.msri.org/applications/applying/.

Mathematical Sciences Research Institute (MSRI)

Research Professorships

Description: The Institute will award about 10 research professorships for stays of 3 months or more during 2002–03, when one full-year program and two half-year programs will be featured: *Commutative Algebra* (August 19, 2002, to May 16, 2003), *Quantum Computation* (August 19 to December 20, 2002), and *Semi-Classical Analysis* (January 2 to May 16, 2003). Some awards will be made in other areas, so applications from candidates in all fields are welcome.
Eligibility: For midcareer mathematicians (Ph.D. earned in 1996 or earlier).
Grant amount: The stipend will be limited to a ceiling of $50,000 (for 10 months) and normally will not exceed half the applicant's salary.
Deadline: Files must be complete by September 28, 2001.
Application information: Please complete online application form at: http://www.msri.org/applications/applying/.

The Michigan Society of Fellows

Horace H. Rackham School of Graduate Studies, The University of Michigan

Description: The Michigan Society of Fellows was founded in 1970 through grants from the Ford Foundation and Horace H. Rackham Graduate School for the purpose of promoting academic and creative excellence

in the arts, sciences, and professions. The objective of the program is to support individuals selected for outstanding achievement, professional promise, and interdisciplinary interests. We invite applications from qualified candidates for three-year postdoctoral fellowships at the University of Michigan. Fellows are appointed as assistant professors/postdoctoral scholars with departmental affiliations. They spend the equivalent of one academic year teaching; the balance of time is devoted to their own scholarly research and creative work. Applications will be screened by faculty in relevant University of Michigan departments. Final selections will be made by the senior Fellows of the Society. New Fellows will be selected for three-year terms beginning September 2002.
Eligibility: Candidates must have received the Ph.D. degree between June 1, 1999, and September 1, 2002.
Grant amount: The annual stipend will be $42,000.
Deadline: Completed applications are due October 5, 2001.
Application information: Please see the application on our Web site or send requests for application materials to: Michigan Society of Fellows, 3030 Rackham Building, University of Michigan, 915 E. Washington St., Ann Arbor, MI 48109-1070; 734-763-1259; e-mail: society.of.fellows@umich.edu; http://www.rackham.umich.edu/Faculty/society.html.

Michigan State University

MSU Postdoctoral Instructorships

Description: Several three-year positions will be available beginning fall 2002 for new or recent Ph.D.'s who show strong promise in research and teaching. The teaching load is four semester courses per year, and participation in the research activities of the department is expected.
Grant amount: A starting salary of $38,500 per year. Additional income from summer teaching is usually available if desired.
Deadline: Completed applications (including letters of recommendation) received by November 19, 2001, are assured of consideration.
Application information: An applicant should send a vita as well as a brief statement of research interests and arrange for at least four letters of recommendation to be sent, one of which must specifically comment on the applicant's ability to teach. Application via e-mail is strongly encouraged. To receive an electronic application and information, send an e-mail to: jobs@math.msu.edu with the message "send application-info". Application materials can also be mailed to The Hiring Committee, Department of Mathematics, Michigan State University, East Lansing, MI 48824-1027. Application should be made as soon as possible. Women and minorities are strongly encouraged to apply. MSU is an Affirmative Action/Equal Opportunity Institution.

National Academies

Christine Mirzayan Internship Program

Description: The Christine Mirzayan Internship Program of the National Academies is designed to engage graduate and postdoctoral science, engineering, medical, veterinary, business, and law students in science and technology policy and to familiarize them with the interactions between science, technology, and government. As a result, students develop essential skills different from those attained in academia and make the transition from being a graduate student to a professional.
Eligibility: Applications for the internships are invited from graduate students through postdoctoral candidates in any physical, biological, or social science field or any field of engineering, medicine/health, or veterinary medicine, as well as business and law students.
Grant amount: The stipend for the 12-week January program is $4,800. The stipend for the 10-week June program is $4,000. In addition, travel expenses of up to $500 will be provided.
Deadline: Deadline for the receipt of materials is November 1 for the January program and March 1 for the June program.
Application information: For more information, e-mail: internship@nas.edu (preferred); fax: 202-334-1667; telephone: 202-334-2455; or write to: The National Academies Internship Program, 2101 Constitution Ave., NW, Suite FO-2050, Washington, DC 20418.The Web site is http://national-academies.org/; then click on Internships & Careers.

National Center for Atmospheric Research

Advanced Study Program

Description: Postdoctoral fellowships are offered for highly qualified atmospheric scientists and scientists from related disciplines who wish to continue basic research in the atmospheric sciences. Appointments are for a one-year period with a possible extension for an additional year.
Eligibility: For recent recipients of the Ph.D. with no more than 4 years' experience past their Ph.D.
Grant amount: Stipends are $40,000 and are adjusted annually in June.
Deadline: The application deadline is January 5, 2002.
Application information: Contact: 303-497-1601; e-mail: barbm@ucar.edu; or Barbara Hansford, NCAR, ASP, P. O. Box 3000, Boulder, CO 80307-3000; fax: 303-497-1646.

National Security Agency

Sabbatical Program

Description: The National Security Agency (NSA) has a program supporting sabbaticals for academic mathematical scientists to visit NSA, usually from 9 to 24 months.
Eligibility: American citizenship for the applicant and all immediate family members is required. Because a complete background investigation is required, applications should be submitted as soon as possible.
Grant amount: (Compensation) A supplement to the university's stipend to bring the visitor's salary up to his or her regular monthly salary and a choice of either an allowance for moving expenses or a housing supplement.

Application information: For further information on the sabbatical program, contact: Dr. Charles F. Osgood, Director, Mathematical Sciences Program, National Security Agency, Suite 6557, Ft. George G. Meade, MD 20755-6557; telephone: 301-688-0400; e-mail: msp@math.umbc.edu.

National Security Agency

Grants Program

Description: Standard research proposals designed principally to provide summer salary for professors and limited support for their graduate students in areas of interest listed below. The National Security Agency (NSA) awards grants to universities in support of self-directed research in the following areas of the mathematical sciences (including possible computational aspects): algebra, number theory, discrete mathematics, probability, and statistics. The NSA also accepts proposals for small grants for conferences, workshops, and special academic endeavors.
Deadline: October 15 each year for all grant and conference proposals. Grants awarded from this funding can expect to incur expenses in the fall of the following year.
Application information: For further information about the program, please call 301-688-0400. All correspondence should be addressed to Dr. Charles F. Osgood, Director, Mathematical Sciences Program, National Science Agency, Suite 6557, Ft. George G. Meade, MD 20755-6557. Queries can also be made by e-mail to msp@math.umbc.edu.

Rice University

Griffith Conrad Evans Instructorships

Description: Postdoctoral appointments for two to three years for promising research mathematicians with research interests in common with the active research areas at Rice. Rice University encourages applications from women and minority group members.
Deadline: Applications received by December 31, 2001, will receive thorough consideration.
Application information: Inquiries and applications should be addressed to Chairman, Evans Committee, Department of Mathematics, Rice University, 6100 Main St.-MS 136, Houston, TX 77005.

President's Commission on White House Fellowships

Description: The President's Commission on White House Fellowships offers up to nineteen fellowships each year giving outstanding Americans who have demonstrated remarkable achievement early in their careers first-hand experience in the process of governing the nation at the highest levels of the federal government. White House Fellows spend a year as full-time paid assistants to senior White House staff, the vice president, Cabinet officers, and other top-ranking government officials. Typically, fellows write speeches, help draft and review proposed legislation, answer congressional inquiries, chair meetings, and conduct briefings. They also take part in an educational program that supplements their work and gives them the opportunity to study and travel as a group.
Eligibility: The White House Fellows Program is open to U.S. citizens only. Employees of the federal government are not eligible for the program, with the exception of career military personnel. Fellows may not retain an official state or local office during their fellowship year.
Grant amount: Salary: $71,000.
Deadline: Application postmark date is February 1.
Application information: Applications for fellowships may be obtained from the website http://www.whitehousefellows.gov/or from the President's Commission on White House Fellowships, 712 Jackson Place, NW, Washington, DC 20503; telephone 202-395-4522; fax: 202-395-6179.

Sloan Foundation

Research Fellowships

Description: Unrestricted grants made to selected university scientists in the physical sciences, mathematics, applied mathematics, computer science, economics, and neuroscience. Candidates do not apply, but are nominated by their department chairmen or other scientists.
Eligibility: Candidates must be members of the regular (i.e., tenure-track) faculty, though not necessarily in a tenured position, at a recognized college or university in the United States or Canada.
Deadline: Nominations are due by September 15 for awards to begin the following September.
Application information: For information write to the Sloan Research Fellowships, Alfred P. Sloan Foundation, Suite 2550, 630 Fifth Avenue, New York, NY 10111; e-mail: gassman@sloan.org; http://www.sloan.org/.

Trinity College, Hartford, Connecticut

Harold L. Dorwart Visiting Assistant Professorship

Description: The Department of Mathematics solicits applications for the third Harold L. Dorwart Visiting Assistant Professorship. This is a three-year, nonrenewable position, carrying with it a highly competitive salary and travel money. The normal course load is 5 semester courses per year ("3/2"), one of which will be a research seminar to be co-taught with a senior member of the faculty.
Eligibility: We are seeking applicants with a Ph.D. in mathematics and a specialization in special functions or the analytic theory of continued fractions. Anticipated fields in future years include algebra, harmonic analysis, and graph theory.
Deadline: There is no closing date for applications; however, the department will begin to read applications in early December, and applications received by December 1, 2001, will receive full consideration.
Application information: Please send a letter of application, c.v., a statement of teaching philosophy, and three letters of reference, at least one of which speaks to teaching, to: Search Committee, Department of Mathematics, Trinity College, 300 Summit Street, Hartford, CT 06106. Be sure to include e-mail contact information. Members

of the Search Committee will be at the Joint Mathematics Meetings in San Diego, California, to participate in the Employment Center. Trinity College is an Affirmative Action/Equal Opportunity Employer. Women and members of minority groups are encouraged to apply. Applicants with disabilities should request in writing any needed accommodation in order to participate more fully in the application process.

University of Illinois at Urbana-Champaign

J. L. Doob Research Assistant Professor

Description: The Department of Mathematics of the University of Illinois at Urbana-Champaign is soliciting applications for postdoctoral positions. Three appointments will be made starting August 21, 2001; each appointment is for three years and is not renewable. The Department of Mathematics will provide an excellent scientific environment to pursue research in pure and applied mathematics.
Eligibility: These positions are for recent Ph.D. recipients (with a strong preference for those not more than one year past the Ph.D. degree).
Grant amount: The position carried a salary of $42,000 in 1999-2000.
Deadline: See Web page for deadline: `http://www.math.uiuc.edu/`.
Application information: Applications should include a curriculum vitae and a brief statement of research interests and activities. The use of the AMS cover sheet will be appreciated. Applications should be sent by regular mail to the Postdoctoral Search Committee, Department of Mathematics, University of Illinois at Urbana-Champaign, 1409 W. Green St., Urbana, IL 61801-2975. Applicants should arrange for at least three letters of recommendation to be sent to the same address. For more information, visit our Web page at `http://www.math.uiuc.edu/`. Inquiries may be sent to `postdocs@math.uiuc.edu`. The University of Illinois is an Affirmative Action/Equal Opportunity Employer. Women and minorities are strongly encouraged to apply.

University of Michigan, Ann Arbor

Assistant Professorships, VIGRE Assistant Professorships, and T. H. Hildebrandt Research Assistant Professorships

Description: These positions for up to three years are designed to provide mathematicians with favorable circumstances for academic career development in research and teaching. Assistant professorships have a teaching responsibility of two courses per semester; the VIGRE and T. H. Hildebrandt positions have a responsibility of one course per semester. These positions may be combined with other postdoctoral fellowships, giving additional reductions in teaching responsibility.
Eligibility: Preference is given to candidates who receive the Ph.D. degree in 2000 or later and who submit a completed application by December 19, 2001.
Grant amount: Salary is competitive, and there are opportunities for supplemental summer salary.
Application information: Application forms and further important information are available at `http://www.math.lsa.umich.edu/information/positions.html`, by e-mail at `math.chair@math.lsa.umich.edu`, or by mail to: Hiring Committee, Department of Mathematics, University of Michigan, 2074 East Hall, 525 E. University, Ann Arbor, MI 48109-1109.

University of Utah

Scott Assistant Professorship in Mathematics

Description: *Scott Assistant Professorship in Mathematics.* One or more nonrenewable three-year Scott Assistant Professorships. Teaching duties for the entire three-year instructorship are nine one-semester courses. Availability of positions is contingent upon funding. The hiring committee will select candidates based on excellence in teaching and research.
Eligibility: Persons of any age receiving Ph.D. degrees in 1999 or later are eligible.
Grant amount: Starting salary will be at least $43,000. Increases are given annually, but amounts vary from year to year.
Deadline: Applications should be completed by December 1, 2001. Review of applications will begin on December 8, 2001. However, applications may be accepted until all positions are filled.
Application information: To apply for any of these positions, you are strongly encouraged to fill out an application at `http://www.math.utah.edu/pos/` or at `http://www.mathjobs.org/`. Alternatively, you may send the AMS cover sheet. To complete your application, send a curriculum vitae, bibliography, and three letters of recommendation. Incomplete files will not be considered. Please send this information to: Committee on Staffing, Department of Mathematics, University of Utah, 155 S. 1400 E., JWB 233, Salt Lake City, UT 84112. The University of Utah is an Equal Opportunity/Affirmative Action Employer, encourages applications from women and minorities, and provides reasonable accommodation to the known disabilities of applicants and employees.

University of Wisconsin-Madison

Van Vleck Assistant Professorship

Description: The Department of Mathematics invites applications for possible Van Vleck assistant professorships to begin on August 26, 2002. Appointments are for a fixed term of two or three years. The usual teaching load is two courses per semester.
Eligibility: Ordinarily only those applicants who have received their doctorates since 1999 will be considered. Promise of excellence in research and teaching is important. Preference will be given to candidates who are likely to interact well with other members of the department.
Deadline: The application deadline is December 15, 2001, although applications will continue to be considered until all available positions are filled.

Application information: Applicants should send a completed AMS Standard Cover Sheet, a curriculum vitae which includes a publication list, and a brief statement of research plans to: Hiring Committee, Dept. of Mathematics, Van Vleck Hall, University of Wisconsin-Madison, 480 Lincoln Drive, Madison, WI 53706-1388. Applicants should also arrange to have three or four letters of recommendation sent to the above address. At least one of these letters must discuss the applicant's teaching experience and capabilities. Other evidence of good teaching will be helpful. The University of Wisconsin is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities.
Note: The department also expects to have available one or more VIGRE Van Vleck assistant professorships, partially funded by an NSF VIGRE grant, with a reduced teaching load; only U.S. citizens and permanent residents are eligible for these.

Washington University

William Chauvenet Assistant Professorship

Description: The Chauvenet Instructorship is a two-year, non-tenure-track faculty appointment beginning August 2002. The teaching load consists of three courses per year, two in one semester and one in the other semester. The teaching assignment normally includes introductory courses for undergraduates as well as specialized graduate courses.
Eligibility: To be eligible for a fall 2002 appointment, a candidate must complete all requirements for the Ph.D. by September 2002. Those receiving the Ph.D. prior to 1998 and those currently holding tenure-track faculty positions are ineligible to apply. The applicant's research interests should mesh with those of one or more of our permanent faculty. Current research interests of our faculty include: algebraic geometry, commutative algebra, complex geometry, foliations, functional analysis, harmonic analysis, low-dimensional topology, mathematical biology, operator theory, partial differential equations, probability and statistics, real and complex analysis, representation theory, Riemannian geometry, and wavelets.
Deadline: We will begin reviewing applications on December 1, 2001, and continue reviewing applications until all positions are filled.
Application information: Applicants should submit a curriculum vitae, thesis abstract, statement of research plans and interests, and should arrange for four letters of recommendation. At least one of these letters should address the candidate's teaching ability. Application materials and inquiries should be sent to the Chauvenet Search Committee, Department of Mathematics, Washington University in Saint Louis, Campus Box 1146, One Brookings Drive, St. Louis, MO 63130-4899. Candidates may address e-mail inquiries to `terri@math.wustl.edu`. Washington University is an Affirmative Action/Equal Opportunity Employer and specifically invites and encourages women and minorities to apply.

Travel and Study Abroad

Alexander von Humboldt Foundation

Research Fellowships

Description: The Humboldt Foundation grants 500 Humboldt Research Fellowships annually to highly qualified scholars under the age of 40 holding doctorates, enabling them to undertake long-term periods of research (6–12 months) in the Federal Republic of Germany. Applications are decided upon by a selection committee which is composed of eminent German scholars from all disciplines. Candidates' academic attainments are the only criterion for selection; there are no limitations in respect to specific countries or subjects.
Eligibility: Application requirements include high academic qualifications, academic publications, a specific research plan, and for humanities scholars a good command of the German language.
Grant amount: Monthly stipends range from DM 3,600 to DM 4,400 net. Family allowances, travel expenses, and language courses are covered by the fellowship.
Deadline: Applications may be submitted at any time; however, the actual selection committees meet in March, July, and November. Applications should be submitted 5 months before the meeting at which the candidate wishes to be considered.
Application information: Interested scholars may contact the Alexander von Humboldt Foundation, Jean-Paul-Str. 12, D-53173 Bonn, Federal Republic of Germany; tel: +49-228-833-0; fax: +49-228-833-199; e-mail: `post@avh.de`; homepage: `http://www.humboldt-foundation.de/`; or, U.S. Liaison Office, 1012–14th Street NW, Ste. 301, Washington, DC 20005; tel: 202-783-1907; fax: 202-783-1908; e-mail: `avh@bellatlantic.net`.

Alexander von Humboldt Foundation

Research Awards

Description: Provides prominent scholars with the opportunity to carry out research at a university or other research institute within the Federal Republic of Germany. Nominations for awards must be made by eminent German scholars; direct applications are not accepted. Award winners are invited to spend a research stay of 4–12 months in Germany.
Eligibility: Scholars must have a position as a full/associate professor and an internationally recognized research record.
Application information: Nominators may contact the Alexander von Humboldt Foundation, Jean-Paul-Str. 12, D-53173 Bonn, Federal Republic of Germany; tel.: +49-228-833-0; fax: +49-228-833-199; e-mail: `post@avh.de`; homepage: `http://www.humboldt-foundation.de/`; or, U.S. Liaison Office, 1012-14th Street NW, Ste. 301, Washington, DC 20005; tel: 202-783-1907; fax: -1908; e-mail: `avh@bellatlantic.net`.

Fulbright Teacher & Administrator Exchange Program

Description: Sponsored by the United States Department of State, this program offers international exchange

opportunities for two-year college faculty members and elementary and secondary school teachers and administrators. Currently the program conducts exchanges with over 25 countries in Eastern and Western Europe, Latin America, Africa, and Canada. (The list of countries is subject to change.) Most exchanges are for the full academic year; however, some are for a semester or six weeks. In most cases both the U.S. and international teacher remain on the payroll of their respective home institutions. The Fulbright Teacher & Administrator Exchange Program also offers an eight-week summer seminar in Italy which is open to college and 2-year college faculty and teachers (grades 9–12) of Latin, Greek, and the Classics.

Eligibility: Eligibility requirements are U.S. citizenship, fluency in English, a bachelor's degree or higher, three years' full-time teaching/administrative experience, a current full-time teaching/administrative position, approval of school administration, and no participation in a Fulbright Program longer than eight weeks in the last two years. In addition to the general eligibility requirements, each applicant must meet the specific subject, level, and language fluency requirements for the countries to which he/she applies; these requirements are detailed in the application booklet.

Grant amount: Grants to teach abroad include round-trip transportation for the participant (except Canada and the United Kingdom).

Deadline: The application deadline is October 15 for the following year's program.

Application information: The application booklet should be requested from the Fulbright Teacher Exchange Program, 600 Maryland Ave., SW, Room 320, Washington, DC 20024-2520; 800-726-0479.

Marshall Scholarships

Description: Marshall Scholarships finance young Americans of high ability to study for a degree in the United Kingdom. The scholarships are tenable at any British university and cover two years of study in any discipline, at either undergraduate or graduate level, leading to the award of a British university degree.

Eligibility: Open only to United States citizens who (by the time they take up their scholarship) hold a first degree from an accredited four-year college or university in the United States with a minimum GPA (after freshman year) of 3.7. To qualify for awards tenable from October 2002, candidates must have graduated from their undergraduate college or university after April 1999 (although this restriction may be waived in the case of those wishing to read business studies or an allied subject). N.B. Persons already studying for or holding a British degree or degree-equivalent qualification are **not** eligible to apply for a Marshall Scholarship.

Deadline: October 9 (postmarked), to commence the following September.

Application information: Apply through British Consulates General in the following regions: Atlanta 404-954-7708; Boston 617-248-9555; Chicago 312-346-1810; Houston 713-659-6270; Los Angeles 310-996-3028; New York 212-745-0252; San Francisco 415-617-1300; Washington, DC 202-588-7854.

National Academy of Sciences (NAS)

Collaboration in Basic Science and Engineering (COBASE)

Description: The NAS invites applications from American scientists who wish to visit or to host foreign scientists from Armenia, Azerbaijan (traveling only), Bosnia (hosting only), Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, former Yugoslav Republic of Macedonia, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. The grants will support in either or both directions for up to 8 weeks in total duration. Applicants for the visits need to demonstrate that a joint proposal for collaborative research will be prepared during their visit for submission to the National Science Foundation for funding.

Eligibility: Applicants must be U.S. citizens or permanent residents and have doctoral degrees or their equivalent. Acceptable topics include physics; chemistry; mathematics and computer sciences; earth, atmospheric, and oceanographic sciences; biological sciences; environmental sciences; engineering; archaeology and anthropology; geography; psychology; science and technology policy; economics; linguistics; or the history and philosophy of science. There is special emphasis on young investigators in each program. In addition, special emphasis is placed on the following topics for 2001–02: (1) mathematics, (2) extreme events, (3) Black Sea transboundary issues.

Application information: E-mail: `ocee@nas.edu`; tel: 202-334-2644; `http://nationalacademies.org/oia/`.

National Science Foundation

International Research Fellows Program

Description: The International Division of the National Science Foundation administers a program to introduce scientists and engineers in the early stages of their careers to research opportunities abroad. The program provides support to carry out research at science and engineering establishments in foreign countries for periods of three to twenty-four months. Applications from women and minorities and for work in developing countries are especially encouraged. Research may be done in any field of science and engineering supported by the National Science Foundation. Appropriate host institutions are institutions of higher education, science and engineering centers, and nonprofit industrial and government research institutes.

Eligibility: Eligible applicants, in addition to being citizens or permanent residents of the United States, must have earned a doctoral degree within six years of the date of application or expect to receive their degree by the award date.

Grant amount: Awards will consist of round-trip economy airfare, in-country travel, a modest living allowance, health insurance, and dependent allowance for visits of six months or more. Support for language training is also available.

Deadline: October 1. Decisions will be announced the following March.

Application information: Interested persons should contact the National Science Foundation for details and application materials. Applications must include a letter of invitation from the proposed host institution. Address inquiries to NSF, Division of International Programs, 4201 Wilson Blvd., Arlington, VA 22230; telephone: 703-292-7225; fax: 703-292-9175; e-mail: sparris@nsf.gov; TDD: 703-360-0090. Information and links to guidelines and forms are available at: http://www.nsf.gov/cgi-bin/getpub?nsf00141/.

U.S. Department of State Fulbright U.S. Student Program

Fulbright and Related Grants for Graduate Study and Research Abroad

Description: For graduate study or research in any field in which the project can be profitably undertaken abroad. If an applicant is already enrolled in a U.S. university, he must apply directly to the Fulbright Program Adviser on his campus. Unenrolled students may apply to the Institute of International Education.
Eligibility: Applicant must be a U.S. citizen, hold a B.A. degree or the equivalent, and have language proficiency sufficient to carry out the proposed study and to communicate with the host country.
Deadline: Application deadline is October 25.
Application information: Further details may be obtained from the U.S. Department of State Fulbright U.S. Student Program, U.S. Student Programs Division, Institute of International Education, 809 United Nations Plaza, New York, NY 10017; 212-984-5330.

Winston Churchill Foundation of the United States

Description: A scholarship program for graduate work in engineering, mathematics, and science at Churchill College, Cambridge University.
Grant amount: Tuition and living allowance worth approximately $27,000, depending upon course of study.
Application information: Application forms are available from representatives on campuses of colleges and universities participating in the program. For further information write to the Winston Churchill Foundation, P.O. Box 1240, Gracie Station, New York, NY 10028.

Study in the U.S. for Foreign Nationals

Many of the programs in the "Graduate Support" and "Postgraduate Support" sections are also applicable to foreign nationals.

American Association of University Women (AAUW) Educational Foundation

International Fellowships

Description: These are awarded to women of outstanding academic ability who are not citizens or permanent residents of the U.S. for full-time graduate or postgraduate study in the U.S. Six of the 46 awards are available to members of the International Federation of University Women to study in any country other than their own. Upon completion of studies, fellowship recipients are expected to return to their home countries to pursue professional careers. Previous and current recipients of AAUW fellowships are not eligible.
Eligibility: Applicants must hold the equivalent of a U.S. bachelor's degree by December 31.
Grant amount: The fellowships provide $18,000 for master's/first professional degree, $20,000 for predoctoral study, and $30,000 for postdoctoral study. Five grants of $5,000–$7,000 are available to successful fellowship applicants to implement a project in the applicant's home country the year following the fellowship year.
Deadline: The deadline is December 15 (postmark deadline).
Application information: For more information contact: AAUW Educational Foundation, P.O. Box 4030, Iowa City, IA 52243-4030; telephone: 319-337-1716; fax: 319-337-1204.

Kennedy Scholarships

Description: These grants are for postgraduate study at Harvard University or the Massachusetts Institute of Technology.
Eligibility: For citizens of the United Kingdom.
Deadline: Application deadline is October 22, 2001.
Application information: Write to Secretary, Kennedy Memorial Trust, 48 Westminster Palace Gardens, Artillery Row, London SWIP 1RR, England.

Sources of Fellowship Information

Some of the publications listed below are available at school or college and university libraries or in the reference room of a good public library.

Dollars for College: The Quick Guide to Financial Aid for Science and Mathematics

(1997, 75 pages), Garrett Park Press, Garrett Park, MD 20896. $7.95 + $1.50 postage.

Financial Aid for Minorities in Engineering and Science

Financial assistance, scholarship and fellowship programs, resources for further information, 1999, Garrett Park Press, P. O. Box 190, Garrett Park, MD 20896. $5.95 + $1.50 shipping.

Graduate School and You: A Guide for Prospective Graduate Students

Council of Graduate Schools, Revised Edition, 1999. Available from the Council of Graduate Schools,

Stipends

1 Dupont Circle, NW, Suite 430, Washington, DC 20036-1173, or call 202-223-3791. This publication is $10.00 plus S&H. It can be obtained by calling CGS for an order form, or download order form from Web site `http://www.cgsnet.org/`.

Pathways to Career Success for Minorities

(2000, 378 pages), Garrett Park Press, Garrett Park, MD 20896. $29.95 plus $3.00 shipping. Telephone 301-946-2863; fax: 301-949-3955.

From the AMS Secretary

Report of the Treasurer (2000)

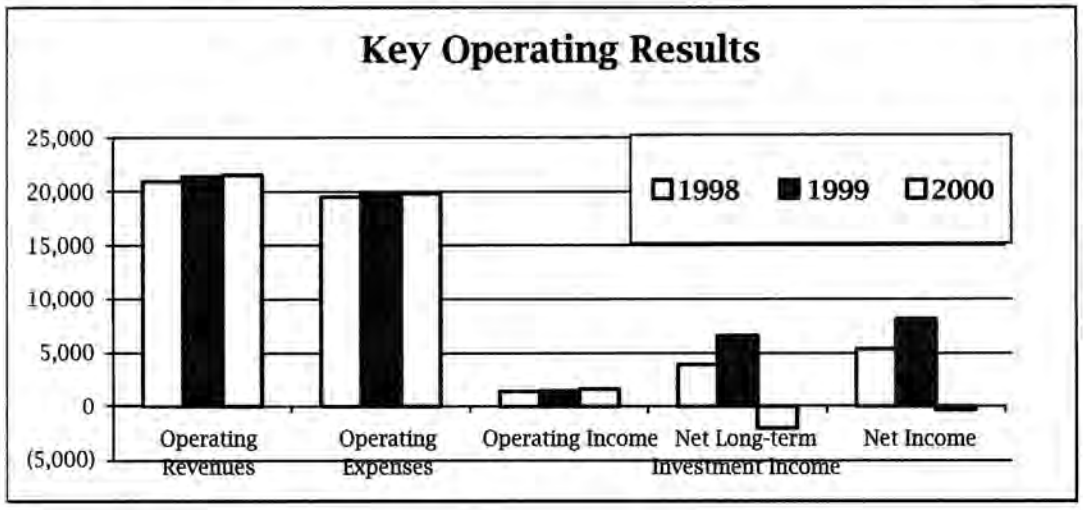
I. Introduction

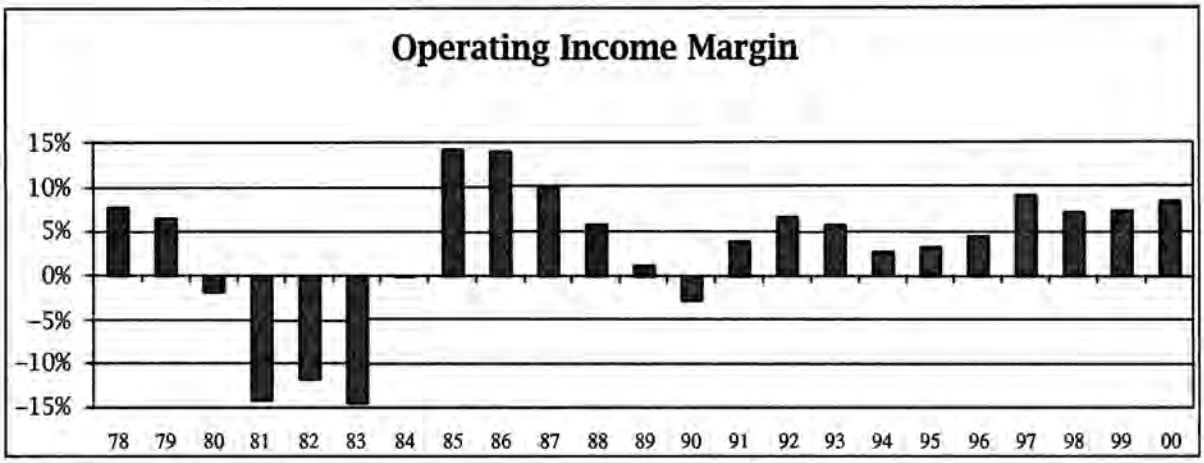
The Report of the Treasurer is presented annually and discusses the financial condition of the Society as of the immediately preceding fiscal year end and the results of its operations for the year then ended. This section contains summary information regarding the operating results and financial condition of the Society for 2000. Section II, "Review of 2000 Operations", contains more detailed information regarding the Society's operations. Section III discusses the assets and liabilities of the Society. Section IV, "Summary Financial Information", presents information regarding the operations, financial condition, and long-term investments of the Society in financial statement format.

The Society segregates its net assets and the activities that increase or decrease net assets into three types. Unrestricted net assets are those that have no requirements as to their use placed on them by donors outside the Society. A substantial majority of the Society's net assets and activities are in this category. Temporarily restricted net assets are those with donor-imposed restrictions or conditions that will lapse upon the passage of time or the accomplishment of a specified purpose. Examples of the Society's temporarily restricted net assets and related activities include grant awards and the spendable income from prize and other income-restricted endowment funds. Permanently restricted net assets are those that must be invested in perpetuity and are commonly referred to as endowment funds. The accompanying financial information principally relates to the unrestricted net assets, as this category includes the operating activities of the Society.

Unrestricted expenses in excess of unrestricted revenues for the year ended December 31, 2000, resulted in a deficit of approximately $357,000. Of this amount, net losses on the unrestricted portion of the long-term investment portfolio totaled $2,025,000 and net income from operations totaled $1,668,000. Exceptionally weak financial markets in the U.S. during the year contributed to losses on our long-term portfolio of approximately 4.3%. These and other matters are discussed in more detail in the following sections.

The Society's net assets totaled $50,697,000 at December 31, 2000: $2,263,000 is permanently restricted, consisting principally of the original amount of donor restricted gifts and bequests received by the Society; $2,210,000 is temporarily restricted by donor-imposed limitations that will lapse upon the passage of time or the use of the asset for its intended purpose; $46,224,000 is unrestricted, of which $36,951,000 has been designated by the Board of Trustees as reserved for future expenditure, principally in the form of the Economic Stabilization Fund (ESF). This fund's purpose is to provide a source of cash in the event of a financial crisis. The Society's Board of Trustees set the minimum level at which to maintain the ESF at 100% of operating expenses plus the current estimate of the post-retirement health benefit obligation. As of the end of 2000, the value of the ESF exceeds the established minimum level. The remaining unrestricted net assets consist of $5,109,000 invested in fixed assets, and undesignated net assets of $4,163,000.





II. Review of 2000 Operations

As indicated in the graph on the preceding page, the past three years have been very good years financially for the Society, apart from investment losses in 2000.

Operationally, the Society continues to do well, as evidenced by positive operating income. Although the Society experienced investment losses in 2000, our losses were only about half of those seen in the broad market indexes, such as the S&P 500. In spite of losses in 2000, long-term investments have generated high returns over a long period, and that income has helped the endowment funds (and the income they produce) to keep pace with inflation.

When reflecting on years with good operating results, it is instructive to review the Society's record for a somewhat longer period. The chart above shows operating income as a percentage of operating revenues. Two observations are noteworthy. First, the margins achieved from 1997 to 2000 are somewhat higher than the average of the years presented. Second, the variation in margin over the more recent years is smaller than the variation in the earlier years. Taken together, these are positive financial indicators.

Sales Trends

The graphs that follow show sales trends from 1993 through 2000, first in historical dollars and second in constant dollars (using 1999 as the base year and adjusting other years for inflation).

Sales Trends—Historical Dollars shows sales trends from 1993 through 2000. Some of the trends are mildly upward, and this may be due to the effects of inflation. Below, the chart is repeated with the underlying data converted to constant dollars.

Mathematical Reviews. Total sales of MR in its various forms declined again in 2000. Much of this decline relates to sales in countries where the exchange rate with the U.S. dollar has been unfavorable. Part of the Society's response to this has been to hold back on price increases for MR-related products and to concentrate on working with consortia, where costs can be spread over a larger number of institutions. MR is currently financially healthy; however, it is probably unrealistic to expect large increases in sales.

Journals. Journal revenues are holding reasonably constant, with perhaps slight decreases in recent years. This decrease is the result of financial pressures on libraries everywhere in the world. In particular, many countries have experienced economic problems that have been compounded by decreases in the value of their currency. This makes U.S. journals quite expensive, even though AMS journals have experienced very small price increases in U.S. dollars. The drop in 1996 resulted from decisions made by those in control of four Russian journals (*Izvestiya, Sbornik, Steklov,* and *Doklady*) to use sources other than the AMS for translation into English and distribution of the resulting translation journals.

Books. Book revenues have leveled off for 2000. This is most likely due to an overall decrease in book sales worldwide. The Society has begun a process of reviewing its marketing and distribution arrangements and other factors that affect sales in order to keep the book program as healthy as possible in a difficult market. It is likely that the current slump will take some time to turn around.

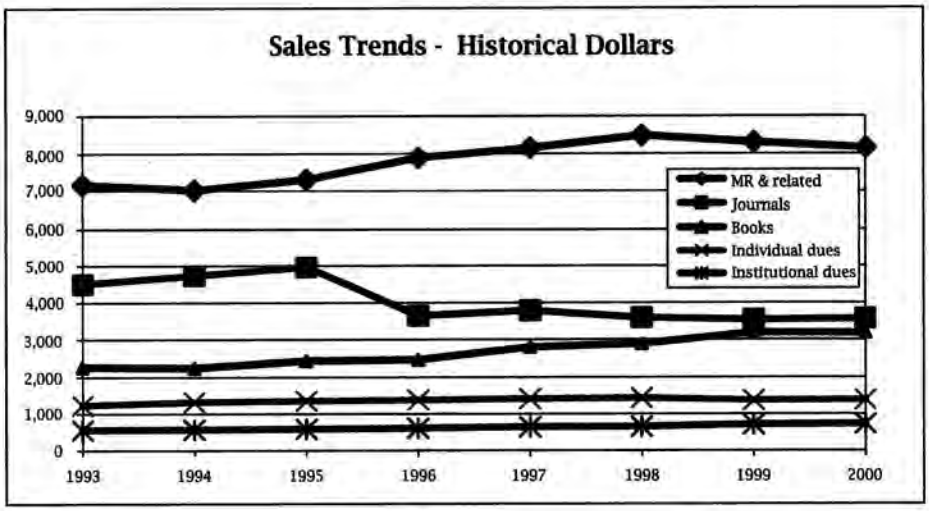
Dues. Dues, the sum of individual and institutional, have shown a slight upward slope on the historical dollars chart and a nearly flat line in constant dollars. This is expected for institutional dues, as the number of members varies little from year to year and the dues rates have been set so that dues will increase at about the same level as inflation. There has been a slight decline in individual dues in the last two years.

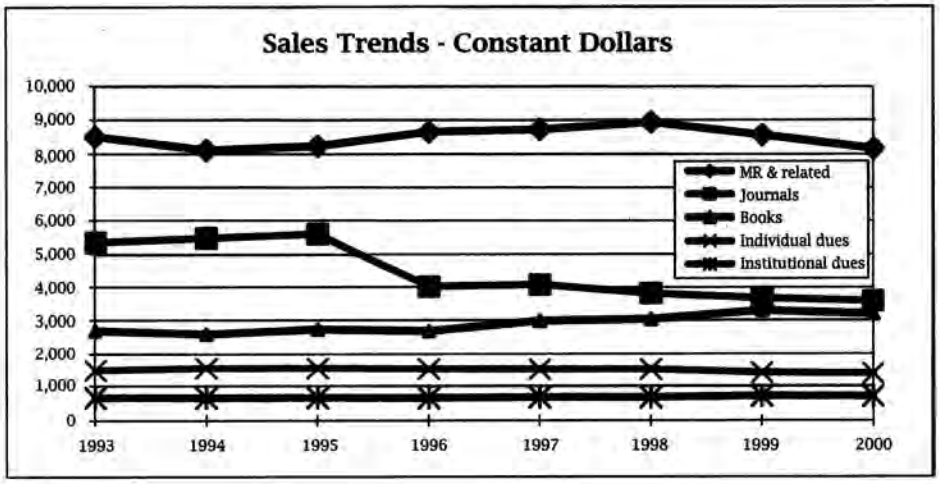
Major Expense Categories

The table on the next page shows the major expense for 1998, 1999, and 2000 in thousands of dollars. In terms of how expense dollars are allocated, there is not much change from year to year.

III. Assets and Liabilities

So far, this report has dealt with revenues and expenditures that affect unrestricted net assets. Another aspect of the Society's finances is what it owns and owes, or its assets and liabilities, which are reported below in the Balance Sheets. As discussed previously, the Society's net assets and activities that increase or decrease net assets are classified as unrestricted, temporarily restricted, or permanently restricted. A majority of the assets and liabilities detailed on the accompanying Balance Sheets relate to the unrestricted net assets. The permanently restricted net assets are supported by investments in the long-term investment portfolio, and the temporarily restricted net assets are supported by investments in the long-term and short-term investment portfolios. The Market Value





Major Expense Categories

	1998		1999		2000	
Personnel Costs	$11,490	62%	$11, 795	64%	$12,027	63%
Building and Equipment Related	1,586	9%	1,540	9%	1,561	8%
Postage	943	4%	897	5%	926	5%
Outside Printing	901	5%	908	5%	950	5%
Travel—Staff and Volunteers	569	3%	571	3%	688	4%
All Other Expenses	3,079	17%	2,580	14%	2,930	15%
TOTAL	$18,568	100%	$18,291	100%	$19,082	100%

The table above shows the major expense for 1998, 1999, and 2000 in thousands of dollars. In terms of how expense dollars are allocated, there is not much change from year to year.

of Invested Funds shows the market value of each endowment and Board-designated (quasi-endowment) fund, including any reinvested earnings.

The Society's fiscal year coincides with the period covered by dues and subscriptions. Since dues and subscriptions are generally received in advance, the Society reports a large balance of cash and short-term investments on its financial statements at year-end. This amounted to about $12,860,000 and $13,068,000 at December 31, 2000 and 1999, respectively. The recorded liability for the revenues received in advance was about $10,543,000 and $11,382,000 at December 31, 2000 and 1999, respectively.

The Society's property and equipment include land, buildings and improvements, office furniture and equipment, as well as software. The Society also owns a small amount of transportation equipment. The land, buildings, and improvements include the Society's Rhode Island headquarters, with buildings in Providence and Pawtucket, and the Mathematical Reviews offices in Ann Arbor. The largest part of the Society's office equipment is its investment in computer facilities.

The Society's endowment is managed under the "total return concept". Under this management policy, income in excess of a reasonable amount (set by the Board of Trustees) is reinvested and increases the value of the fund. This allows for growth in income over time.

IV. Summary Financial Information

The following are summaries of the annual financial statements of the Society. A copy of the Society's audited financial statements, as submitted to the Trustees and the Council, will be sent from the Providence office to any member who requests it from the treasurer. The treasurer will be happy to answer any questions members may have regarding the financial affairs of the Society.

Respectfully submitted,

John M. Franks
Treasurer

BALANCE SHEETS
December 31, 2000 and 1999

Assets	2000	1999
Cash and cash equivalents	$ 511,733	$ 699,138
Short-term investments	12,348,162	12,369,218
Receivables, less allowances of $225,006 and $207,874 at December 31, 2000 and 1999, respectively	1,644,914	1,430,152
Deferred prepublication costs	557,469	654,015
Completed books	1,312,616	1,225,881
Prepaid expenses and deposits	978,627	1,038,070
Land, buildings, and equipment, less accumulated depreciation	5,109,451	5,403,831
Long-term investments	45,619,867	45,541,088
Total assets	**$68,082,839**	**$68,361,393**
Liabilities and Net Assets		
Liabilities:		
Accounts payable	$ 1,184,407	$ 1,284,514
Accrued expenses:		
Severance and study leave pay	1,201,485	1,310,192
Payroll, benefits & other	2,312,014	1,531,264
Deferred revenue	10,542,898	11,381,639
Post-retirement benefit obligation	2,144,990	1,904,990
Total liabilities	**17,385,794**	**17,412,599**
Net assets:		
Unrestricted:		
Undesignated	4,163,022	4,550,682
Designated	36,951,344	36,626,593
Invested in fixed assets	5,109,451	5,403,831
	46,223,817	46,581,106
Temporarily restricted	2,209,840	2,370,442
Permanently restricted	2,263,388	1,997,246
Total net assets	**50,697,045**	**50,948,794**
Total liabilities and net assets	**$68,082,839**	**$68,361,393**

STATEMENTS OF ACTIVITIES
Years Ended December 31, 2000 and 1999

Changes in unrestricted net assets:

Operating Revenue	2000	1999
Publication:		
Mathematical Reviews and related activities	$ 8,164,037	$ 8,315,837
Journals (excluding MR)	3,572,020	3,548,819
Books	3,189,452	3,195,422
Sale of services	417,993	388,305
Other	102,448	96,899
Total publication revenue	15,445,950	15,545,282
Membership and professional services, including assets released from restrictions of $337,995 and $325,587 in 2000 and 1999, respectively:		
Meetings	914,959	791,625
Dues and membership services	3,537,191	3,375,669
Grants, prizes and awards	732,508	927,124
Total membership and professional services revenue	5,184,658	5,094,418
Short-term investment income	611,478	451,690
Other	262,020	270,940
Total operating revenue	**$21,504,106**	**$21,362,330**
Operating Expenses		
Publication:		
Mathematical Reviews and related activities	$ 5,155,811	$ 5,604,184
Journals (excluding MR)	1,142,677	1,289,722
Books	2,477,906	2,317,998
Publication—divisional indirect	1,241,856	1,060,489
Warehousing and distribution	640,838	646,450
Marketing director	271,082	275,508
Sale of services	260,408	260,105
Total publication expense	11,190,578	11,454,456
Membership and professional services:		
Dues and member services	2,499,926	2,168,147
Grants, prizes and awards	815,040	951,931
Meetings	878,310	752,803
Governance	378,653	475,768
Divisional indirect	144,977	213,438
Total membership and professional services expense	4,716,906	4,562,087
Interest portion of post-retirement benefits	125,000	120,000
Other	361,444	212,853
Membership and customer services	1,123,440	920,983
General and administrative	2,318,674	2,622,253
Total operating expenses	**19,836,042**	**19,892,632**
Excess of operating revenue over operating expenses	1,668,064	1,469,698
Long-term investment income (loss)in excess of amounts designatedfor current operations	(2,025,353)	6,626,224
Increase in unrestricted net assets	**(357,289)**	**8,095,922**

Changes in temporarily restricted net assets:		
Contributions and grants	206,939	328,340
Long-term investment income (loss)	(29,546)	442,228
Net assets released from restrictions	(337,995)	(325,587)
Increase (decrease) in temporarily restricted net assets	(160,602)	444,981
Increase in permanently restricted net assets - Contributions	266,142	579,027
Change in net assets	(251,749)	9,119,930
Net assets, beginning of year	50,948,794	41,828,864
Net assets, end of year	$50,697,045	$50,948,794

MARKET VALUE OF INVESTED FUNDS
December 31

	2000	1999	1998
Endowment Funds			
Prize Funds:			
Steele	$ 666,186	$ 723,427	$ 632,794
Birkhoff	40,302	43,764	38,282
Veblen	13,610	14,780	12,928
Wiener	13,610	14,780	12,928
Bôcher	9,898	10,749	9,402
Conant	44,429	48,246	42,202
Cole	21,945	23,831	20,845
Satter	35,384	38,424	33,610
Morgan	48,349	52,504	45,926
Albert Whiteman	29,571	29,305	21,244
Arnold Ross Lectures	56,397	50,383	35,324
Trjitzinksky	535,304	581,299	508,466
C. V. Newsom	249,253	270,670	236,757
Centennial	123,905	133,465	116,743
Menger	11,800	12,814	6,515
Ky Fan (China)	376,397	393,572	
Epsilon	251,165	163,191	
Total (income restricted)	2,527,505	2,605,204	1,773,966
Endowment	759,397	794,048	676,963
Morita	120,913	126,430	106,372
Henderson	4,092,150	4,352,067	3,711,411
Laha	189,309		
Ritt	240,820	251,808	211,858
Moore	22,700	23,736	19,971
Total (income unrestricted)	5,425,289	5,548,089	4,726,575
Total endowment funds	7,952,794	8,153,293	6,500,541
Quasi-endowment Funds:			
Friends of Math	123,572	123,572	123,572
Russian Royalties	17,829	17,829	17,829
Journal Archive Fund	206,528	176,218	116,588
Economic Stabilization Fund	36,055,884	36,259,273	30,484,232
Young Scholars	500,000		
Charitable Gift Annuities	47,532	49,701	41,816
Total quasi-endowment funds	36,951,345	36,626,593	30,784,037
Total funds	$44,904,139	$44,779,886	$37,284,578

Officers and Committee Members

Numbers to the left of headings are used as points of reference in an index to AMS committees which follows this listing. Primary and secondary headings are:

1. Officers
   1.1. Liaison Committee
2. Council
   2.1. Executive Committee of the Council
3. Board of Trustees
4. Committees
   4.1. Committees of the Council
   4.2. Editorial Committees
   4.3. Committees of the Board of Trustees
   4.4. Committees of the Executive Committee and Board of Trustees
   4.5. Internal Organization of the AMS
   4.6. Program and Meetings
   4.7. Status of the Profession
   4.8. Prizes and Awards
   4.9. Institutes and Symposia
   4.10. Joint Committees
5. Representatives
6. Index

Terms of members expire on January 31 following the year given unless otherwise specified.

1. Officers

President	Hyman Bass	2002
Immediate Past President		
	Felix E. Browder	2001
Vice Presidents	James G. Arthur	2001
	Ingrid Daubechies	2003
	David Eisenbud	2002
Secretary	Robert J. Daverman	2002
Associate Secretaries	John L. Bryant	2002
	Susan J. Friedlander	2001
	Bernard Russo	2001
	Lesley M. Sibner	2002
Treasurer	John M. Franks	2002
Associate Treasurer	B. A. Taylor	2002

1.1. Liaison Committee

All members of this committee serve *ex officio*.

	Roy L. Adler
Chair	Hyman Bass
	Robert J. Daverman
	John M. Franks

2. Council

2.0.1. Officers of the AMS

President	Hyman Bass	2002
Immediate Past President		
	Felix E. Browder	2001
Vice Presidents	James G. Arthur	2001
	Ingrid Daubechies	2003
	David Eisenbud	2002
Secretary	Robert J. Daverman	2002
Associate Secretaries*	John L. Bryant	2002
	Susan J. Friedlander	2001
	Bernard Russo	2001
	Lesley M. Sibner	2002
Treasurer	John M. Franks	2002
Associate Treasurer	B. A. Taylor	2002

2.0.2. Representatives of Committees

Bulletin	Donald G. Saari	2001
Colloquium	Susan J. Friedlander	2001
Executive Committee	Robert L. Bryant	2003
Executive Committee	Joel H. Spencer	2001
Executive Committee	Karen Vogtmann	2002
Journal of the AMS	Carlos E. Kenig	2003
Mathematical Reviews	Hugh L. Montgomery	2001
Mathematical Surveys and Monographs	Michael P. Loss	2002
Mathematics of Computation	Lars B. Wahlbin	2001
Proceedings	Eric D. Bedford	2004
Transactions and Memoirs	William Beckner	2003

2.0.3. Members at Large

Patricia E. Bauman	2002	Alexander Nagel	2003
Haim Brezis	2001	Louise A. Raphael	2003
Walter L. Craig	2003	Jonathan M. Rosenberg	2002
Keith J. Devlin	2003	Donald G. Saari	2001
Robert A. Fefferman	2001	Tatiana Toro	2001
Irene Fonseca	2003	Lisa M. Traynor	2002
William Fulton	2002	Nolan R. Wallach	2001
Martin Golubitsky	2002		

*Only one Associate Secretary at a time is a voting member of the Council, namely the cognizant Associate Secretary for the scientific sessions.

2.1. Executive Committee of the Council

	Hyman Bass	*ex officio*
	Felix E. Browder	*ex officio*
	Robert L. Bryant	2003
	Robert J. Daverman	*ex officio*
	David Eisenbud	2004
	Joel H. Spencer	2001
	Karen Vogtmann	2002

3. Board of Trustees

Chair	Roy L. Adler	2002
	Hyman Bass	*ex officio*
	John B. Conway	2005
	John M. Franks	*ex officio*
Secretary	Eric M. Friedlander	2004
	Linda Keen	2003
	Andy R. Magid	2001
	B. A. Taylor	*ex officio*

4. Committees

4.1. Committees of the Council

Standing Committees

4.1.1. Editorial Boards

	George E. Andrews	2001
	Tony F. C. Chan	2003
	Jane P. Gilman	2003
	Palle E. T. Jorgensen	2002
	Krystyna M. Kuperberg	2001
Chair	Gregory F. Lawler	2002

4.1.2. Nominating Committee

Terms begin on January 1 and end on December 31 of the year listed.

	William Browder	2001
	Ruth M. Charney	2002
	Ramesh A. Gangolli	2002
	Lisa Claire Jeffrey	2001
	Irwin Kra	2003
Chair	Frank Morgan	2002
	Marc A. Rieffel	2001
	Cora S. Sadosky	2003
	Steven H. Weintraub	2003

4.2. Editorial Committees

4.2.1. Abstracts Editorial Committee

All members of this committee serve *ex officio*.

	John L. Bryant
Chair	Robert J. Daverman
	Susan J. Friedlander
	Bernard Russo
	Lesley M. Sibner

4.2.2. Bulletin (New Series)

Chief Editor	Donald G. Saari	2001
	Bhama Srinivasan	2001

Associate Editors for Bulletin Articles

John C. Baez	2001	Haynes R. Miller	2001
John M. Franks	2001	Hugo Rossi	2001
Eric M. Friedlander	2001	Daniel Ruberman	2001
Craig L. Huneke	2001	Panagiotis E. Souganidis	
Douglas A. Lind	2001		2003
Barry Mazur	2001	David A. Vogan	2001

Associate Editors for Book Reviews

Lawrence Craig Evans	2001	Audrey A. Terras	2002
Andy R. Magid	2001	Wolfgang Ziller	2001
Philip E. Protter	2002		

4.2.3. Collected Works

Chair	Jonathan L. Alperin	2003
	Elliott H. Lieb	2002
	Cathleen S. Morawetz	2003

4.2.4. Colloquium

Chair	Susan J. Friedlander	2001
	Yuri Manin	2003
	Peter Sarnak	2002

4.2.5. Contemporary Mathematics

	Andreas Blass	2001
Chair	Dennis DeTurck	2004
	Andy R. Magid	2001
	Michael S. Vogelius	2001

4.2.6. Electronic Research Announcements

	Stuart Antman	2002
	David J. Benson	2001
	Dimitri Burago	2003
	Mark Freidlin	2002
	Ronald L. Graham	2003
Chair	Svetlana R. Katok	2003
	Yitzhak Katznelson	2001
	David Kazhdan	2001
	Alexander S. Kechris	2002
	Alexandre A. Kirillov	2002
	Frances C. Kirwan	2002
	Krystyna M. Kuperberg	2002
	Robert K. Lazarsfeld	2001
	Grigorii A. Margulis	2002
	Hugh L. Montgomery	2003
	Walter David Neumann	2003
	Klaus Schmidt	2003
	Richard M. Schoen	2001
	Masamichi Takesaki	2003
	Michael E. Taylor	2001
	Guido L. Weiss	2003
	Zhihong (Jeff) Xia	2003
	Don B. Zagier	2001
	Efim I. Zelmanov	2003
	———	2003

4.2.7. Graduate Studies in Mathematics

	Steven G. Krantz	2003
Chair	David J. Saltman	2002
	David Sattinger	2001
	Ronald J. Stern	2001

4.2.8. Journal of the AMS

	Ingrid Daubechies	2001
	Aise Johan de Jong	2002
Chair	Carlos E. Kenig	2003
	Richard M. Schoen	2003
	Bernd Sturmfels	2001

Associate Editors

James G. Arthur	2002	Grigorii A. Margulis	2003
Alexander Beilinson	2001	Curtis T. McMullen	2002
F. Michael Christ	2001	Tomasz S. Mrowka	2002
Constantine M. Dafermos	2001	Bjorn Poonen	2002
Weinan E	2003	Jonathan M. Rosenberg	2002
Lawrence Craig Evans	2001	Karen E. Smith	2002
Michael J. Hopkins	2002	Richard P. Stanley	2003
Ehud Hrushovski	2003	W. Hugh Woodin	2002
Robert K. Lazarsfeld	2002	Efim I. Zelmanov	2001

4.2.9. Mathematical Reviews

AMS staff contact: Jane E. Kister.

	Heinz W. Engl	2002
	Jonathan I. Hall	2003
	Yuji Ito	2003
	Joyce R. McLaughlin	2002
Chair	Hugh L. Montgomery	2001
	Clarence Wilkerson	2001

4.2.10. Mathematical Surveys and Monographs

	Peter S. Landweber	2003
Chair	Michael P. Loss	2002
	Tudor Stefan Ratiu	2003
	J. Tobias Stafford	2003

4.2.11. Mathematics of Computation

	Stanley J. Osher	2001
	René Schoof	2001
Chair	Lars B. Wahlbin	2001
	Joseph D. Ward	2001

Associate Editors

Randolph E. Bank	2003	Roswitha März	2002
David W. Boyd	2003	Harald G. Niederreiter	2002
Susanne C. Brenner	2001	Ricardo Horacio Nochetto	2001
Richard P. Brent	2003	Haesun Park	2001
Joe P. Buhler	2003	Joseph E. Pasciak	2001
Carsten Carstensen	2003	Lothar Reichel	2001
Arjeh M. Cohen	2002	Chi-Wang Shu	2001
Ronald F. A. Cools	2002	Frank Stenger	2001
Howard Elman	2003	Denis Talay	2003
Richard S. Falk	2001	Nico M. Temme	2001
Andrew J. Granville	2001	Hugh C. Williams	2003
Daniel W. Lozier	2001	Jinchao Xu	2003
Zhi-Quan Luo	2002		

4.2.12. Notices Editorial Board

Terms begin on January 1 and expire on December 31 of the year listed

Editor	Harold P. Boas	2003

Associate Editors

Susanne C. Brenner	2003	Elliott H. Lieb	2003
William Casselman	2003	Andy R. Magid	2003
Robert J. Daverman		Judith Roitman	2003
	ex officio	Mark E. Saul	2003
Nathaniel Dean	2003	Karen E. Smith	2003
Richard T. Durrett	2003	Audrey A. Terras	2003
Susan J. Friedlander	2003	Lisa M. Traynor	2003
Robion C. Kirby	2003		

4.2.13. Proceedings

Coordinating	Mark J. Ablowitz	2002
	Joseph A. Ball	2002
	Dan M. Barbasch	2002
Chair	Eric D. Bedford	2004
	Jonathan Borwein	2002
	Suncica Canic	2004
	Carmen C. Chicone	2003
	Bennett Chow	2002
	Richard A. Davis	2003
	J. Dodziuk	2004
	Alan Dow	2003
Coordinating	Ronald A. Fintushel	2002
	Paul Goerss	2004
	Michael Handel	2001
	Juha M. Heinonen	2003
	Dennis A. Hejhal	2001
	Rebecca A. Herb	2002
	Carl G. Jockusch, Jr.	2004
Coordinating	Linda Keen	2001
	David R. Larson	2004
	Martin Lorenz	2004
	Claudia M. Neuhauser	2002
	David Preiss	2002
	Mohan Ramachandran	2003
	David E. Rohrlich	2002
	Andreas Seeger	2004
	David H. Sharp	2003
	Mei-Chi Shaw	2004
Coordinating	Lance W. Small	2001
	Stephen D. Smith	2002
Coordinating	Christopher D. Sogge	2001
	John R. Stembridge	2001
	Michael Stillman	2002
	David S. Tartakoff	2002
	N. Tomczak-Jaegermann	2003
	Wolmer V. Vasconcelos	2001
	Wolfgang Ziller	2003
		2004

4.2.14. Proceedings of Symposia in Applied Mathematics

	Marsha J. Berger	2000
Chair	Peter S. Constantin	2001
	Eitan Tadmor	2002

4.2.15. Transactions and Memoirs

	Peter W. Bates	2003
Chair	William Beckner	2003
	Bruce E. Blackadar	2001
	Krzysztof Burdzy	2003
	Charles W. Curtis	2001
	Lawrence M. Ein	2002
	Sergey Fomin	2004
	Lisa Claire Jeffrey	2004
	Barbara L. Keyfitz	2001
	Michael J. Larsen	2003
	D. H. Phong	2004
	Stewart B. Priddy	2003
	Theodore A. Slaman	2001
	Robert J. Stanton	2001
	Abigail Thompson	2004
	Robert F. Williams	2001
		2002

4.2.16. Translation from Chinese

	Sun-Yung Alice Chang
	S.-Y. Cheng
Chair	Tsit-Yuen Lam
	Tai-Ping Liu
	Chung-Chun Yang

4.2.17. Translation from Japanese

Chair	Shoshichi Kobayashi	1999
	Masamichi Takesaki	1999

Standing Committees

4.2.18. Conformal Geometry and Dynamics

	Kari Astala	2003
	Frederick W. Gehring	2003
Chair	Linda Keen	2002
	Misha Lyubich	2002
	Howard Masur	2001
	Lei Tan	2002

4.2.19. History of Mathematics

	George E. Andrews	2003
	Joseph W. Dauben	2003
Chair	Karen H. Parshall	2004
	Michael I. Rosen	2004

4.2.20. Representation Theory

	Anthony W. Knapp	2003
	James I. Lepowsky	2001
	George Lusztig	2003
	Dragan Milicic	2001
	Birgit Speh	2002
Chair	David A. Vogan	2002

4.2.21. Student Mathematics Library

	David M. Bressoud	2001
Chair	Robert L. Devaney	2001
	Carl Pomerance	2001
	Hung-Hsi Wu	2001

4.2.22. University Lecture Series

Chair	Jerry L. Bona	2002
	Jean-Luc Brylinski	2001
	Nigel J. Hitchin	2003
	Nicolai Reshetikhin	2002

4.3. Committees of the Board of Trustees

4.3.1. Agenda and Budget

All members of this committee serve *ex officio.*

Roy L. Adler
Hyman Bass
Robert J. Daverman
John M. Franks
Joel H. Spencer
B. A. Taylor

4.3.2. Audit

All members of this committee serve *ex officio.*
AMS staff contact: Gary G. Brownell.

Roy L. Adler
John M. Franks

4.3.3. Investment

AMS staff contact: Gary G. Brownell.

	Roy L. Adler	*ex officio*
Chair	John M. Franks	*ex officio*
	B. A. Taylor	*ex officio*
	Peter Weinberger	2003

4.3.4. Salaries

All members of this committee serve *ex officio.*

Roy L. Adler
Chair — John M. Franks
Linda Keen
B. A. Taylor

4.3.5. Staff and Services

All members of this committee serve *ex officio.*

Roy L. Adler
John M. Franks
Chair — B. A. Taylor

4.4. Committees of the Executive Committee and Board of Trustees

4.4.1. Long Range Planning

All members of this committee serve *ex officio.*
AMS staff contact: Raquel E. Storti.

Roy L. Adler
Hyman Bass
Robert L. Bryant
Robert J. Daverman
John H. Ewing
John M. Franks
Chair — Karen Vogtmann

4.4.2. Nominating

All members of this committee serve *ex officio.*

Robert L. Bryant
Eric M. Friedlander
Chair — Linda Keen
Frank Morgan
Joel H. Spencer

4.5. Internal Organization of the American Mathematical Society

Standing Committees

4.5.1. Archives

	Robert M. Fossum	2001
	Albert C. Lewis	2003
Chair	Karen H. Parshall	2002

4.5.2. Book and Journal Donations Steering Committee

	M. Salah Baouendi	2004
	Peter W. K. Li	2003
Chair	James L. Rovnyak	2003

4.5.3. Committee on Committees

	Josefina Alvarez	2002
	Hyman Bass	*ex officio*
	Dave Bayer	2002
	Curtis D. Bennett	2002
	Spencer J. Bloch	2002
Chair	Jerry L. Bona	2002
	Edward B. Burger	2002
	Robert J. Daverman	*ex officio*
	Andy R. Magid	2002
	Robert Eugene Megginson	2002
	Donald St. P. Richards	2002
	Alice Silverberg	2002
	Ronald J. Stern	2002

4.5.4. Library Committee

Co-chair	Igor Dolgachev	2002
	Robert S. Doran	2002
	John B. Garnett	2003
Co-chair	Carol Hutchins	2002
	Reinhard Laubenbacher	2003
	Robert S. Seeds	2003
	Helena F. Warburg	2003
	Molly T. White	2003

4.5.5. Publications

AMS staff contact: Donald G. Babbitt.

	Donald G. Babbitt	*ex officio*
	Hyman Bass	*ex officio*
Chair	Robert L. Bryant	2003
	Robert J. Daverman	*ex officio*
	Nathaniel Dean	2002
	Keith J. Devlin	2003
	John H. Ewing	*ex officio*
	Jay R. Goldman	2001
	Martin Golubitsky	2002
	Palle E. T. Jorgensen	2001
	Linda Keen	2001
	Gail D. L. Ratcliff	2002
	Donald G. Saari	2001
	Ronald J. Stern	2001

4.6. Program and Meetings

Standing Committees

4.6.1. Meetings and Conferences

AMS staff contact: Diane Saxe

	James G. Arthur	2001
	Hyman Bass	*ex officio*
	Dominic P. Clemence	2002
	Karen L. Collins	2001
	John B. Conway	2001
	Robert J. Daverman	*ex officio*
	John H. Ewing	*ex officio*
	Irene Fonseca	2003
	Rick Miranda	2001
	Karen H. Parshall	2001
	Richard Randell	2003
	Hema Srinivasan	2003
Chair	Karen Vogtmann	2002

4.6.2. Program Committee for National Meetings

	Spencer J. Bloch	2003
	Robert J. Daverman	*ex officio*
	Bjorn Engquist	2002
Chair	Curtis Greene	2002
	George C. Papanicolaou	2001
	David J. Saltman	2003
	Lai-Sang Young	2003

4.6.3. Short Course Subcommittee

	Samuel R. Buss	2001
	Annalisa Crannell	2002
Chair	Martin Golubitsky	2001
	Christopher E. Heil	2003
	Kirk Lancaster	2003
	John R. Swallow	2002
	Michael I. Weinstein	2003

4.6.4. Central Section Program Committee

	Susan J. Friedlander	*ex officio*
	Irene Martinez Gamba	2002
	Steve Hofmann	2002
	Louis H. Kauffman	2001
Chair	Karen E. Smith	2001

4.6.5. Eastern Section Program Committee

	Gregory L. Cherlin	2002
	Walter L. Craig	2002
Chair	M. Beth Ruskai	2001
	Lesley M. Sibner	*ex officio*
	Gang Tian	2001

4.6.6. Southeastern Section Program Committee

	John L. Bryant	*ex officio*
Chair	Ronald A. DeVore	2001
	Amassa C. Fauntleroy	2002
	Guillermo Segundo Ferreyra	2002
	Carla D. Savage	2001

4.6.7. Western Section Program Committee

	James H. Curry	2002
	Gustavo Ponce	2001
	Bernard Russo	*ex officio*
Chair	Tatiana Toro	2001
	William T. Trotter	2002

4.6.8. Agenda for Business Meetings

Chair	Robert J. Daverman	*ex officio*
	_____	2002
	_____	2002

4.6.9. Arnold Ross Lecture Series Committee

	Arthur T. Benjamen	2003
Chair	Robert L. Devaney	2002
	Victoria A. Powers	2003
	Judy L. Walker	2003

4.6.10. Colloquium Lecture

	Luis A. Caffarelli	2002
Chair	David Jerison	2001
	Sergiu Klainerman	2003

4.6.11. Gibbs Lecturer for 2001 and 2002, Committee to Select

Chair	Percy Alec Deift
	Persi W. Diaconis
	Michael E. Fisher

4.7. Status of the Profession

Standing Committees

4.7.1. Academic Freedom, Tenure, and Employment Security

	Idris Assani	2003
	Birgit Speh	2002
	Abigail A. Thompson	2001
	Roger A. Wiegand	2003
	Jay A. Wood	2002
	_____	2001
	_____	2001

4.7.2. Education

AMS staff contact: Samuel M. Rankin III.

	Hyman Bass	*ex officio*
	Felix E. Browder	*ex officio*
	Charles Herbert Clemens	2001
	Carl C. Cowen	2002
	Robert J. Daverman	*ex officio*
	Robert L. Devaney	2003
	John H. Ewing	*ex officio*
	Robert A. Fefferman	2001
Chair	Roger E. Howe	2002
	Arthur M. Jaffe	2003
	Peter Kuchment	2002
	William James Lewis	2001
	Andy R. Magid	2001
	Curtis C. McKnight	2002
	Alexander Nagel	2003
	Louise A. Raphael	2003
	Judith Roitman	2001
	Lisa M. Traynor	2002

4.7.3. Fan Fund

Chair	Fan R. K. Chung-Graham	2002
	Yanyan Li	2003
	Gang Tian	2002

4.7.4. Human Rights of Mathematicians

	Haim Brezis	2002
	Pao-sheng Hsu	2001
	Tsit-Yuen Lam	2001
Chair	Joel L. Lebowitz	2002
	Louis Nirenberg	2002
	Yakov Sinai	2003
	Susan G. Staples	2003
	Michael Tom	2003
	David A. Vogan	2001

4.7.5. Profession

AMS staff contact: James W. Maxwell.

	Roy Adler	2001
	Hyman Bass	*ex officio*
Chair	Patricia E. Bauman	2002
	William Beckner	2001
	Haim Brezis	2001
	Walter L. Craig	2003
	Robert J. Daverman	*ex officio*
	John H. Ewing	*ex officio*
	Mark L. Green	2002
	Sheldon Katz	2002
	Donald E. McClure	2001
	Louis Pigno	2002
	Frank S. Quinn	2001
	Jonathan M. Rosenberg	2001
	Karen E. Smith	2001

4.7.6. Professional Ethics

	Sylvain E. Cappell	2001
	Douglas S. Kurtz	2003
	Anne Leggett	2003
Chair	John C. Meakin	2003
	Efton L. Park	2003
	Floyd L. Williams	2002

4.7.7. Science Policy

AMS staff contact: Samuel M. Rankin III.

	Hyman Bass	*ex officio*
Chair	Felix E. Browder	*ex officio*
	Ingrid Daubechies	2003
	Robert J. Daverman	*ex officio*
	David Eisenbud	2002
	John H. Ewing	*ex officio*
	Eric M. Friedlander	2001
	Roger E. Howe	2001
	Arthur M. Jaffe	2002
	Carl Pomerance	2002
	M. Beth Ruskai	2001
	Donald G. Saari	2001
	Gilbert Strang	2003
	Nolan R. Wallach	2001
	Efim I. Zelmanov	2001

4.7.8. Young Scholars Program, Interim Committee on the

	Leonore J. Cowen	2001
	Alan Edelman	2003
Chair	Joel H. Spencer	2001
	Karen Vogtmann	2001

4.8. Prizes and Awards

Standing Committees

4.8.1. Award for Distinguished Public Service, Committee to Select the Winner of the

Chair	Frederick W. Gehring	2002
	Peter D. Lax	2001
	D. J. Lewis	2003
	Calvin C. Moore	2004
	William Yslas Velez	2005

4.8.2. Bôcher Prize

	Luis Caffarelli	2002
Chair	Sergiu Klainerman	2002
	Linda Preiss Rothschild	2002

4.8.3. Centennial Fellowships

Terms expire on June 30

	Frederic Davis Ancel	2001
	Noel Patrick Brady	2002
	Robert Hardt	2001
Chair	Thomas Liggett	2002
	Michael P. Loss	2002
	Janos Pach	2001
	Alejandra Uribe	2002

4.8.4. Conant Prize for 2001, Committee to Select the Winner of the

	Brian J. Parshall	2003
Chair	Anthony V. Phillips	2002
	Joseph H. Silverman	2002

4.8.5. Mathematics in Moscow Progam—Travel Support

Terms expire on June 30

Chair	Rafe R. Mazzeo	2004
	Jack Morava	2003
	Nicolai Reshetikhin	2004

4.8.6. Menger Prize Committee

Terms expire on May 31

	Gisele R. Goldstein	2002
	Mubenga Ngandu Nkashama	2001
Chair	Julian I. Palmore	2003

4.8.7. National Awards and Public Representation

Chair	Hyman Bass	*ex officio*
	Felix E. Browder	*ex officio*
	Fan R. K. Chung-Graham	2001
	Robert J. Daverman	*ex officio*
	Arthur M. Jaffe	2002

4.8.8. Satter Prize, Committee to Select the Winner of the

	Alexandra Bellow	2003
Chair	Bhama Srinivasan	2002
	Jean E. Taylor	2004

4.8.9. Steele Prizes

	M. Salah Baouendi	2003
	Sun-Young Alice Chang	2003
	Michael G. Crandall	2003
	Constantine M. Dafermos	2002
	Daniel J. Kleitman	2003
	Hugh L. Montgomery	2001
	Barry Simon	2002
Chair	S. R. S. Varadhan	2001
	Herbert S. Wilf	2002

Special Committees

4.8.10. Automatic Theorem Proving, Committee to Recommend Winners of Prizes for

Chair	Ronald L. Graham	2002
	Oscar E. Lanford III	2002
	David Mumford	2002

4.8.11. Cole Prize

	Benedict H. Gross	
	Carl Pomerance	
Chair	Paul A. Vojta	

4.9. Institutes and Symposia

Standing Committees

4.9.1. Liaison Committee with AAAS

	Douglas N. Arnold	2002
	Richard A. Askey	*ex officio*
	Lenore Blum	*ex officio*
	John H. Ewing	2001
	Gene H. Golub	*ex officio*
	Arthur M. Jaffe	*ex officio*
	Herbert B. Keller	*ex officio*
	Warren Page	*ex officio*
	Jeffrey R. Weeks	2002

4.9.2. Von Neumann Symposium

4.10. Joint Committees

4.10.1. AMS-ASA-AWM-IMS-MAA-NCTM-SIAM Committee on Women in the Mathematical Sciences

NCTM members' terms expire April 1 of the year given.

	Susan R. Ackerman (ASA)	2002
	Ann S. Almgren (SIAM)	1999
	Mary E. Flahive (MAA)	2000
	Diane L. Herrmann (AWM)	2000
	Judith Jacobs (NCTM)	2002
	Deborah Lockhart (SIAM)	1998
Chair	Harriett M. Lord (MAA)	2001
	Connie Page (IMS)	1998
	Gail D. Ratcliff (AWM)	2001
	Rosemary A. Renaut (AMS)	2001
	Tamar Schlick (SIAM)	1999
	Sanford Segal (MAA)	2001
	Tara L. Smith (AMS)	2003
	Elizabeth Stasny (IMS)	2000
	Mary Wheeler (AMS)	2001
	Patricia J. Wozniak (ASA)	1999
	_____(AMS)	2001
	_____(AWM)	2002

4.10.2. AMS-ASL-IMS-SIAM Committee on Translations from Russian and Other Slavic Languages

Chair	James D. Stasheff (AMS)	1995

AMS Subcommittee Members

Consultant	V. I. Arnol'd	
	Luchezar Avramov	1994
	Igor Dolgachev	1994
Consultant	S. G. Gindikin	
Consultant	Askol'd Georgievič Khovanskiĭ	
	Robert D. MacPherson	1996
	Grigorii A. Margulis	1996
Consultant	N. K. Nikol'skiĭ	
Chair	James D. Stasheff	1995

ASL Subcommittee Members

Terms expire on January 1

	Marat Arslanov	2002
	Sergei N. Artemov	2002
	Oleg Belegradek	2002
	Elisabeth Bouscaren	2002
	Wilfried Buchholz	2002
Chair	Steffen Lempp	2002
	Mariko Yasugi	2002

IMS Subcommittee Members

Chair	M. I. Freidlin
	B. Pittel
	A. Rukhin
	W. J. Studden

4.10.3. AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences

Terms expire on June 30

	Paul F. Baum (AMS)	2002
	David Brydges (AMS)	2001
	Charles R. Doering (SIAM)	2003
	Ron Donagi (AMS)	2004
	James A. Fill (IMS)	2002
	Steven E. Hurder (AMS)	2001
	Barbara L. Keyfitz (SIAM)	2003
	W. Brent Lindquist (AMS)	2001
	Mark Low (IMS)	2003
	Hema Srinivasan (AMS)	2004
	Kenneth Stephenson (AMS)	2004
	Olof B. Widlund (SIAM)	2003
Chair	Wing Wong (IMS)	2004

4.10.4. AMS-IMS-SIAM Summer Research Conference Advisory Panel

Terms expire on June 30

	Percy Alec Deift (SIAM)	2004
	Prem K. Goel (IMS)	2004
	Alan F. Karr (IMS)	2002
	Bart Ng (SIAM)	2003
	Robert Osserman (AMS)	2002
	John Polking (AMS)	2003

4.10.5. AMS-MAA Committee on Cooperation

All members of this committee serve *ex officio*.

Thomas F. Banchoff (MAA)
Hyman Bass (AMS)
Felix E. Browder (AMS)
Robert J. Daverman (AMS)
John H. Ewing (AMS)
Martha J. Siegel (MAA)
Tina H. Straley (MAA)
Ann E. Watkins (MAA)

4.10.6. AMS-MAA Committee on Mathematicians with Disabilities

Chair	Lawrence W. Baggett (AMS)	2001
	Robert Coleman (AMS)	2000
	John D. Fulton (MAA)	2000
	Eileen L. Poiani (MAA)	2000
	Gerard Walschap (AMS)	2002
	Jon Wilkin (MAA)	2002

4.10.7. AMS-MAA Committee on Research in Undergraduate Mathematics Education (CRUME)

	Anne E. Brown (MAA)	2001
	Julie M. Clark (MAA)	2002
	Ed Dubinsky (MAA)	2003
Chair	Joan Ferrini-Mundy (NCTM)	2001
	Gregory D. Foley (AMATYC)	2001
	Douglas S. Kurtz (AMS)	2002
	R. Bruce Lind (MAA)	2000
	David C. Manderscheid (AMS)	2003
	Louise A. Raphael (AMS)	2002
	Herbert S. Wilf (AMS)	2001

4.10.8. AMS-MAA Committee on Teaching Assistants and Part-time Instructors (TA/PTI)

	Neal Brand (AMS)	2002
	Bettye Anne Case (AMS)	2003
	David R. Finston (AMS)	2003
	John B. Garnett (AMS)	2001
Chair	Suzanne Lenhart (AMS)	2001
	Teri J. Murphy (MAA)	2000
	Bruce Reznick (MAA)	2002
	Stephen B. Rodi (MAA)	2000

4.10.9. AMS-MAA Joint Archives Committee

	Robert M. Fossum (AMS)	2001
	Victor Katz (MAA)	2000
	Albert C. Lewis (AMS)	2003
	John H. McCleary (MAA)	1999
	Karen H. Parshall (AMS)	2002
	James J. Tattersall (MAA)	2001

4.10.10. AMS-MAA Joint Meetings Committee

All members of this committee serve *ex officio.*

	Robert J. Daverman
	John H. Ewing
Consultant	Diane Saxe
	Tina H. Straley
Chair	James J. Tattersall

4.10.11. AMS-MAA Exhibits Advisory Subcommittee

Donald J. Albers
Janice Bowers
Collier Brown
Robert J. Daverman
James Gandorf
Jim Gross
Beth Huber
Elaine Pedreira-Sullivan
Penny Pina
Diane M. Saxe
Jackie Smith
Chair James J. Tattersall
David Tranah
Paul Wellin
Bruce Virga
_____

4.10.12. AMS-MAA Arrangements Committee for the San Diego Meeting January 6–9, 2002

Chair	Jane E. Friedman
	_____
	_____
	_____
	_____
	_____
	_____
	_____
	_____
	_____

4.10.13. AMS-MAA Joint Program Committee for the San Diego Meeting

	Joseph A. Gallian (MAA)
Chair	Curtis Greene (AMS)
	Anita E. Solow (MAA)
	Nolan Wallach (AMS)

4.10.14. AMS-MAA-SIAM Joint Administrative Committee

All members of this committee serve *ex officio.*

James M. Crowley (SIAM)
Robert J. Daverman (AMS)
John H. Ewing (AMS)
John M. Franks (AMS)
Samuel Gubins (SIAM)
Thomas A. Manteuffel (SIAM)
Martha J. Siegel (MAA)
Tina H. Straley (MAA)
Ann E. Watkins (MAA)

4.10.15. AMS-MAA-SIAM Joint Committee on Employment Opportunities

AMS staff contact: James W. Maxwell.

	Neil J. Calkin (AMS)	2003
	Min Chen (AMS)	2003
	J. Kevin Colligan (MAA)	2000
	James W. Daniel (MAA)	2000
Chair	David A. Field (SIAM)	2001
	James W. Maxwell	*ex officio*
	Thomas W. Rishel (MAA)	*ex officio*
	David S. Ross (SIAM)	2003
	Katherine St. John (AMS)	2002
	_____(MAA)	2003

4.10.16. AMS-MAA-SIAM Joint Policy Board for Mathematics (see 2001 Mathematical Sciences Professional Directory, page 31)

4.10.17. AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student

	Kelly J. Black (SIAM)	2000
	Thomas C. Hales (AMS)	2003
	Catherine A. Roberts (SIAM)	1999
Chair	Robert O. Robson (MAA)	2002
	Martha J. Siegel (MAA)	2000
	Robert S. Strichartz (AMS)	2002

4.10.18. AMS-SIAM Committee on Applied Mathematics

James W. Demmel	1998
Tai-Ping Liu	1998
Juan C. Meza	1997
Tamar Schlick	1997
_____	1999
_____	1999

4.10.19. Annual Survey Data Committee

AMS staff contact: James W. Maxwell.

	Lorraine Denby (ASA)	2003
	J. Douglas Faires (MAA)	2002
	Mary W. Gray (MAA)	2002
	Peter E. Haskell (AMS)	2002
	G. Samuel Jordon (AMS)	2003
	Ellen E. Kirkman (AMS)	2001
	James Kister (AMS)	2001
	William James Lewis (AMS)	2001
Chair	Don O. Loftsgaarden (MAA)	2002
	James W. Maxwell (AMS)	*ex officio*
	Yashaswini Mittal (IMS)	2001

Special Committees

4.10.20. AMS-Real Sociedad Matemática Española (RSME) Joint Program Committee, Seville, Spain, June 2003

Antonio J. Cordoba
Rafael de la Llave
Antonio J. Duran
William G. Dwyer
Carlos Kenig
Antonio Ros

4.10.21. AMS-SMM Joint Program Committee, Mexico, May 23–26, 2001

Alejandro Adem
John W. Neuberger
Raymond A. Wells, Jr.

4.10.22. AMS-Société de Mathématique de France Joint Program Committee, France, July 17–20, 2001

Lawrence Craig Evans
Robin Hartshorne
Lisa Claire Jeffrey
Chair — Barry Mazur
Lesley M. Sibner

4.10.23. AMS-Unione Matematica Italiana Joint Program Committee, Italy, June 16–20, 2002

Charles H. Clemens
Victor Kac
Chair — Joseph J. Kohn
Lesley M. Sibner
Francois Treves

5. Representatives

5.0.1. American Association for the Advancement of Science

Terms expire on February 21

Section A	Lenore Blum	2004
Section Q	Richard A. Askey	2004

5.0.2. Canadian Mathematical Society

Walter Craig 2002

5.0.3. Commission on Professionals in Science and Technology

Mary W. Gray 2002

5.0.4. Committee on the American Mathematics Competition

Term expires on June 30

Noam Elkies 2003

5.0.5. Conference Board of the Mathematical Sciences

Hyman Bass 2002

5.0.6. Fulkerson Prize Committee

Ronald L. Graham

5.0.7. Joint Public Service Award Committee of the AAS-AMS-APS

Hyman Bass	2002
Arthur M. Jaffe	2001

5.0.8. MAA Committee on Undergraduate Program in Mathematics (CUPM)

Amy Cohen	2002
Naomi Fisher	2002

5.0.9. U.S. National Committee on Theoretical and Applied Mechanics

Term expires on October 31

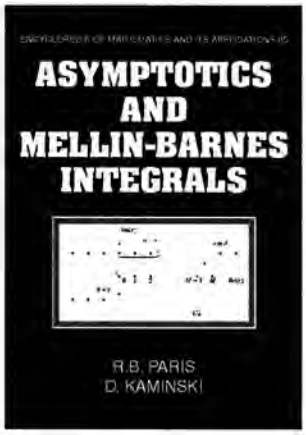
David Kinderlehrer 2004

6. Index

New and Noteworthy Mathematics Titles from Cambridge

Encyclopedia of Mathematics and Its Applications

This series focuses on significant topics or themes that have wide application in mathematics or mathematical science and for which a detailed development of the abstract theory is less important than a thorough and concrete exploration of the implications and applications.



Asymptotics and Mellin-Barnes Integrals

R.B. Paris and D. Kaminski

Shows the use and properties of a complex integral representation that arises in the study of special functions typically of interest in classical analysis and mathematical physics.

Encyclopedia of Mathematics and its Applications 85

0-521-79001-8 Hardback $95.00

Geometries on Surfaces

Burkard Polster and Gunther Stienke

Contains sections on classical geometries, methods for constructing non-classical geometries and classifications and characterizations of geometries.

Encyclopedia of Mathematics and its Applications 84

0-521-66058-0 Hardback $95.00

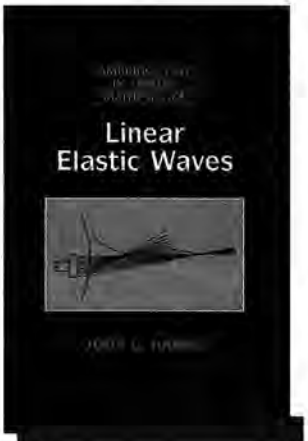
Navier-Stokes Equations and Turbulence

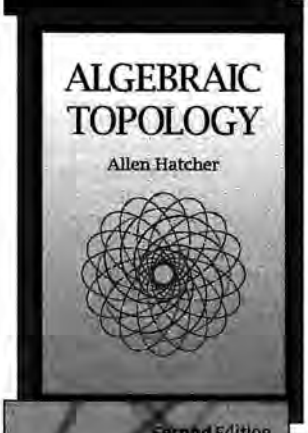
C. Foias, O. Manley, R. Rosa, and R. Temam

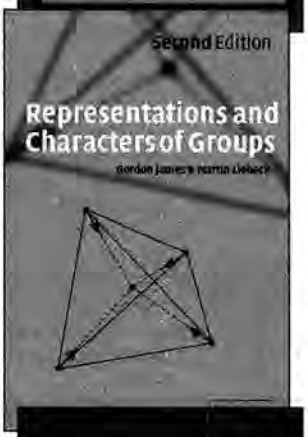
Presents the mathematical theory of turbulence to engineers and physicists, and the physical theory of turbulence to mathematicians.

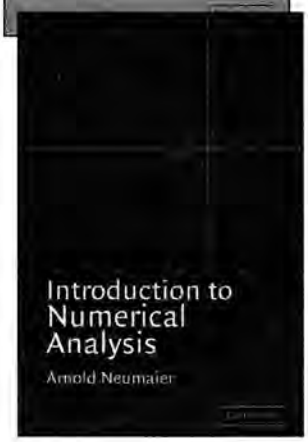
Encyclopedia of Mathematics and its Applications 83

0-521-36032-3 Hardback $90.00









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Béla Bollobás

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Cambridge Studies in Advanced Mathematics 73

0-521-80920-7 Hardback $110.00
0-521-79722-5 Paperback $44.95

Linear Elastic Waves

John G. Harris

Describes wave propagation using the equations of elasticity. Topics include reflection, refraction, the propagation of interfacial waves, integral representations, radiation and diffraction, and propagation in closed and open waveguides.

Cambridge Texts in Applied Mathematics 26

0-521-64368-6 Hardback $69.95
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Allen Hatcher

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Cambridge Tracts in Mathematics 146

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Introduction to Numerical Analysis

Arnold Neumaier

Introduces methods that provide approximations to the solution of numerical problems, and the analysis of the influence that errors in data, finite-precision calculations, and approximation formulas have on results, problem formulation and the choice of method.

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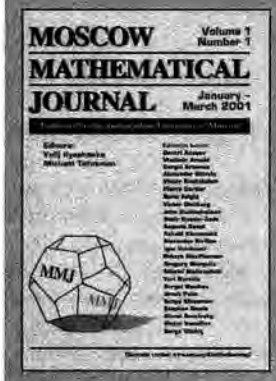

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How to use this form

1. Using the facing page or a photocopy, (or visit the AMS web site for a choice of electronic versions at www.ams.org/coversheet/), fill in the answers which apply to *all* of your academic applications. Make photocopies.

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The purpose of the cover form is to aid department staff in tracking and responding to each application for employment. Mathematics departments in Bachelor's-, Master's-, and Doctorate-granting institutions are expecting to receive the form from each applicant, along with the other application materials they require.

The AMS suggests that applicants and employers visit the Job Application Database for Mathematicians (www.mathjobs.com), a new electronic resource being offered by the AMS (in partnership with Duke University) for the first time in 2001-02. The system provides a way for applicants to produce printed coversheet forms, apply for jobs, or publicize themselves in the "Job Wanted" list. Employers can post a job listing, and once applications are made, search and sort among their applicants. Note-taking, rating, e-mail, data downloading and customizable EOE funnctions are available to employers. Also, reference writers can submit their letters online. A paperless application process is possible with this system, however; employers can choose to use any portion of the service. It is hoped that departments hiring for postdoc positions, especially, will utilize the system this year. There will be no fees for any services this year. This system was developed at the Duke University Department of Mathematics, and was tested by a group of departments in 2000-01.

Please direct all questions and comments to: emp-info@ams.org.

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Granting Institution _____ **Date (optional)** _____

Ph.D. Advisor _____

Ph.D. Thesis Title (optional) _____

Indicate *the mathematical subject area(s) in which you have done research using, if applicable, the Mathematics Subject Classification printed on the back of this form or on e-MATH. If listing more than one number, list first the one number which best describes your current primary interest.*

Primary Interest _____

Secondary Interests *optional* _____

Give a brief synopsis *of your current research interests (e.g. finite group actions on four-manifolds). Avoid special mathematical symbols and please do not write outside of the boxed area.*

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Most recent, if any, position held *post Ph.D.*

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Position Title _____

Indicate the position for which you are applying and position posting code, if applicable

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If unsuccessful for this position, would you like to be considered for a temporary position?

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☐ Postdoctoral Position ☐ 2+ Year Position ☐ 1 Year Position

List the names, affiliations, and e-mail addresses *of up to four individuals who will provide letters of recommendation if asked. Mark the box provided for each individual whom you have already asked to send a letter.*

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2000 Mathematics Subject Classification

00 General
01 History and biography
03 Mathematical logic and foundations
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General algebraic systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra, matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 *K*-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
37 Dynamical systems and ergodic theory
39 Difference and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
49 Calculus of variations and optimal control, optimization
51 Geometry
52 Convex and discrete geometry
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
74 Mechanics of deformable solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum theory
82 Statistical mechanics, structure of matter
83 Relativity and gravitational theory
85 Astronomy and astrophysics
86 Geophysics
90 Operations research, mathematical programming
91 Game theory, economics, social and behavioral sciences
92 Biology and other natural sciences
93 Systems theory, control
94 Information and communication, circuits
97 Mathematics education

Mathematics Calendar

The most comprehensive and up-to-date Mathematics Calendar information is available on the AMS website at http://www.ams.org/mathcal/.

October 2001

*2-5 **DIMACS Workshop and Tutorial on Bioconsensus II**, DIMACS Center, Rutgers University, Piscataway, New Jersey.
Sponsors: DIMACS Center, Alfred P. Sloan Foundation, National Science Foundation.
Description: This workshop is a followup to a working group meeting on bioconsensus held in October 2000 at DIMACS. A one-day tutorial is planned, followed by a series of public lectures in workshop format.
Organizers: M. Janowitz, Rutgers Univ.; F. Lapointe, Univ. de Montréal; F. McMorris, Illinois Inst. of Tech.; B. Mirkin, Univ. of London; F. Roberts, Rutgers Univ.
Contacts: M. Janowitz, Rutgers Univ., melj@dimacs.rutgers.edu.
Local Arrangements: J. Herold, DIMACS Center, jessicah@dimacs.rutgers.edu, tel: 732-445-5928.
Information: http://dimacs.rutgers.edu/Workshops/index.html.

*6 **Cahit Arf Lectures**, Dept. of Math., Middle East Technical Univ., Ankara, Turkey.
Topic: Brauer groups and data security.
Speaker: G. Frey (Univ. of Essen).
Information: http://arflectures.math.metu.edu.tr/.

*19-20 **Midwest Probability Colloquium**, University of Chicago, Chicago, Illinois.
Organizer: S. Lalley, Dept. of Stat., Univ. of Chicago, 5734 University Ave., Chicago, IL 60637; tel: 773-902-9890; fax: 773-902-9810.
Program: C. Tracy (Univ. of California, Davis), two lectures; J. Rosinski (Univ. of Tennessee), one lecture; Q.-M. Shao (Univ. of Oregon), one lecture. On Thursday, October 18, there will be a workshop on random matrices.
Information: Further details of the program will be posted at the conference web page when they become available. The web page also has links to maps and other information about the University of Chicago, the city of Chicago, and the Lakeshore Ramada. The address of the conference web page is http://www.math.nwu.edu/mwp/.

*19-20 **Prairie Analysis Seminar**, Kansas State University, Manhattan, Kansas.
Description: The goal is to provide an opportunity for scientific exchange and cooperation among analysts (broadly defined). The centerpiece of the seminar is a series of one-hour lectures given by a keynote speaker, with additional matching lectures in the area. There is time allocated for shorter contributed talks.
Main Speaker: F.-H. Lin, Courant Institute, NYU.
Organizers: Kansas State University and the University of Kansas.
Organizing Committee: M. Korten (marianne@math.ksu.edu), E. Gavosto (gavosto@math.ukans.edu), C. Moore (cnmoore@math.ksu.edu), R. Torres (torres@math.ukans.edu).
Information: http://www.math.ksu.edu/pas/.

November 2001

*2-4 **Third Midwest Arithmetical Geometry in Cryptography Workshop**, University of Illinois, Urbana-Champaign, Urbana, Illinois.
Speakers: D. Boneh, Y. Desmedt, D. Bernstein, R. Harley, K. Kedlaya, E. Teske, A. Weng.
Information: http://www.math.uiuc.edu/~boston/magc3.html.

*7-9 **First International Conference on Mathematics Applied to Engineering and Mathematics Education in Engineering (IN-MAT 2001)**, Facultad de Ingeniería, Univ. de Buenos Aires, Paseo Colón 850, Buenos Aires, Argentina.

This section contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings and symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete list of meetings of the Society can be found on the last page of each issue.
An announcement will be published in the *Notices* if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in every third issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.
In general, announcements of meetings and conferences held in North America carry only the date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the *Notices* in care of the American Mathematical Society in Providence or electronically to notices@ams.org or mathcal@ams.org.
In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence **six months** prior to the scheduled date of the meeting.
The complete listing of the Mathematics Calendar will be published only in the September issue of the *Notices*. The March, June, and December issues will include, along with new announcements, references to any previously announced meetings and conferences occurring within the twelve-month period following the month of those issues. New information about meetings and conferences that will occur later than the twelve-month period will be announced once in full and will not be repeated until the date of the conference or meeting falls within the twelve-month period.
The Mathematics Calendar, as well as Meetings and Conferences of the AMS, is now available electronically through the AMS website on the World Wide Web. To access the AMS website, use the URL: http://www.ams.org/.

Organizers: Facultad de Ingeniería, Facultad de Ciencias Exactas y Naturales, and Instituto Argentino de Matemática.

Organizing Committee: B. Cernuschi, G. Corach, R. Durán.

Scientific Committee: L. Caffarelli, Department of Mathematics Univ. of Texas, USA; M. Virasoro, International Centre for Theoretical Physics, Trieste, Italia.

Description: The conference will have two areas of interest: (1) Mathematics Applied to Engineering: There will be invited plenary talks and short communications. Areas of interest include: deterministic and stochastic control, linear and nonlinear optimization, differential equations, probability, numerical analysis, signal processing, inverse problems, finite elements, approximation theory, stochastic processes, modeling, and any other area of interest in engineering. (2) Mathematics Education in Engineering: Discussion panels with invited speakers will be organized.

Support: INVAP (Investigación Aplicada S.E.), CONAE (Comisión Nacional de Actividades Espaciales), AADECA (Asociación Argentina de Control Automático).

Local Organizers: S. Grynberg, e-mail: sebgryn@fi.uba.ar; J. Mancilla, e-mail: jmancil@fi.uba.ar; G. P. G. Vargas, e-mail: gvargas@fi.uba.ar.

*28 **Combinatorial Optimization and Integer Programming, the State of the Art**, Columbia University, New York, New York.

Speakers: Barahona, Bixby, Ceria, Chvatal, Cook, Johnson, Nemhauser, Shepherd.

Information: http://www.corc.ieor.columbia.edu/meetings/c1/c1.html.

December 2001

*15–19 **International Conference on the Use of Technology in Teaching and Learning Mathematics and Biomathematics (UTEL-MB 2001)**, University of Delhi, Delhi, India.

Program: Clark Atlanta University (USA), University of Delhi (India), and the Mathematics in the New Millennium Project (USA) are organizing UTEL-MB2001. Themes of the conference include, but are not limited to: (a) Technology Resources in Mathematics and Biomathematics; (b) Future Directions in Mathematics and Biomathematics and Their Implications to Curriculum; (c) Distance Learning and the Global Classroom; (d) Empowering the Teacher of Tomorrow: Using Technology in the Classroom; (e) Technology as an Equalizer and Its Implications to Communities with Limited or Restricted Resources; (f) Balance between Technology and Traditions. UTEL-MB2001 is sponsored by the Indian National Science Academy (INSA). It will feature plenaries by authorities in their fields, invited talks, poster sessions, panel discussions, exhibits, short courses, hands-on experiences. T. Banchoff, D. Hughes-Hallett, and B. Fischer will deliver plenary lectures.

Deadline: Deadline for submission of abstracts: August 31, 2001.

Registration: (Before August 31, 2001): US $300.00. Students/retired professors can register for US $150.00. Residents of India & SAARC countries pay Rs.500.00. However, students/retired professors from India & SAARC countries pay a reduced rate of Rs.250.00. (After August 31, 2001): US $350.00. Students/retired professors can register for US $175.00. Residents of India & SAARC countries pay Rs.600.00. However, student/retired professors from India and SAARC countries pay a reduced rate of Rs.300.00. Registration fees include conference fees, local hospitality, and accommodations in university and INSA guest houses.

Information: M. S. Arora, Dept. of Math. Sci., Clark Atlanta University, Atlanta, GA., USA, e-mail: mohan_arora@yahoo.com; M. Bleicher, Chair, Dept. of Math. Sci., Clark Atlanta University, Atlanta, GA., USA, e-mail: bleicher@math.wisc.edu; A. Iqbal Singh, Dept. of Math., Univ. of Delhi, Delhi, India, e-mail: singhira@netkracker.com.

*20–23 **The First International Conference of the New Millennium on History of Mathematical Sciences**, Ramjas College, University of Delhi, Delhi, India.

Organizers: The Indian Society for History of Mathematics, Ramjas College, Univ. of Delhi and other national institutions.

Focus: The conference will cover all aspects of the history of mathematical sciences including mathematics, statistics, operations research and computer science and applications thereof to societal needs. In particular the conference will focus on the following areas: (1) General histories, source books and biographies of mathematicians; (2) Mathematics and indigenous cultures of the world; (3) Ancient Indian mathematics; (4) The origin of mathematics; (5) Mathematics in 15th to 18th Centuries, Renaissance; (6) 19th and 20th centuries mathematics and mathematical sciences; (7) History of mathematics as a subject in educational curricula; (8) Future prospectives. The academic sessions will consist of invited plenary talks and contributed paper presentations.

Invited Speakers: A. Aggarwal (UK), A. Prasad Pant (Nepal), A. Drago (Italy), B. Artmann (Germany), C. Goldstein (France), D. Schlomiuk (Canada), D. Young (Egypt), E. Von Collani (Germany), E. Giusti (Italy), F. Hawkins (USA), F. Swetz (Philippines), G. G. Joseph (UK), G. P. Dhakal (Nepal), I. Grattan- Guinness (UK), J. S. Chahal (USA), J. M. Balmaceda (Philippines), K. V. Mardia (UK), K. Chanda (USA), K. Williams (UK), M. L. Ferreira (USA), Milogardner (USA), M. Bagheri (Iran), N. Singhi (USA), P. N. Bajaj (USA), R. Kumar (USA), R. Gupta (Australia), R. Duduchava (Georgia), R. Jeltsch (Switzerland), S. Leela (USA), S. S. Hashemi (Iran), U. Bottazzini (Italy), V. Lakshmikantham (USA), V. Milman (Israel), and V. Peckhaus (Germany), apart from a number of eminent mathematicians from the country.

Call for Papers: Papers covering topics pertaining to the above areas are invited for the conference. The authors are requested to submit the full version of their papers in publishable form by October 1, 2001, along with the abstract. The Proceedings of the conference will be published.

Information: All communications, including papers and payments, should be addressed to: Y. P. Sabharwal, Organizing Secretary, ICHM2001, Department of Mathematics & Statistics, Ramjas College, University of Delhi, Delhi 10007 India; e-mail: ichm2001rjc@yahoo.com, indianshm@yahoo.com.

January 2002

*7–12 **International Conference on Long Range Dependent Stochastic Processes and their Applications**, Indian Institute of Science, Bangalore, India.

Organizers: G. Rangarajan (Indian Inst. of Science, India) and M. Ding (Florida Atlantic Univ., USA).

International Advisory Committee: V. Balakrishnan (IIT Madras), J. Beran (Konstanz), C. W. J. Granger (San Diego), J. Klafter (Tel Aviv), K. R. Parthasarathy (ISI Delhi), M. F. Shlesinger (ONR), Ya. G. Sinai (Princeton), M. Taqqu (Boston), M. Teich (Boston).

Description: The range of topics covered by the conference would include mathematical aspects of long range dependent/ long memory / heavy tailed stochastic processes, their applications in areas like finance, communication systems (including internet traffic analysis), biology/medicine/neuroscience, statistical physics (especially in the context of anomalous diffusions).

Contact: G. Rangarajan, Dept. of Math., Indian Inst. of Sci., Bangalore 560 012, India; phone: 91-80-360 0373; e-mail: rangaraj@math.iisc.ernet.in; fax: 91-80-360 0683.

Information: http://math.iisc.ernet.in/~rangaraj/conf2.htm for further information including registration information and the list of Invited Speakers.

February 2002

*1–April 30 **Special Research Trimester on Dynamical Systems**, Scuola Normale Superiore, Pisa, Italy.

Scientific Committee: S. Marmi, J. Mather, J. Milnor, J. Palis, J.-C. Yoccoz.

Local Organizing Committee: C. Carminati, G. Da Prato, M. Giaquinta, S. Marmi.

Topics: The following broad areas will be covered: nonuniformly and partially hyperbolic systems, quasiperiodic orbits, holomorphic

dynamics and foliations, interaction between dynamical systems and biology, interaction between dynamical systems and physics (including celestial mechanics).
Support: A limited number of grants supporting preferably long-term visits (at least one month) will be available for Ph.D. students and postdocs.
Information: http://www.math.sns.it/degiorgi/dynsys/; e-mail: dynsys@math.sns.it.

March 2002

*4-6 **RTST 2002: Research Trends in Science and Technology**, Lebanese American University, Beirut and Byblos, Lebanon.
Description: Over the past several years, the International Conference on Research Trends in Science and Technology has become a primary forum for engineers, mathematicians, and scientists from around the world to interact and present their work.
Information: Visit http://www.lau.edu.lb/news-events/conferences/rtst2002/index.html,or contact M. Hamdan, rtst@lau.edu.lb.

April 2002

*1-6 **International Workshop on Relaxation Oscillations and Hysteresis**, University College Cork, Cork, Ireland.
Organizing Committee: M. Mortell (Cork, Ireland) and A. Pokrovskii (Cork, Ireland, alexei@caesar.ucc.ie).
Scientific Committee: R. O'Malley (USA), V. Sobolev (Russia).
Topics: Singular perturbations, hysteresis, economic dynamics, laser dynamics, chemical kinetics, control.
Information: http://www.ucc.ie/ro&h2002/.

May 2002

*20-21 **Improving the Reasoning of College Students**, Virginia Commonwealth University, Richmond, Virginia.
Description: The conference is intended for college/university faculty members who are concerned over the degree of reasoning skills displayed by their students. The presentations at the conference will be of two types: plenary sessions on general topics in areas such as cognitive psychology, linguistics, science, and mathematics education and philosophy (e.g., ethics, philosophy of science and/or logic); and more discipline-specific sessions.

The center is soliciting papers for the discipline-specific presentations. These should be on classroom methods for improving reasoning. Examples of possible topics are improving reasoning in English composition classes, innovative courses in logic and critical thinking, problem solving techniques in the physical and social sciences, teaching decision techniques in business and data management, explaining the logic operators in computer programming courses, and new methods for teaching mathematical concepts. In other words, we are looking for presentations on effective classroom techniques for improving reasoning skills in a variety of disciplines.
Information: e-mail: n.pole@csuohio.edu.

*20-31 **Tamagawa Numbers and Special Values of L-Functions**, Institut Galilée, Université Paris 13, France.
Organizers: G. Kings (Muenster), J. Wildeshaus (Paris 13).
Information: http://www-math.math.univ-paris13.fr/~tamagawa/.

June 2002

*5-9 **A Conference in Honour of Hans Wallin**, Umeå, Sweden.
Conference Theme: The aim of the conference is to bring together researchers in some of the areas in which H. Wallin has been working—such as potential theory, function spaces, approximation theory, and mathematics education—in order to get a picture of some current research in these areas. We hope that the conference will be useful for a comparatively broad audience, and we especially encourage Ph.D. students to participate.
Invited Speakers (preliminary): Mathematics: A. Ambroladze (Univ. of Lund, Sweden), D. Broomhead (UMIST, Great Britain), L. Carleson (Univ. of Uppsala, Sweden), Z. Cieselski (Polish Acad. of Sciences, Poland), S. Janson (Univ. of Uppsala, Sweden), D. S. Lubinsky (Wits Univ., South Africa), P. Mattila (Univ. of Jyväskylä, Finland), E. B. Saff (Univ. of South Florida, USA), J. O. Strömberg (KTH, Sweden), A. Teplyaev (Univ. of California, USA); Mathematics Education: O. Björkqvist (Abo Akademi, Finland), G. Gjone (Oslo Univ., Norway), M. Niss (Roskilde Univ., Denmark). There will also be a number of shorter contributed talks. Since the time for these talks is limited, they will be by invitation, and participants are kindly asked to note in their registration if they are prepared to give a contributed talk. These speakers will have some of their local costs paid for by the meeting. To register, complete the preliminary form and send it to M. Brinkstam, e-mail: margareta.brinkstam@math.umu.se, or by mail or fax, no later than October 31, 2001.
Information: Further information will be supplied in a second announcement which will be sent to the registered participants of the conference. Information will also appear on our homepage, http://www.math.umu.se/. Please check this website regularly, as the information is continuously updated. Department of Mathematics, Umeå University, SE-901 87 Umeå, Sweden; tel: +46 90 786 5217; fax: +46 90 786 5222.

*24-28 **Tenth International Conference on Fibonacci Numbers and Their Applications**, Flagstaff, Arizona.
Sponsors: The Fibonacci Association, Northern Arizona University.
Purpose: The purpose of the conference is to bring together people from all branches of mathematics and science who are interested in Fibonacci numbers, their applications and generalizations, and other special number sequences.
Organizer: F. T. Howard, Wake Forest Univ., Box 7388 Reynolda Station, Winston-Salem, NC 27109; e-mail: howard@mthcsc.wfu.edu.
Local Committee: C. Long (chair), T. Crites, S. Wilson, J. Rushal. C. Long's address is: 2120 North Timberline Road, Flagstaff, AZ 86004; e-mail: calvin.long@nau.edu.
International Committee: M. Bicknell-Johnson (USA), A. Adelberg (USA), C. Cooper (USA), H. Harborth (Germany), A. Horadam (Australia, cochair), Y. Horibe (Japan), P. Kiss (Hungary), J. Lahr (Luxembourg), A. Philippou (Cyprus, cochair), G. Phillips (Scotland), J. Turner (New Zealand).
Conference Proceedings: For the conference proceedings, manuscripts that include new, unpublished results will be considered. For papers not intended for the proceedings, authors may submit just an abstract, describing new work, published work, or work in progress. Papers and abstracts, which should be submitted in duplicate to F. T. Howard at the address above, are due by May 1, 2002. Authors of accepted submissions will be allotted twenty minutes on the conference program.
Information: For more information, contact F. T. Howard or C. Long at the above addresses.

*25-29 **The Twenty-Sixth Summer Symposium in Real Analysis**, Washington and Lee University, Lexington, Virginia.
Organizers: M. J. Evans (Washington and Lee Univ.), P. D. Humke (St. Olaf College), T. H. Steele (Weber State Univ.).
Main Speakers: C. Freiling (California State Univ., San Bernardino), S. Graf (Univ. of Passau, Germany), A. Olevskii (Univ. of Tel Aviv, Israel), L. Olsen (Univ. of St. Andrews, Scotland).
Information: http://www.stolaf.edu/people/analysis/ or e-mail to analysis@stolaf.edu.

July 2002

*29-August 10 **50 Years of the Cauchy Problem in General Relativity-Summer School**, Corsica, France.
Topic: The topic of the school will be the current problems in mathematical general relativity. The date and the title of the school have been chosen to mark the publication in 1952 of the fundamental paper by Yvonne Choquet-Bruhat on the Cauchy problem in general relativity.

Information: More information about the school can be found at URL http://www.phys.univ-tours.fr/Cauchy/. Online registration is also available there. Alternatively, send an e-mail or letter to P. Chrusciel, Departement de Mathematiques, Faculte des Sciences, Parc de Grandmont, F 37200 Tours, France; e-mail: chrusciel@univ-tours.fr.

September 2002

*September–December 2002 **Set Theory and Analysis Program**, The Fields Institute, Toronto, Ontario, Canada.
Organizing Committee: A. Dow, A. Kechris, M. Laczkovich, C. Laflamme, J. Steprans, S. Todorcevic.
Program: From its very beginnings, set theory has enjoyed a relationship with analysis which, while at times close and at others distant, has always allowed for the possibility of symbiosis. During the fall of 2002 The Fields Institute will host a thematic program devoted to fostering the interaction between these two areas. Internationally recognized experts from both disciplines will be on site from September 2002 through December 2002.
Format: The format of the program will include at least two short but intense thematic workshops. One will focus on set theoretic techniques in the theory of Banach spaces, and another will concentrate on Borel relations. While some participants will actively participate throughout the semester, others will be brought in for a specific workshop. Graduate students and postdoctoral fellows on site for the entire program will be exposed to a wide range of research topics, while invited specialists will be able to contribute in their area of expertise. The program will also incorporate, whenever possible, minicourses intended to quickly bring graduate students to the frontiers of knowledge on particular subjects.
Participants: Among those who have already indicated their interest in participating for at least part of the semester are: T. Bartoszynski, M. Foreman, D. Fremlin, G. Godefroy, G. Hjorth, A. Kechris, M. Laczkovich, R. Laver, D. Mauldin, A. Miller, N. Kalton, E. Odell, J. Pawlikowski, H. Rosenthal, S. Shelah, S. Solecki, S. Todorcevic, H. Woodin.
Information: To be informed when registration is open and to receive updates about the Set Theory and Analysis Program, please subscribe to the mail list at http://www.fields.utoronto.ca/maillist/.

*4–7 **International Conference on Dynamical Methods for Differential Equations**, Medina del Campo, Valladolid, Spain.
Description: The conference will focus on those recent advances in topological methods and ergodic theory which are relevant to the analysis of ordinary differential equations, partial differential equations and functional equations, as well as on their applications to science and technology.
Information: http://wmatem.eis.uva.es/~dmde02/.

*13–14 **Topics in Linear Algebra**, Iowa State University, Ames, Iowa.
Sponsors: Institute for Mathematics and its Applications and Iowa State University.
Organizers: L. Hogben (lhogben@iastate.edu), B. Cain (bcain@iastate.edu), L. DeAlba (luz.dealba@drake.edu), I. Hentzel (hentzel@iastate.edu), M. Mills (millsm@central.edu), Y. T. Poon, (ytpoon@iastate.edu), H. Wu (isuhwu@iastate.edu).
Invited Speakers: S. Hedayat, University of Illinois-Chicago; D. P. Jacobs, Clemson Univ.; C. R. Johnson, College of William and Mary; C. K. Li, College of William and Mary; H. Schneider, Univ. of Wisconsin-Madison.
Description: This conference will provide an opportunity for those working in several areas of linear algebra to meet, share ideas, and work together. The conference is organized around the following topics: matrix completion problems, numerical ranges, matrix stability and convergence, applications of linear algebra to nonassociative algebra, statistical applications of linear algebra. For each topic there will be a presentation by an invited speaker, a session for contributed papers, and a work session. There will also be a contributed paper session for areas of linear algebra within the focus of the conference but not specifically within one of the topics. Speakers will have the opportunity to submit their papers for publication in a special issue of the *Electronic Journal of Linear Algebra* (ELA), "Proceedings of the Topics in Linear Algebra Conference". This meeting has been endorsed by the International Linear Algebra Society.
Call for Papers: Contributed talks of 20 minutes in length are invited. To contribute a talk, submit the title and abstract by May 1, 2002, to L. DeAlba (luz.dealba@drake.edu).
Information: http://www.math.iastate.edu/lhogben/TLA/homepage.html.

*20–25 **International Conference on Computational and Mathematical Methods in Science and Engineering (CMMSE 2002)**, Alicante, Spain.
Topics: Celestial mechanics, computational chemistry & physics, computational engineering, computational mathematics, computational statistics, high performance computing, industrial mathematics, mathematical economics & finance, mathematical models for the information society.
Sponsors: Univ. de Alicante and the Center for Industrial Mathematics, University of Wisconsin-Milwaukee.
Program: The conference aims to act as a unifying, cross-cutting, interdisciplinary catalyst where specialists can have exposure to others' fields as well as participate in special sessions at the forefront of their own specialties. The program consists of 1-hour plenary lectures that highlight major accomplishments, trends, and technical challenges in scientific computing in selected fields of research, special sessions with 25-minute invited talks, and a poster session.
Call for Papers: Researchers are invited to propose special sessions to the general chairs or submit papers for 25-minute talks or the poster session.
Important Dates: December 15, 2001: Declaration of participation and submission of abstract of minimum three A4 pages in standard LaTeX; January 30, 2002: Notice of acceptance, early registration begins; March 1, 2002: End of early registration, standard registration begins; June 15, 2002: Full paper submission; maximum ten A4 pages in standard LaTeX; July 30, 2002: Confirmation, program is set; September 20–25, 2002: Conference (9/22 is a free day).
Information: http://www.ua.es/cmmse2002/ or http://www.uwm.edu/Dept/CIM/.

*23–27 **Ramification in Arithmetic and Geometry**, Institut Galilée, Université Paris 13, France.
Organizers: A. Abbes (Paris), B. Erez (Bordeaux), T. Saito (Tokyo).
Information: http://www-math.math.univ-paris13.fr/~ramifica/.

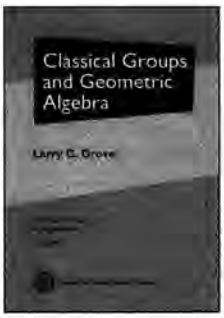
The following new announcements will not be repeated until the criteria in the next to the last paragraph at the bottom of the first page of this section are met.

January 2003

*6–11 **International Conference on Dynamical Systems and Geometry, to Celebrate the Sixtieth Anniversary of Alberto Verjovsky**, Cuernavaca, Mexico.
Scientific Committee: J. Eells, E. Ghys, M. Lyubich, J. Palis, and J. Seade.
Information: jseade@matcuer.unam.mx.

New Publications Offered by the AMS

Algebra and Algebraic Geometry



Classical Groups and Geometric Algebra

Larry C. Grove, *University of Arizona, Tucson*

"Classical groups", named so by Hermann Weyl, are groups of matrices or quotients of matrix groups by small normal subgroups.

Thus the story begins, as Weyl suggested, with "Her All-embracing Majesty", the general linear group $GL_n(V)$ of all invertible linear transformations of a vector space V over a field F. All further groups discussed are either subgroups of $GL_n(V)$ or closely related quotient groups.

Most of the classical groups consist of invertible linear transformations that respect a bilinear form having some geometric significance, e.g., a quadratic form, a symplectic form, etc. Accordingly, the author develops the required geometric notions, albeit from an algebraic point of view, as the end results should apply to vector spaces over more-or-less arbitrary fields, finite or infinite.

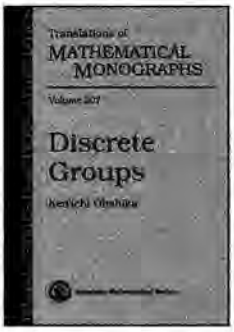
The classical groups have proved to be important in a wide variety of venues, ranging from physics to geometry and far beyond. In recent years, they have played a prominent role in the classification of the finite simple groups.

This text provides a single source for the basic facts about the classical groups and also includes the required geometrical background information from the first principles. It is intended for students who have completed standard courses in linear algebra and abstract algebra. The author, L. C. Grove, is a well-known expert who has published extensively in the subject area.

Contents: Permutation actions; The basic linear groups; Bilinear forms; Symplectic groups; Symmetric forms and quadratic forms; Orthogonal geometry (char $F \neq 2$); Orthogonal groups (char $F \neq 2$), I; $O(V)$, V Euclidean; Clifford algebras (char $F \neq 2$); Orthogonal groups (char $F \neq 2$), II; Hermitian forms and unitary spaces; Unitary groups; Orthogonal geometry (char $F = 2$); Clifford algebras (char $F = 2$); Orthogonal groups (char $F = 2$); Further developments; Bibliography; List of notation; Index.

Graduate Studies in Mathematics, Volume 39

October 2001, 169 pages, Hardcover, ISBN 0-8218-2019-2, LC 2001046251, 2000 *Mathematics Subject Classification*: 20G15, 20G40, 11E57; 11E39, 11E88, 51N30, Order code GSM/39N



Discrete Groups

Ken'ichi Ohshika, *Osaka University, Japan*

This book deals with geometric and topological aspects of discrete groups. The main topics are hyperbolic groups due to Gromov, automatic group theory, invented and developed by Epstein, whose subjects are groups that can be manipulated by computers, and Kleinian group theory, which enjoys the longest tradition and the richest content within the theory of discrete subgroups of Lie groups.

What is common among these three classes of groups is that when seen as geometric objects, they have the properties of a negatively curved space rather than a positively curved space. Since Kleinian groups are groups acting on a hyperbolic space of constant negative curvature, the technique employed to study them is that of hyperbolic manifolds, typical examples of negatively curved manifolds. Although hyperbolic groups in the sense of Gromov are much more general objects than Kleinian groups, one can apply for them arguments and techniques that are quite similar to those used for Kleinian groups. Automatic groups are further general objects, including groups having properties of spaces of curvature 0. Still, relationships between automatic groups and hyperbolic groups are examined here using ideas inspired by the study of hyperbolic manifolds. In all of these three topics, there is a "soul" of negative curvature upholding the theory. The volume would make a fine textbook for a graduate-level course in discrete groups.

Contents: Basic notions for infinite groups; Hyperbolic groups; Automatic groups; Kleinian groups; Prospects; Bibliography; Index.

Translations of Mathematical Monographs (*Iwanami Series in Modern Mathematics*)

October 2001, approximately 207 pages, Softcover, ISBN 0-8218-2080-X, 2000 *Mathematics Subject Classification*: 20F65, 20F67, 20F69, 57M07, 57M50, 57S30, 30F40; 46E25, 20C20, Order code MMONO-OHSHIKAN

Analysis

Rudiments de dynamique holomorphe

François Berteloot, *Université Paul Sabatier (Toulouse III), France*, and **Volker Mayer**, *Université de Lille I, France*

A publication of the Société Mathématique de France.

This book is an introduction to rational iteration theory. In the first four chapters, the authors deal with the classical theory. The basic properties of the Julia set and its complement, the Fatou set, are presented; the highest points of the treatment are the classification of the components of the Fatou set and Sullivan's non-wandering theorem.

The second part of the book studies several topics in more detail. The authors begin by considering at length two classes of rational maps: the chaotic maps and the hyperbolic maps. In the closing chapters, they include respectively a study of holomorphic families of rational maps with a view to discussing Fatou's famous problem concerning the density of hyperbolic maps and an exposition of the methods of potential theory, touching on questions of ergodicity, which may serve as a preparation for generalizations in higher dimensions.

A number of the developments treated here appear for the first time in book form. Several original proofs are presented.

Contents: Introduction; La dichotomie dynamique de Fatou et Julia; Dynamiques locales et composantes de Fatou; Ensemble de Julia; Classification des composantes de Fatou; Fractions rationnelles chaotiques; Fractions rationnelles hyperboliques; Familles holomorphes de fractions rationnelles; Le point de vu potentialiste; Mesure et dimension de Hausdorff; Applications quasiconformes et structures conformes; Quelques points de théorie du potentiel; Bibliographie; Index.

Cours Spécialisés—Collection SMF, Number 7

May 2001, 160 pages, Softcover, ISBN 2-86883-521-X, 2000 *Mathematics Subject Classification*: 37F50, 37F15, 30C62, 37F45, 37A25, 31A05, **Individual member $30**, List $33, Order code COSP/7N

Differential Equations

Les systèmes hamiltoniens et leur intégrabilité

Michèle Audin, *Université Louis Pasteur et CNRS, Strasbourg, France*

A publication of the Société Mathématique de France.

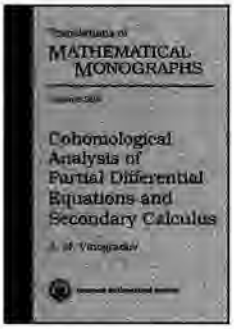
This book presents some modern techniques in the theory of integrable systems viewed as variations on the theme of action-angle coordinates. These techniques include analytical methods coming from the Galois theory of differential equations, as well as more classical algebro-geometric methods related to Lax equations. Many examples are given.

Contents: Introduction; Introduction aux systèmes intégrables; Variables action-angles; Intégrabilité et groupes de Galois; Une introduction aux èquations de Lax; *Appendix:* Ce qu'il faut savoir en théorie de Galois différentielle; Ce qu'il faut savoir sur les courbes algèbriques; Bibliographie; Index.

Cours Spécialisés—Collection SMF, Number 8

May 2001, 160 pages, Softcover, ISBN 2-86883-522-8, 2000 *Mathematics Subject Classification*: 70H06, 53C15, 12Hxx, 34A30, 14H10, 14Pxx, **Individual member $30**, List $33, Order code COSP/8N

Differential Equations



Cohomological Analysis of Partial Differential Equations and Secondary Calculus

A. M. Vinogradov, *University of Salerno, Baronossi (SA), Italy*

This book is dedicated to fundamentals of a new theory, which is an analog of affine algebraic geometry for (nonlinear) partial differential equations. This theory grew up from the classical geometry of PDE's originated by S. Lie and his followers by incorporating some nonclassical ideas from the theory of integrable systems, the formal theory of PDE's in its modern cohomological form given by D. Spencer and H. Goldschmidt and differential calculus over commutative algebras (Primary Calculus). The main result of this synthesis is Secondary Calculus on diffieties, new geometrical objects which are analogs of algebraic varieties in the context of (nonlinear) PDE's.

Secondary Calculus surprisingly reveals a deep cohomological nature of the general theory of PDE's and indicates new directions of its further progress. Recent developments in quantum

field theory showed Secondary Calculus to be its natural language, promising a nonperturbative formulation of the theory.

In addition to PDE's themselves, the author describes existing and potential applications of Secondary Calculus ranging from algebraic geometry to field theory, classical and quantum, including areas such as characteristic classes, differential invariants, theory of geometric structures, variational calculus, control theory, etc. This book, focused mainly on theoretical aspects, forms a natural dipole with *Symmetries and Conservation Laws for Differential Equations of Mathematical Physics*, Volume 182 in this same series, Translations of Mathematical Monographs, and shows the theory "in action".

This item will also be of interest to those working in algebra and algebraic geometry.

Contents: From symmetries of partial differential equations to Secondary Calculus; Elements of differential calculus in commutative algebras; Geometry of finite-order contact structures and the classical theory of symmetries of partial differential equations; Geometry of infinitely prolonged differential equations and higher symmetries; C-spectral sequence and some applications; Introduction to Secondary Calculus; Bibliography; Index.

Translations of Mathematical Monographs, Volume 204

November 2001, approximately 264 pages, Hardcover, ISBN 0-8218-2922-X, LC 2001046087, 2000 *Mathematics Subject Classification*: 35A30, 37K10; 37Jxx, 58J10, **Individual member $53**, List $89, Institutional member $71, Order code MMONO/204N

General and Interdisciplinary

Ramanujan: Essays and Surveys

Bruce C. Berndt, *University of Illinois, Urbana-Champaign, IL*, and **Robert A. Rankin**, *University of Glasgow, Scotland*, Editors

This book contains essays on Ramanujan and his work that were written especially for this volume. It also includes important survey articles in areas influenced by Ramanujan's mathematics. Most of the articles in the book are nontechnical, but even those that are more technical contain substantial sections that will engage the general reader.

The book opens with the only four existing photographs of Ramanujan, presenting historical accounts of them and information about other people in the photos. This section includes an account of a cryptic family history written by his younger brother, S. Lakshmi Narasimhan. Following are articles on Ramanujan's illness by R. A. Rankin, the British physician D. A. B. Young, and Nobel laureate S. Chandrasekhar. They present a study of his symptoms, a convincing diagnosis of the cause of his death, and a thorough exposition of Ramanujan's life as a patient in English sanitariums and nursing homes.

Following this are biographies of S. Janaki (Mrs. Ramanujan) and S. Narayana Iyer, Chief Accountant of the Madras Port Trust Office, who first communicated Ramanujan's work to the *Journal of the Indian Mathematical Society*. The last half of the book begins with a section on "Ramanujan's Manuscripts and Notebooks". Included is an important article by G. E. Andrews on Ramanujan's lost notebook.

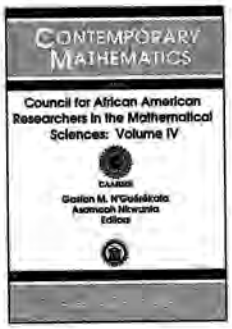
The final two sections feature both nontechnical articles, such as Jonathan and Peter Borwein's "Ramanujan and pi", and more technical articles by Freeman Dyson, Atle Selberg, Richard Askey, and G. N. Watson.

This volume complements the book *Ramanujan: Letters and Commentary*, Volume 9, in the AMS series, History of Mathematics. For more on Ramanujan, see these AMS publications *Ramanujan: Twelve Lectures on Subjects Suggested by His Life and Work*, Volume 136.H, and *Collected Papers of Srinivasa Ramanujan*, Volume 159.H, in the AMS Chelsea Publishing series.

Contents: R. A. Rankin, Commentary (by R. A. R.); *The life of Ramanujan:* The four photographs of Ramanujan; The books studied by Ramanujan in India; The influence of Carr's synopsis on Ramanujan; The notebooks of Srinivasa Ramanujan; A recently discovered letter giving Ramanujan's examination scores; On Ramanujan; The Ramanujan family record; *Ramanujan's illness:* Ramanujan as a patient; Ramanujan's illness; An incident in the life of S. Ramanujan, F.R.S.: Conversations with G. H. Hardy, F.R.S. and J. E. Littlewood, F.R.S. and their sequel; *S. Janaki:* S. Janaki Ammal (Mrs. Ramanujan); Conversation "I didn't understand his work, but I knew his worth"; *S. Narayana Iyer:* A short biography of S. Narayana Iyer; The distribution of primes; Some theorems in summation; *E. H. Neville:* Srinivasa Ramanujan; University lectures in Madras; *Ramanujan's manuscripts and notebooks:* Ramanujan's manuscripts and notebooks; Ramanujan's manuscripts and notebooks, II; An overview of Ramanujan's notebooks; An introduction to Ramanujan's "lost" notebook; *Nontechnical articles on Ramanujan's work:* Ramanujan and pi; π related developments since 1988; Reflections around the Ramanujan centenary; The problems submitted by Ramanujan to the Journal of the Indian Mathematical Society; *Somewhat more technical articles on Ramanujan's work:* A walk through Ramanujan's garden; Ramanujan and hypergeometric and basic hypergeometric series; The final problem: An account of the mock theta functions.

History of Mathematics

December 2001, 347 pages, Hardcover, ISBN 0-8218-2624-7, LC 2001045097, 2000 *Mathematics Subject Classification*: 01A61; 11P83, 11P82, 33C05, 33C20, 11A99, 33D15, 11-03, 33-03, **All AMS members $63**, List $79, Order code HMATH-BERNDT2N



Council for African American Researchers in the Mathematical Sciences: Volume IV

Gaston M. N'Guérékata and **Asamoah Nkwanta**, *Morgan State University, Baltimore, MD*, Editors

This volume contains selected papers from the Sixth Conference for African American Researchers in the Mathematical

Sciences (CAARMS), held at Morgan State University in Baltimore (MD). The CAARMS organizes this annual conference showcasing the current research primarily, but not exclusively, of African Americans in the mathematical sciences. Since the first conference in 1995, significant numbers of researchers have presented their current work in technical talks, and graduate students have presented their work in organized poster sessions.

Research topics include mathematics (number theory, analysis, topology, differential equations, algebra, combinatorics, etc.), mathematical physics, mathematical biology, operations research, probability and statistics, and computer science. In addition to the invited talks, tutorials and group discussions on various topics are organized to stimulate, nurture, and encourage increased participation by African Americans and other underrepresented groups in the mathematical sciences. These events create an ideal forum for mentoring and networking where attendees can meet researchers and graduate students who are interested in the same fields.

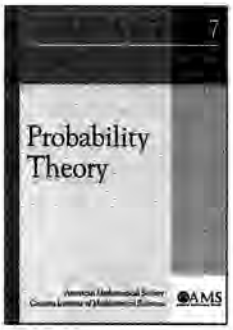
For volumes based on previous CAARMS proceedings, see *African Americans in Mathematics*, Volume 34, in the AMS Series in Discrete Mathematics and Theoretical Computer Science, *African Americans in Mathematics II*, Volume 252, and *Council for African American Researchers in the Mathematical Sciences: Volume III*, Volume 275, in the AMS series, Contemporary Mathematics.

Contents: *Research articles:* **K. M. Lewis**, Hyponormality and a family of Toeplitz operators on the Bergman space; **E. Goins**, A ternary algebra with applications to binary quadratic forms; **I. Assani**, Spectral characterization of ergodic dynamical systems; **C. Castillo-Chavez** and **A.-A. Yakubu**, Epidemics on attractors; **K. F. Sellers**, A definition of vague coherent systems; **M. C. Jackson**, Spatial data analysis for discrete data on a lattice; **C. R. Handy**, New perspectives in moment-wavelet analysis from quantum operator theory: Scalets and local quantization; *Historical articles:* **J. L. Houston**, Numbers that count–Persons who impact, mathematically!.

Contemporary Mathematics, Volume 284

November 2001, 135 pages, Softcover, ISBN 0-8218-2793-6, 2000 *Mathematics Subject Classification*: 01A30, 37A30, 28D05, 92B05, 92B99, 81Q99, 03B05, 03E72, 90B10, 47A15, **Individual member $26**, List $44, Institutional member $35, Order code CONM/284N

Probability



Probability Theory

S. R. S. Varadhan, *New York University - Courant Institute of Mathematical Sciences*

This volume presents topics in probability theory covered during a first-year graduate course given at the Courant Institute of Mathematical Sciences. The necessary background material in measure theory is developed, including the standard topics, such as extension theorem, construction of measures, integration, product spaces, Radon-Nikodym theorem, and conditional expectation.

In the first part of the book, characteristic functions are introduced, followed by the study of weak convergence of probability distributions. Then both the weak and strong limit theorems for sums of independent random variables are proved, including the weak and strong laws of large numbers, central limit theorems, laws of the iterated logarithm, and the Kolmogorov three series theorem. The first part concludes with infinitely divisible distributions and limit theorems for sums of uniformly infinitesimal independent random variables.

The second part of the book mainly deals with dependent random variables, particularly martingales and Markov chains. Topics include standard results regarding discrete parameter martingales and Doob's inequalities. The standard topics in Markov chains are treated, i.e., transience, and null and positive recurrence. A varied collection of examples is given to demonstrate the connection between martingales and Markov chains.

Additional topics covered in the book include stationary Gaussian processes, ergodic theorems, dynamic programming, optimal stopping, and filtering. A large number of examples and exercises is included. The book is a suitable text for a first-year graduate course in probability.

Contents: Measure theory; Weak convergence; Independent sums; Dependent random variables; Martingales; Stationary stochastic processes; Dynamic programming and filtering; Bibliography; Index.

Courant Lecture Notes, Volume 7

October 2001, 167 pages, Softcover, ISBN 0-8218-2852-5, LC 2001045216, 2000 *Mathematics Subject Classification*: 60-01, **All AMS members $19**, List $24, Order code CLN/7N

Previously Announced Publications

The Schur Algorithm, Reproducing Kernel Spaces and System Theory

Daniel Alpay, *Ben-Gurion University of the Negev, Beersheva, Israel*

From a review of the French edition:

This excellent survey showing a rich interplay between functional analysis, complex analysis and systems science is very informative and can be highly recommended to functional analysts curious about the systems science impact of their discipline or to theoretically inclined systems scientists, in particular those involved in the realization theory.

—Zentralblatt für Mathematik

The class of Schur functions consists of analytic functions on the unit disk that are bounded by 1. The Schur algorithm associates to any such function a sequence of complex constants, which is much more useful than the Taylor coefficients. There is a generalization to matrix-valued functions and a corresponding algorithm. These generalized Schur functions have important applications to the theory of linear operators, to signal processing and control theory, and to other areas of engineering.

In this book, Alpay looks at matrix-valued Schur functions and their applications from the unifying point of view of spaces with reproducing kernels. This approach is used here to study the relationship between the modeling of time-invariant dissipative linear systems and the theory of linear operators. The inverse scattering problem plays a key role in the exposition. The point of view also allows for a natural way to tackle more

general cases, such as nonstationary systems, non-positive metrics, and pairs of commuting nonself-adjoint operators. This is the English translation of a volume originally published in French by the Société Mathématique de France. Translated by Stephen S. Wilson.

This item will also be of interest to those working in applications.

SMF/AMS Texts and Monographs, Volume 5

August 2001, 150 pages, Softcover, ISBN 0-8218-2155-5, LC 2001031602, 2000 *Mathematics Subject Classification*: 46E22, 93-02, **All AMS members $39**, List $49, Order code SMFAMS/5RT110

Recommended Text

Theta Constants, Riemann Surfaces and the Modular Group

An Introduction with Applications to Uniformization Theorems, Partition Identities and Combinatorial Number Theory

Hershel M. Farkas, *The Hebrew University, Jerusalem, Israel*, and **Irwin Kra**, *State University of New York, Stony Brook*

There are incredibly rich connections between classical analysis and number theory. For instance, analytic number theory contains many examples of asymptotic expressions derived from estimates for analytic functions, such as in the proof of the Prime Number Theorem. In combinatorial number theory, exact formulas for number-theoretic quantities are derived from relations between analytic functions. Elliptic functions, especially theta functions, are an important class of such functions in this context, which had been made clear already in Jacobi's *Fundamenta nova*. Theta functions are also classically connected with Riemann surfaces and with the modular group $\Gamma = \mathrm{PSL}(2,\mathbb{Z})$, which provide another path for insights into number theory.

Farkas and Kra, well-known masters of the theory of Riemann surfaces and the analysis of theta functions, uncover here interesting combinatorial identities by means of the function theory on Riemann surfaces related to the principal congruence subgroups $\Gamma(k)$. For instance, the authors use this approach to derive congruences discovered by Ramanujan for the partition function, with the main ingredient being the construction of the same function in more than one way. The authors also obtain a variant on Jacobi's famous result on the number of ways that an integer can be represented as a sum of four squares, replacing the squares by triangular numbers and, in the process, obtaining a cleaner result.

The recent trend of applying the ideas and methods of algebraic geometry to the study of theta functions and number theory has resulted in great advances in the area. However, the authors choose to stay with the classical point of view. As a result, their statements and proofs are very concrete. In this book the mathematician familiar with the algebraic geometry approach to theta functions and number theory will find many interesting ideas as well as detailed explanations and derivations of new and old results.

Highlights of the book include systematic studies of theta constant identities, uniformizations of surfaces represented by subgroups of the modular group, partition identities, and Fourier coefficients of automorphic functions.

Prerequisites are a solid understanding of complex analysis, some familiarity with Riemann surfaces, Fuchsian groups, and elliptic functions, and an interest in number theory. The book contains summaries of some of the required material, particularly for theta functions and theta constants.

Readers will find here a careful exposition of a classical point of view of analysis and number theory. Presented are numerous examples plus suggestions for research-level problems. The text is suitable for a graduate course or for independent reading.

This item will also be of interest to those working in number theory.

Graduate Studies in Mathematics, Volume 37

October 2001, 531 pages, Hardcover, ISBN 0-8218-1392-7, LC 2001035711, 2000 *Mathematics Subject Classification*: 30F35, 30F30, 11F20, 11F25, 11F30, 11P81, 11P82, 11P83, 14H42, 14H45, 14H55, 20H10, **All AMS members $55**, List $69, Order code GSM/37RT110

Recommended Text

Linear Algebra and Differential Equations

Alexander Givental, *University of California, Berkeley*

This is based on the course, "Linear Algebra and Differential Equations", taught by the author to sophmore students at UC Berkeley.

From the Introduction: "We accept the currently acting syllabus as an outer constraint ... but otherwise we stay rather far from conventional routes.

"In particular, at least half of the time is spent to present the entire agenda of linear algebra and its applications in the 2*D* environment; Gaussian elimination occupies a visible but supporting position; abstract vector spaces intervene only in the review section. Our eye is constantly kept on *why?*, and very few facts (the fundamental theorem of algebra, the uniqueness and existence theorem for solutions of ordinary differential equations, the Fourier convergence theorem, and the higher-dimensional Jordan normal form theorem) are stated and discussed without proof."

Specific material in the book is organized as follows: Chapter 1 discusses geometry on the plane, including vectors, analytic geometry, linear transformations and matrices, complex numbers, and eigenvalues. Chapter 2 presents differential equations (both ODEs and PDEs), Fourier series, and the Fourier method. Chapter 3 discusses classical problems of linear algebra, matrices and determinants, vectors and linear systems, Gaussian elimination, quadratic forms, eigenvectors, and vector spaces. The book concludes with a sample final exam.

This item will also be of interest to those working in differential equations.

Berkeley Mathematical Lecture Notes, Volume 11

August 2001, 132 pages, Softcover, ISBN 0-8218-2850-9, 2000 *Mathematics Subject Classification*: 15-01; 34-01, 35-01, 51-01, **All AMS members $15**, List $19, Order code BMLN/11RT110

Supplementary Reading

Smooth Ergodic Theory and Its Applications

Anatole Katok, *Pennsylvania State University, University Park*, **Rafael de la Llave**, *University of Texas at Austin*, and **Yakov Pesin** and **Howard Weiss**, *Pennsylvania State University, University Park*, Editors

During the past decade, there have been several major new developments in smooth ergodic theory, which have attracted substantial interest to the field from mathematicians as well as scientists using dynamics in their work. In spite of the impressive literature, it has been extremely difficult for a student—or even an established mathematician who is not an expert in the area—to acquire a working knowledge of smooth ergodic theory and to learn how to use its tools.

Accordingly, the AMS Summer Research Institute on Smooth Ergodic Theory and Its Applications (Seattle, WA) had a strong educational component, including ten mini-courses on various aspects of the topic that were presented by leading experts in the field. This volume presents the proceedings of that conference.

Smooth ergodic theory studies the statistical properties of differentiable dynamical systems, whose origin traces back to the seminal works of Poincaré and later, many great mathematicians who made contributions to the development of the theory. The main topic of this volume, smooth ergodic theory, especially the theory of nonuniformly hyperbolic systems, provides the principle paradigm for the rigorous study of complicated or *chaotic* behavior in deterministic systems. This paradigm asserts that if a non-linear dynamical system exhibits sufficiently pronounced exponential behavior, then global properties of the system can be deduced from studying the linearized system. One can then obtain detailed information on topological properties (such as the growth of periodic orbits, topological entropy, and dimension of invariant sets including attractors), as well as statistical properties (such as the existence of invariant measures, asymptotic behavior of typical orbits, ergodicity, mixing, decay of correlations, and measure-theoretic entropy). Smooth ergodic theory also provides a foundation for numerous applications throughout mathematics (e.g., Riemannian geometry, number theory, Lie groups, and partial differential equations), as well as other sciences.

This volume serves a two-fold purpose: first, it gives a useful gateway to smooth ergodic theory for students and nonspecialists, and second, it provides a state-of-the-art report on important current aspects of the subject. The book is divided into three parts: lecture notes consisting of three long expositions with proofs aimed to serve as a comprehensive and self-contained introduction to a particular area of smooth ergodic theory; thematic sections based on mini-courses or surveys held at the conference; and original contributions presented at the meeting or closely related to the topics that were discussed there.

This item will also be of interest to those working in geometry and topology.

Contributors include: L. Barreira, Ya. Pesin, M. Brin, D. Dolgopyat, H. Hu, A. Katok, E. A. Robinson, Jr., R. de la Llave, V. Baladi, K. Burns, C. Pugh, M. Shub, A. Wilkinson, Y. Kifer, M. Pollicott, J. Schmeling, H. Weiss, G. Świątek, M. P. Wojtkowski, P. Eberlein, G. Knieper, B. Kalinin, D. Kleinbock, K. Schmidt, L. H. Eliasson, J. Pöschel, M. Levi, J. Moser, J. Buzzi, M. Guysinsky, V. Niţică, F. Xavier, N. Peyerimhoff, A. Windsor, and M. Jakobson.

October 2001, 867 pages, Hardcover, ISBN 0-8218-2682-4, LC 2001041216, 2000 *Mathematics Subject Classification*: 11-XX, 28-XX, 34Cxx, 34Dxx, 37-XX, 53-XX, 70-XX, **Individual member $98**, List $164, Institutional member $131, Order code PSPUM-PESINRT110

Geometric Asymptotics for Nonlinear PDE. I

V. P. Maslov, *Moscow State University, Russia*, and **G. A. Omel'yanov**, *Moscow Institute of Electronic Engineering, Russia*

The study of asymptotic solutions to nonlinear systems of partial differential equations is a very powerful tool in the analysis of such systems and their applications in physics, mechanics, and engineering. In the present book, the authors propose a new powerful method of asymptotic analysis of solutions, which can be successfully applied in the case of the so-called "smoothed shock waves", i.e., nonlinear waves which vary fast in a neighborhood of the front and slowly outside of this neighborhood. The proposed method, based on the study of geometric objects associated to the front, can be viewed as a generalization of the geometric optics (or WKB) method for linear equations. This volume offers to a broad audience a simple and accessible presentation of this new method.

The authors present many examples originating from problems of hydrodynamics, nonlinear optics, plasma physics, mechanics of continuum, and theory of phase transitions (free boundary problems). In the examples, characterized by smoothing of singularities due to dispersion or diffusion, asymptotic solutions in the form of distorted solitons, kinks, breathers, or smoothed shock waves are constructed. By a unified rule, a geometric picture is associated with each physical problem that allows for obtaining tractable asymptotic formulas and provides a geometric interpretation of the physical process. Included are many figures illustrating the various physical effects.

Translations of Mathematical Monographs, Volume 202

August 2001, 285 pages, Hardcover, ISBN 0-8218-2109-1, LC 2001040045, 2000 *Mathematics Subject Classification*: 35Qxx, 76L05, **Individual member $59**, List $99, Institutional member $79, Order code MMONO/202RT110

Classified Advertisements

Positions available, items for sale, services available, and more

CALIFORNIA

UNIVERSITY OF CALIFORNIA AT BERKELEY
CHARLES B. MORREY JR. ASSISTANT PROFESSORSHIPS
Department of Mathematics
Berkeley, CA 94720

We invite applications for these special (non-tenure-track) positions effective July 1, 2002. The terms of these appointments may range from two to three years. Applicants should have a recent Ph.D. or the equivalent in an area of pure or applied mathematics. Applicants should send a résumé, reprints, preprints, and/or dissertation abstract, and ask three people to send letters of evaluation to the Vice Chair for Faculty Affairs at the above address. All letters of evaluation are subject to Berkeley campus policies on confidentiality of letters of evaluation, a summary of which can be found on our home page (`http://math.berkeley.edu`) by clicking on available teaching position and then confidentiality policy. We request that applicants use the AMS standardized application form and indicate their subject area using the AMS subject classification numbers. The form is the Academic Employment in Mathematics, Application Cover Sheet, available courtesy of the American Mathematical Society.

Applications must be postmarked by December 1, 2001. Applications postmarked after the deadline will not be considered. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA AT BERKELEY
TEMPORARY POSTDOCTORAL POSITIONS
Department of Mathematics
Berkeley, CA 94720

Several temporary positions beginning in fall 2002 are anticipated for new and recent Ph.D.'s of any age in any area of pure or applied mathematics. The terms of these appointments may range from one to three years. Applicants for NSF or other postdoctoral fellowships are encouraged to apply for these positions. Mathematicians whose research interests are close to those of regular department members will be given some preference. Applicants should send a résumé and reprints, preprints, and/or dissertation abstract, and ask three people to send letters of evaluation to the Vice Chair for Faculty Affairs at the above address. All letters of evaluation are subject to Berkeley campus policies on confidentiality of letters of evaluation, a summary of which can be found on our home page (`http://math.berkeley.edu`) by clicking on available teaching position and then confidentiality policy. We request that applicants use the AMS standardized application form and indicate their subject area using the AMS subject classification numbers. The form is the Academic Employment in Mathematics, Application Cover Sheet, available courtesy of the American Mathematical Society.

Applications must be postmarked by December 1, 2001. Applications postmarked after the deadline will not be considered. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA, DAVIS
Department of Mathematics

The University of California, Davis, is soliciting applications for up to three tenure-track/tenured positions and several Visiting Research Assistant Professor (VRAP) positions starting July 1, 2002. These positions and appointments are contingent upon budgetary and administrative approval.

Appointment of the tenure-track/tenured position will be made commensurate with qualifications. It will normally be made at the level of Assistant Professor, but exceptional candidates will be considered for Associate Professorship with tenure. The focus research areas of the Department are: Analysis and Partial Differential Equations, Applied Mathematics, Discrete Mathematics, Geometry and Topology, Mathematical Physics, Numerical Analysis, and Scientific Computation. The Department has current needs in 1) Applied Mathematics and Scientific Computation, and 2) Geometry and Topology; however outstanding candidates in all of the focus research areas will be considered. Minimum qualifications for this position include a Ph.D. degree in mathematical sciences and great promise

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Suggested uses for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

The 2001 rate is $100 per inch or fraction thereof on a single column (one-inch minimum), calculated from top of headline. Any fractional text of 1/2 inch or more will be charged at the next inch rate. No discounts for multiple ads or the same ad in consecutive issues. For an additional $10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

Advertisements in the "Positions Available" classified section will be set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Headlines will be centered in boldface at no extra charge. Ads will appear in the language in which they are submitted.

There are no member discounts for classified ads. Dictation over the telephone will not be accepted for classified advertising.

Upcoming deadlines for classified advertising are as follows: November 2001 issue-August 27, 2001; December 2001 issue-September 27, 2001; January 2002 issue-October 24, 2001; February 2002 issue-November 20, 2001; March 2002 issue-December 28, 2001; April 2001 issue-January 25, 2002.

U.S. laws prohibit discrimination in employment on the basis of color, age, sex, race, religion, or national origin. "Positions Available" advertisements from institutions outside the U.S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U.S. laws. Details and specific wording may be found on page 1373 (vol. 44).

Situations wanted advertisements from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-321-4AMS (321-4267) in the U.S. and Canada or 401-455-4084 worldwide for further information.

Submission: Promotions Department, AMS, P. O. Box 6248, Providence, Rhode Island 02940; or via fax: 401-331-3842; or send e-mail to `classads@ams.org`. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.

in research and teaching. Duties include mathematical research, undergraduate and graduate teaching (4.0 quarter courses per year), and departmental and university service. Candidates for the Associate Professor position must have demonstrated outstanding attainment in research and teaching.

The VRAP positions are renewable for a total of three years with satisfactory performance in research and teaching. The VRAP applicants are required to have completed their Ph.D. by the time of their appointment, but no earlier than 1998. The Department is interested in applicants in any of the focus research areas listed above.

Applications will be accepted until the positions are filled, but to receive full consideration, applications should be received by December 14, 2001. To initiate the application process, please request an application package by either sending an e-mail message to forms@math.ucdavis.edu, or, by writing to the Chair of Search Committee, Department of Mathematics, University of California, One Shields Avenue, Davis, CA 95616-8633. Additional information on the Department may be found on the World Wide Web at http://math.ucdavis.edu/.

The University of California, Davis, is an affirmative action/equal opportunity employer. The University undertakes affirmative action to assure equal employment opportunity for minorities and women, for persons with disabilities, and for special disabled veterans, Vietnam era veterans, and any other veterans who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized.

THE UNIVERSITY OF CALIFORNIA, IRVINE
Announces the Creation of a Department of Statistics

The University of California, Irvine, is starting a Department of Statistics. We anticipate appointing a full-time faculty in statistics of 6-8 people over the next seven years, with several more half-time appointments shared with other units at UCI. It will be a department with a strongly interdisciplinary flavor, focused both on theoretical research and applied problems, and it will be associated with an independent statistical consulting center that presently serves the campus and surrounding businesses and industry.

Three faculty positions are open for recruitment in 2001-02: two with tenure, including one for the Chair of the Department; and one tenure-track assistant professorship. In all cases demonstrated excellence in research, teaching, and service are sought and, in the case of the Chair, evidence of leadership ability is required.

UCI is one of the youngest campuses in the University of California, yet we are already ranked 10th among public universities. We are projected to grow by almost 50% over the next ten years, with significant increases in graduate enrollment. The new Department of Statistics will occupy a prominent place in this expanding academic profile, and it will interact significantly with a wide range of existing departments and innovative programs across the whole campus.

A detailed account of plans for the new department is available at http://www.evc.uci.edu/proposal.pdf/. For information about UCI, see http://www.uci.edu/. For information about the community around UCI, see http://www.oc.ca.gov/.

Completed applications with a cover letter, sample research publications, and if possible, three letters of recommendation and up to five additional names who may be contacted should be sent to the Chair of the search committee, Professor Duncan Luce, c/o Office of the Executive Vice Chancellor, 535 Administration Bldg., University of California, Irvine, Irvine, CA 92697-1000.

Applications received before November 1, 2001, will receive preference, but later applications will be considered.

The University of California is an Equal Opportunity Employer committed to excellence through diversity.

UNIVERSITY OF CALIFORNIA, IRVINE
Department of Mathematics
Irvine, CA 92697-3875

Applications are invited for several one- or three-year Visiting Assistant Professor positions in the following areas of research: (1) applied and computational mathematics, (2) analysis and PDE (includes mathematical physics), (3) geometry and topology (includes geometric analysis), (4) logic and set theory, (5) probability, (6) algebra and number theory (includes algebraic and arithmetic geometry). Candidates must possess a Ph.D. Strong promise in research and teaching is required. Current annual salary is set at $46,100. Teaching load: 5 to 6 quarter-courses per year. Applicants should send résumé, preprints, dissertation abstract and ask three people to send letters of recommendation to: Visiting Assistant Professor Search Committee at the above address. Electronic submission not accepted.

The deadline for applications is November 30, 2001, or until the positions are filled. The University of California, Irvine, is an Equal Opportunity Employer committed to excellence through diversity.

UNIVERSITY OF CALIFORNIA, IRVINE
Department of Mathematics
Irvine, CA 92697-3875

Applications are invited for tenure-track or tenured positions. Priorities will be placed on the following areas: (A) applied and computational mathematics, (B) analysis and PDE (includes mathematical physics), (C) geometry and topology (includes geometric analysis), (D) logic and set theory, (E) probability, (F) algebra and number theory (includes algebraic and arithmetic geometry). Candidates must possess a Ph.D. Strong record and potential in research and teaching are required for the positions. Send curriculum vitae (include e-mail address), list of publications, preprints, reprints, and research plan to the Recruiting Committee at the above address. Designate area by letter A–F. Applicants should also arrange for four letters of recommendation to be sent. If possible, use the AMS cover sheet. Electronic submission not accepted.

The deadline for applications is November 30, 2001, or until the positions are filled. The University of California, Irvine, is an Equal Opportunity Employer committed to excellence through diversity.

UNIVERSITY OF CALIFORNIA, LOS ANGELES
Department of Mathematics

Subject to availability of resources and administrative approval, the following positions are available:

1) Several tenure-track and senior positions in all areas of mathematics.

2) Several E. R. Hedrick Assistant Professorships. Salary is $52,900. Three-year appointment. Teaching load: four quarter-courses per year, which may include one advanced course in the candidate's field.

3) Several Research Assistant Professorships in Computational and Applied Mathematics (CAM). Salary is $52,900. Three-year appointment. Teaching load: normally reduced to two or three quarter-courses per year by research funding as available; may include one advanced course in the candidate's field.

4) Several Adjunct Assistant Professorships or Lectureships in the Program in Computing (PIC). Applicants for the Adjunct position must show very strong promise in teaching and research in an area related to computing. Teaching load: four one-quarter programming courses each year and one seminar every two years. One-year initial appointment, with the option of applying for renewal for a second year and possibly longer, up to a maximum service of four years. Salary is $56,600. Applicants for the Lectureship must show very strong promise in the teaching of programming. An M.S. in Computer Science or equivalent degree is preferred. Teaching load: six one-quarter programming courses per year. One-year appointment, probably renewable one or more times, depending on the needs of the program. Salary is $43,152 or more, depending on experience.

5) Several VIGRE Assistant Professorships. Hedrick, CAM, or PIC applicants who are U.S. citizens or permanent residents may also apply for a VIGRE Assistant Professor position. Three-year appointment. Salary is $52,900. The successful recipient will receive a summer stipend of $6,500 for two summers and $2,500 per year for travel, equipment, and supplies for three years. Teaching load: 3 courses per year.

6) Several Adjunct Assistant Professorships and Research Postdocs. Up to one-year appointment, with the possibility of renewal. Strong research and teaching background required. Salary $48,700–$52,900. Teaching load for Adjuncts: five quarter-courses per year.

7) Several visiting instructorships.

For more details, see http://www.math.ucla.edu/~search/. To apply, complete the application on the website, or send e-mail to search@math.ucla.edu, or write to: Staff Search, Department of Mathematics, University of California, Los Angeles, CA 90095-1555. Preference will be given to applications completed by January 7, 2002.

UCLA is an Equal Opportunity/Affirmative Action Employer. Under federal law, the University of California may employ only individuals who are legally authorized to work in the United States as established by providing documents specified in the Immigration Reform and Control Act of 1986.

GEORGIA

UNIVERSITY OF GEORGIA
Department of Mathematics
Assistant Professor Position

Applications are invited for a tenure-track position at the rank of assistant professor, designated to support teacher preparation. This position will begin August 2002, but is subject to the availability of funds. The teaching duties will include mathematics content courses designed to prepare elementary and middle school teachers in addition to other mathematics courses.

Candidates should have a Ph.D. in pure or applied mathematics and should exhibit an outstanding research potential in mathematics. Candidates should also exhibit a commitment to excellence in teaching and show evidence of an interest in and aptitude for teaching prospective teachers.

Applicants should send a completed AMS Standard Cover Sheet, a curriculum vitae, a statement about their current and future research plans, and a statement about teaching philosophy and experiences to: Search Committee Chair, Department of Mathematics, University of Georgia, Athens, GA 30602. They should also arrange to have three letters of recommendation concerning research and two concerning teaching sent directly to the above address. Email can be directed to search@math.uga.edu.

The University of Georgia is an Affirmative Action/Equal Opportunity Employer that is committed to increasing the diversity of its faculty. We especially encourage applications from women, minorities and under represented groups.

To assure full consideration, applications must be received by December 3, 2001.

GEORGIA INSTITUTE OF TECHNOLOGY
School of Mathematics

The School of Mathematics at Georgia Tech expects to have several visiting, tenure-track and senior positions available beginning fall 2002 and will consider applications in pure and applied mathematics and statistics. The school is interested in adding new areas of expertise to complement its existing strengths. Candidates with strong research and teaching records or potential should arrange for a résumé, at least three letters of reference, and a summary of future research plans to be sent to the Hiring Committee, School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332-0160. Review of applications will begin in September 2001 and will continue until all positions have been filled. Georgia Tech, an institution of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

ILLINOIS

ILLINOIS WESLEYAN UNIVERSITY
Department of Mathematics and Computer Science
Bloomington, IL

The Department of Mathematics and Computer Science at Illinois Wesleyan University invites applications for a full-time tenure-track assistant professor in computer science to begin in August 2002. Candidates should have a Ph.D. in computer science or a Ph.D. in a closely related field with significant computing experience or significant graduate work in computer science. Candidates must be able to teach in the core CS curriculum. Preference may be given to candidates who can teach upper-level courses in any of the following areas: networking, computer architecture, human-computer interaction, software engineering, operating systems.

Illinois Wesleyan University is a highly selective undergraduate university of approximately 2,000 students located in Bloomington, Illinois, a community of about 120,000. The Department of Mathematics and Computer Science is located in the Center for Natural Science Learning and Research, a $25 million facility opened in 1995.

Candidates for the position should submit a letter of application and résumé, and have three letters of recommendation sent separately to: Melvyn Jeter, Department of Mathematics and Computer Science, Illinois Wesleyan University, P.O. Box 2900, Bloomington, IL 61702-2900. Applications received after November 16, 2001, may not receive full consideration. Women and minorities are encouraged to apply. Illinois Wesleyan is an Equal Opportunity Employer. For further information see our jobs web page at: http://www.iwu.edu/~iwujobs/.

ILLINOIS WESLEYAN UNIVERSITY
Department of Mathematics and Computer Science
Bloomington, IL

The Department of Mathematics and Computer Science at Illinois Wesleyan University invites applications for a tenure-track assistant professor in mathematics. Employment would begin in August 2002, and the teaching load would be six courses per year. All candidates should possess a Ph.D. in mathematics and a dedication to excellent teaching in a liberal arts environment where undergraduate research is encouraged. We are primarily interested in candidates with expertise in number theory, graph theory, or combinatorics. Candidates in other fields which do not seriously overlap the interests of existing faculty will also be considered. The opportunity to participate in university-wide general education programs is available for interested faculty.

Illinois Wesleyan University is a highly selective undergraduate university of approximately 2,000 students located in Bloomington, Illinois, a community of about 120,000. This year the average ACT for Illinois Wesleyan's entering class of freshmen was 28. In recent years as many as 4% of the undergraduate population at Illinois Wesleyan University have declared majors in mathematics. The department maintains a healthy balance between applied mathematics and pure mathematics. Faculty areas of professional expertise include algebra, approximation theory, differential equations, dynamical systems, electrical engineering, linear algebra, logic, operations research, probability, topology, topos theory, numerical analysis and wavelet analysis. The Department of Mathematics and Computer Science is located in the Center for Natural Science Learning and Research, a $25 million facility opened in 1995. The department operates five computer labs for students which have around 80 SunSparc and IMac computers. For additional information on the mathematics curriculum, facilities, and faculty interests, see http://titan.iwu.edu/~math/.

Candidates for the position should submit a letter of application, a vita, an AMS Standard Cover Sheet, a teaching state-

ment, a research statement, and three letters of recommendation to: Melvyn Jeter, Department of Mathematics and Computer Science, Illinois Wesleyan University, P.O. Box 2900, Bloomington, IL 61702-2900. Preliminary interviews for this position will be held at the Joint Mathematics Meetings in San Diego, CA (January 2002). Applications received after December 15, 2001, may not receive full consideration. Women and minorities are encouraged to apply. Illinois Wesleyan is an Equal Opportunity Employer. For further information see our jobs web page at: http://www.iwu.edu/~iwujobs/.

NORTHWESTERN UNIVERSITY
Department of Mathematics
2033 Sheridan Road
Evanston, Illinois 60208-2730

Applications are invited for anticipated tenure-track or tenured positions starting September 2002, pending final approval. Priority will be given to exceptionally promising research mathematicians. Fields of interest within the department include Algebra, Algebraic Geometry, Analysis, Dynamical Systems, Mathematical Physics, Probability, Partial Differential Equations, and Topology.

Application material should be sent to Personnel Committee, at the department address and include: (1) the American Mathematical Society's Application Cover Sheet for Academic Employment, (2) a curriculum vitae, and (3) at least four letters of recommendation including one which discusses in some detail the candidate's teaching qualifications. Inquiries may be sent via e-mail to hiring@math.nwu.edu.

Applications are welcome at any time, but the review process starts in October 2001. Northwestern University is an affirmative action, equal opportunity employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

NORTHWESTERN UNIVERSITY
Department of Mathematics
2033 Sheridan Road
Evanston, Illinois 60208-2730
Boas Assistant Professor

Applications are solicited from people whose research is related to Nonlinear Partial Differential Equations and related analysis for two Ralph Boas assistant professorships of three years each starting in September 2002. These positions are non-tenure track and are part of the Emphasis Year in Nonlinear Partial Differential Equations which the department will be sponsoring in 2002-2003.

Applications should be sent to the Emphasis Year Committee at the department address and include: (1) the American Mathematical Society's Application Cover Sheet for Academic Employment, (2) a curriculum vitae, and (3) three letters of recommendation including one which discusses in some detail the candidate's teaching qualifications. Inquiries may be sent via e-mail to hiring@math.nwu.edu.

Applications are welcome at any time, but the review process starts December 1, 2001. Northwestern University is an affirmative action, equal opportunity employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

UNIVERSITY OF ILLINOIS AT CHICAGO
Department of Mathematics, Statistics, and Computer Science

The Department has active research programs in all areas of pure mathematics, computational and applied mathematics, combinatorics and computer science, statistics, and mathematics education. See http://www.math.uic.edu for more information.

Applications are invited for the following positions, effective August 21, 2002.

At least one Tenure track or tenured position. Candidates in all areas of interest to the Department will be considered. The position is initially budgeted at the Assistant Professor level, but candidates with a sufficiently outstanding research record may be considered at higher levels. Applicants must have a Ph.D. or equivalent degree in mathematics, computer science, statistics, mathematics education or related field, an outstanding research record, and evidence of strong teaching ability. Salary negotiable.

Research Assistant Professorship/VIGRE Postdoctoral Fellowship. This is a non-tenure track position, normally renewable annually to a maximum of three years. This position is partially funded by a VIGRE grant from the NSF and is open only to U.S. citizens, nationals or permanent residents. The position carries a teaching load of one course per semester, with the requirement that the incumbent play a significant role in the research life of the Department. The salary for AY 2001-2002 for this position is $45,000; the salary for AY 2002-2003 may be higher; in each of the first two years the VIGRE grant provides an additional $6,000 for summer support. Applicants must have a Ph.D. or equivalent degree in mathematics, computer science, statistics, mathematics education or related field, and evidence of outstanding research potential.

There may also, subject to availability of funds, be one or more "non-VIGRE" Research Assistant Professorships available, which would not be subject to these nationality requirements.

Send vita and direct 3 letters of recommendation, clearly indicating the position being applied for, and whether you are eligible for a VIGRE fellowship, to: Appointments Committee; Dept. of Mathematics, Statistics, and Computer Science; University of Illinois at Chicago; 851 S. Morgan (M/C 249); Chicago, IL 60607. No e-mail applications will be accepted. To ensure full consideration, materials must be received by November 9, 2001, for the tenure/tenure track positions, and December 30, 2001 for the postdoctoral fellowships. However, we will continue considering candidates until all positions have been filled. Minorities, persons with disabilities, and women are particularly encouraged to apply. UIC is an AA/EOE.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Mathematics
Open Rank Position in Actuarial Science
OAA #7866

Applications are invited for a full time open rank faculty position in Actuarial Science to commence August 21, 2002. This position is at the tenure-track level, although a tenured appointment may be possible for an exceptional candidate. The person selected will be expected to teach and advise graduate and advanced undergraduate students, and to pursue research in actuarial science or a related area such as statistics or financial mathematics. Salary and teaching load are competitive.

Preference will be given to applicants who are Associates or Fellows of one of the professional societies, have completed the Ph.D. (or equivalent) by the time the appointment begins, and have some experience as practicing actuaries. A strong commitment to teaching is essential. Applicants should send a letter of application, a curriculum vitae and a publication list, and should arrange to have three letters of reference sent directly to the address below. It is the responsibility of applicants to see that letters of recommendation are sent.

Joseph Rosenblatt, Chair
Department of Mathematics
University of Illinois
at Urbana-Champaign
1409 West Green Street
Urbana IL 61801
Tel: (217) 333-3352
e-mail: search@math.uiuc.edu

For fullest consideration, complete dossiers, including letters of reference, should be received by November 16, 2001. We encourage use of the application cover sheet provided by the American Mathematical Society. Minority candidates, women, and other designated class members are encouraged to apply. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Mathematics
Postdoctoral Positions as
J. L. Doob Research Assistant Professor

The Department of Mathematics of the University of Illinois at Urbana-Champaign is soliciting applications for postdoctoral positions. Three appointments will be made starting August 21, 2002; each appointment is for 3 years and is not renewable. These positions are for recent Ph.D. recipients (with a strong preference for those not more than one year past the Ph.D. degree). The Department of Mathematics and the University of Illinois will provide an excellent scientific environment to pursue research in pure and applied mathematics. The position carries a salary of $42,500 per year plus a $1,000 annual travel allowance.

Applicants should send a letter of application, a curriculum vitae and publication list, (please provide hard copies of your application and supporting documents), and arrange to have three letters of reference sent directly to the address below. It is the responsibility of applicants to see that letters of recommendation are received in a timely fashion.

Postdoctoral Search Committee
Department of Mathematics
University of Illinois
at Urbana-Champaign
1409 West Green Street
Urbana, IL 61801-2975
e-mail: search@math.uiuc.edu

To insure full consideration, all materials, including letters of reference, should be received by November 16, 2001. Late applications will be reviewed until the search is closed. We encourage use of the application cover sheet provided by the American Mathematical Society and the indication of the subject area using the AMS subject classification numbers. Minority candidates, women, and other designated class members are encouraged to apply. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Mathematics
Postdoctoral Positions as
NSF Vigre Research Assistant Professor

The Department of Mathematics of the University of Illinois at Urbana-Champaign is soliciting applications for National Science Foundation VIGRE postdoctoral positions. Appointments are for three years, are not renewable, and will begin August 21, 2002. Eligibility is limited to United States citizens, nationals and permanent residents who will have a Ph.D. and are not beyond 18 months of completion of their degree at the time of appointment. The Department of Mathematics and the University of Illinois will provide an excellent scientific environment to pursue research in pure and applied mathematics. Each position carries a salary of $36,000 per 9-month academic year, an additional $6,500 for both the first and second summers, and a $7,500 travel allowance over the term of the appointment.

Applicants should send a letter of application, a curriculum vitae and publication list, (please provide hard copies of your application and supporting documents), and arrange to have three letters of reference sent directly to the address below. It is the responsibility of applicants to see that letters of recommendation are received in a timely fashion.

Postdoctoral Search Committee
Department of Mathematics
University of Illinois
at Urbana-Champaign
1409 West Green Street
Urbana, IL 61801-2975
e-mail: search@math.uiuc.edu

To insure full consideration, all materials, including letters of reference, should be received by November 16, 2001. Late applications will be reviewed until the search is closed. We encourage use of the application cover sheet provided by the American Mathematical Society and the indication of the subject area using the AMS subject classification numbers. Minority candidates, women, and other designated class members are encouraged to apply. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Mathematics
Postdoctoral Research Positions in Model Theory and its Applications

The Department of Mathematics of the University of Illinois at Urbana-Champaign is soliciting applications for postdoctoral positions in applications of model theory to other areas of mathematics. These research positions are funded by a three-year National Science Foundation Focused Research Grant to the department's model theory research group. Lengths of appointment will be between one and three years and are not renewable. Starting dates are flexible; a first appointment could begin as early as January 2002. Applicants are requested to say which period of appointment they prefer. These positions are for recent Ph.D. recipients. They carry a salary of $42,500 per academic year plus a $1,000 annual travel allowance.

Preferred areas of research interest are (a) the interface of model theory, symbolic dynamics and algebraic geometry; (b) model theory and the algebraic theory of differential equations; (c) nonstandard analysis; (d) model theory and geometry; (e) model theory and bimeromorphic geometry; (f) model theory and ultraproducts of structures based on metric spaces, such as finitely generated groups or Banach spaces; and (g) model theory and number theory.

Applications are encouraged from all recent Ph.D. recipients who have an interest in methods and techniques connected with model theory and mathematical logic. Applicants should send a letter of application, a curriculum vitae and publication list (please provide hard copies of your application and supporting documents), and arrange to have three letters of reference sent directly to the address below. It is the responsibility of applicants to see that letters of recommendation are received in a timely fashion.

Model Theory Postdoctoral
Search Committee
Department of Mathematics
University of Illinois
at Urbana-Champaign
1409 West Green Street
Urbana, IL 61801-2975

To ensure full consideration, all materials, including letters of reference, should be received by November 16, 2001. Late applications will be reviewed until the search is closed. We encourage use of the application cover sheet provided by the American Mathematical Society and the indication of the subject area using the AMS subject classification numbers. Minority candidates, women, and other designated class members are encouraged to apply. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Mathematics
Tenure-Track Position
OAA #7864

Applications are invited for one or more full time faculty positions to commence August 21, 2002, at the tenure-track (assistant professor) level. Appointees will be expected to pursue a vigorous research program, and teach graduate as well as undergraduate students. The department will consider applicants in all fields of mathematics. We are particularly interested in algebraic geometry, analysis, logic, computational mathematics, discrete mathematics, interdisciplinary mathematics, mathematical physics, number theory, partial differential equations, and probability theory. Salary and teaching load are competitive.

Applicants should have completed the Ph.D. (or equivalent) by the time the appointment begins, and are expected to present evidence of excellence in research and teaching. Applicants should send a letter of application, a curriculum vitae and publication list, and also arrange to have three letters of reference sent directly to the address below. It is the responsibility of applicants to see that letters of recommendation are sent.

Joseph Rosenblatt, Chair
Department of Mathematics
University of Illinois
at Urbana-Champaign
1409 West Green Street
Urbana, IL 61801
tel: (217) 333-3352
e-mail: search@math.uiuc.edu

For fullest consideration, complete dossiers, including letters of reference, should be received by November 16, 2001. We encourage use of the application cover sheet provided by the American Mathematical Society. Minority candidates, women, and other designated class members are encouraged to apply. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Mathematics
Tenured Position
OAA #7865

Applications are invited for one or more full time tenured faculty positions to commence August 21, 2002. Appointees will be expected to pursue an outstanding research program, and teach graduate students as well as undergraduate students. The department will consider applicants in all fields of mathematics. We are particularly interested in algebraic geometry, analysis, logic, computational mathematics, discrete mathematics, interdisciplinary mathematics, mathematical physics, number theory, partial differential equations, and probability theory. Salary and teaching load are competitive.

Applicants are expected to have a Ph.D. (or equivalent) and a documented record of leadership in research as well as of excellence in teaching. Applicants should send a curriculum vitae, a list of publications, a few selected reprints or preprints, and the names and addresses of three references to the address below. The department will solicit letters for the finalists for the tenured positions.

Joseph Rosenblatt, Chair
Department of Mathematics
University of Illinois
at Urbana-Champaign
1409 West Green Street
Urbana, IL 61801
tel: (217) 333-3352
e-mail: search@math.uiuc.edu

For fullest consideration, applications should be on file in our department office by October 5, 2001. We anticipate an on-going search but will begin considering applications and conducting interviews following the deadline. We encourage use of the application cover sheet provided by the American Mathematical Society and the indication of the subject area using the AMS subject classification numbers. Minority candidates, women, and other designated class members are encouraged to apply. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

WHEATON COLLEGE
Department of Mathematics

Wheaton College seeks candidates for an anticipated full-time, tenure-track position in mathematics at the assistant professor level beginning August 2002. The candidates are expected to teach in a strong mathematics/computer science program. A Ph.D. in the mathematical sciences is expected. A strong commitment to innovative undergraduate teaching, to undergraduate research development, and to extensive out-of-class interaction with students is expected. The department has five mathematics faculty and three computer science faculty and graduates 15 mathematics and 15 CS majors each year. Wheaton College, an evangelical Christian liberal arts college whose faculty and staff affirm a Statement of Faith and adhere to lifestyle expectations, complies with federal and state guidelines for nondiscrimination in employment. Women and minority candidates are encouraged to apply. Applicants should send a curriculum vita, three letters of recommendation, a description of their teaching philosophy and research interest to Dr. Robert Brabenec, Chair, Department of Mathematics and Computer Science, Wheaton College, Wheaton, IL 60871; 630-752- 5869; Robert.L.Brabenec@wheaton.edu. Review of applications will begin November 15, 2001.

INDIANA

UNIVERSITY OF NOTRE DAME
NOTRE DAME, IN 46556
Department of Mathematics
Regular Position in Mathematics

The Department of Mathematics of the University of Notre Dame invites applications for the John P. McAndrews Assistant Professorship in Mathematics starting August 24, 2001. Outstanding candidates in any field of pure or applied mathematics are encouraged to apply. The position is at the tenure track level, though a tenured associate professor appointment may be possible for an exceptional candidate. The teaching load is one course one semester and two courses the other semester. Salaries are competitive and a research fund is included. Applications, including a curriculum vitae, a letter of application, and a completed AMS standard cover sheet, should be sent to: Steven A. Buechler, Chair, at the above address. Applicants should also arrange for at least three letters of recommendation to be sent to the chair. These letters should address the applicant's research accomplishments and supply evidence that the applicant can communicate articulately and teach effectively. Notre Dame is an equal opportunity employer. Women and minorities are urged to apply. The evaluation of candidates will begin December 1. Information about the department is available at http://www.math.nd.edu/math.

UNIVERSITY OF NOTRE DAME
NOTRE DAME, IN 46556
Department of Mathematics
Regular Position in Stochastic Analysis

The Department of Mathematics of the University of Notre Dame invites applications for a position in the field of Applied Stochastic Analysis to start on August 24, 2001. The position is at the tenure track level, but a tenured appointment may be possible for an exceptional candidate. The teaching load is one course one semester and two courses the other semester. The salary is competitive. Applications, including a curriculum vitae, a letter of application, and a completed AMS standard cover sheet, should be sent to: Steven A. Buechler, Chair, at the above address. Applicants should also arrange for at least three letters of recommendation to be sent to the chair. These letters should address the applicant's research accomplishments and supply evidence that the applicant has the ability to communicate articulately and teach effectively. Notre Dame is an equal opportunity employer. Women and minorities are urged to apply. The evaluation of candidates will begin December 1. Information about the department is available at http://www.math.nd.edu/math/.

MARYLAND

JOHNS HOPKINS UNIVERSITY
Department of Mathematics
404 Krieger Hall
Baltimore, MD 21218-2689

The J. J. Sylvester Assistant Professorship in Mathematics. The Department of Mathematics invites applications for a nontenure track three year Assistant Professorship to be awarded again this year on July 1, 2002. Preference will be given to candidates who have received their Ph.D. within the last two years and who have demonstrated high potential in teaching and research in the general areas of Algebra, Analysis, Geometry, Number Theory and Topology. The position carries a teaching load of two courses one semester and one the other semester with a competitive salary and a discretionary research fund. Applications should be sent to: J.J. Sylvester Assistant Professorship, Department of Mathematics, Johns Hopkins University, 404 Krieger Hall, Baltimore, MD 21218-2689 and should include a complete curriculum vitae, at least four letters of recommendation (including a letter concerning teaching) and a description of current and planned research. Applications received

by December 1, 2001 will be given priority. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer. Minority and women candidates are encouraged to apply.

UNIVERSITY OF MARYLAND, COLLEGE PARK
Computational Nonlinear Dynamics Faculty Position

A nonlinear dynamicist with strong interest in computation is sought for a tenured or tenure-track appointment in the Department of Mathematics, possibly joint with the Institute for Physical Science and Technology. An outstanding record of research accomplishments and a proven ability to attract research support are important for a senior position. Good teaching is a priority of the university.

Applications should be sent to: Chair's Office, Computational Nonlinear Dynamics, Department of Mathematics, University of Maryland, College Park, MD 20742-4015. Priority will be given to applications received by December 1, 2001. Appointments will commence in fall 2002. The University of Maryland is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF MARYLAND, COLLEGE PARK
Department of Mathematics

Applications are invited for tenured and tenure-track positions in the Department of Mathematics. Strong preference will be given to candidates in (1) applied statistics, (2) algebraic geometry, (3) dynamics, and (4) geometry, but candidates from all areas will be considered.

Priority will be given to applications received by December 1, 2001. Appointments will commence in fall 2002.

The University of Maryland is an Equal Opportunity/Affirmative Action Employer that strongly encourages applications from female and minority candidates.

Please send a curriculum vitae and AMS Standard Cover Sheet, and three letters of recommendation to:

The Hiring Committee
Department of Mathematics
University of Maryland
College Park, MD 20742

UNIVERSITY OF MARYLAND, COLLEGE PARK
Lectureships in the Department of Mathematics

Applications are invited for Avron Douglis Lectureships, starting in fall 2002. These positions are for recent Ph.D. recipients, with a preference for those not more than one year past the Ph.D. degree. The lectureship is for two years and is nonrenewable. Candidates must have superior research potential and a strong commitment to teaching. The Department of Mathematics provides an excellent scientific environment to foster the professional development of junior mathematicians. The teaching duties consist of three courses per year. The salary is $47,000 per academic year, supplemented by a $1,000 research stipend. Priority will be given to applications completed by December 15, 2001.

The University of Maryland is an Equal Opportunity/Affirmative Action Employer that strongly encourages applications from female and minority candidates.

Please send a curriculum vitae and AMS Standard Cover Sheet, and three or more letters of recommendation, at least one of which speaks to the applicant's teaching credentials, to:

Douglis Lectureship Committee
Department of Mathematics
University of Maryland
College Park, MD 20742

MASSACHUSETTS

WILLIAMS COLLEGE
Department of Mathematics and Statistics
Williamstown, Massachusetts 01267

Tenure-track position in mathematics or statistics, beginning fall 2002, at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research and a Ph.D. by time of appointment are required.

Please send a vita and have three letters of recommendation on teaching and research sent to the Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, Massachusetts 01267. Evaluation of applications will begin on or after December 10. As an EEO/AA employer, Williams especially welcomes applications from women and minority candidates.

WILLIAMS COLLEGE
Department of Mathematics and Statistics
Williamstown, Massachusetts 01267

Tenure-track position in statistics, beginning fall 2002, at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research and a Ph.D. at the time of appointment are required.

Please send a vita and have three letters of recommendation on teaching and research sent to the Statistics Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, Masschusetts 01267. Evaluation of applications will begin on or after December 10. As an EEO/AA employer, Williams especially welcomes applications from women and minority candidates.

MICHIGAN

UNIVERSITY OF MICHIGAN
Department of Mathematics

The department has several openings at the tenure-track or tenured level. Candidates should hold the Ph.D. in mathematics or a related field and should show outstanding promise and/or accomplishments in both research and teaching. Areas of special interest are: analysis; geometry/topology; applied and interdisciplinary mathematics, including mathematical biology, computational science, probability, and actuarial or financial mathematics. However, we encourage applications from any area of pure or applied mathematics. Salaries are competitive, based on credentials. Applicants should send a C.V.; bibliography; descriptions of research and teaching experience; and three or four letters of recommendation, at least one of which addresses the candidate's teaching experience and capabilities, to: Personnel Committee, University of Michigan, Department of Mathematics, 2074 East Hall, Ann Arbor, MI 48109-1109. Applications are considered on a continuing basis, but candidates are urged to apply by November 1, 2001. More detailed information regarding available positions may be found on our web page, `http://www.math.lsa.umich.edu/`. Inquiries may be made by e-mail to `math.chair@math.lsa.umich.edu`. The University of Michigan is an Equal Opportunity/Affirmative Action Employer.

MINNESOTA

UNIVERSITY OF MINNESOTA-MINNEAPOLIS
School of Mathematics
Post-Doctoral Position
(Assistant Professor)
with emphasis in Math Education

The School of Mathematics will have available a temporary position (Assistant Professor) starting fall semester, 2002. Ph.D. or equivalent degree in mathematics, teaching and some related education experiences at the undergraduate level are required. This position will emphasize: * excellence in teaching, including some experiences with mathematically talented high school students; * involvement with creative academic programs, curriculum development, and educational scholarship/professional activities (i.e., new curricula and curricula supplements, professional development materials, and relevant statistical/evaluative studies and publications). Experience working with K-12 mathematics coursework and preservice/inservice teacher education is desirable. Preference will be given to applicants within 4 years of their Ph.D. degree whose background and experience are compatible

with the above stated objectives. The position can be structured to allow sufficient opportunities to work on mathematical research and related activities. This position will initially be a 2-year appointment, with the possibility of an additional 2-year appointment, contingent on satisfactory performance and funding. Salary will be commensurate with background and experience. Consideration of applicants will begin December 1, 2001 and will continue until the position is filled. Send cover letter of interest, a current curriculum vitae, including a complete description of related experience and research to this position, and 3 letters of recommendation, at least one of which comments on teaching ability and educational experience, to: Professor Harvey Keynes, School of Mathematics, University of Minnesota, 127 Vincent Hall, 206 Church Street S.E., Minneapolis, MN 55455. The University of Minnesota is an equal opportunity educator and employer. See our web page at http://www.math.umn.edu.

UNIVERSITY OF MINNESOTA-MINNEAPOLIS
School of Mathematics
Tenure-Track Position
with emphasis in Math Education

The School of Mathematics will have available a tenure-track position (Assistant Professor or higher) starting fall semester, 2002. Ph.D. or equivalent degree in mathematics, teaching and related education experiences at the undergraduate level and research are required. This position will emphasize: * excellence in teaching, including experience with mathematically talented high school students; * involvement with creative academic programs, curriculum development, and educational scholarship/professional activities (i.e., new curricula and curricula supplements, professional development materials, and relevant statistical/evaluative studies and publications); * developing capabilities for educational leadership, and the ability to constructively work with management and public relations aspects of educational programs and projects. Experience working with K-12 mathematics coursework and preservice/inservice teacher education is desirable. Preference will be given to applicants at any level whose background and experience are compatible with the above stated objectives. The position can be structured to allow sufficient opportunities to work on mathematics research and related activities. Salary will be commensurate with background and experience. Consideration of applicants will begin December 1, 2001 and will continue until the position is filled. Send cover letter of interest, current curriculum vitae, including a complete description of related experience and research to this position, and 4 letters of recommendation, at least one of which comments on teaching ability and educational experience, to: Professor Harvey Keynes, School of Mathematics, University of Minnesota, 127 Vincent Hall, 206 Church Street S.E., Minneapolis, MN 55455. The University of Minnesota is an equal opportunity educator and employer. See our web page at http://www.math.umn.edu.

UNIVERSITY OF MINNESOTA-MINNEAPOLIS
School of Mathematics
Dunham Jackson Assistant Professor

This is a three-year appointment from fall semester, 2002 through spring semester, 2005 with a teaching load of 3 one-semester courses per academic year. Outstanding research and teaching abilities required. Preference will be given to applicants whose research interests are compatible with those of the School. Applicants should have received a Ph.D. or equivalent degree in mathematics no earlier than Jan. 1, 2001 and no later than August 25, 2002. Summer School teaching may be available during the summer of 2003 and 2004 to supplement regular stipend. Salary competitive. Consideration of applications will begin December 1, 2001 and continue until available positions are filled. Send letter of application, current curriculum vitae, minimum 4 letters of recommendation, one of which should address teaching ability, and description of research to Naresh Jain, Head, School of Mathematics, University of Minnesota, 206 Church Street S.E., 127 Vincent Hall, Minneapolis, MN 55455. The University of Minnesota is an equal opportunity educator and employer. See http://www.math.umn.edu.

UNIVERSITY OF MINNESOTA-MINNEAPOLIS
Tenured or Tenure Track Positions

The School of Mathematics may have available several tenure track Assistant Professor or tenured Associate or Full Professor positions starting fall semester, 2002. Ph.D. or equivalent degree in mathematics by the beginning date of appointment, outstanding research and teaching abilities are required. Applications at all levels are invited; preference will be given to applicants whose research interests are compatible with those of the School. Consideration of applications will begin November 1, 2001 and will continue until available positions are filled. Send letter of application, current curriculum vitae, at least 4 letters of recommendation, one of which should address teaching ability, and description of research to: Naresh Jain, Head, School of Mathematics, University of Minnesota, 127 Vincent Hall, 206 Church Street S.E., Minneapolis, MN 55455. The University of Minnesota is an equal opportunity educator and employer.

NEVADA

UNIVERSITY OF NEVADA
Department of Mathematics

Applications are invited for a tenure-track Assistant Professorship beginning Fall 2002. Minimum qualifications: Ph.D. in a mathematical science with a specialization in the area of partial differential equations and/or numerical analysis. Candidate: must also have documented excellence in teaching and evidence of strong potential for future significant research. (At least one reference letter must provide strong evidence of good teaching.) Academic year salary is dependent on experience and qualifications. Teaching load is approximately 6 to 8 credit hours per semester. See http://jobs.unr.edu for complete position announcement and requirements, and http://www.unr.edu/math for a detailed position announcement and information about our department, including research interests of the faculty.

Send curriculum vitae, research summary, and at least three letters of recommendation to: DE/NA Search Committee; Department of mathematics/084; University of Nevada; Reno, NV 89557. Please include the Academic Employment in Mathematics APPLICATION COVER SHEET, which may be downloaded from http://www.ams.org. Review of complete applications will begin December 1, 2001. AA/EEO

NEW JERSEY

INSTITUTE FOR ADVANCED STUDY
School of Mathematics

The School of Mathematics has a limited number of memberships, some with financial support for research in mathematics at the Institute during the 2002-03 academic year. Candidates must have given evidence of ability in research comparable at least with that expected for the Ph.D. degree. The special program for the year will focus on stochastic PDE and models of turbulence, and both Weinan E and John Ball will be in residence. For a brief description of the program and information about application materials and deadline, please consult "Activities" and "How To Apply" on our homepage at: http://www.math.ias.edu/.

RUTGERS UNIVERSITY - NEWARK
Assistant Professor of Mathematics

The Department of Mathematics and Computer Science invites applications for a tenure-track assistant professor position in mathematics to begin September 2002. Candidates must have a Ph.D., a strong research record, show outstanding promise for future work, and demonstrate a commitment to effective teaching.

In addition to participating in our undergraduate and Ph.D. math programs, candidates must be prepared to teach courses and advise students in our department's undergraduate Computer Science program. Preference will be given to candidates with a willingness to take a leadership role in this area.

Applicants should arrange for (1) an AMS Standard Cover Sheet, (2) a curriculum vitae, (3) a research statement, and (4) at least four letters of recommendation, one of which addresses teaching, to be sent to:

Personnel Committee
Department of Mathematics
and Computer Science
Rutgers University
Newark, New Jersey 07102

The review process will begin January 15, 2002. Applications may be accepted until the position is filled.

Rutgers University is an Equal Opportunity/Affirmative Action Employer.

NEW MEXICO

THE UNIVERSITY OF NEW MEXICO
Albuquerque, New Mexico
Department of Mathematics and Statistics

Pending approval, the department anticipates an appointment in Applied Analysis beginning Fall of 2001 at the Assistant Professor level. Exceptionally well-qualified senior candidates may be considered. Minimal qualifications include a Ph.D. in mathematics or related area. Additional information is available at `http://www.math.unm.edu`. Applicants should send a C.V. and have three letters of recommendation sent to: Search Committee, Applied Analysis, Dept. of Math. & Stat., University of New Mexico, Albuquerque, NM 87131. We shall begin reviewing applications on November 2, 2001. EO/AA.

NEW YORK

NEW YORK UNIVERSITY
Courant Institute of Mathematical Sciences

The Courant Institute is a center for advanced training and research in the mathematical sciences. It has long been a leader in mathematical analysis, differential geometry, probability theory, applied mathematics, and scientific computation, with special emphasis on partial differential equations and their applications. Its scientific activities include an extensive array of research seminars and advanced graduate courses.

Each year a limited number of Courant Instructorships are awarded to postdoctoral scientists. These appointments carry a light teaching load of one course per semester and ordinarily are for a three-year term. These positions are primarily for recent Ph.D.'s and candidates must have a degree in mathematics or an affiliated field.

For an application and further information write to: Visiting Membership Committee, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, NY 10012-1185. Forms may also be obtained directly from the web at `http://www.cims.nyu.edu/information/brochure/visiting.html` or by sending e-mail to `vm-apply@cims.nyu.edu`. Applications and supporting documents are due by December 15th, 2001 for appointments to begin the following academic year.

The Courant Institute at New York University is an Equal Opportunity/Affirmative Action Employer.

QUEENS COLLEGE, CUNY
Gorenstein Visiting Professorship

Applications are invited for the Daniel Gorenstein Visiting Professorship at Queens College, City University of New York for the 2002–2003 Academic Year. Applicatios may be made for either one semester or two. Applicants should offer a strong research record as well as demonstrated excellence in undergraduate teaching. Applicants should have at least eight years experience beyond the Ph.D. in university or industrial positions. Appointment is to visiting associate/full professor. Applications from faculty who will be on sabbatical are welcome.

Queens College is a liberal arts institution with undergraduate and Master's level programs in mathematics and mathematics education. Advanced courses are often taught in conjunction with our Mathematics laboratory. Queens College is located in Flushing, New York and is easily accessible from Manhattan by public transportation.

Applicants should send a letter of intent indicating semester(s) of interest, a current vita, a brief description of research interests and three letters of reference to Gorenstein Chair Search Committee, Department of Mathematics, Queens College, Flushing, New York 11367. All material must be received by the Search Committee by November 13, 2001.

Queens College is an Equal Opportunity/Affirmative Action/Americans with Disabilities employer.

OHIO

THE OHIO STATE UNIVERSITY
Department of Mathematics

The Department of Mathematics of The Ohio State University expects to have available several tenure-track/tenured positions and several visiting positions, effective Autumn Quarter 2002. Candidates in all areas of pure and applied mathematics are invited to apply. Significant mathematical research accomplishment and evidence of excellent teaching ability are required.

The Department will also have available several Hans J. Zassenhaus Assistant Professorships and Arnold Ross Assistant Professorships. These term positions are renewable annually up to a total of three years. Candidates are expected to present evidence of excellence in research and teaching.

Please send a CV and have at least three letters of recommendation sent to Professor Peter March, Chair, Department of Mathematics, The Ohio State University, 231 W. 18th Avenue, Columbus, Ohio 43210.

The Ohio State University is an Equal Opportunity/Affirmative Action employer. Women and minority candidates are encouraged to apply.

RHODE ISLAND

BROWN UNIVERSITY
J. D. Tamarkin Assistant Professorship

One or two three-year non-tenured non-renewable appointments, beginning July 1, 2002. Teaching load: one to two courses per semester (3-6 hours per week). Candidates are required to have received a Ph.D. degree or equivalent by the start of this appointment, and they may have up to three years of academic and/or postdoctoral research experience by then.

VIGRE Postdoctoral Fellow: One three-year non-tenured non-renewable appointment, beginning July 1, 2002. Teaching load: one course per semester (3 hours per week). The fellowship includes summer support and a $2,500/year research fund. Candidates are required to have received a Ph.D. degree by the start of this appointment, and they may have up to 18 months of academic and/or postdoctoral research experience by then. Candidates must be U.S. citizens, nationals, or permanent residents to qualify for the VIGRE fellowships which are NSF supported positions.

Applicants should have strong research potential and a commitment to teaching. Field of research should be consonant with the current research interests of the department. For full consideration, a curriculum vitae, an AMS Standard Cover Sheet, and three letters of recommendation must be received by December 1, 2001. All inquiries and materials should be addressed to: Junior Search Committee, Department of Mathematics, Brown University, Providence, RI 02912. To access the AMS Standard Cover Sheet, visit our website: `http://www.math.brown.edu/juniorsearch.shtml`. Email inquiries can be addressed to `juniorsearch@math.brown.edu`. Brown University is an Equal Opportunity/Affirmative Action Employer and encourages applications from women and minorities.

TENNESSEE

VANDERBILT UNIVERSITY
Department of Mathematics
1326 Stevenson Center
Nashville, Tennessee 37240

Pending administrative approval, the Biomathematics Study Group at Vanderbilt University invites applications for two non-tenure-track positions, beginning Fall 2002. Each position is a two-year appointment at the level of post-doctoral fellow or assistant professor, depending on qualifications. Successful applicants will participate in collaborative research with the members of the Biomathematics Study Group as well as with scientists in life science and medicine at Vanderbilt. Topics include, but are not limited to, neuroscience, molecular biology and signal transduction, ligand-receptor binding problems, growth of malignant tissues, cellular kinetics, registration and functional imaging, computational biology and physiology, and the mathematical modeling and analysis of medical procedures and devices. The applicants must have a doctorate in mathematics or a closely related area (e.g. computer science) and a background in biology or medicine. Submit your application and supporting material in a single mailing, inclusive of an e-mail address, a fax number, an AMS standardized curriculum vitae, and a research summary. Do not send additional information (including letters of recommendation) unless requested to do so after our initial screening. Evaluation of the applications will commence on November 15, 2001 and continue until the positions are filled. Prospective applicants are invited to visit the Biomathematics Study Group's web site `http://www.math.vanderbilt.edu/~biomath/` for the research interests of the faculty.

Vanderbilt University is an affirmative action/equal opportunity employer.

TEXAS

RICE UNIVERSITY
Griffith Conrad Evans Instructorships

Postdoctoral appointments for two to three years for promising research mathematicians with research interests in common with the active research areas at Rice, particularly geometric topology, geometric analysis, differential geometry, wavelets, combinatorics, and ergodic theory. Duties will include research and classroom teaching. Applications received by December 31, 2001 will receive full consideration. Rice University is an Equal Opportunity Affirmative Action Employer and strongly encourages applications from women and minority group members. Inquiries and applications should be addressed to Chair, Evans Committee, Department of Mathematics, Rice University, PO Box 1892, Houston, Texas 77251-1892. Submitting the AMS Application Cover Sheet (available in Notices, EIMS or e-math) would be greatly appreciated.

WEST VIRGINIA

WEST VIRGINIA UNIVERSITY
Eberly College of Arts and Sciences
Department of Mathematics

Applications and nominations are invited for up to three faculty positions starting August 16, 2002, to be part of the "Institute for Math Learning". The Department of Mathematics seeks mathematicians, or mathematics educators, with excellent teaching skills and strong commitment to extending and developing effective, efficient ways of teaching mathematics students, generating new initiatives with the K-12 community, and aggressively competing for nationally-awarded grants that would support the pedagogical dimension of the Institute. We are working toward an Institute that is regarded for its national leadership in innovative, effective research-based math learning models. The Institute is part of the Department of Mathematics in the Eberly College of Arts & Sciences, with its own Director, and with operational governance that allows tenured and tenure track faculty to be rewarded and recognized for their roles in teaching excellence, and in research and scholarship associated with the goals of the Institute and pedagogy associated with math learning. All applicants should have professional credentials qualifying for a tenure-track appointment at least at the rank of Assistant Professor. A truly outstanding individual with the capacity to provide research leadership will be considered for appointment at the rank of Associate/Full Professor as an Eberly Professor, with benefits accorded to the Eberly Family Distinguished Professors in the Eberly College of Arts and Sciences.

West Virginia University is a Land Grant institution in the State of West Virginia, enrolling 22,000 students. It is a Doctoral/Research University-Extensive in the Carnegie Classification of Institutions of Higher Education, based on the complexity and breadth of the Institution's mission. The Department of Mathematics has 26 full-time faculty members and approximately 30 M.S. and Ph.D. students. The Department is housed in newly refurbished facilities that include networked offices and the University's Mathematical Library. The University is located in Morgantown, an award winning city with a metropolitan population of 80,000. Morgantown has diverse cultural and recreational opportunities, excellent medical facilities, and a favorable location with ready access to the urban areas of Pittsburgh, PA and Washington, D.C.

Applicants should provide a letter of application including: a statement of teaching philosophy and any experience and vision you have related to achieving the goals of the Institute; a vita; and the names and contact information of three references. Please send applications, references, and inquiries to

Sherman D. Riemenschneider
Chair, Department of Mathematics
320 Armstrong Hall P.O. Box 6310
West Virginia University
Morgantown, WV 26506-6310
(`sherm@math.wvu.edu`)

Priority will be given to applications received by December 1, 2001.

West Virginia University is an Equal Opportunity/Affirmative Action Employer. Minority, disabled, and women candidates are urged to apply.

WISCONSIN

UNIVERSITY OF WISCONSIN-MADISON
Mathematical Physics/String Theory
Cluster Hiring

The Departments of Mathematics and Physics anticipate openings for three positions to begin August 26, 2002, at either the tenure-track (assistant professor) or tenured (associate/full professor) level. This cluster hiring is a part of the Madison Initiative and is intended to establish a prominent research group connecting the existing groups in particle physics phenomenology in the physics department and topology/geometry in the mathematics department. Applications are especially encouraged from theorists pursuing innovative research in string theory, quantum gravity, physics with extra dimensions, quantum field theory, supersymmetry, and unification theories, as well as from mathematicians working on aspects of string theory or related topics. Successful candidates will be encouraged to participate in interdisciplinary research which will strengthen ties between the two departments. Joint appointments in the mathematics and physics departments are contemplated.

Candidates should exhibit evidence of outstanding research records, normally including achievements significantly beyond the doctoral dissertation. A strong commitment to excellence in instruction at both undergraduate and graduate levels is also expected. Applicants should send a curriculum vitae which includes a publication list, and brief descriptions of research and teaching accomplishments and goals to:

Math/Physics Cluster Hiring
Committee
Dept. of Mathematics, Van Vleck Hall
University of Wisconsin-Madison

480 Lincoln Drive
Madison, WI 53706-1388

Applicants should also arrange to have sent to the above address three letters of recommendation which address the applicant's research potential and teaching experiences. Review of applications will begin on November 1, 2001. Applications will be accepted until the positions are filled. Additional letters will be solicited by the hiring committee for senior appointments.

The Departments of Mathematics and Physics are committed to increasing the number of women and minority faculty. The University of Wisconsin is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities. Unless confidentiality is requested in writing, information regarding the applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

Additional departmental information is available on the websites http://www.math.wisc.edu/ or http://www.physics.wisc.edu/. Information about the cluster hiring initiative is available at http://wiscinfo.doit.wisc.edu/cluster/.

CANADA

UNIVERSITY OF OTTAWA
Department of Mathematics and Statistics

The University of Otttawa invites applications for two tenure-track positions starting July 1, 2002. One position will be for a recent Ph.D. at the assistant professor level. For the second position, the rank and salary will be commensurate with qualifications and experience. Applications in all areas of mathematics and statistics will be considered.

Applicants should send a curriculum vitae; a research plan; and arrange to have sent four confidential letters of recommendation, with one addressing teaching, to: Erhard Neher, Chairman, Department of Mathematics and Statistics, University of Ottawa, Ottawa, ON, Canada K1N 6N5. Applicants are also encouraged to include up to three copies of their most significant publications. The evaluation of files will start October 15, 2001, but applications will be accepted until the positions have been filled.

Conditions of employment are set by a collective agreement. Employment equity is university policy, and the university strongly encourages applications from women. Canadian citizens and permanent residents will be considered first for these positions.

Information about the department can be found at http://www.science.uottawa.ca/mathstat/.

UNIVERSITÉ DE MONTRÉAL
Department of Mathematics and Statistics
Pure mathematics

The Department of Mathematics and Statistics of the Université de Montréal invites applications for a tenure-track position in pure mathematics at the assistant professor level, starting June 2002. Applicants should have a Ph.D. in mathematics. A preference will be given to candidates in one of the following areas: differential equations, partial differential equations, spectral analysis, geometric functional analysis, arithmetic geometry, but every outstanding candidate in pure mathematics will be considered. The research record is of prime importance. The successful candidate must also possess excellent teaching skills. Courses are taught in French. Candidates who do not speak French must acquire an adequate knowledge of it within a reasonable period of time after the appointment. Duties include undergraduate and graduate teaching, supervision of graduate students, and research. The Department collaborates to the activities of the Centre de recherches mathématiques (CRM). For more information on the Department or the CRM, visit http://www.dms.umontreal.ca/ and http://www.crm.umontreal.ca/. The position is subject to budgetary approval. The Université de Montréal offers competitive salaries and a complete package of social benefits.

The interested candidates must submit a curriculum vitae including a concise statement of their research interests, at least three letters of reference, and copies of at most three of their most important research publications before November 15, 2001 (or until the position is filled), to: Chair, Départmente de mathématiques et de statistique, Université de Montréal, C.P. 6128, succursale Centre-ville, Montréal, Québec, Canada H3C 3J7, phone: (514) 343-6743, fax: (514) 343-5700, e-mail: mathstat@dms.umontreal.ca.

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. The Université de Montréal subscribes to an affirmative action program for women and to employment equity.

UNIVERSITÉ DE MONTRÉAL
Department of Mathematics and Statistics
NSERC'S University Faculty Awards Competition
POSITION IN MATHEMATICS OR STATISTICS
FOR A NSERC'S UNIVERSITY FACULTY AWARD HOLDER

The Department of Mathematics and Statistics of the Université de Montréal invites applications from talented females or Aboriginal researchers, Canadian citizens or permanent residents of Canada, in all areas of mathematics and statistics for the University Faculty Awards (UFA) program of NSERC. The holder will be appointed at the assistant professor level, starting June 2002. Exceptionally, an outstanding candidate at the associate professor level could be considered. Applicants should have a Ph.D. in mathematics or statistics. The research record is of prime importance. The successful candidate must also possess excellent teaching skills. Courses are taught in French. Candidates who do not speak French must acquire an adequate knowledge of it within a reasonable period of time after the appointment. Duties will include undergraduate and graduate teaching, supervision of graduate students, and research. The Department collaborates to the activities of the Centre de recherches mathématiques (CRM). For more information on the Department, the CRM or NSERC'S UFA program, visit http://www.dms.umontreal.ca/, http://www.crm.umontreal.ca/ and http://www.nserc.ca/programs/schol4_e.htm. The position is subject to budgetary approval. The Université Montréal offers competitive salaries and a complete package of social benefits.

The interested candidates must submit a curriculum vitae including a concise statement of their research interests, at least three letters of reference, and copies of at most three of their most important research publications before October 1, 2001 (or until the position is filled), to: Chair, Départément de mathématiques de statistique, Université de Montréal, C.P. 6128, succursale Centre-ville, Montréal, Québec, Canada H3C 3J7, phone: (514) 343-6743, fax: (514) 343-5700, e-mail: mathstat@dms.umontreal.ca.

KOREA

KAIST
Faculty position for English speakers (open level)

Applications and nominations are invited for faculty positions in mathematics as a part of institutional foreign faculty program. Number of positions is subject to availability of resources and administrative approval. Successful candidates are expected to have strong research credentials in pure mathematics and a commitment to excellence in teaching. Three-year appointment, probably renewable depending on the need of program. Salary $40,000-$100,000 and negotiable. Considerable amount of research fund is available depending on need. Benefits may include housing and schooling for children in foreign school. Preference will be given to native English speakers. No specific deadline. Applications will be considered on the basis of budget availability and approval

of administration. Interested candidates should contact the chairman with a CV and a description of their background and research interests to:

Do Young Kwak
Department of Mathematics,
Korea Advanced Institute
of Science and Tech.,
Taejon, Korea 305-701;
e-mail: dykwak@math.kaist.ac.kr

PUBLICATIONS WANTED

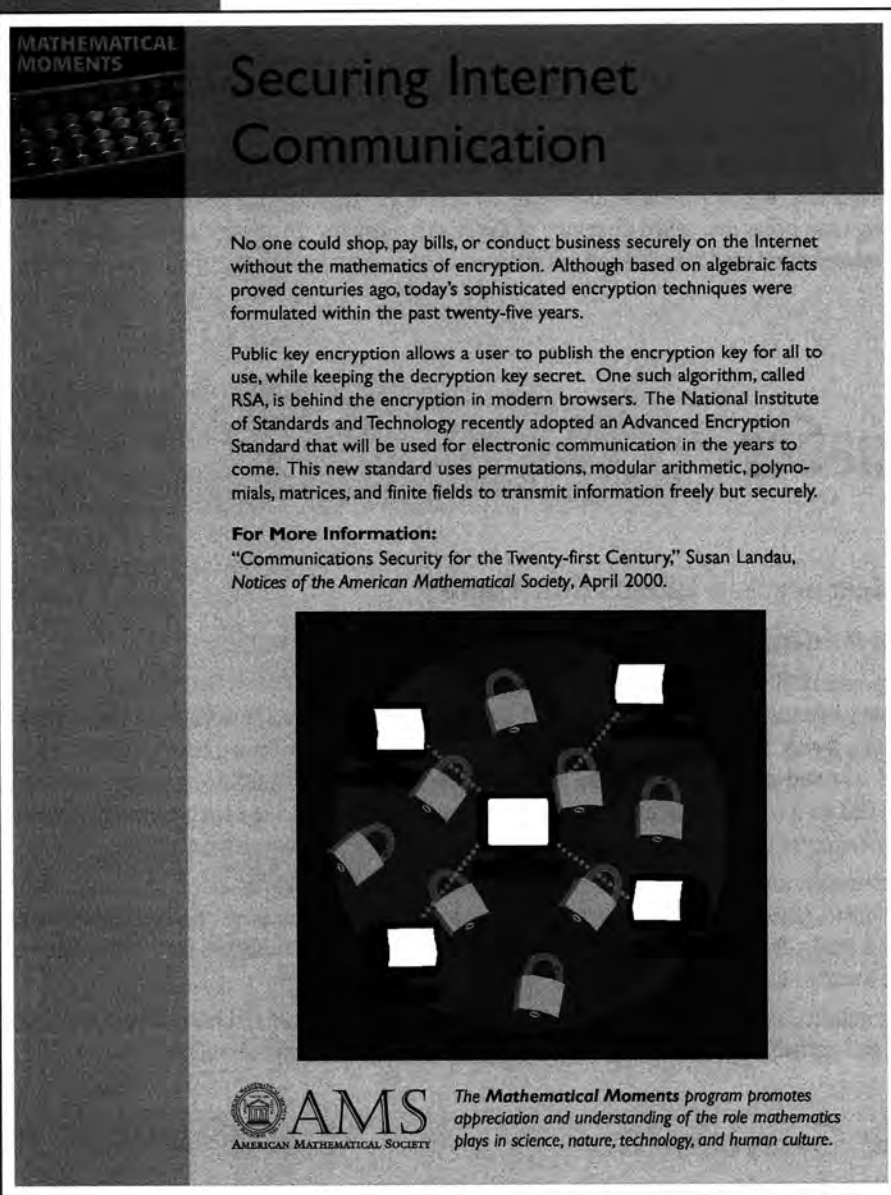
MATHEMATICS BOOKS PURCHASED

Pure & appl. adv. & research level, any age, usable cond. Reprints OK. One box to whole libraries sought. Contact: Collier Brown or Ryan Thomas @ **Powell's Technical Bks.**, Portland, OR. Call 800-225-6911, fax 503-228-0505, or e-mail ryan.thomas@powells.com.

MATHEMATICAL MOMENTS

The ***Mathematical Moments*** program is a series of illustrated "snapshots" designed to promote appreciation and understanding of the role mathematics plays in science, nature, technology, and human culture.

Download these and other ***Mathematical Moments*** pdf files at www.ams.org/mathmoments.



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DE GRUYTER SERIES IN Nonlinear Analysis and Applications

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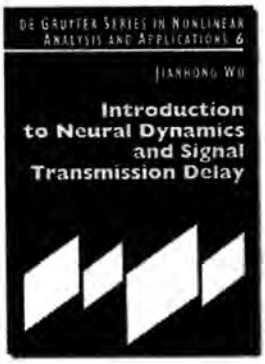
The theory of set-valued maps and of differential inclusion is developed in recent years both as a field of his own and as an approach to control theory. The book deals with the theory of semilinear differential inclusions in infinite dimensional spaces. In this setting, problems of interest to applications do not suppose neither convexity of the map or compactness of the multi-operators. These assumption implies the development of the theory of measure of noncompactness and the construction of a degree theory for condensing mapping. Of particular interest is the approach to the case when the linear part is a generator of a condensing, strongly continuous semigroup. In this context, the existence of solutions for the Cauchy and periodic problems are proved as well as the topological properties of the solution sets. Examples of applications to the control of transmission line and to hybrid systems are presented.



Jianhong Wu

Volume 6: Introduction to Neural Dynamics and Signal Transmission Delay

2001. x + 182 pages. ISBN 3-11-016988-6. Cloth. $49.95

In the design of a neural network, either for biological modeling, cognitive simulation, numerical computation or engineering applications, it is important to investigate the network's computational performance which is usually described by the long-term behaviors, called dynamics, of the model equations. The purpose of this book is to give an introduction to the mathematical modeling and analysis of networks of neurons from the viewpoint of dynamical systems.

DE GRUYTER STUDIES IN Mathematics

Heinz Bauer

Volume 26: Measure and Integration Theory

Translated from the German by Robert B. Burckel

2001. xvi + 230 pages. ISBN 3-11-016720-4. Cloth. $42.95

This book gives a straightforward introduction to the field as it is nowadays required in many branches of analysis and especially in probability theory. The first three chapters (Measure Theory, Integration Theory, Product Measures) basically follow the clear and approved exposition given in the author's earlier book on "Probability Theory and Measure Theory". Special emphasis is laid on a complete discussion of the transformation of measures and integration with respect to the product measure, convergence theorems, parameter depending integrals, as well as the Radon-Nikodym theorem.

The final chapter, essentially new and written in a clear and concise style, deals with the theory of Radon measures on Polish or locally compact spaces. With the main results being Luzin's theorem, the Riesz representation theorem, the Portmanteau theorem, and a characterization of locally compact spaces which are Polish, this chapter is a true invitation to study topological measure theory.

The text addresses graduate students, who wish to learn the fundamentals in measure and integration theory as needed in modern analysis and probability theory. It will also be an important source for anyone teaching such a course.

W DE G

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AIMS AND SCOPE

IMRN provides very fast publication of research articles of high current interest in all areas of mathematics. All articles are fully refereed and are judged by their contribution to advancing the state of the science of mathematics. Issues are published as frequently as necessary. IMRN is expected to publish 36+ issues in 2002. The articles of the IMRN are reviewed/indexed in INSPEC, Mathematical Reviews, PubSCIENCE, Science Citation Index, and Zentralblatt für Mathematik.

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IMRN is devoted to advancing the state of the science of mathematics by publishing research articles of high current interest in all fields of mathematics. Articles of any length are welcome and all articles are refereed and judged for correctness, interest, originality, depth, and applicability. There are no page charges. Submissions are made by email to submit@imrn.hindawi.com. An abstract for each article should be included. A copy may also be sent to an editor. Only an acknowledgment from the editorial office officially establishes the date of receipt. Submissions not prepared using TEX should be typed or printed on one side of the page, be double-spaced (including references), have ample margins, and be accompanied by a page that lists all potentially ambiguous notations. Check contact information for submission by fax or post. When articles are accepted, production begins immediately; authors should be available to assist the editorial staff.

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- Classification of Solutions of a Toda System in $\mathbb{R}^2$, *Jürgen Jost and Guofang Wang*
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NEMMERS PRIZES

NORTHWESTERN UNIVERSITY

THE FREDERIC ESSER NEMMERS PRIZE IN MATHEMATICS

$125,000 AWARD PRESENTED BY

NORTHWESTERN UNIVERSITY

Northwestern University invites nominations for the Frederic Esser Nemmers Prize in Mathematics, to be awarded during the 2001–02 academic year. The award includes payment to the recipient of $125,000. Made possible by a generous gift from the late Erwin Esser Nemmers and the late Frederic Esser Nemmers, the award is given every other year.

Previous recipients were Yuri I. Manin (1994), Joseph B. Keller (1996), John H. Conway (1998), and Edward Witten (2000).

Candidacy for the Nemmers Prize in Mathematics is open to individuals with careers of outstanding achievement in mathematics, as demonstrated by major contributions to new knowledge or the development of significant new modes of analysis. Individuals of all nationalities and institutional affiliations are eligible, except current or former members of the Northwestern University faculty.

The recipient of the 2002 Nemmers Prize in Mathematics will deliver a public lecture and participate in other scholarly activities at Northwestern University for 10 weeks during the 2002–03 academic year.

Nominations for the Frederic Esser Nemmers Prize in Mathematics will be accepted until December 1, 2001. Nominating letters of no more than three pages should describe the nominee's professional experience, accomplishments, and qualifications for the award. A brief *curriculum vitae* of the nominee is helpful but not required. Nominations from experts in the field are preferred to institutional nominations; direct applications will not be accepted.

Send nominations to
Secretary
Selection Committee
for the Nemmers Prizes
Office of the Provost
Northwestern University
633 Clark Street
Evanston, Illinois 60208-1119
U.S.A.

AMS APPLICATION FOR MEMBERSHIP 2002

AMERICAN MATHEMATICAL SOCIETY

JANUARY—DECEMBER

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Fields of Interest

If you wish to be on the mailing lists to receive information about publications in fields of mathematics in which you have an interest, please consult the list of major headings below. These categories will be added to your computer record so that you will be informed of new publications or special sales in the fields you have indicated.

00 General
01 History and biography
03 Mathematical logic and foundations
05 Combinatorics
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11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra; matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 *K*-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
37 Dynamical systems and ergodic theory
39 Difference and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
49 Calculus of variations and optimal control; optimization
51 Geometry
52 Convex and discrete geometry
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
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65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
74 Mechanics of deformable solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum theory
82 Statistical mechanics, structure of matter
83 Relativity and gravitational theory
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91 Game theory, economics, social and behavioral sciences
92 Biology and other natural sciences
93 Systems theory; control
94 Information and communication, circuits
97 Mathematics Education

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Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

Members can purchase a ***multi-year membership*** by prepaying their current dues rate for either two, three, four or five years. This option is not available to category-S, unemployed, or student members.

Introductory ordinary member rate applies to the first five ***consecutive*** years of ordinary membership. Eligibility begins with the first year of membership in any category other than student and nominee. Dues are $52.

For ***ordinary members*** whose annual professional income is below $75,000, the dues are $105; for those whose annual professional income is $75,000 or more, the dues are $140.

Minimum dues for ***contributing members*** are $210. The amount paid which exceeds the higher ordinary dues level and is purely voluntary may be treated as a charitable contribution.

For a ***joint family membership,*** one member pays ordinary dues, based on his or her income; the other pays ordinary dues based on his or her income, less $20. (Only the member paying full dues will receive the *Notices* and the *Bulletin* as a privilege of membership, but both members will be accorded all other privileges of membership.)

The annual dues for ***reciprocity members*** who reside outside the U.S. are $70. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement. Annual verification is required. Reciprocity members who reside in the U.S. must pay ordinary member dues ($105 or $140).

The annual dues for ***category-S members,*** those who reside in developing countries, are $16. Members can chose only one privilege journal. Please indicate your choice below.

For either ***students*** or ***unemployed individuals,*** dues are $35, and annual verification

2002 Dues Schedule (January through December)

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Joint family member (reduced rate)	☐$85		☐$120
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Student member (please verify)[1]			☐$35
Unemployed member (please verify)[2]			☐$35
Reciprocity member (please verify)[3]	☐$70	☐$105	☐$140
Category-S member [4]			☐$16
Multi-year membership	$	for	years

[1] ***Student Verification*** (sign below)
I am a full-time student at _____

_____ currently working toward a degree.

[2] ***Unemployed Verification*** (sign below) I am currently unemployed and actively seeking employment.

[3] ***Reciprocity Membership Verification*** (sign below) I am currently a member of the society indicated on the right and am therefore eligible for reciprocity membership.

_____
Signature

[4] ☐ ***send*** **NOTICES** ☐ ***send*** **BULLETIN**

Reciprocating Societies

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- ☐ Australian Mathematical Society
- ☐ Azerbaijan Mathematical Society
- ☐ Balkan Society of Geometers
- ☐ Berliner Mathematische Gessellschaft
- ☐ Calcutta Mathematical Society
- ☐ Canadian Mathematical Society
- ☐ Croatian Mathematical Society
- ☐ Cyprus Mathematical Society
- ☐ Dansk Matematisk Forening
- ☐ Deutsche Mathematiker-Vereinigung
- ☐ Edinburgh Mathematical Society
- ☐ Egyptian Mathematical Society
- ☐ European Mathematical Society
- ☐ Gesellschaft für Angewandte Mathematik und Mechanik
- ☐ Glasgow Mathematical Association
- ☐ Hellenic Mathematical Society
- ☐ Icelandic Mathematical Society
- ☐ Indian Mathematical Society
- ☐ Iranian Mathematical Society
- ☐ Irish Mathematical Society
- ☐ Israel Mathematical Union
- ☐ János Bolyai Mathematical Society
- ☐ The Korean Mathematical Society
- ☐ London Mathematical Society
- ☐ Malaysian Mathematical Society
- ☐ Mathematical Society of Japan
- ☐ Mathematical Society of Serbia
- ☐ Mathematical Society of the Philippines
- ☐ Mathematical Society of the Republic of China
- ☐ Mongolian Mathematical Society
- ☐ Nepal Mathematical Society
- ☐ New Zealand Mathematical Society
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- ☐ Norsk Matematisk Forening
- ☐ Österreichische Mathematische Gesellschaft
- ☐ Palestine Society for Mathematical Sciences
- ☐ Polskie Towarzystwo Matematyczne
- ☐ Punjab Mathematical Society
- ☐ Ramanujan Mathematical Society
- ☐ Real Sociedad Matemática Española
- ☐ Saudi Association for Mathematical Sciences
- ☐ Singapore Mathematical Society
- ☐ Sociedad Colombiana de Matemáticas
- ☐ Sociedad Española de Matemática Aplicada
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- ☐ Sociedad Matemática Mexicana
- ☐ Sociedad Uruguaya de Matemática y Estadística
- ☐ Sociedade Brasileira Matemática
- ☐ Sociedade Brasileira de Matemática Aplicada e Computacional
- ☐ Sociedade Paranaense de Matemática
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Change of Address

Members of the Society who move or change positions are urged to notify the Providence Office as soon as possible.

Journal mailing lists must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

Besides mailing addresses for members, the Society's records contain information about members' positions and their employers (for publication in the Combined Membership List). In addition, the AMS maintains records of members' honors, awards, and information on Society service.

When changing their addresses, members are urged to cooperate by supplying the requested information. The Society's records are of value only to the extent that they are current and accurate.

If your address has changed or will change within the next two or three months, please fill out this form, supply any other information appropriate for the AMS records, and mail it to:

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ICM2002 TRAVEL GRANT APPLICATION

for U.S. mathematicians attending the
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U.S. mathematicians are those affiliated with a U.S. institution or organization. Funding by NSF for this program has been requested. An award to attend the Congress in Beijing under this program may NOT be supplemented by other NSF funds. Persons traveling under NSF grants must travel by U.S. flag carriers, if available.

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Early career mathematicians only (those within 6 years of their doctorate) are urged to have senior professional mathematicians (no more than 2) write on their behalf concerning their ability, and the value of attendance at this Congress to the research and professional interests of such early career mathematicians. Submission of these letters is strongly encouraged but not required. Letters should be sent to Professional Services, AMS, 201 Charles Street, Providence, RI 02904. LETTERS ONLY (not applications) may be sent via e-mail to icm02@ams.org. Name of applicant and "ICM02" should appear on the first line of the message. Deadline for receipt of letters is October 31, 2001.

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Conferences

AMS Short Course

Symbolic Dynamics and Its Applications

San Diego, California, January 4–5, 2002

This program is under the direction of **Susan Williams**, University of South Alabama. Please refer to the website maintained by the organizer at `http://mathstat.usouthal.edu/williams/ams.html/` for the most current information.

Lecture notes will be available to those who register for this course. Advance registration fees: $80 AMS/MAA members; $110 nonmembers; ($35/student/unemployed/emeritus); on-site registration fees: $100 AMS/MAA members; $130 nonmembers; ($50/student/unemployed/emeritus). Registration and housing information can be found in this issue of the *Notices*; see the section "Registering in Advance and Hotel Accommodations" in the announcement for the meetings in San Diego.

A symbolic dynamical system is a dynamical system with a discrete state space. Such systems were first considered as a tool for analyzing general dynamical systems by discretizing space. We partition the state space into finitely many pieces, each identified with a symbol in some finite alphabet, and then associate to each point of the space the sequence of symbols corresponding to the partition elements visited by its trajectory. Ideally, we look for a partition for which the set of symbolic trajectories has a simple description and dynamical properties that mirror those of the original system. This technique was first employed by Hadamard in 1898 to study geodesic flows on surfaces of negative curvature. It has been sucessfully extended to a wide range of dynamical systems, including hyperbolic diffeomorphisms and complex dynamical systems.

The study of symbolic systems in their own right was initiated in a 1938 paper of Marston Morse and Gustav Hedlund. Subsequent developments in information theory brought an added impetus. Strings of symbols are natural objects in mathematical communication and coding theory, which remain vital areas of application of symbolic dynamics.

The *full (two-sided) shift* on an alphabet A is the sequence space $A^{\mathbb{Z}}$, given the product topology, together with the *shift map* which shifts each coordinate of the sequence to the left. Any closed, shift-invariant subset is a symbolic dynamical system. An important class are the *shifts of finite type*, which are defined by a finite set of local constraints, that is, by forbidding the occurrence of symbol strings in a certain finite list. The definition of a symbolic dynamical system may be expanded in several ways. The finite alphabet may be replaced by a countable one. The dynamics of one-sided sequences is also studied and applied to the analysis of general noninvertible dynamical systems. The past decade has seen substantial development in the theory of multidimensional symbolic systems, with applications to tilings, modeling of materials, and coding of images.

The course will begin with an introductory survey of symbolic dynamics: its history and the fundamental definitions, results, and examples. This will be followed by a series of lectures on selected applications and new directions in the field.

Combining Modulation Codes and Error-Correction Codes

Brian Marcus, IBM Almaden Research Center

Synopsis

In the abstract, a channel is a "black box" with inputs and outputs. The inputs represent messages that are transmitted through the channel. The outputs are supposed to faithfully represent the inputs. However, distortions in the channel can adversely affect the output. For this reason, coding is applied to protect the messages.

One usually thinks of a channel as a communications system in which information is sent from one point in space to another. Examples of communications systems include telephones, cellphones, digital subscriber lines, and deep space communications. But recording systems, such as magnetic/optical disk/tape drive systems, can also be viewed as channels. Current recording applications require storage devices to have very high immunity against errors. On the other hand, the ever-growing demand for storage forces the designers of such devices to write more data per unit area, thereby making the system less reliable. In magnetic recording systems this is manifested in the effects of interference between successive transitions in magnetization (called intersymbol interference), inaccurate clocking, and random noise.

A modulation encoder, also known as a constrained encoder or line encoder, transforms arbitrary user data sequences into sequences, also called codewords, that satisfy a given constraint. In the most general terms, the purpose of a modulation code is to improve the performance of the system by matching the characteristics of the recorded signals to those of the channel; the recorded signals are thereby constrained in such a way as to reduce the likelihood of error. For instance, run length constraints, which bound the runs of zeros in an encoded data stream,

help to mitigate the problems of intersymbol interference and inaccurate clocking.

In addition to modulation coding, an error-correction code (ECC) may be used to protect the data against random noise sources. A good ECC has the property that any two distinct codewords differ enough so as to be distinguishable even after being subjected to a certain amount of channel noise. While both error-correction coding and constrained coding have been active for fifty years, the former enjoys much greater notoriety.

What is the difference between an error-correction code and a modulation code? One difference is that the "goodness" of an error-correction code is measured by how the different codewords relate to one another (e.g., in how many bit locations must any two distinct codewords differ?), whereas the "goodness" of a modulation code is measured by properties of the individual codewords (e.g., how well does each codeword pass through the channel?).

On the other hand, this distinction is not hard and fast. Clearly, if an error-correction code is to have any value at all, then its codewords cannot be completely arbitrary and therefore must be constrained. Conversely, in recent years there has been a great deal of interest in constrained codes that also have error-correction properties. Such developments have contributed to a blurring of the lines between these two types of coding. Nevertheless, each subject has its own emphases and fundamental problems that are shaped by the distinction posed in the preceding paragraph.

Ideally the messages recorded on a channel should be determined by a single code that has both "pairwise" error-correction properties as well as "individual" modulation properties. In this talk we will survey some methods for combining modulation codes with error correction codes. Part of this will involve connections with symbolic dynamics: an algorithm for constructing modulation codes based on state splitting of shifts of finite type and a method of constructing combined modulation/error-correction codes based on the follower set description of sofic shifts. The talk will assume only a minimal familiarity with symbolic dynamics and coding theory. The references below provide much more than is needed.

Reading List

[1] B. MARCUS, R. ROTH, P. SIEGEL, Constrained systems and coding for recording channels, Chapter 20 of *Handbook of Coding Theory* (V. Pless, C. Huffman, and R. Brualdi, eds.), Elsevier, 1998.

[2] S. B. WICKER, *Error Control Coding in Digital Communication and Storage*, Prentice-Hall, 1995 (Chapters 1, 4, 5, and 8).

Complex Dynamics and Symbolic Dynamics

Robert L. Devaney, Boston University

Synopsis

As so often happens in mathematics, there is a surprising connection between two quite distinct subfields of dynamical systems theory, namely, the structure of the automorphism group of the one-sided shift map on d-symbols and the topology of the analogue of the Mandelbrot set for degree d polynomials of one complex variable. In this lecture we will give an elementary overview of both of these topics, highlighting the tools that relate them.

Let Σ_d denote the space of (one-sided) sequences of integers $0, 1, \dots d-1$, and let σ denote the usual shift map $\sigma(s_0 s_1 s_2 \dots) = (s_1 s_2 \dots)$. An important question in symbolic dynamics concerns the group of automorphisms of the shift, i.e., maps $\eta : \Sigma_d \to \Sigma_d$ that commute with the shift map. For one-sided shift maps, this group is well understood thanks to work of Hedlund [6], Boyle, Franks, and Kitchens [3], and Ashley [1]. The automorphism group for the 2-shift is simple: There is only one nontrivial element, namely, the automorphism that interchanges the two symbols 0 and 1. For the d-shift the group is infinitely generated with a rich algebraic structure.

Turning now to complex dynamics, consider first the dynamics of quadratic polynomials of the form $Q_c(z) = z^2 + c$. As is well known, the interesting dynamics of this map takes place on the Julia set [7], J_c. This set assumes one of two topological types: either J_c is connected or J_c is a Cantor set. In the latter case, the action of Q_c on the Julia set is equivalent to the one-sided 2-shift. The well-known Mandelbrot set $\mathcal{M}$ is a picture of this dichotomy: If c lies in $\mathcal{M}$, the Julia set is connected; outside $\mathcal{M}$, J_c is a Cantor set. If we follow a closed loop in the complement of $\mathcal{M}$, the return to the original position induces an automorphism of the shift. If this loop winds once around $\mathcal{M}$, then the induced automorphism is the nontrivial element of the group; on the other hand, if the loop does not contain $\mathcal{M}$, the trivial automorphism is induced.

The main goal of this lecture is to describe a similar phenomenon that occurs for polynomials of higher degree. Here the analogue of $\mathcal{M}$ lies in complex $d-1$, dimensional space and has a rich topology. Following loops around various portions of this space again induces an automorphism of the d-shift. We will describe how one can generate every automorphism of the shift in this manner, thus yielding a surjection from the fundamental group of this space onto the group of automorphisms [2].

For background on complex dynamics, we suggest the proceedings from several previous AMS Short Courses [4], [5]. For background on the relevant symbolic dynamics, see [8].

References

[1] J. ASHLEY, Marker automorphisms of the one-sided d-shift, *Ergodic Theory Dynam. Systems* **10** (1990), 247-262.

[2] P. BLANCHARD, R. DEVANEY, and L. KEEN, The dynamics of complex polynomials and automorphisms of the shift, *Inventiones Math.* **104** (1991), 545-580.

[3] M. BOYLE, J. FRANKS, and B. KITCHENS, Automorphisms of the one-sided shift and subshifts of finite type, *Ergodic Theory Dynam. Systems* **10** (1990), 421-449.

[4] R. DEVANEY, *Complex Dynamical Systems: The Mathematics behind the Mandelbrot and Julia Sets*, Amer. Math. Soc., 1994.

[5] R. DEVANEY and L. KEEN, *Chaos and Fractals: The Mathematics behind the Computer Graphics*, Amer. Math. Soc., 1989.

[6] G. HEDLUND, Endomorphisms and Automorphisms of the Shift Dynamical System, *Math. Systems Theory* **3** (1969), 320-375.

[7] L. KEEN, Julia sets, *Chaos and Fractals: The Mathematics behind the Computer Graphics*, Amer. Math. Soc. 1989, pp. 57-74.

[8] D. Lind and B. Marcus, *Symbolic Dynamics and Coding*, Cambridge Univ. Press, 1995.

Multi-Dimensional Symbolic Dynamics

Douglas Lind, University of Washington

Synopsis

Dynamics has traditionally studied the iterates of a single transformation, modeling the time evolution of a physical system. However, many physical and mathematical systems have other symmetries as well. This leads directly to the study of the joint action of several commuting transformations. This lecture will introduce simple examples of such actions, describe some of their properties and significant theorems, and discuss a few of the many open problems. The main message is that the study of joint actions is much more than a routine generalization of a single transformation and that genuinely new and deep phenomena occur which are only now being understood.

We will begin by describing the higher-dimensional analogue of a shift of finite type, which consists of all d-dimensional arrays of symbols from a finite alphabet subject to a finite number of local rules or conditions. Such arrays can be shifted in each of the d coordinate directions, given d commuting invertible transformations, or what amounts to the same thing, an action of the lattice $\mathbb{Z}^d$ of d-tuples of integers. Already a deep distinction arises between $d = 1$, where it is quite easy to describe the space of such arrays, and $d \geq 2$, where there is no general algorithm which will decide, given the set of local rules, whether or not the space is empty!

A good example to keep in mind is that of Wang tiles. Imagine a finite set of unit squares, with each square having its four edges colored (two different edges are allowed to have the same color). The corresponding two-dimensional shift of finite type is the set of all tilings of the plane by copies of these squares, subject to the local rule that overlapping edges must have the same color. Different collections of Wang tiles lead to quite different shifts of finite type, some of which are well understood and some still mysterious.

Although multidimensional shifts of finite type are in general still quite difficult to understand, there is one class of commuting transformations for which a systematic and powerful theory has been recently developed. These are *algebraic* actions, which are commuting automorphisms of compact abelian groups. Here is a simple but very instructive example: consider all two-dimensional arrays of 0's and 1's subject to the condition that, at each site, the sum of the digits at the site itself, the one to the right, and the one above is even. It is not hard to see that this set is a compact abelian group under coordinate-wise operations and that the horizontal and vertical shifts are commuting group automorphisms. We will see how very concrete examples like this can be thoroughly investigated using tools from harmonic analysis and commutative algebra.

Finally, we will conclude with a taste of open problems, such as Furstenburg's conjecture about measures simultaneously invariant under several commuting transformations, Lehmer's conjecture on Mahler measure and its connections with entropy, and the computation of information capacity that arises in holographic data storage.

Reading List

[1] Douglas Lind and Brian Marcus, *An Introduction to Symbolic Dynamics and Coding*, Cambridge Univ. Press, 1995.

[2] Klaus Schmidt, *Dynamical Systems of Algebraic Origin*, Birkhäuser, 1995.

Symbolic Dynamics and Tilings of $\mathbb{R}^d$

E. Arthur Robinson Jr., George Washington University

Synopsis

Let X_p be the set of all of tilings of $\mathbb{R}^d$, $d \geq 1$, by translations of a fixed finite set of basic tile shapes (called *prototiles*). We assume that tilings $x \in X_p$ satisfy the *local finiteness* condition: For any $R > 0$ there are, up to a small translation, only finitely many pictures in an R-ball sampled from any $x \in X_p$. It then follows that X_p is compact metrizable in the tiling topology: two tilings are ϵ-close if they agree after an ϵ translation in a $1/\epsilon$ ball around $\mathbf{0}$. We allow $\mathbb{R}^d$ to act on X by translation and denote this action by $T^t x$. This action is clearly continuous.

Tiling dynamics studies the pair (X_p, T) using dynamical systems theory. More generally, one studies (X, T), where X is a closed T-invariant subspace of X_p.

The interpretation of (X_p, T) or (X, T) is that they are multidimensional continuous-time symbolic dynamical systems. In particular, we think of the prototiles as the symbols, i.e., p is the alphabet. Carrying this analogy a little further and using the language of symbolic dynamics, X_p is the full p shift and X is a subshift. In some cases X is determined by a set of "local matching rules", which restrict the types of allowed tile adjacencies. This occurs, for example, in the famous *Penrose tilings*. We view such an (X, T) as a tiling "shift of finite type". In other cases when X is defined via a "tiling inflation", (X, T) generalizes the idea of a substitution dynamical system.

The tiling topology on X is reminiscent of the product topology on a one-dimensional discrete shift space $\{1, 2, \ldots, n\}^{\mathbb{Z}}$. There are, however, interesting new complications that arise for tiling systems. First, the acting group is continuous (i.e., $\mathbb{R}^d$ instead of $\mathbb{Z}^d$ or $\mathbb{Z}$), making geometry play a significant role in the theory. For example, allowing rotations as well as translations to act on X leads to applications to the study of the symmetries of quasicrystals.

The second complication is that the acting group is multi-dimensional. Because of this, the theory acquires all the complexity of $\mathbb{Z}^d$ symbolic dynamics, including the phenomenon of undecidability: For p in general, it is undecidable whether $X_p \neq \varnothing$.

In this lecture we will discuss the foundations of tiling dynamical systems and survey some of the main results. We will discuss various dynamical concepts and properties and describe their counterparts in the theory of tilings. We will also briefly discuss quasicrystals.

Reading List

[1] Branko Grünbaum and G. C. Shephard, *Tilings and Patterns*, W. H. Freeman, New York, 1987.

[2] CHARLES RADIN, *Miles of Tiles*, Amer. Math. Soc., Providence, RI, 1999.
[3] E. ARTHUR ROBINSON JR., The dynamical properties of Penrose tilings, *Trans. Amer. Math. Soc.* **348** (1996), 4447–4464.
[4] ____, The dynamical theory of tilings and quasicrystallography, *Ergodic Theory of $\mathbb{Z}^d$ Actions* (Warwick, 1993–1994), Cambridge Univ. Press, Cambridge, 1996, pp. 451–473.
[5] MARJORIE SENECHAL, *Quasicrystals and Geometry*, Cambridge University Press, Cambridge, 1995.
[6] BORIS SOLOMYAK, Dynamics of self-similar tilings, *Ergodic Theory Dynam. Systems* **17** (1997), 695–738.

Strong Shift Equivalence and Positive Algebraic K-Theory

J. B. Wagoner, University of California at Berkeley

Synopsis

Strong shift equivalence theory emerged from work on the long-standing Shift Equivalence Conjecture in symbolic dynamics. But it turns out to be closely related to areas of mathematics outside dynamics, such as algebraic K-theory, cyclic homology, and topological quantum field theory. We will survey some of these developments.

One way of describing subshifts of finite type is by zero-one transition matrices A arising from Markov partitions for discrete time dynamical systems. Another comes from variable length coding and represents a subshift of finite type by a matrix of the form $I - P$ where P has entries that are polynomials in a variable t with nonnegative integral coefficients. Passing from the first approach to the second is achieved by setting $P = tA$. A subshift of finite type generally has infinitely many Markov partitions and therefore infinitely many presentations in either of the two frameworks. The classification program seeks to determine when two apparently different subshifts of finite type actually have the same dynamical behavior. R. F. Williams formulated an algebraic approach to this problem in [7] by introducing strong shift equivalence and shift equivalence over the nonnegative integers, the latter being much more accessible algebraically. These concepts can be expressed in an elementary fashion by graphs and matrices.

The Shift Equivalence Conjecture/Problem dates from 1974 and asks whether shift equivalence implies strong shift equivalence. Kim and Roush [2] produced the first counterexamples in 1997 for primitive matrices using the Boyle-Krieger sign-gyration-compatibility condition. Subsequently, in [5] another way of detecting primitive counterexamples was found using the algebraic K-theory group K_2. The method comes from an analogy with one-parameter Morse theory, and it uses the polynomial matrix viewpoint. It is part of what might be called positive algebraic K-theory, because multiplication by an elementary matrix transforming $I - P$ to $I - Q$ generates a topological conjugacy in the presence of certain natural positivity conditions.

Polynomial matrix techniques have other applications in symbolic dynamics, such as finding new inert automorphisms of infinite order [4] which are conjecturally detected by the cyclic cohomology Chern character on K_3, characterization of nonzero spectra of nonnegative integral matrices [3], and efficient representation of subshifts of finite type [1]. See the expository account [6] for an overview and references to background literature.

References

[1] M. BOYLE and D. LIND, *Small polynomial matrix representations of nonnegative matrices*, in preparation.
[2] K. H. KIM and F. W. ROUSH, The Williams conjecture is false for irreducible subshifts, *Ann. of Math.* **149** (1999), 545–558.
[3] K. H. KIM, N. ORMES, and F. W. ROUSH, The spectra of nonnegative integer matrices via formal power series, *J. Amer. Math. Soc.* **13** (2000), 773–806.
[4] K. H. KIM, F. W. ROUSH, and J. B. WAGONER, Characterization of inert actions on periodic points, Part I and Part II, *Forum Math.* **12** (2000), 565–602 and 671–712.
[5] J. B. WAGONER, Strong shift equivalence and K_2 of the dual numbers, *J. Reine Angew. Math.* **521** (2000), 110–160.
[6] ____, Strong shift equivalence and the shift equivalence problem, *Bull. Amer. Math. Soc. (N.S.)* **36** (1999), 271–296.
[7] R. F. WILLIAMS, Classification of subshifts of finite type, *Ann. of Math.* (2) 98 (1973), 120–153; Errata ibid. **99** (1974), 380–381.

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Meetings & Conferences of the AMS

IMPORTANT INFORMATION REGARDING MEETINGS PROGRAMS: AMS Sectional Meeting programs do not appear in the print version of the *Notices*. However, comprehensive and continually updated meeting and program information with links to the abstract for each talk can be found on the AMS website. See `http://www.ams.org/meetings/`. Programs and abstracts will continue to be displayed on the AMS website in the Meetings and Conferences section until about three weeks after the meeting is over. Final programs for Sectional Meetings will be archived on the AMS website in an electronic issue of the *Notices* as noted below for each meeting.

Columbus, Ohio

Ohio State University

September 21–23, 2001

Meeting #969

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: June 2001
Program first available on AMS website: August 9, 2001
Program issue of electronic *Notices*: October 2001
Issue of *Abstracts*: Volume 22, Issue 3

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses

Alex Eskin, University of Chicago, *Billiards in rational polygons.*

Dennis Gaitsgory, Harvard University, *On the geometric Langlands conjecture.*

Yakov B. Pesin, Pennsylvania State University, *"Fubini's nightmare" in smooth ergodic theory. .*

Thaleia Zariphopoulou, University of Texas at Austin, *Pricing and risk management in incomplete markets.*

Special Sessions

L^2 Methods in Algebraic and Geometric Topology, **Dan Burghelea** and **Michael Davis**, Ohio State University.

Algebraic Cycles, Algebraic Geometry, **Roy Joshua**, Ohio State University.

Coding Theory and Designs, **Tom Dowling**, Ohio State University, and **Dijen Ray-Chaudhuri**.

Commutative Algebra, **Evan Houston**, University of North Carolina, Charlotte, and **Alan Loper**, Ohio State University.

Cryptography and Computational and Algorithmic Number Theory, **Eric Bach**, University of Wisconsin-Madison, and **Jonathan Sorenson**, Butler University.

Differential Geometry and Applications, **Andrzej Derdzinski** and **Fangyang Zheng**, Ohio State University.

Fractals, **Gerald Edgar**, Ohio State University.

Group Theory, **Koichiro Harada**, **Surinder Sehgal**, and **Ronald Solomon**, Ohio State University.

Multivariate Generating Functions and Automatic Computation, **Robin Pemantle**, Ohio State University.

Proof Theory and the Foundations of Mathematics, **Timothy Carlson**, Ohio State University.

Quantum Topology, **Thomas Kerler**, Ohio State University.

Rings and Modules, **S. K. Jain**, Ohio University, and **Tariq Rizvi**, Ohio State University.

Spectral Theory of Schrödinger Operators, **Boris Mityagin**, Ohio State University, and **Sergei Novikov**, University of Maryland.

Stochastic Modeling in Financial Mathematics, **Ronnie Sircar**, Princeton University.

Chattanooga, Tennessee

University of Tennessee, Chattanooga

October 5-6, 2001

Meeting #970

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: August 2001
Program first available on AMS website: August 23, 2001
Program issue of electronic *Notices*: November 2001
Issue of *Abstracts*: Volume 22, Issue 3

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses

Susanne C. Brenner, University of South Carolina, Columbia, *Additive multigrid theory.*

Edward B. Saff, University of South Florida, *Logarithmic potentials with external fields.*

Joel H. Spencer, New York University, *Erdős magic.*

Roberto Triggiani, University of Virginia, *Differential geometric methods in the control of partial differential equations.*

Special Sessions

Applications of Partial Differential Equations in Geometric Analysis (Code: AMS SS N1), **Bo Guan** and **Changyou Wang**, University of Tennessee, Knoxville.

Asymptotic Behavior of Solutions of Differential and Difference Equations (Code: AMS SS B1), **John R. Graef**, University of Tennessee, Chattanooga, and **Chuanxi Qian**, Mississippi State University.

Commutative Ring Theory (Code: AMS SS A1), **David F. Anderson** and **David E. Dobbs**, University of Tennessee, Knoxville.

Differential Geometric Methods in the Control of Partial Differential Equations (Code: AMS SS L1), **Walter Littman**, University of Minnesota, and **Roberto Triggiani**, University of Virginia.

Mathematical and Numerical Aspects of Wave Propagation (Code: AMS SS F1), **Boris P. Belinskiy** and **Yongzhi Xu**, University of Tennessee, Chattanooga.

New Directions in Combinatorics and Graph Theory (Code: AMS SS C1), **Teresa Haynes** and **Debra J. Knisley**, East Tennessee State University.

Numerical Analysis and Approximation Theory (Code: AMS SS G1), **Tian-Xiao He**, Illinois Wesleyan University, and **Don Hong**, Eastern Tennessee State University.

Numerical Methods for PDEs (Code: AMS SS J1), **Susanne C. Brenner**, University of South Carolina, and **Craig C. Douglas**, University of Kentucky.

Real Analysis (Code: AMS SS D1), **Paul D. Humke**, Saint Olaf College, **Harry I. Miller**, University of Tennessee, Chattanooga, and **Clifford E. Weil**, Michigan State University.

Recent Advances in Optimization Methods (Code: AMS SS H1), **Jerald P. Dauer** and **Aniekan Ebiefung**, University of Tennessee, Chattanooga.

Sphere-Related Approximation and Applications (Code: AMS SS M1), **Edward B. Saff**, University of South Florida, and **Larry L. Schumaker**, Vanderbilt University.

Topics in Geometric Function Theory (Code: AMS SS E1), **Lelia Miller-Van Wieren**, Penn State Berks Campus, and **Bruce P. Palka**, University of Texas at Austin.

Variational Problems for Free Surface Interfaces (Code: AMS SS K1), **John E. McCuan**, Georgia Institute of Technology, **Thomas I. Vogel**, Texas A&M University, and **Henry C. Wente**, University of Toledo.

Williamstown, Massachusetts

Williams College

October 13-14, 2001

Meeting #971

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: August 2001
Program first available on AMS website: August 30, 2001
Program issue of electronic *Notices*: November 2001
Issue of *Abstracts*: Volume 22, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses

Hubert Bray, Massachusetts Institute of Technology, *Title to be announced.*

Robin Forman, Rice University, *Title to be announced.*

Emma Previato, Boston University, *Theta functions, old and new.*

Yisong Yang, Polytechnic University, *Harmonic maps, gauge fields, and magnetic vortices.*

Special Sessions

Abelian Varieties (Code: AMS SS K1), **Alexander Polishchuk** and **Emma Previato**, Boston University.

Algebraic and Topological Combinatorics (AMS SS D1), **Eva Maria Feichtner**, ETH, Zürich, Switzerland, and **Dmitry N. Kozlov**, KTH, Stockholm, Sweden.

Commutative Algebra (Code: AMS SS C1), **Susan R. Loepp**, Williams College, and **Graham J. Leuschke**, University of Kansas.

Diophantine Problems (Code: AMS SS F1), **Edward B. Burger**, Williams College, and **Jeffrey D. Vaaler**, University of Texas at Austin.

Ergodic Theory (Code: AMS SS H1), **Cesar Silva**, Williams College.

Geometry and Topology of the Universe (Code: AMS SS E1), **Colin C. Adams**, Williams College, **Glenn Starkmann**, Case Western Reserve University, and **Jeffrey R. Weeks**, Canton, New York.

Harmonic Analysis Since the Williamstown Conference of 1978 (Code: AMS SS G1), **Janine E. Wittwer**, Williams College, and **David Cruz-Uribe**, Trinity College.

History of Mathematics (Code: AMS SS A1), **Glen R. Van Brummelen**, Bennington College, **Della D. Fenster**, Richmond University, **James J. Tattersall**, Providence College, and **Shawnee L. McMurran**, California State University, San Bernadino.

Integrable Systems and Quantum Groups (Code: AMS SS L1), **Pavel I. Etingof**, Massachusetts Institute of Technology, and **Emma Previato**, Boston University.

Nonlinear PDEs and Calculus of Variations (Code: AMS SS J1), **Yisong Yang**, Polytechnic University, and **Fanghua Lin** and **Nader Masmoudi**, Courant Institute, New York University.

Number Theory, Holomorphic Dynamics, and Algebraic Dynamics (Code: AMS SS B1), **Robert L. Benedetto**, University of Rochester, **John W. Milnor**, IMS and SUNY at Stony Brook, and **Kevin M. Pilgrim**, University of Missouri at Rolla.

Irvine, California

University of California Irvine

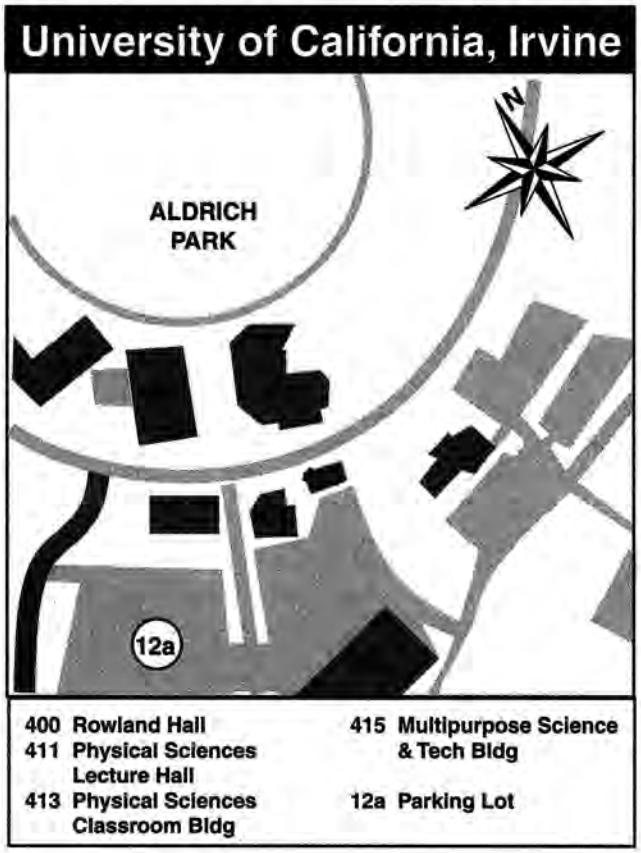
November 10–11, 2001

Meeting #972

Western Section
Associate secretary: Bernard Russo
Announcement issue of *Notices*: September 2001
Program first available on AMS website: September 27, 2001
Program issue of electronic *Notices*: December 2001
Issue of *Abstracts*: Volume 22, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: September 18, 2001



Invited Addresses

William Duke, University of California Los Angeles, *Title to be announced.*

Grigory Mikhalkin, University of Utah, *Title to be announced.*

Gigliola Staffilani, Stanford University, *Title to be announced.*

Jonathan Weitsman, University of California Santa Cruz, *Title to be announced.*

Special Sessions

Dynamical Systems of Billiard Type (Code: AMS SS L1), **Marek Rychlik**, University of Arizona.

Extremal Metrics and Moduli Spaces (Code: AMS SS F1), **Steven Bradlow**, University of Illinois, Urbana-Champaign, **Claude LeBrun**, State University of New York, Stony Brook, and **Yat Sun Poon**, University of California Riverside.

Groups and Covering Spaces in Algebraic Geometry (Code: AMS SS D1), **Michael Fried**, University of California Irvine, and **Helmut Voelklein**, University of Florida.

Harmonic Analyses and Partial Differential Equations (Code: AMS SS H1), **Gustavo Ponce**, University of California Santa Barbara, and **Gigliola Staffilani**, Stanford University.

Harmonic Analysis and Complex Analysis (Code: AMS SS G1), **Xiaojun Huang**, Rutgers University, and **Song-Ying Li**, University of California Irvine.

Operator Spaces, Operator Algebras, and Applications (Code: AMS SS J1), **Marius Junge**, University of Illinois, Urbana-Champaign, and **Timur Oikhberg**, University of Texas and University of California Irvine.

Partial Differential Equations and Applications (Code: AMS SS C1), **Edriss S. Titi**, University of California Irvine.

Quantum Topology (Code: AMS SS A1), **Louis Kauffman**, University of Illinois at Chicago, **Jozef Przytyzki**, George Washington University, and **Fernando Souza**, University of Waterloo.

Random and Deterministic Schrödinger Operators (Code: AMS SS E1), **Svetlana Jitomirskaya** and **Abel Klein**, University of California Irvine.

Symplectic Geometry (Code: AMS SS M1), **Jonathan Weitsman**, University of California San Diego.

Topology of Algebraic Varieties (Code: AMS SS B1), **Eriko Hironaka**, Florida State University, and **Grigory Mikhalkin**, University of Utah.

San Diego, California

San Diego Convention Center

January 6–9, 2002

Meeting #973

Joint Mathematics Meetings, including the 108th Annual Meeting of the AMS, 85th Meeting of the Mathematical Association of America (MAA), with minisymposia and other special events contributed by the Society for Industrial and Applied Mathematics (SIAM), the annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).
Associate secretary: John L. Bryant
Announcement issue of *Notices*: October 2001
Program first available on AMS website: November 1, 2001
Program issue of electronic *Notices*: January 2002
Issue of *Abstracts*: Volume 23, Issue 1

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: October 2, 2001
For summaries of papers to MAA organizers: September 14, 2001

Joint MAA-AMS Invited Addresses

Dennis DeTurck, University of Pennsylvania, *Helicity of vector fields in geometry, biology, and plasma physics*, Sunday, 11:10 a.m.

Hendrik W. Lenstra Jr., University of California Berkeley, *Harmonic numbers and the ABC-conjecture*; Tuesday, 11:10 a.m.

AMS Committee on Science Policy-MAA Science Policy Committee Government Speaker, Tuesday, 4:20 p.m. Speaker to be announced.

Joint Special Sessions

History of Mathematics (Code: AMS SS A1), **Thomas Archibald**, Acadia University, and **David E. Zitarelli**, Temple University (AMS-MAA); Tuesday and Wednesday mornings and afternoons.

Mathematics and Education Reform (Code: AMS SS Q1), **William H. Barker**, Bowdoin College, **Jerry L. Bona**, University of Texas at Austin, **Naomi D. Fisher**, University of Illinois at Chicago, and **Kenneth C. Millett**, University of California Santa Barbara (AMS-MAA); Sunday and Monday mornings and afternoons.

Set Theory and Classification Problems (Code: AMS SS DD1), **Simon R. Thomas**, Rutgers University (AMS-ASL); Sunday morning and Sunday and Monday afternoons.

Other Joint Sessions

Research on TAs: Background, Beliefs, Attitude, and Practice, Monday, 1:00 p.m.–2:30 p.m., organized by **Bruce Reznick**, University of Illinois at Urbana-Champaign. Over the past decade, many models for TA preparation and development have been described and discussed. Programs based on these models have had a positive impact on the experience of graduate teaching assistants and on their students. More recently, researchers in mathematics education have been studying the way that TA attitudes towards mathematics and its teaching affect their instruction. Researchers have gained a deeper understanding of how new TAs view teaching and learning, and what is needed to help new TAs become effective teachers. This research has the potential to suggest modifications and adaptations of existing models as well as the design of the next generation of programs. The panelists will present relevant research findings and lead a discussion about what the results may mean for TA preparation and development programs. The session is sponsored by the AMS-MAA Committee on Teaching Assistants and Part-Time Instructors (TA/PTI).

Prize Session and Reception: In order to showcase the achievements of the recipients of various prizes, the AMS and MAA are cosponsoring this event at 4:25 p.m. on Monday. A cash bar reception will immediately follow. All participants are invited to attend. The AMS, MAA, and SIAM will award the Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student.

The AMS will announce the winners of the Bôcher Memorial Prize, Frank Nelson Cole Prize in Number Theory, Levi L. Conant Prize, the Award for Distinguished Public Service, and the Leroy P. Steele Prizes. The AWM will present the Louise Hay Award for Contributions to Mathematics Education and the Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman. This

session also will be the venue for the announcement of the Joint Policy Board for Mathematics Communication Award.

108th Annual Meeting of the AMS

AMS Invited Addresses

Michael V. Berry, Bristol University, *Title to be announced* (AMS Josiah Willard Gibbs Lecture), Sunday, 8:30 p.m.

Felix E. Browder, Rutgers University, *Reflections on the future of mathematics* (AMS Retiring Presidential Address), Sunday, 10:05 a.m.

L. Craig Evans, University of California Berkeley, *Titles to be announced* (AMS Colloquium Lectures), Sunday, Monday, and Tuesday, 1:00 p.m.

John M. Franks, Northwestern University, *The role of rotation numbers in dynamical systems*, Tuesday, 9:00 a.m.

Jeffrey C. Lagarias, AT&T Laboratories Research, *Computational problems in topology: The complexity of unknotting*, Monday, 3:20 p.m.

Fanghua Lin, Courant Institute, New York University, *Analytical and topological issues concerning Sobolev mappings*, Wednesday, 2:15 p.m.

John Preskill, California Institute of Technology, *Putting weirdness to work: Quantum information and quantum computation*, Monday, 2:15 p.m.

Richard L. Taylor, Harvard University, *Meromorphic continuation of L-functions*, Tuesday, 10:05 a.m.

AMS Special Sessions

Algebraic Coding Theory (Code: AMS SS D1), **Marcus Grefrath**, **Michael E. O'Sullivan**, and **Roxana N. Smarandache**, San Diego State University; Monday morning and Monday and Tuesday afternoons.

Algebraic Combinatorics (Code: AMS SS E1), **Rosa C. Orellana**, Dartmouth College, and **Michael Zabrocki**, York University; Wednesday morning and afternoon.

Algebras, Forms, and Algebraic Groups (Code: AMS SS F1), **R. Skip Garibaldi**, University of California Los Angeles, **David J. Saltman**, University of Texas at Austin, and **Adrian R. Wadsworth**, University of California San Diego; Monday and Tuesday mornings and Monday afternoon.

Analysis and Application of Quasilinear Partial Differential Equations (Code: AMS SS G1), **Sunčica Čanić** and **Eun Heui Kim**, University of Houston; Sunday morning and Sunday and Monday afternoons.

Chaos, Stability, and Asymptotics in Difference Equations (Code: AMS SS H1), **Saber N. Elaydi**, Trinity University, **Gerasimos Ladas**, University of Rhode Island, and **Donald A. Lutz**, San Diego State University; Tuesday and Wednesday mornings and Wednesday afternoon.

Commutative Algebra and Algebraic Geometry (Code: AMS SS BB1), **Paul C. Roberts** and **Anurag K. Singh**, University of Utah; Sunday and Monday mornings and afternoons.

Computability Theory with Applications (Code: AMS SS J1), **Douglas Cenzer**, University of Florida, and **Jeffrey B. Remmel**, University of California San Diego; Sunday and Monday mornings and Sunday afternoon.

Computational Commutative Algebra and Algebraic Geometry (Code: AMS SS CC1), **Elizabeth Arnold**, Texas A&M University, and **Amelia Taylor**, Rutgers University; Tuesday and Wednesday afternoons and Wednesday morning.

Computational Topology (Code: AMS SS EE2), **Jeffrey C. Lagarias**, AT&T Research Laboratories, and **William H. Jaco**, Oklahoma State University; Tuesday morning and afternoon.

Dynamic Equations on Time Scales (Code: AMS SS B1), **Martin J. Bohner**, University of Missouri, Rolla, and **Billur Kaymakcalan**, Georgia Southern University; Monday and Tuesday afternoons and Tuesday morning.

Fractal Geometry and Applications: A Jubilee of Benoit Mandelbrot (Code: AMS SS L1), **Michel L. Lapidus**, University of California Riverside, and **Machiel van Frankenhuysen**, Rutgers University; Sunday and Monday mornings and afternoons.

Graph Theory (Code: AMS SS M1), **Andre Kundgen** and **K. Brooks Reid**, California State University, San Marcos; Sunday and Monday mornings and Sunday afternoon.

Hybrid Systems (Code: AMS SS N1), **Elena Litsyn**, Ben-Gurion University, and **A. S. Vatsala**, University of Louisiana at Lafayette; Tuesday and Wednesday afternoons and Wednesday morning.

Low Dimensional Topology (Code: AMS SS Z1), **Tim D. Cochran**, Rice University; Sunday and Monday mornings and afternoons.

Nonlinear Elliptic Partial Differential Equations (Code: AMS SS R1), **Maya Chhetri**, University of North Carolina at Greensboro, and **Jon T. Jacobsen**, Pennsylvania State University; Sunday and Monday mornings and Sunday afternoon.

Partial Differential Equations and Their Applications (Code: AMS SS S1), **Reza Malek-Madani** and **Peter A. McCoy**, United States Naval Academy, and **John W. Neuberger**, University of North Texas; Tuesday and Wednesday morning and Tuesday afternoon.

Probabilistic Methods in Combinatorics and the Internet (Code: AMS SS C1), **Fan Chung Graham** and **Van Vu**, University of California San Diego; Tuesday and Wednesday mornings and Wednesday afternoon.

Quantum Computation and Information (Code: AMS SS T1), **Philip L. Bowers** and **Washington Mio**, Florida State University, and **John Preskill**, California Institute of Technology; Sunday and Monday mornings and Sunday afternoon.

Recent Developments in Analysis and Numerics of Fluid Problems (in memory of Jacques-Louis Lions) (Code: AMS SS K1), **Jie Shen**, Pennsylvania State University and University of Central Florida, **Shouhong Wang**, Indiana University, and **Xiaoming Wang**, Iowa State University; Tuesday and Wednesday mornings and Wednesday afternoon.

Research in Mathematics by Undergraduates (Code: AMS SS U1), **Carl V. Lutzer** and **Darren A. Narayan**, Rochester Institute of Technology; Wednesday morning and afternoon.

Stochastic Processes and Functional Analysis (in honor of M. M. Rao) (Code: AMS SS V1), **Alan C. Krinik** and **Randall J. Swift**, California State Polytechnic University Pomona; Tuesday and Wednesday afternoons and Wednesday morning.

Symbolic Dynamics (Code: AMS SS AA1), **Aimee S. A. Johnson**, Swarthmore College, and **Kathleen M. Madden**, Drew University; Sunday and Monday mornings and afternoons.

The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics (Code: AMS SS P1), **Jonathan D. Farley**, University of Oxford and Vanderbilt University; Monday and Tuesday afternoons and Tuesday morning.

The Theory and Applications of Symmetric Functions (Code: AMS SS W1), **Adriano Garsia** and **Jeffrey B. Remmel**, University of California San Diego; Sunday and Monday mornings and Sunday afternoon.

Topology and Its Applications (Code: AMS SS X1), **Alexander Arhangelskii**, Ohio University, **Melvin Henriksen**, Harvey Mudd College, **James E. Keesling**, University of Florida, **Ralph D. Kopperman**, City College of CUNY, and **John C. Mayer**, University of Alabama at Birmingham; Tuesday morning and Tuesday and Wednesday afternoons.

Wavelets for Undergraduates (Code: AMS SS Y1), **Edward F. Aboufadel** and **Steven J. Schlicker**, Grand Valley State University; Monday afternoon.

AMS Contributed Papers

There will be sessions for contributed papers of ten minutes' duration. Contributed papers will be grouped by related Mathematics Subject Classification into sessions insofar as possible. The author(s) and their affiliation(s) and the title of each paper accepted will be listed in the program along with the date and time of presentation. Abstracts will be published in *Abstracts Presented to the American Mathematical Society* and should be submitted electronically. Send a blank message to `abs-submit@ams.org` and type `help` as the subject to see your electronic options. See the beginning of this announcement for pertinent deadlines.

Other AMS Sessions

How the World Sees Mathematicians, Sunday, 4:30 p.m.–6:00 p.m., organized by **Allyn Jackson**, AMS. In recent years there has been a surge of popular interest in mathematics and mathematicians, spurred by such works as Sylvia Nasar's acclaimed biography of John Nash, *A Beautiful Mind*; David Auburn's Pulitzer Prize- and Tony Award-winning play *Proof*; and Simon Singh's book and BBC program about Andrew Wiles's proof of Fermat's Last Theorem.

But consider also the recent study finding that British and American schoolchildren believe "mathematicians are fat, scruffy and have no friends" (*London Times*, January 3, 2001). Perceptions of mathematicians may be changing, but stereotypes die hard.

How does the public perceive mathematicians? Are those perceptions changing as a result of the increased popular interest in mathematics? What more can be done to give the public a more realistic view of mathematics and mathematicians?

A major motion picture based on *A Beautiful Mind* is scheduled to be released three weeks before the Joint Mathematics Meetings, providing an excellent occasion for a panel discussion on this topic.

Panelists include: **Dave Bayer** of Columbia University, who served as the mathematics consultant for the movie *A Beautiful Mind*; **K. C. Cole**, a science reporter for the *Los Angeles Times* and author, most recently, of *The Hole in the Universe: How Scientists Peered over the Edge of Emptiness and Found Everything*; and **Keith J. Devlin** of Stanford University, prolific mathematics popularizer and regular NPR commentator. This panel discussion is sponsored by the AMS Committee on the Profession.

Committee on Science Policy Panel Discussion, Tuesday, 2:30 p.m.–4:00 p.m.

Committee on Education Panel Discussion, Wednesday, 8:30 a.m.–10:00 a.m.

Other AMS Events

Council Meeting, Saturday, 1:00 p.m.–10:00 p.m.

Business Meeting, Wednesday, 11:45 a.m.–12:15 p.m. The secretary notes the following resolution of the Council: Each person who attends a business meeting of the Society shall be willing and able to identify himself as a member of the Society. In further explanation, it is noted that each person who is to vote at a meeting is thereby identifying himself as and claiming to be a member of the American Mathematical Society. The Society has a Committee on the Agenda for Business Meetings. The purpose is to make business meetings orderly and effective. The committee does not have legal or administrative power. It is intended that the committee consider what may be called "quasipolitical" motions. The committee has several possible courses of action on a proposed motion, including but not restricted to:

(a) doing nothing,

(b) conferring with supporters and opponents to arrive at a mutually accepted amended version to be circulated in advance of the meeting,

(c) recommending and planning a format for debate to suggest to a business meeting,

(d) recommending referral to a committee, and

(e) recommending debate followed by referral to a committee.

There is no mechanism that requires automatic submission of a motion to the committee. However, if a motion has not been submitted through the committee, it may be thought reasonable by a business meeting to refer it rather than to act on it without benefit of the advice of the committee.

In order that a motion for this business meeting receives the service offered by the committee in the most effective manner, it should be in the hands of the secretary by December 13, 2001.

AMS Short Course

This two-day course on *Symbolic Dynamics* organized by **Susan Williams**, University of South Alabama, takes place on Friday and Saturday, January 4 and 5. Please see the complete article beginning on page 1086.

85th Annual Meeting of the MAA

MAA Invited Addresses

Thomas F. Banchoff, Brown University, *The down side of the trapezoid: An immediate past president surveys the Internet*, Wednesday, 10:05 a.m. (MAA Retiring Presidential Address).

Manuel P. Berriozábal, University of Texas at San Antonio, *Reforms in mathematics education: Best practices and malpractices*, Wednesday, 9:00 a.m.

Persi W. Diaconis, Stanford University, *From shuffling cards to the roots of randomness*, Tuesday, 2:15 p.m.

Andrew J. Granville, University of Georgia, *Probability, combinatorics and physics in analytic number theory*, Monday, 10:05 a.m.

Susan Landau, Sun Microsystems, *Old math, new math: Using polynomials to gain insight into the design of cryptosystems*, Sunday, 2:15 p.m.

M. Elisabeth Pate-Cornell, Stanford University, *Finding and fixing systems' weaknesses: The art and science of engineering risk analysis*, Tuesday, 7:30 p.m. (Student Lecture).

David J. Pengelley, New Mexico State University, *Sophie Germain's grand plan for proving Fermat's Last Theorem*, Sunday, 3:20 p.m.

MAA Minicourses

Minicourses are open only to persons who register for the Joint Meetings and pay the Joint Meetings registration fee in addition to the appropriate minicourse fee. If the only reason for registering for the Joint Meetings is to gain admission to a minicourse, please make a notation on your registration form. If the minicourse is fully subscribed or cancelled, a full refund of the Joint Meetings advance registration fee (otherwise subject to the 50% rule) will be made. The MAA reserves the right to cancel any minicourse that is undersubscribed. Minicourses #1 and #2 are scheduled before the Joint Mathematics Meetings actually begin, so those interested **must register in advance**; there will be no on-site registration for #1 and #2.

Minicourse #1: *Using interactive labs to explore abstract algebra topics*, organized by **Allen C. Hibbard**, Central College, and **Kenneth M. Levasseur**, University of Massachusetts at Lowell. Part A: Saturday, 8:00 a.m. to 10:00 a.m.; Part B: Saturday, 1:00 p.m. to 3:00 p.m. Using Mathematica, participants will become engaged in examining interactive laboratory activities focusing on groups, rings, and morphisms. The notebooks, designed for exploration and investigation of these structures, are intended to expand upon or motivate classroom discussions. No programming with Mathematica is necessary, since packages are read in that define the required functionality. (Minimal familiarity using the software is helpful, however.) A CD with our packages and notes will be distributed. For more information, go to `http://www.central.edu/eaam.html`. Cost is $90; enrollment limit is 30. N.B. Those interested must register in advance; there is no on-site registration for this minicourse.

Minicourse #2: *Mathematical algorithms, models, and graphic representations using spreadsheets*, organized by **Robert S. Smith**, Miami University, **Deane E. Arganbright**, University of Tennessee at Martin, and **Erich Neuwirth**, University of Vienna. Part A: Saturday, 10:30 a.m. to 12:30 p.m.; Part B: Saturday, 3:30 p.m. to 5:30 p.m. This minicourse will draw on examples from calculus, precalculus, finite mathematics, numerical analysis, statistics, geometry, number theory, and discrete dynamical systems to illustrate a variety of mathematical concepts. We will use the spreadsheet's graphical power to design interactive mathematical displays that illustrate algorithms and to create classical curves, tessellations, and elementary fractal patterns. The course will also briefly demonstrate how other mathematical packages can be integrated into spreadsheets. Spreadsheet experience is desirable but not necessary. Cost is $90; enrollment limit is 30. N.B. Those interested must register in advance; there is no on-site registration for this minicourse.

Minicourse #3: *Optimal use of technology in teaching geometry at the college-university level*, organized by **Subhash C. Saxena**, Coastal Carolina University, and **Nick Jackiw**, Key Curriculum Press. Part A: Sunday, 8:00 a.m. to 10:00 a.m.; Part B: Tuesday, 8:00 a.m. to 10:00 a.m. The latest version of Dynamic Geometry software empowers us to teach a lot more geometry in an enhanced pedagogical environment. This minicourse will provide hands-on experience to participants in the optimal use of technology in diverse college geometry classrooms. We will discuss plane isometries, dilations, affine transformations, inversions, non-Euclidean models, fractals, and various custom tools with this technology. An abbreviated guide for its Windows version with emphasis on specific topics will be available to participants. Cost is $90; enrollment limit is 30.

Minicourse #4: *Environmental mathematics*, organized by **Ben Fusaro**, Florida State University. Part A: Sunday, 2:15 p.m. to 4:15 p.m.; Part B: Tuesday, 1:00 p.m. to 3:00 p.m. The goal of this Web-assisted minicourse is to acquaint teachers with a method for modeling environmental problems suitable for a liberal arts course. The prerequisite is Algebra II, yet nonlinear flow problems (such as the logistic) can be solved. A five-model solution pattern starts with a simple visual. This is used to construct a qualitative graphical model and a flow equation (a DE in disguise). The equation is solved computationally with a calculator or spreadsheet. These numerical results are used to plot a graph on a coordinate system. Cost is $90; enrollment limit is 30.

Minicourse #5: *Using physical and computerized puzzles as models of permutation groups in teaching abstract algebra*, organized by **John O. Kiltinen**, Northern Michigan University. Part A: Sunday, 4:30 p.m. to 6:30 p.m.; Part B: Tuesday, 3:15 p.m. to 5:15 p.m. Concrete models are helpful for students learning abstract algebra. This minicourse offers ideas on using physical models (an egg carton with numbered compartments and numbered markers or the familiar "15" puzzle) and computerized puzzles for learning permutation groups. The computerized puzzles are developed by the presenter. Participants will explore using models to illuminate the concepts of parity, cycle structure, conjugates and commutators. They will learn to use Maple's group theory package for exploring puzzles. Cost is $90; enrollment limit is 30.

Minicourse #6: *WeBWorK, an Internet-based system for generating and delivering homework problems to students*, organized by **Arnold K. Pizer**, **Michael E. Gage**, and **Vicki Roth**, University of Rochester. Part A: Monday, 8:00 am. to 10:00 a.m.; Part B: Wednesday, 8:00 a.m. to 10:00 a.m. This minicourse introduces participants to WeBWorK, a freely available system that comes with an extensive library of problems. WeBWorK won the 1999 ICTCM Award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics. Supported by a grant from NSF, WeBWorK has already been adopted by a number of colleges and universities. Participants will actively participate in using WeBWorK and writing WeBWorK problems. Readers can learn more about WeBWorK by connecting to `http://www.math.rochester.edu/webwork/`. Cost is $90; enrollment limit is 30.

Minicourse #7: *Creating and exporting computer animations to the Web*, organized by **William D. Emerson**, **Louis A. Talman**, and **Bradford Kline**, Metropolitan State College of Denver. Part A: Monday, 10:15 a.m. to 12:15 p.m.; Part B: Wednesday, 1:00 p.m. to 3:00 p.m. Minicourse participants will use Mathematica to develop animations that illustrate concepts from the undergraduate curriculum and will learn to export these animations to the Web via QuickTime. A modest familiarity with Mathematica or other computer algebra systems is assumed. We will conduct this minicourse in a computer laboratory, but participants are welcome to supply their own laptops equipped with Mathematica ($\geq$ 3.0). Cost is $90; enrollment limit is 30.

Minicourse #8: *Real-world problem solving using technology and student projects*, organized by **Bruce Pollack-Johnson** and **Audrey Borchardt**, Villanova University. Part A: Monday, 1:00 p.m. to 3:00 p.m.; Part B: Wednesday, 3:15 p.m. to 5:15 p.m. Looking for a better way to teach business calculus? Want to learn how to use math modeling and technology to teach real-world problem solving and motivate your students using projects from their own lives? Participants will acquire technological, pedagogical, and organizational skills to implement these ideas. They will participate in the project experience and receive hands-on technology training. Experience with TI-83/82 or Excel helpful, but not necessary. Participants will receive Excel templates and technology booklets. Cost is $90; enrollment limit is 30.

Minicourse #9: *The Fibonacci and Catalan numbers*, organized by **Ralph P. Grimaldi**, Rose-Hulman Institute of Technology. Part A: Sunday, 8:00 a.m. to 10:00 a.m.; Part B: Tuesday, 8:00 a.m. to 10:00 a.m. In introductory courses in discrete or combinatorial mathematics one encounters the Fibonacci numbers—and sometimes the Catalan numbers. This minicourse will review and then extend this first encounter as it examines some of the properties these numbers exhibit as well as applications where these sequences arise. A survey of applications dealing with chemistry, physics, computer science, linear algebra, set theory, graph theory, and number theory will show why these sequences are of interest and importance. Cost is $60; enrollment limit is 60.

Minicourse #10: *A dynamical systems approach to the differential equations course*, organized by **Paul A. Blanchard** and **Robert L. Devaney**, Boston University. Part A: Sunday, 2:15 p.m. to 4:15 p.m.; Part B: Tuesday, 1:00 p.m. to 3:00 p.m. This minicourse will give an overview of the Boston University Differential Equations Project, originally funded by the National Science Foundation. The BU project involves a complete redesign of the sophomore-level ODE course. It includes more emphasis on qualitative and geometric methods as well as the incorporation of technology and numerical methods throughout. This minicourse will be useful to college instructors wishing to restructure their ODE courses. Cost is $60; enrollment limit is 60.

Minicourse #11: *Incorporating discrete mathematics in the preparation of K-12 mathematics teachers*, organized by **Lolina Alvarez**, New Mexico State University. Part A: Monday, 8:00 a.m. to 10:00 a.m.; Part B: Wednesday, 8:00 a.m. to 10:00 a.m. More than a fixed set of topics, discrete mathematics is really a way of thinking that deals with important and interesting problems in contemporary mathematics. We will start by picking up some simple situations from art, biology, social psychology, and computer science, just to name a few. We will expose, at different levels of sophistication, the mathematics related to each situation. We will emphasize the interplay between mathematical content and methods of teaching and learning. Each course participant will receive a collection of materials, including an extensive list of resources. Cost is $60; enrollment limit is 60.

Minicourse #12: *Introduction to mathematical card tricks*, organized by **Colm K. Mulcahy** and **Jeffrey A. Ehme**, Spelman College. Part A: Monday, 1:00 p.m. to 3:00 p.m.; Part B: Wednesday, 1:00 p.m. to 3:00 p.m. Card tricks liven up any gathering—including mathematics classes—and can help to convince people that math is fun and that there is a rational explanation for some seemingly impossible events. This interactive introduction to mathematical card tricks will survey applications of permutations, binary and ternary numbers, probability, and more and will feature classic tricks based on the Gilbreath principle and faro shuffle. Cost is $60; enrollment limit is 60.

Minicourse #13: *Getting students involved in undergraduate research*, organized by **Aparna W. Higgins**, University of Dayton, **Joseph A. Gallian**, University of Minnesota, Duluth, and **Stephen G. Hartke**, Rutgers

University. Part A: Sunday, 8:00 a.m. to 10:00 a.m.; Part B: Tuesday, 8:00 a.m. to 10:00 a.m. This course will cover many aspects of facilitating research by undergraduates, such as finding appropriate problems, deciding how much help to provide, and presenting and publishing the results. Examples of research in summer programs and research that can be conducted during the academic year will be presented. Although the examples used will be primarily in the area of discrete mathematics, the strategies discussed can be applied to any area of mathematics. Cost is $60; enrollment limit is 40.

Minicourse #14: *Viewing mathematics via interrelations for undergraduate courses*, organized by **Simon R. Quint**, Stockton College of New Jersey. Part A: Sunday, 2:15 p.m. to 4:15 p.m.; Part B: Tuesday, 1:00 p.m. to 3:00 p.m. Generally unknown to undergraduates, interrelations are a wondrous, prevalent and powerful feature of contemporary mathematics. This minicourse interactively presents material from a manuscript for a capstone course Mathematical Interrelations and for interrelational companion pieces to courses. Minicourse aspects: via calculus and linear algebra, introductions to multifaceted elliptic curves, Lie algebras and groups as interconnectors among algebra, analysis, number theory, geometry; MSC2000 scheme; relations with Mathematical Challenges of the 21st Century conference; Why view mathematics via interrelations? Cost is $60; enrollment limit is 60.

Minicourse #15: *Mathematical finance*, organized by **Walter R. Stromquist**, Berwyn, PA. Part A: Monday, 8:00 a.m. to 10:00 a.m.; Part B: Wednesday, 8:00 a.m. to 10:00 a.m. We will examine market price statistics to test the validity of the "standard model" for stock prices (Geometric Brownian Motion). Then we will cover two main ideas of modern finance: portfolio optimization and option valuation. Portfolio optimization uses matrix algebra and quadratic programming to balance risk and reward. We will extend option valuation from stock options (Black-Scholes) to oil field valuation. The presenter will draw on practical examples from his consulting work. Cost is $60; enrollment limit is 60.

Minicourse #16: *Developing the ability to write proofs in high school students and college mathematics majors*, organized by **Daniel M. Fendel**, San Francisco State University. Part A: Monday, 1:00 p.m. to 3:00 p.m.; Part B: Wednesday, 1:00 p.m. to 3:00 p.m. The focus of this minicourse is on ways to help both high school students and college mathematics majors develop the ability to write meaningful proofs, that is, convincing arguments. A key element of the approach is to have students work from their own conjectures, gradually attaining greater rigor. Participants will work with activities from the presenter's high school and college texts, will see student work, and will discuss the controversies that arise from this approach. Cost is $60; enrollment limit is 60.

MAA Contributed Paper Sessions

See the complete descriptions and instructions on how to participate in these sessions beginning on page 22 in the May/June issue of *FOCUS* or at `http://www.ams.org/amsmtgs/2049_maacall.html`. Please note that the days and times listed are tentative.

Best Practices in Undergraduate Statistics Education, Tuesday morning; **Mary M. Sullivan**, Rhode Island College, and **Carolyn M. Cuff**, Westminster College.

Changing Student Views Regarding the Usefulness of Mathematics in Order to Increase the Number of Mathematics Majors, Sunday afternoon; **Sarah L. Mabrouk**, Framingham State College.

Classroom Demonstrations and Course Projects That Make a Difference, Tuesday and Wednesday afternoons; **David R. Hill**, Temple University, **Sarah L. Mabrouk**, Framingham State College, and **Lila F. Roberts**, Georgia Southern University.

Computational Mathematics in Linear Algebra and Differential Equations, Sunday and Monday afternoons; **Richard J. Marchand**, SUNY at Fredonia, **Elias Y. Deeba**, University of Houston-Downtown, and **Timothy J. McDevitt**, Millersville University.

Deep Understanding of School Mathematics Needed by Teachers, Monday afternoon; **Albert D. Otto**, Illinois State University, **Catherine M. Murphy**, Purdue University-Calumet, and **Philip Quartararo**, Southern University.

Environmental Mathematics in the Classroom, Tuesday and Wednesday afternoons; **Ben Fusaro**, Florida State University, and **Marty E. Walter**, University of Colorado.

General Contributed Paper Session, Sunday and Monday afternoons; **Shawnee L. McMurran**, California State University, San Bernardino, **Emelie Kenney**, Siena College, and **Sarah L. Mabrouk**, Framingham State College.

History of Mathematics in the Second Millennium, Sunday and Monday mornings; **Janet L. Beery**, University of Redlands, and **C. Edward Sandifer**, Western Connecticut State University.

Initiating and Sustaining Undergraduate Research Projects and Programs, Sunday and Monday afternoons; **John R. Swallow**, Davidson College, **Suzanne M. Lenhart**, University of Tennessee, and **Daniel J. Schaal**, South Dakota State University.

Innovative Outcome Assessment in Statistics Education, Tuesday afternoon; **Robert del Mas**, University of Minnesota, Minneapolis, and **Carolyn M. Cuff**, Westminster College.

Innovative Uses of the World Wide Web in Teaching Mathematics, Sunday and Monday mornings; **Marcelle Bessman**, Jacksonville University, and **Brian E. Smith**, McGill University.

Integrating Mathematics and Other Disciplines, Sunday and Monday mornings; **William G. McCallum** and **Deborah Hughes Hallett**, University of Arizona, Tucson, and **Yajun Yang**, SUNY, Farmingdale.

Learning to Prove in Cooperative Learning and Technology-Supported Environments, Sunday afternoon; **G. Joseph Wimbish**, Huntingdon College, **Connie M. Campbell**, Millsaps College, and **Draga D. Vidakovic**, Georgia State College.

Mathematics Courses for Teachers, K–12, Sunday and Monday mornings; **Ira J. Papick**, University of Missouri, Columbia, **Duane Porter**, University of Wyoming, and **Diane M. Spresser**, National Science Foundation.

Redefining What a Modern "College Algebra" Experience Means, Tuesday and Wednesday mornings; **Sheldon P. Gordon**, SUNY at Farmingdale, **Florence S. Gordon**, New York Institute of Technology, **Arlene H. Kleinstein**, SUNY at Farmingdale, **Mary Robinson**, University of New Mexico, Valencia Campus, **Linda H. Boyd**, Georgia Perimeter College, and **Richard A. Gillman**, Valparaiso University.

SIGMAA on RUME Contributed Paper Session, Tuesday and Wednesday mornings; **Julie Morrisett Clark**, Hollins University.

Strategies for Increasing the Diversity of Students in Mathematics, Tuesday morning; **William Yslas Velez**, University of Arizona, Tucson, **Marjorie Enneking**, Portland State University, **William A. Hawkins**, SUMMA, **Michael B. Freeman**, University of Kentucky, **Robert E. Megginson**, University of Michigan, **Wade Ellis**, West Valley College.

Using Examples from Sports to Enhance the Teaching of Mathematics, Tuesday morning; **Robert E. Lewand**, Goucher College, and **Howard L. Penn**, U.S. Naval Academy.

Who Needs Algebra! Alternative Introductory Mathematics Courses, Tuesday afternoon; **Judy E. Ackerman**, Montgomery College, **Susan L. Forman**, Bronx Community College, and **Kathie A. Yoder**, L. A. Pierce College.

Other MAA Sessions

Teaching at Two-Year Colleges: Rewards, Research, Resources, and Recommendations, Sunday, 9:00 a.m.–10:30 a.m., organized by **Jay A. Malmstrom**, Oklahoma City Community College, and **Janet P. Ray**, Seattle Central Community College. A quick glance at the *Chronicle of Higher Education* will leave one with the impression that there are quite a few jobs available in mathematics—at the two-year college level. The current emphasis on developing a technically literate work force along with initiatives to improve the mathematical preparation of elementary school teachers has led to increased enrollments in mathematics courses that are typically taken during the first two years of college. A significant percentage of these courses are being taught at two-year colleges. With increased enrollments and retirements, the opportunities for employment at a two-year institution are expanding. But what is that environment like? These schools have cultures different from that experienced by most graduate students. What is professional life like at a two-year college? What resources are available? How does one qualify to teach there? Do two-year faculty engage in mathematical research? This panel will address these issues from a variety of perspectives. Panelists include **Susan S. Wood**, J. Sargeant Reynolds Community College, **Curtis C. McKnight**, University of Oklahoma, **Sandy Gokey**, Greenfield Community College, and **Stephen B. Rodi**, Austin Community College. The panel will be moderated by **Jay A. Malmstrom**. The panel is sponsored by the MAA Committee on Two-Year Colleges (CTYC).

New CUPM Curriculum Guide, Sunday, 9:00 a.m.–10:30 a.m., organized by **Harriet S. Pollatsek**, Mount Holyoke College. Draft portions of the new CUPM Curriculum Guide (scheduled for publication late in 2002) will be available on MAA Online before the Joint Mathematics Meeting. Members of CUPM will briefly summarize key elements and then invite audience comments, questions, and suggestions. The panel is sponsored by the MAA Committee on the Undergraduate Program in Mathematics (CUPM).

AP Calculus: Bridges and Bumps between School and College, Sunday, 9:00 a.m.–10:30 a.m., organized by **Judith E. Broadwin**, and **Susan Kornstein**, The College Board. Panelists will consider issues in the transition from school to college mathematics involving Advanced Placement Calculus, including dual enrollment, use of technology, level of rigor, appropriate placement of students, and use of the Internet and other resources to enhance the teaching and learning of mathematics at all levels. These issues will be discussed from the perspective of both high school and college faculty with the goal of improving communication and cooperation. Panelists include **Ray Cannon**, Baylor University, **Thomas P. Dick**, Oregon State University, **Bernard L. Madison**, MAA, **Lawrence H. Riddle**, Agnes Scott College, **Jane L. Wortman**, Beverly Hills High School, **Judith E. Broadwin**, and **Susan Kornstein**.

A Comprehensive Department-Based Program for the Preparation and Professional Development of Graduate Teaching Assistants (GTAs) in Mathematics, Sunday, 2:15 p.m.–3:45 p.m., organized by **Eileen T. Shugart**, Virginia Polytechnic Institute and State University. GTAs, the undergraduates they teach, the graduate program, the department, the university itself—everyone benefits when mathematics GTAs are well prepared for their assistantship duties. This session provides a model for an effective department-based program to provide strong support and training for graduate students both as GTAs and as future college faculty. We will describe a two-phase teaching preparation process; computing and teaching orientations; regular graduate issues seminars; and a progressive support system for teachers that includes faculty and peer mentors, course coordinators, formative evaluation, and classroom observations. We will discuss the resources and financial commitment such a program requires and will share the department manual and teaching handbook developed specifically for our GTAs. In addition, we will present a model for leadership opportunities for qualified GTAs and discuss activities designed to give graduate students a preview of their future role as a college or university faculty member. Panelists include **Eileen T. Shugart**, **Eric Sorensen**, **Gregory Hartman**, and **Brian Camp**, all from Virginia Polytechnic Institute and State University.

Session for Chairs, Sunday, 2:15 p.m.–3:45 p.m., organized by **Catherine M. Murphy**, Purdue University Calumet, and **Gerald L. Alexanderson**, Santa Clara University. The topic of discussion will be effective teaching and the scholarship of teaching: which aspects coincide, which differ? What evidence is required to support effective teaching? What evidence is required to support teaching as an area of scholarship?

NCTM's Work to Improve Mathematics Education for All Students, Sunday, 2:15 p.m.–3:45 p.m., organized by **Johnny W. Lott**, University of Montana, and **Eric Hart**, Western Michigan University, Maharishi University of Management, and University of Iowa. Since the release of *Principles and Standards for School Mathematics* (April

2000), NCTM continues to try to ensure a high-quality mathematics education for every student. Explore an exciting and growing set of electronic resources such as the E-Standards and Illuminations Web site. Learn about NCTM's Navigations project, a new book series that will contain more than 30 titles when complete and designed to support the implementation of *Principles and Standards.* See how NCTM encourages family involvement in math through the "Figure This!" campaign.

Introduction to the Hiring Process: Preparation, Execution, and Follow-up, Sunday, 2:15 p.m.–3:30 p.m., organized by **Sarah-Marie Belcastro**, University of Northern Iowa and Bowdoin College, and **Dusty E. Sabo**, Southern Oregon University. Many institutions expect to have faculty openings in the near future. At some institutions it has been a long time since there was a search; at other institutions newer faculty are becoming involved in their first hiring committees. Our panel discussion (hopefully with lots of audience participation!) aims to help faculty become aware of the issues involved with hiring new colleagues. We will discuss how the departmental environment and direction can frame a search, spend the bulk of the allotted time discussing the mechanics of a search (from writing the position advertisement to informal interviews to campus interviews), and briefly discuss how to make a search a lasting success by mentoring new department members. This session was organized by the 1994–7 MAA Project NExT Fellows to address issues of concern to faculty who have four to ten years of teaching experience. Panelists include **Tamara B. Veenstra**, University of Redlands, **Carolyn Yackel**, Mercer University, **Dennis M. Luciano**, Western New England College, **Mark J. Nielsen**, University of Idaho, and **Michael E. Boardman**, Pacific University.

Mathematical Preparation and Support of Teachers through Rural Universities, Sunday, 4:00 p.m.–5:30 p.m., organized by **Warren P. Koepp** and **Raymond A. Beaulieu**, Sul Ross State University. Faculty at many rural universities teach courses in mathematics for preservice teachers as a major part of our mission as well as graduate math education courses and workshops for in-service teachers. They face many challenges (many nontraditional students, commuting students, issues surrounding distance education and Web-based courses, computer connectivity, etc.) that are peculiar to this type of school, making the implementation of innovative ideas and programs developed in more urban settings difficult (if not impossible). This panel discussion will address issues peculiar to the training and support of teachers in geographically remote areas. Panelists include **Raymond A. Beaulieu**, **Leslie Garrison**, San Diego State University, and **Harel Barzilai**, Salisbury State University.

Modeling in College Algebra, Sunday, 4:00 p.m.–5:30 p.m., organized by **Donald B. Small**, U.S. Military Academy. Modeling is a major component of reformed college algebra courses. Modeling brings together the problem-solving attributes of developing a mathematical description of a given situation, applying appropriate solution techniques, and interpreting the solution in light of the original setting. The panelists have been involved in reforming college algebra courses through modeling and/or evaluating the impact of modeling in the curriculum. Panelists include **Benny D. Evans**, Oklahoma State University, **Alexander H. Fluellen**, Clark Atlanta University, **Florence S. Gordon**, New York Institute of Technology, and **Scott Herriott**, Maharishi University of Management. The panel will be moderated by **Della D. Bell**, Texas Southern University, and is sponsored by the MAA CUPM Subcommittee on Calculus Reform and the First Two Years (CRAFTY).

Changing Attitudes in the Elementary Education Mathematics Content Courses: What Works?, Monday, 9:00 a.m.–10:30 a.m., organized by **Bonnie L. Oppenheimer**, Mississippi University for Women, **Sigrid E. Wagner**, Ohio State University, and **Joan S. Morrison**, Goucher College. We offer elementary preservice content courses that are one, two, or even three semesters long at various institutions nationwide. By and large, the students enter these classes with negative attitudes about mathematics in general. Sometimes students leave the content sequence with a true enjoyment of mathematics, looking forward with anticipation to the day they begin teaching mathematics. The panel would like to share some anecdotal and/or research-based numerical data about how this change occurs and possible ways you can make it happen in your own content class. Panelists include **Charles E. Lamb**, Texas A&M University, **Robert B. Brown**, Ohio State University, and **Anne L. Madsen**, University of New Mexico. The panel is sponsored by the MAA Committee on the Mathematical Education of Teachers (COMET).

The Environment: A Context for Learning, Monday, 9:00 a.m.–10:30 a.m., organized by **Marcia Sward Doherty**, Ocean View, DE, and **Ben Fusaro**, Florida State University. Teaching mathematics, science, and other subjects using the environment as a real-world context is proving to be remarkably effective in K–12 schools across the country. **Gerald Lieberman**, coauthor of *Closing the Achievement Gap: Using the Environment As an Integrating Context for Learning*, will speak about his research on environment-based programs at hundreds of schools. He will talk about the implications for mathematics and teacher education. **Nancy E. Zumoff**, Kennesaw State University, and **Lee Seitelman**, Pratt & Whitney (retired) and University of Connecticut, will comment on environment-based education from the faculty point of view. The session is sponsored by the MAA Committee on Mathematics and the Environment.

Opportunities for Mathematically Motivated Youth, Monday, 9:00 a.m.–10:30 a.m., organized by **Richard D. Sommer**, Stanford University. In this session we will examine several opportunities for advanced study in mathematics, mainly for middle school and high school students. These include computer-based distance learning, residential summer programs, after-school and evening programs (math circles), and mathematics competitions (local, national, and international).

The purpose of the session is to increase awareness in the collegiate mathematical community of programs for mathematically-talented K–12 students. Panelists include **Linda Brody**, Johns Hopkins University, **Rafe A. Mazzeo**,

Stanford University, **Raymond Ravaglia**, Stanford University, and **Zvezdelina E. Stankova-Frenkel**, Mills College.

How to Make the Most of Teaching Evaluations, Monday, 9:00 a.m.–10:30 a.m, organized by **T. Christine Stevens**, St. Louis University, **Joseph A. Gallian**, University of Minnesota, Duluth, and **Aparna W. Higgins**, University of Dayton. For faculty at all stages of their careers, student evaluations often play an important role in the assessment of teaching. To assist faculty to make the most of teaching evaluations, this panel will address the following topics: how to read, interpret, and learn from student evaluations; what instructors can do to provide their departments and institutions with a more robust picture of their teaching; how departments and institutions use student evaluations in the review process. Panelists include **Jeffery S. Connor**, Ohio University, **Carl C. Cowen**, Purdue University, **William E. Fenton**, Bellarmine University, and **Pamela B. Pierce**, The College of Wooster.

Life after a Math Sciences Major: Tracking and Using Alumni Career Information, Monday, 10:45 a.m.–12:15 p.m., organized by **John D. Fulton**, Virginia Polytechnic Institute and State University. The career paths of alumnae/alumni of undergraduate mathematics and mathematical sciences programs lead to diverse careers in which mathematical skills are crucial to success. Many of these paths lead to completion of graduate or professional programs in a wide variety of disciplines. Making students aware of the variety of career options can attract many students to programs in the mathematical sciences. Panelist **Andrew Sterrett** will address the variety of careers and graduate programs in which mathematical sciences alumni are involved. Panelists **David J. Lutzer**, **Laura J. Person**, and **Lisa M. Traynor** will describe how they have collected career information from alumnae/alumni of mathematics programs at William and Mary, SUNY at Potsdam, and Bryn Mawr respectively and how that feedback has been used in advising students and in planning and adjusting programs at these colleges and universities. The panel will be moderated by **Michael G. Monticino**, University of North Texas. The session is sponsored by the MAA Committee on the Profession; ASA-MAA Committee on Statistics; Business, Industry and Government SIGMAA; MAA Committee on Industrial and Government Mathematicians; MAA Committee on the Undergraduate Program in Mathematics; and the SIGMAA on Statistics Education.

College Credit by Examination: The Advanced Placement (AP®) and College-Level Examination (CLEP®) Programs, Monday, 10:45 a.m.–12:15 p.m., organized by **Gloria S. Dion**, Educational Testing Service. The College Board offers examinations that enable students to obtain credit for college-level work in high school (AP) or through nontraditional academic experiences (CLEP). Most college and university math departments in the United States have policies for awarding credit and/or placement for AP and CLEP exams in mathematics. How are these exams developed? Who decides on the content of the exams and the passing scores? A panel of faculty members from several test development committees and ETS mathematics test development staff will discuss the programs, the work of the committees, and the processes that ensure the validity of the exams. The panel, moderated by **Gloria S. Dion**, will include **Chan Jones**, Educational Testing Service, **James R. Choike**, Oklahoma State University, **Jane P. Coffee**, College of Staten Island, CUNY, **Roxy Peck**, California Polytechnic State University, and **Lawrence H. Riddle**, Agnes Scott College.

NSF Funding Opportunities for Learning and Teaching in the Mathematical Sciences, Monday, 10:45 a.m.–12:15 p.m., organized by **Dennis E. Davenport**, **James H. Lightbourne**, **Elizabeth J. Teles**, **Lee L. Zia**, NSF/Division of Undergraduate Education. The NSF Division of Undergraduate Education and sister NSF divisions offer a variety of grant programs to support innovations in learning and teaching in the mathematical sciences. These programs will be discussed along with examples of successful projects. In addition, anticipated budget highlights and other new initiatives for the next fiscal year will be presented. Panelists include **John S. Bradley** and **Diane M. Spresser** from the Division for Elementary, Secondary, and Informal Education and **Lloyd E. Douglas** from the Division of Mathematical Sciences.

Providing and Promoting Opportunities for Undergraduates: A Win-Win Situation, Monday, 1:00 p.m.–2:30 p.m., organized by **Sandra O. Paur**, North Carolina State University. The focus of this panel will be on some of the excellent opportunities available to math undergraduates and how students (and also their departments and institutions) can benefit from them. Each of the four panelists will take 12–15 minutes to discuss their program and the benefits provided for the students as well as the panelist's institution. The remaining 30 minutes will be for questions and comments from the audience. **Colin C. Adams** will discuss REU's and other undergraduate research with specific reference to the SMALL program at Williams College. **Paul D. Humke** will talk about the Budapest Semesters in Mathematics, and **Sergei Tabachnikov** will discuss the MASS Program at Pennsylvania State University. **Sandra Paur** will point out how utilizing these special opportunities has benefited North Carolina State students in terms of national fellowships, acceptance at excellent graduate schools, as well as the procedures she has used to identify and recruit students for these programs. She will also comment briefly on some of the other special programs available for math majors. The panel is sponsored by the MAA CUPM Subcommittee on Undergraduate Research.

Rethinking the Preparation for Calculus, Monday, 1:00 p.m.–2:30 p.m., organized by **Sheldon P. Gordon**, SUNY at Farmingdale, and **Nancy Baxter Hastings**, Dickinson College. Over the last decade most aspects of the mathematics curriculum have been undergoing major changes. The calculus reform movement has brought about changes both in terms of what is taught and how it is taught. The NCTM Standards, which are being widely implemented, likewise have introduced significant changes in both content and pedagogy in high school mathematics. A major MAA initiative has begun to redefine courses in college algebra to better reflect the actual needs of the students who take such courses, not merely to prepare a relative handful for calculus. The courses that emerge may well give students a much broader (but less algebraically

intense) experience in mathematics and how it is used in other disciplines and in the real world. The NSF has arranged, under the direction of Jack Y. Narayan, for a special invited conference to bring together leaders of all of these efforts. The purpose of the conference is to rethink the preparation for calculus, given: (1) that students are having such different mathematical experiences in high school, (2) that calculus in college is placing different expectations on the students, and (3) that technology is providing an ever wider selection of mathematical tools for both the teaching and learning of mathematics. In this session the speakers will discuss the highlights of the conference and share with the mathematics community their insights and experiences in the issues raised during the conference. The panelists include **Nancy Baxter Hastings, Steven R. Dunbar**, University of Nebraska, and **Sheldon P. Gordon**. The panel will be moderated by **Jack Y. Narayan**, SUNY at Oswego, and is cosponsored by the MAA CUPM Subcommittee on Calculus Reform and the First Two Years (CRAFTY) and the Task Force on the First College Level Mathematics Course.

Probability and Combinatorics in Analytic Number Theory, Monday, 1:00 p.m.–4:00 p.m. This invited paper session is organized by **Andrew J. Granville**, University of Georgia. Speakers include **Henry L. Cohn**, Microsoft Research, **Brian Conrey**, American Institute for Mathematics, **Ernest S. Croot III**, University of California Berkeley, **William D. Duke**, University of California Los Angeles, **Daniel A. Goldston**, San Jose State University, and **Andrew D. Pollington**, Brigham Young University.

MAA Project NExT and YMN Poster Session, Monday, 2:00 p.m.–4:00 p.m. organized by **Kenneth A. Ross**, University of Oregon, and **Kevin E. Charlwood**, Washburn University. The session will include exhibits from 15–25 new or recent Ph.D.'s in the mathematical sciences or from those still pursuing graduate study. Applications should be submitted to Kevin Charlwood, zzcharlw@washburn.edu, and Ken Ross, ross@math.uoregon.edu, by December 11, 2001.

Successful Programs That Integrate Mathematics with Other Disciplines, Monday, 2:15 p.m.–3:45 p.m., organized by **Timothy D. Comar**, Benedictine University, and **Michael J. Dorff**, Brigham Young University. The panelists will discuss their successful programs and projects designed to enrich undergraduate education by integrating mathematics with other disciplines and will provide advice for initiating interdisciplinary activities. Panelists include **Mary Garner**, Kennesaw State University, who will discuss her experience team-teaching an interdisciplinary course linking mathematics, philosophy, and the literature of Jorge Borges; **Joan Ferrini-Mundy**, Michigan State University, who is a leader in mathematics education and has experience in working together with mathematicians and mathematics educators to develop programs that prepare future public school teachers; **Agnes M. Rash**, St. Joseph's University, who has worked on developing a calculus software with applications in business and economics and will discuss her experience with team-teaching—organizing, finding a partner, and choosing topics; and **John L. Scharf**, Carroll College, who will discuss his experiences teaching the integrated curriculum at Carroll College. This session was organized by the 1994-7 MAA-Project NExT Fellows to address issues of concern to faculty who have four to ten years of teaching experience.

Mathematics Preparation of Doctorates in Mathematics Education, Monday, 2:45 p.m.–4:15 p.m., organized by **Robert E. Reys**, University of Missouri, Columbia. Doctorates in mathematics education pursue many different career options. Is there a core of mathematics that doctorates in mathematics education should possess? If so, what should be the core and how should it be tailored to fit individual career goals? Mathematics cores for different career options will be presented and discussed, as well as results from a survey of doctoral programs and information from recent graduates with doctorates in mathematics education. Time will be allowed for interaction with participants attending the session. Participants include **Glenda Lappan**, Michigan State University, and **Jeremy Kilpatrick**, University of Georgia. **Jim Lewis**, University of Nebraska, will serve as the reactor.

SUMMA Special Presentation, Monday, 2:45 p.m.–4:15 p.m., organized by **William A. Hawkins Jr.**, MAA and the University of the District of Columbia. Panelists **Eda Davis-Butts**, Oregon State University, **Daniel J. Madden**, University of Arizona at Tucson, and **David L. Pagni**, California State University at Fullerton, will discuss their programs for precollege students. The panel will be moderated by William A. Hawkins Jr., director of the SUMMA program, and is sponsored by the MAA SUMMA (Strengthening Underrepresented Minority Mathematics Achievement) Program and the MAA Committee on Minority Participation in Mathematics.

Integrating Statistics/Data Analysis through the Core Curriculum, Monday, 2:45 p.m.–4:15 p.m., organized by **Donald B. Small**, U.S. Military Academy. The rapid growth of information science and the increasing emphasis on integrating modeling through the core curriculum call for a discussion of how to integrate statistics/data analysis through the core curriculum. The panelists are influential contributors to the growing debate over the role and place of statistics/data analysis in undergraduate curriculums. Panelists include **George W. Cobb**, Mount Holyoke College, **Steve W. Horton**, U.S. Military Academy, **Roxy Peck**, California Polytechnic State University at San Luis Obispo, and **Alan J. Rossman**, Dickinson College. The panel will be moderated by **Gary H. Krahn**, U.S. Military Academy, and is sponsored by the MAA CUPM Subcommittee on Calculus Reform and the First Two Years (CRAFTY).

Time for Your First Sabbatical...Now What?, Tuesday, 9:00 a.m.–10:15 a.m., organized by **Cheri L. Boyd**, Nazareth College, and **Mark R. Parker**, Carroll College. We all look forward to the sabbatical periods in our careers with great anticipation. These opportunities for renewal and invigoration can take on many forms. Research, curricular development, and writing are only a few options. Our panelists will describe a broad array of sabbatical experiences from start to finish: generating worthy ideas, writing successful proposals, garnering support, carrying through and following up. This session was organized

by the 1994–7 MAA Project NExT Fellows to address issues of concern to faculty who have four to ten years of teaching experience. Panelists include **David L. Allen**, Eastern Oregon University, **Thomas H. Barr**, Rhodes College, **Christine L. Kinsey**, Canisius College, **William A. Marion**, Valparaiso University, and **Cynthia J. Woodburn**, Pittsburgh State University.

Successful Mathematics Outreach Programs for Women and Girls, Tuesday, 9:00 a.m.–10:30 a.m., organized by **Elizabeth G. Yanik**, Emporia State University, **Virginia G. Kasten**, General Motors, and **Kathleen A. Sullivan**, Seattle University. This session will highlight mathematics outreach programs for middle school or high school young women. These programs may involve summer camps, one-day conferences, or continuing programs throughout a school year. Topics such as participant selection, program activities, special speakers, funding sources, and program assessment will be discussed. This session is sponsored by the Women and Mathematics Network and the MAA Committee on the Participation of Women.

Mathematics in a Postmodern Age, Tuesday, 9:00 a.m.–10:30 a.m., organized by **Russell W. Howell**, Westmont College, Santa Barbara, and **W. James Bradley**, Calvin College. Conversations these days are loaded with the word "postmodernism". What exactly is this construct, and how, if at all, might it apply to mathematics? In particular, how do we engage a student culture with cognitive issues when that very culture emphasizes the affective, rejecting as irrelevant anything that deals with the theoretical? What is the proper role of mathematics in our culture? Are the truths of mathematics merely expressions of social agreement, as some postmodernists would claim, or are they universally true? How do we know? What criteria should guide our mathematical pursuits? In society at large mathematics has had an enormous influence. Has it been a proper influence? Should it become stronger? Redirected? These and other questions will be the focus of our panel discussion. Panelists include **W. James Bradley**, and **Calvin Jongsma**, Dordt College. **Russell W. Howell** will moderate the session.

Grant-Writing Workshop for Proposals to the NSF Division of Undergraduate Education, Tuesday, 9:00 a.m.–10:30 a.m., organized by **Dennis E. Davenport, James H. Lightbourne, Elizabeth J. Teles, Lee L. Zia**, NSF/Division of Undergraduate Education. Presenters will describe the general NSF grant proposal process and consider particular details relevant to programs in the Division of Undergraduate Education. Attendees of this session will have an opportunity to read sample proposals and take part in a "mock" panel review of proposals.

Discrete Mathematics in the First Two Years, Tuesday, 1:00 p.m.–2:30 p.m., organized by **Donald D. Mills, Donald B. Small**, and **Kathleen Snook**, U.S. Military Academy. Our increasingly information-driven society is pressuring undergraduate mathematics departments to integrate discrete topics earlier in the curriculum. This early introduction supports the growing emphasis on discrete modeling as well as courses in computer science and information technology. The study of discrete mathematics at this level could include topics in combinatorics, recursive relationships, graph theory and networks, discrete probability, and Boolean algebras. The purpose of this panel discussion is to discuss ways to successfully introduce these topics and others into an undergraduate mathematics program. Panelists include **D. Chris Arney**, College of Saint Rose, **Diana M. Thomas**, Montclair State University, and **Marie M. Vanisko**, Carroll College. The panel is sponsored by the MAA CUPM Subcommittee on Calculus Reform and the First Two Years (CRAFTY).

BIG Math: Projects in Business, Industry and Government, Tuesday, 1:00 p.m.–2:30 p.m., organized by **Philip E. Gustafson**, Mesa State College. This panel session will feature mathematicians representing business, industry and government. The panelists will speak on specific projects they have worked on in their jobs, spending about 15–20 minutes outlining a project, their role in it, and the mathematics involved. The panelists will then discuss the similarities/differences between their projects and those of the other panelists, as well as other aspects of their jobs as mathematicians.

The Medium and the Message: Practical Suggestions on Student Reading and Course Efficiency Using a Structured Conversation Format, Tuesday, 1:00 p.m.–3:00 p.m., organized by **Mary Ellen Foley**, Louisiana State University–Shreveport, **Sandra A. Gokey**, Greenfield Community College, **Tom J. Linton**, Central College, and **Kirk E. Weller**, Bethel College. Many faculty struggle with getting their students to read the text, as well as with "covering" enough material when using active learning. The organizers of this session propose that course efficiency is greatly enhanced when students actually read the text. This session, sponsored by the Committee on the Teaching of Undergraduate Mathematics (CTUM), focuses on motivating student reading through course structure, helping students learn how to read a math text, and assessing what students learn by reading. Attendees will generate and evaluate ideas related to these topics by actively participating in a format that models an effective cooperative learning technique. Participants will leave with both newly generated and tried-and-true tools to increase their courses' efficiency by getting students to read.

Projects Supported by the NSF Division of Undergraduate Education, Tuesday, 1:00 p.m.–3:00 p.m., organized by **Jon W. Scott**, Montgomery Community College. This session will feature principal investigators (PIs) presenting progress and outcomes from various NSF-funded projects in the Division of Undergraduate Education. The poster session format will permit ample opportunity for attendees to engage in small group discussions with the PIs and to network with each other.

Presentations by Teaching Award Recipients, Tuesday, 3:30 p.m.–5:00 p.m. Winners of the Awards for Distinguished College or University Teaching will give presentations on the secrets of their success.

Actuarial Education, Tuesday, 5:00 p.m.–7:00 p.m., organized by **Krzysztof M. Ostaszewski**, Illinois State University. This informal session sponsored by the Actuarial Faculty Forum provides an opportunity for those involved in actuarial education, interested in it, or curious about it to get together to discuss common concerns such

as the major changes in the actuarial exam systems that will have just taken place.

Association for Research on Undergraduate Mathematics Education SIGMAA Reception and Business Meeting, Tuesday, 5:00 p.m.–7:00 p.m., organized by **Julie M. Clark**, Hollins University. ARUME is a group formed for mathematics educators and professional mathematicians interested in research on undergraduate mathematics education. There will be a welcoming address, business meeting, election of officers, an invited address exemplifying research on undergraduate mathematics, followed by a reception.

Closing the Deal: The Campus Interview and Beyond, Tuesday, 5:30 p.m.–7:00 p.m., a panel discussion organized by **Chawne M. Kimber**, Lafayette College, and **David T. Kung**, St. Mary's College of Maryland, and cosponsored by the MAA and the Young Mathematicians Network.

Carroll College Project InterMath Workshop Reunion, Tuesday, 5:30 p.m.–7:00 p.m., organized by **Marie M. Vanisko**, Carroll College. Participants from the Project InterMath Curriculum Workshop at Carroll College in June 2001 will share with the group the curriculum changes they plan to make at their schools. The focus of the discussions will be to further the group's efforts to form a consortium of schools interested in applying for a National Science Foundation Adaptation and Implementation (CCLI-A&I) grant in order to provide funding for curriculum changes at participating schools. Colleges represented include Carroll College, St. Olaf's College, Western Washington University, U. S. Air Force Academy, Salisbury State University, University of Tennessee, Appalachian State University, University of Florida Atlantic Honors College, Montclair State University, Penn State University, LaGrange University, Ohio Northern, University of New Hampshire, University of Connecticut, and University of Colorado, Denver.

Planning Ahead for the Tenure/Promotion Process, Tuesday, 6:00 p.m.–7:00 p.m., organized by **Karrolyne Fogel**, California Lutheran University, and **J. Lyn Miller**, Western Kentucky University. Tenure-track positions don't stay that way forever. Hear tips and advice from both sides of the tenure process in this panel discussion designed to help you successfully turn "tenure-track" into "tenured". Cosponsored by MAA Project NExT and the Young Mathematicians Network.

SIGMAA on Statistics Education, 2002 Business Meeting and Lecture, Tuesday, 6:00 p.m.–8:00 p.m., organized by **Dexter C. Whittinghill**, Rowan University. The SIGMAA for Statistics Education will hold its second annual business meeting, including an invited talk. After some necessary formalities, we will hear the chair's report, results of the fall elections, and discuss new business. Topics of discussion will include outreach, membership services, and suggestions from the membership related to statistics education. At 7:00 p.m. **Roxy Peck**, California Polytechnic State University, San Luis Obispo, and current chief faculty consultant for the AP statistics exam, will speak on the AP statistics exam.

Want to Coach a Math Modeling Team? Where to Start and How to Finish, Wednesday, 9:00 a.m.–10:30 a.m., organized by **Ben Fusaro**, Florida State University, and **Mark R. Parker**, Carroll College. The purpose of this workshop is to encourage and prepare faculty to become advisors for the Mathematical Contest in Modeling. There will be a ten-minute introduction on the history and purpose of MCM. The main part of the program will consist of successful advisors telling about their experiences and answering questions. The emphasis will be on *how to do it*. We will then have a ten-minute wrap-up from an advisor who has also been an MCM judge. Handouts will have references for print and video materials. We would like to show how easy it is for a faculty member to be the conductor for a great (and likely) unique experience for a team of three students. Participants include **John E. August**, Mount Saint Mary's College, **Robert A. Beezer**, University of Puget Sound, **Thomas O'Neil**, California Polytechnic State University, San Luis Obispo, **Holly Zullo**, Carroll College, **Ben Fusaro**, and **Mark R. Parker**.

Outreach Programs for Women: Assessment Issues, Wednesday, 9:00 a.m.–10:30 a.m., organized by **Carolyn C. Connell**, Westminster College of Salt Lake City. Many outreach programs (for women, minorities, and others) could benefit greatly from devoting more attention to long-range questions of effectiveness. Members of this panel will discuss a variety of ideas that are important in assessment of any intervention program. The panel, moderated by **Susan L. Forman**, Bronx Community College, will include **Carole B. Lacampagne**, senior researcher, RAND, **Charlene Morrow**, SummerMath Program, Mount Holyoke College, and **Florence Fasanelli**, The College Board.

The Mathematics Community and Public Support, Wednesday, 1:00 p.m–2:30 p.m., organized by **Christopher C. Leary**, SUNY at Geneseo. For mathematics to continue to thrive in our society, we need to ensure that the public understands, appreciates, and supports our profession. Unfortunately, mathematicians tend to compartmentalize their thinking about mathematics, and so we tend to subdivide not only by discipline but also by whether we see ourselves as students, teachers, or researchers. The panelists will discuss ways in which we can bring a greater sense of cohesiveness to our profession and ways in which we can use that cohesiveness to improve directly and indirectly the public's perception of mathematics. The goal of the discussion is to actively engage mathematicians, mathematics students, and those who teach mathematics at any level. Panelists include **Herbert Clemens**, University of Utah, **Daniel L. Goroff**, Harvard University, **Joseph Malkevitch**, York College, City University of New York, **Michael A. Breen**, AMS, and **Daniel N. Rockmore**, Dartmouth College.

Reflections on the West Point Summary Conference for the CRAFTY Curriculum Foundations Workshops, Wednesday, 1:00 p.m.–2:30 p.m., organized by **Donald B. Small**, U.S. Military Academy. The Curriculum Foundations Project (CF) is part of a major MAA review of its recommendations for undergraduate programs in mathematics. The CF project consisted of a series of eleven disciplinary-based workshops conducted by CRAFTY over the past two years and a summary conference held at the U.S. Military Academy at West Point. The purpose of each workshop was

to consider the role of mathematics in their discipline over the next five to ten years and to formulate a description of what students in that discipline needed to learn in their first two years of college mathematics. The West Point Conference consolidated the individual workshop reports into a set of statements and recommendations for the Committee on the Undergraduate Program in Mathematics (CUPM). Panelists **William H. Barker**, Bowdoin College, **William G. McCallum**, University of Arizona, **Harriet S. Pollatsek**, Mount Holyoke College, and **Donald B. Small** will reflect on the disciplinary-based workshops and the West Point Conference. The panel will be moderated by **Kathleen Snook**, U.S. Military Academy, and is sponsored by the MAA CUPM Subcommittee on Calculus Reform and the First Two Years (CRAFTY).

Enhance Undergraduate Mathematics Courses Using Globally Interactive, Live Dynamic Mathematics on the Web, Wednesday, 2:45 p.m.–4:15 p.m., organized by **Joan Bookbinder**, Arlington Heights, IL. Using LiveMath Maker, mathematics educators can create symbolically correct, interactive, dynamic notebooks or "mathlets", including animations, which can be accessed and interacted with by colleagues and students using a free browser plug-in. No programming, no code to learn—just drag and drop and a few clicks of a mouse. These notebooks also integrate into course management systems such as WebCT or BlackBoard and can be created in over twelve languages.

Reforming College Algebra, Wednesday, 2:45 p.m.–4:15 p.m., organized by **Donald B. Small**, U.S. Military Academy. The college algebra reform movement has focused attention on the largest block of students enrolled in mathematics. In several schools, the enrollment in college algebra is larger than that in all other mathematics courses combined. The panelists will discuss their studies of college algebra students (who are they? how do they fare? where do they go?) and then open up the discussion to participant participation. Panelists include **Steven R. Dunbar**, University of Nebraska, and **Mercedes A. McGowen**, William Rainey Harper College. The panel will be moderated by **Donald B. Small** and is sponsored by the MAA CUPM Subcommittee on Calculus Reform and the First Two Years (CRAFTY).

MAA Student Activities

Information on the special **Student Lecture** on Friday evening is included in the "MAA Invited Address" section.

Undergraduate Student Poster Session, Tuesday, 4:00 p.m.–6:30 p.m., organized by **Mario U. Martelli**, Claremont McKenna College. Send title and one-page abstract including author's name, address, phone number, e-mail, and the name of the faculty advisor to Mario Martelli, mario_martelli@mckenna.edu, Mathematics Department, Claremont McKenna College, Claremont, CA 91711, by December 10, 2001. Notification of acceptance will be e-mailed two weeks after the abstract has been received. Apply early! Space is limited. The session is reserved to undergraduates. First-year graduate students may submit posters about work done while undergraduates. Posters' content cannot be purely expository. The best posters will be awarded a monetary prize with funds provided by MAA, AMS, and CUR. Tri-fold, self-standing 48" x 36" tabletop posters will be provided. Additional material or equipment is the responsibility of each presenter. This session is sponsored by the MAA and the National Security Agency.

Other student opportunities appear under the "Social Events" section.

MAA Short Course

A Sampler of Applications of Graph Theory, Friday and Saturday, January 4 and 5, organized by **Fred S. Roberts**, Rutgers University.

The Short Course will survey a variety of applications of graph theory. Graph theory is an old subject that has found a vast number of exciting applications in recent years. The speakers will introduce the graph-theoretical topics needed, describe both historical and current applications, and discuss current research topics in graph theory related to the applications. Many of the topics to be covered will be amenable to discussion in the classroom and will make good research topics for both researchers and students. No prior knowledge of graph theory will be required. Speakers and their talks include **Nathaniel Dean**, Rice University, *Applications to network visualization*; **Sridhar Rajagopalan**, IBM Almaden, *The graph structure of the World Wide Web*; **Ramamoorthy Ravi**, Carnegie Mellon University, *Applications to molecular biology*; **K. Brooks Reid**, California State University, San Marcos, *Applications to facility location*; **Fred S. Roberts**, *Social networks*; and **Peter M. Winkler**, Bell Labs, *Applications to statistical physics*.

Please note that there is a separate registration fee for this Short Course. To register in advance, please use the Advance Registration/Housing Form found at the back of this issue, or see http://www.ams.org/amsmtgs/2049_registration.html. Advance registration fees are $125/member; $175/nonmember; and $50/student, unemployed, emeritus. On-site registration fees are $140/member; $190/nonmember; and $60/student, unemployed, emeritus.

Other MAA Events

Board of Governors, Saturday, 8:30 a.m.–4:00 p.m.

Section Officers, Sunday, 4:30 p.m.–6:30 p.m.

Business Meeting, Wednesday, 11:10 a.m.–11:40 a.m.

See the listings for various receptions in the "Social Events" section.

Society for Industrial and Applied Mathematics

Invited Address

Tony F. Chan, University of California Los Angeles and Institute for Pure and Applied Mathematics, *Variational PDE models and algorithms in image processing*, Monday, 11:10 a.m.

Minisymposia

Optimization for modeling and simulation: Theory versus practice, organized by **Juan C. Meza**, Sandia National Laboratories, Sunday morning.

Modeling and simulation for thin films, organized by **Russel Caflisch**, University of California Los Angeles, Sunday morning.

Applications of symmetry in dynamical systems, organized by **Debra K. Lewis**, University of California Santa Cruz, Sunday afternoon.

Partial differential equations and applications, organized by **Oscar P. Bruno**, California Institute of Technology, Monday morning.

Mathematics and computers in biology and medicine, organized by **Angela Y. Cheer**, University of California Davis, Monday morning.

Mathematical models for image analysis and computer vision, organized by **Luminita Aura Vese**, University of California Los Angeles, Monday afternoon.

Undergraduate programs and research projects in applied and computational mathematics, organized by **Terry L. Herdman**, Virginia Polytechnic Institute and State University, Monday afternoon.

Activities of Other Organizations

Several organizations or special groups are having receptions or other social events. Please see the "Social Events" section of this announcement for details.

Association for Symbolic Logic (ASL)

This two-day program on Tuesday and Wednesday will include Invited Address and sessions of contributed papers. The following speakers will give invited addresses; titles, days, and times will be listed in the program.

Michael Benedikt, Lucent Technology/Bell Labs (Naperville, IL);
John D. Clemens, California Institute of Technology;
Rodney G. Downey, Victoria University (New Zealand);
Sergey Goncharov, Novosibirsk State University;
Martin Grohe, University of Freiburg;
Leonid Libkin, University of Toronto;
Philipp S. Rothmaler, Wesleyan University;
Moshe Vardi, Rice University; and
Martin Zeman, University of California Irvine.

See also the Special Session jointly sponsored by ASL in the "Joint Special Sessions" section.

Association for Women in Mathematics (AWM)

Twenty-Second Annual Emmy Noether Lecture, Monday, 9:00 a.m.–9:50 a.m., **Lenore C. Blum**, Carnegie Mellon University, *Computing over the Reals: Where Turing Meets Newton*.

A dinner in honor of the lecturer will be held on Sunday evening. See the "Social Events" section for details on how to participate.

Mathematics after High School: How to Promote Success for More, Sunday, 3:20 p.m.–4:20 p.m., organized by **Catherine B. Kessel**, University of California Berkeley, **Suzanne M. Lenhart**, University of Tennessee and Oak Ridge National Laboratory, and **Teri Jo Murphy**, University of Oklahoma.

At the conclusion of the panel discussion, AWM will recognize the Alice T. Schafer prizewinner, runner-up, and honorable mention honorees. Note that formal prizewinner announcements are made at the Joint Prize Session on Monday afternoon (see the AWM inclusion in the "Joint Sessions" section at the beginning of this announcement).

Business Meeting, Sunday, 4:20 p.m.–4:50 p.m.

Workshop, Wednesday, 8:30 a.m.–5:00 p.m. With funding from the Office of Naval Research and the National Science Foundation (pending final funding approval), AWM will conduct its workshop for women graduate students and women who have received the Ph.D. within the last five years.

Twenty women mathematicians have been selected in advance of this workshop to present their research. The selected graduate students will present posters, and the recent Ph.D.'s will give 20-minute talks. Travel funds are provided to the twenty selected presenters. The workshop will also include a panel discussion on issues of career development and a luncheon. Participants will have the opportunity to meet with other women mathematicians at all stages of their careers. All mathematicians (female and male) are invited to attend the entire program. Departments are urged to help graduate students and recent Ph.D.'s who do not receive funding to obtain some institutional support to attend the workshop and the associated meetings. The deadline for applications for presenting and funding has expired. Inquiries regarding future workshops may be made to AWM by telephone: 301-405-7892, by e-mail: `awm@math.umd.edu`, or by visiting `http://www.awm-math.org/`.

AWM seeks volunteers to lead discussion groups and to act as mentors for workshop participants. If you are interested in volunteering, please contact the AWM office.

Reception, Sunday, 9:30 p.m.–11:00 p.m. See the listing in the "Social Events" section of this announcement.

National Association of Mathematicians (NAM)

Granville-Brown Session of Presentations by Recent Doctoral Recipients in the Mathematical Sciences, Tuesday, 1:00 p.m.–5:00 p.m., moderated by **William A. Massey**, Lucent Technologies.

Cox-Talbot Address, to be given by **Gloria C. Hewitt**, University of Montana, Tuesday after the banquet.

Distance Learning, a panel discussion on Wednesday, 9:00 a.m.–9:50 a.m.

Business Meeting, Wednesday, 10:00 a.m.–10:50 a.m.

William W. S. Claytor Lecture: Katherine Okikiolu, University of California San Diego, *Title to be announced*, Wednesday, 1:00 p.m.

See details about the banquet on Tuesday in the "Social Events" section.

National Science Foundation (NSF)

The NSF will be represented at a booth in the exhibit area. NSF staff members will be available to provide

counsel and information on NSF programs of interest to mathematicians. The booth is open the same days and hours as the exhibits. Times that staff will be available will be posted at the booth.

Pi Mu Epsilon (PME)

Council Meeting, Tuesday, 8:00 a.m.–11:00 a.m.

Rocky Mountain Mathematics Consortium (RMMC)

Board of Directors Meeting, Tuesday, 2:15 p.m.–4:10 p.m.

Young Mathematicians Network (YMN)

Concerns of Young Mathematicians: A Town Meeting, Sunday, 7:15 p.m.–8:15 p.m., organized by **Kevin E. Charlwood**, Washburn University. This panel discussion will focus on the current primary concerns of young mathematicians, with emphasis on audience participation.

Also see details about the poster session (Monday afternoon) and two panel discussions (Tuesday afternoon at 5:30 p.m. and 6:00 p.m.) cosponsored by YMN under the "Other MAA Sessions" listings.

Ancillary Conference

American Statistical Association (ASA): Mathematicians and others who teach courses in introductory statistics will be pleased to know that the course Teaching Statistics with Active Learning will again be offered on January 4 and 5 preceding the Joint Mathematics Meetings in San Diego. Presenters for this two-day LearnSTAT course are Beth L. Chance and Allan J. Rossman, California Polytechnic State University. The course is designed for instructors from universities, colleges, junior colleges, and high schools. It will actively involve participants with hands-on investigations that can be adopted for use with students. The course is of particular value to those who teach statistics but have little training in the discipline. Visit the LearnSTAT site at `http://www.amstat.org/education/learnstat.html` for complete course description, registration, hotel information, and course cost. Inquiries can be directed to: `learnstat@amstat.org`.

Social Events

It is strongly recommended that for any event requiring a ticket, tickets should be purchased through advance registration. Only a very limited number of tickets, if any, will be available for sale on site. If you must cancel your participation in a ticketed event, you may request a 50% refund by returning your ticket(s) to the Mathematics Meetings Service Bureau (MMSB) **by December 21**. After that date no refunds can be made. Special meals are available at banquets upon advance request, but this must be indicated on the Advance Registration/Housing Form.

Student Hospitality Center, Sunday–Tuesday, 9:00 a.m.–5:00 p.m., and Wednesday, 9:00 a.m.–3:00 p.m., organized by **Richard Neal**, University of Oklahoma.

Graduate Student Reception, Sunday, 5:00 p.m.–6:00 p.m. Mathematicians representing a wide range of disciplines will join interested graduate students at an informal reception. Complimentary food and beverages will be served. NOTE: This event is only for students who sign up on the Advance Registration/Housing Form.

Reception for First-Time Participants, Sunday, 6:00 p.m.–7:00 p.m. The AMS and the MAA Committee on Membership are cosponsoring a social hour on Sunday from 6:00 p.m. to 7:00 p.m. All participants (especially first-timers) are encouraged to come and meet some old-timers and pick up a few tips on how to survive the environment of a large meeting. Refreshment will be served.

All participants are invited to a **dinner to honor AWM's Noether Lecturer** on Sunday. A sign-up sheet for those interested will be located at the AWM table in the exhibit area and also at the AWM panel discussion.

AWM Reception: There is an open reception on Sunday at 9:30 p.m. after the AMS Gibbs Lecture. This has been a popular, well-attended event in the past.

MER Banquet: The Mathematicians and Education Reform (MER) Network welcomes all mathematicians who are interested in precollege, undergraduate, and/or graduate educational reform to attend the MER banquet on Monday evening. This is an opportunity to make or renew contacts with other mathematicians who are involved in education projects and to engage in lively conversation about educational issues. The after-dinner discussion is an open forum for participants to voice their impressions, observations, and analyses of the current education scene. There will be a cash bar beginning at 6:30 p.m. Dinner will be served at 7:30 p.m. Tickets are $47 each, including tax and gratuity.

Joint Pi Mu Epsilon and MAA Student Chapter Advisors' Breakfast, Tuesday, 7:00 a.m.–8:00 a.m.; contact Richard Jarvinen, `rdjarvinen@vax02.winona.msus.edu`.

Welcome Reception for Mathematicians in Business, Industry, and Government, Tuesday, 5:00 p.m.–6:00 p.m., organized by **Phil Gustafson**, Mesa State College. This reception is open to all conference participants and in particular to those interested in the mathematics of business, industry, and government (BIG). The reception will be a great opportunity to interact with BIG mathematicians and learn more about BIG mathematics. The reception is sponsored by the BIG SIGMAA.

NAM Banquet, Tuesday, 5:30 p.m. to 8:00 p.m. The National Association of Mathematicians will host a banquet on Tuesday evening. A cash bar reception will be held at 5:30 p.m., and dinner will be served at 6:00 p.m. Tickets are $47 each, including tax and gratuity.

MAA Project NExT Reception, Tuesday, 8:30 p.m.–10:30 p.m., organized by **Christine Stevens**, St. Louis University. All MAA Project NExT national and Section NExT Fellows, consultants, and other friends of MAA Project NExT are invited.

AMS Banquet: As a fitting culmination to the meetings, the AMS banquet provides an excellent opportunity to socialize with fellow participants in a relaxed atmosphere. The participant who has been a member of the Society for the greatest number of years will be recognized and will receive a special award. The banquet will be held on Wednesday, with a cash bar reception at 6:30 p.m. and dinner at 7:30 p.m. Tickets are $47, including tax and gratuity.

A special highlight of the evening will be a talk by **Hendrick W. Lenstra Jr.**, University of California Berkeley, on *Pi in de Pieterskerk*. On July 5, 2000, the Dutch crown prince Willem-Alexander unveiled in the historic Pieterskerk in Leiden a stone commemorating the Dutch mathematician Ludolph van Ceulen (1540–1610). Van Ceulen achieved fame for his accurate computation of the number pi. Remarkably, his result was first made public on his tombstone, a unique mathematical monument that was lost in the early nineteenth century. In the lecture the speaker will describe the rediscovery of the original text on the tombstone and his initiative to have a replacement copy made and installed in the Pieterskerk.

Other Events of Interest

AMS Information Booth: All meeting participants are invited to visit the AMS Information Booth during the meeting. Complimentary coffee and tea will be served. A special gift will be available for participants, compliments of the AMS. The membership manager of the Society will be at the booth to answer questions about membership.

Book Sales and Exhibits: All participants are encouraged to visit the book, education media, and software exhibits from noon to 5:30 p.m. on Sunday, 9:30 a.m. to 5:30 p.m. on Monday and Tuesday, and 9:00 a.m. to noon on Wednesday. Books published by the AMS and MAA will be sold at discounted prices somewhat below the cost for the same books purchased by mail. These discounts will be available only to registered participants wearing the official meetings badge. Most major credit cards will be accepted for book sale purchases at the meetings. Also, AMS electronic products and the AMS website will be demonstrated. Participants visiting the exhibits will be asked to display their meetings badge or acknowledgment of advance registration from the Mathematics Meetings Service Bureau (MMSB) in order to enter the exhibit area.

Mathematical Sciences Employment Center: Those wishing to participate in the Mathematical Sciences Employment Center should read carefully the important article about the Center beginning on in this issue of *Notices* or at `http://www.ams.org/emp-reg/`.

Networking Opportunities: There are many opportunities to meet new friends and greet old acquaintances in addition to the vast array of scientific sessions offered at these meetings. Newcomers may want to investigate the many receptions listed in the "Social Events" section, the Student Hospitality Center, and the Employment Center. On site a Networking Center featuring casual seating and lists of registered participants sorted by school and math subject classification will be available for your perusal. This is a great place to relax between sessions and forge new friendships.

Registering in Advance and Hotel Accommodations

How to Register in Advance: The importance of advance registration cannot be overemphasized. Advance registration fees are considerably lower than the fees that will be charged for registration at the meeting. Participants registering by November 7 will receive their badges, programs, and tickets purchased in advance by mail approximately three weeks before the meetings, unless they check the appropriate box to the contrary on the Advance Registration/Housing Form. Because of delays that occur in U.S. mail to Canada, it is strongly suggested that advance registrants from Canada choose to pick up their materials at the meetings. Because of delays that occur in U.S. mail to overseas, materials are never mailed overseas. There will be a special Registration Assistance Desk at the Joint Meetings to assist individuals who either do not receive this mailing or who have a problem with their registration. Please note that a $5 replacement fee will be charged for programs and badges that are mailed but not taken to San Diego. Acknowledgments of registrations will be sent by e-mail to the e-mail addresses given on the Advance Registration/Housing Form. If you do not wish your registration acknowledged by e-mail, please mark the appropriate box on the form.

E-mail Advance Registration: This service is available for advance registration and housing arrangements by requesting the forms via e-mail from `meetreg-request@ams.org`, or by visiting `http://www.ams.org/amsmtgs/2049_registration.html`. VISA, MasterCard, Discover, and American Express are the only methods of payment which can be accepted for e-mail advance registration, and charges to credit cards will be made in U.S. funds. Completed e-mail forms should be sent to `meetreg-submit@ams.org`. All advance registrants will receive acknowledgment of payment prior to the meetings.

Internet Advance Registration: This service is available for advance registration and housing arrangements at `http://www.ams.org/amsmtgs/2049_registration.html`. VISA, MasterCard, Discover, and American Express

are the only methods of payment which are accepted for Internet advance registration, and charges to credit cards will be made in U.S. funds. All Internet advance registrants will receive acknowledgment of payment upon submission of this form.

Cancellation Policy: Those who cancel their advance registration for the meetings, MAA Minicourses, or Short Courses by January 2 (the deadline for refunds for banquet tickets is December 21) will receive a 50% refund of fees paid. No refunds will be issued after this date.

Joint Mathematics Meetings Registration Fees

	by Dec. 10	at meeting
Member of AMS, ASL, Canadian Mathematical Society, MAA, SIAM	$185	$241
Emeritus Member of AMS, MAA; Graduate Student; Unemployed; Librarian; High School Teacher; Developing Countries Special Rate	35	45
Undergraduate Student	20	26
Temporarily Employed	145	166
Nonmember	287	373
High School Student	2	5
One-Day Member of AMS, ASL, CMS, MAA, SIAM	n/a	132
One-Day Nonmember	n/a	205
Nonmathematician Guest	5	5
Employment Center		
Employer (first table)	$210	$300
Employer (each additional table)	60	100
Employer Posting Fee	50	N/A
Applicants (all services)	40	75
Applicants (*Winter List* & message center only)	20	20
AMS Short Course		
Member of AMS or MAA	$ 80	$100
Nonmember	110	130
Student/Unemployed/Emeritus	35	50
MAA Minicourses		
Minicourses #9–16	$60	$60*
Minicourses #1–8	90	90*
*if space is available		
MAA Short Course		
MAA Member	$125	$140
Nonmember	175	190
Student/Unemployed/Emeritus	50	60

Full-Time Students: Those currently working toward a degree or diploma. Students are asked to determine whether their status can be described as graduate (working toward a degree beyond the bachelor's), undergraduate (working toward a bachelor's degree), or high school (working toward a high school diploma) and to mark the Advance Registration/Housing Form accordingly.

Emeritus: Persons who qualify for emeritus membership in either the Society or the Association. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more and who retired because of age or long-term disability from his or her latest position.

Librarian: Any librarian who is not a professional mathematician.

Unemployed: Any person currently unemployed, actively seeking employment, and not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

Developing Country Participant: Any person employed in developing countries where salary levels are radically noncommensurate with those in the U.S.

Temporarily Employed: Any person currently employed but who will become unemployed by June 1, 2002, and who is actively seeking employment.

Nonmathematician Guest: Any family member or friend who is not a mathematician and who is accompanied by a participant of the meetings. These official guests will receive a badge and may attend all sessions and the exhibits.

Participants who are not members of the AMS and/or the MAA will receive mailings after the meetings are over with a special membership offer from AMS and MAA.

Advance registration and on-site registration fees only partially cover the expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register and should be prepared to show their badges if so requested. Badges are required to enter the exhibit area, to obtain discounts at the AMS and MAA Book Sales, and to cash a check with the Joint Meetings cashier. If a registrant should arrive too late in the day to pick up his/her badge, he/she may show the acknowledgment of advance registration received from the MMSB as proof of registration.

Advance registration forms accompanied by insufficient payment either will be returned, thereby delaying the processing of any housing request, or a $5 charge will be assessed if an invoice must be prepared to collect the delinquent amount. Overpayments of less than $5 will not be refunded.

For each invalid check or credit card transaction that results in an insufficient payment for registration or housing, a $5 charge will be assessed. Participants should check with their tax preparers for applicable deductions for education expenses as they pertain to these meetings.

If you wish to be included in a **list of individuals sorted by mathematical interest**, please provide the one mathematics subject classification number of your major area of interest on the Advance Registration/Housing Form. (A list of these numbers is available by sending an empty e-mail message to `abs-submit@ams.org`; include the number 973 as the subject of the message.) Copies of this list will be available for your perusal in the Networking Center.

If you do not wish to be included in any mailing list used for promotional purposes, please indicate this in the appropriate box on the Advance Registration/Housing Form.

Advance Registration Deadlines

There are three separate advance registration deadlines, each with its own advantages and benefits.

EARLY advance registration

(room lottery, inclusion in the *Winter Lists* for the Employment Center) **October 26**

ORDINARY advance registration (hotel reservations, materials mailed) **November 7**

FINAL advance registration (advance registration, Short Courses, Employment Center, MAA Minicourses, banquets) **December 10**

Early Advance Registration: Those who register by the **early** deadline of October 26 will be included in a random drawing to select winners of complimentary hotel rooms in San Diego. Multiple occupancy is permissible. The location of rooms to be used in this lottery will be based on the number of complimentary rooms available in the various hotels. Therefore, the free room may not necessarily be in the winner's first-choice hotel. The winners will be notified by mail prior to December 25. So register early! (See the list of the winners in New Orleans on the hotel page.) Also, applicant and employer forms must be received by October 26 in order to be reproduced in the *Winter Lists* for the Employment Center.

Ordinary Advance Registration: Those who register after October 26 and by the **ordinary** deadline of November 7 may use the housing services offered by the MMSB but are not eligible for the room lottery. You may also elect to receive your badge and program by mail in advance of the meetings.

Final Advance Registration: Those who register after November 7 and by the **final** deadline of December 10 must pick up their badges, programs, and any tickets for social events at the meetings. Unfortunately, it is not possible to provide **final** advance registrants with housing. Please note that the **December 10 deadline is firm**; any forms received after that date will be returned and full refunds issued. Please come to the registration desk in Hall B of the San Diego Convention Center to register on site.

Hotel Reservations

Participants should be aware that the AMS and MAA contract only with facilities who are working toward being in compliance with the public accommodations requirements of the ADA.

Participants requiring hotel reservations should read the instructions on the following hotel pages. Participants who did not reserve a room during advance registration and would like to obtain a room at one of the hotels listed on the following pages should call the hotels directly after December 14. However, after that date the MMSB can no longer guarantee availability of rooms or special convention rates. Participants should be aware that most hotels are starting to charge a penalty fee to guests for departure changes made after guests have checked into their rooms. Participants should inquire about this at check-in and make their final plans accordingly.

Participants should also be aware that it is general hotel practice in most cities to hold a nonguaranteed reservation until 6:00 p.m. only. When one guarantees a reservation by paying a deposit or submitting a credit card number as a guarantee in advance, however, the hotel usually will honor this reservation up until checkout time the following day. If the individual holding the reservation has not checked in by that time, the room is then released for sale, and the hotel retains the deposit or applies one night's room charge to the credit card number submitted.

If you hold a guaranteed reservation at a hotel but are informed upon arrival that there is no room for you, there are certain things you can request the hotel do. First, they should provide for a room at another hotel in town for that evening at no charge. (You already paid for the first night when you made your deposit.) They should pay for taxi fares to the other hotel that evening and back to the meetings the following morning. They should also pay for one telephone toll call so that you can let people know you are not at the hotel you expected. They should make every effort to find a room for you in their hotel the following day and, if successful, pay your taxi fares to and from the second hotel so that you can pick up your baggage and bring it to the first hotel. Not all hotels in all cities follow this practice, so your request for these services may bring mixed results or none at all.

Miscellaneous Information

Audio-Visual Equipment: Standard equipment in all session rooms is one overhead projector and screen. (Invited 50-minute speakers are automatically provided with two overhead projectors.) Blackboards are not available. Organizers of sessions that by their nature demand additional equipment (e.g., VCR and monitor or projection panel) and where the majority of speakers in the session require this equipment should contact the audio-visual coordinator for the meetings at the AMS office in Providence at 401-455-4140 or by e-mail at `wsd@ams.org` to obtain the necessary approvals. Individual speakers must consult with the session organizer(s) if additional equipment or services are needed. If your session has no organizer, please contact the audio-visual coordinator directly. All requests should be received by November 4.

Equipment requests made at the meetings most likely will not be granted because of budgetary restrictions. Unfortunately no audio-visual equipment can be provided for committee meetings or other meetings or gatherings not on the scientific program.

Childcare: The Marriott Hotel and Marina will provide recommendations for in-room childcare for guests through their concierge desks. Call 619-234-1500 and ask for the concierge desk at least one day in advance. For other hotels you should make inquiries with the front desk. Arrangements represent a contractual agreement between each individual and the child-care provider. The Joint Meetings assumes no responsibility for the services rendered.

E-mail Services: The AMS and MAA are pleased to announce that Wolfram Research, Inc., makers of Mathematica, will once again sponsor e-mail access for all Joint Meeting participants. The hours of operation will be published in the program. The AMS and MAA

How to Obtain Hotel Accommodations

Room Lottery: (See the ***How to Register in Advance*** section to learn how to qualify for this year's room lottery.) Last year's winners were Marlow Anderson, Jan Hogendijk, Keith Howard, Stacy Langton, Shayne Redmond, and Rebecca Sparks.

General Instructions: Participants must register in advance in order to obtain hotel accommodations through the Mathematics Meetings Service Bureau (MMSB). Special meeting rates have been negotiated at the following hotels. These rates apply exclusively to reservations made through the MMSB. Hotels will start accepting reservations directly after **December 14**, at which time rooms and rates will be based on availability. **A higher rate will be applied to any rooms reserved directly with the hotels before December 14.**

To make a reservation, please submit a completed housing section of the Advance Registration/Housing (ARH) Form (paper or electronic) with a guarantee by **November 7. Sorry, reservations cannot be taken by phone.** Participants interested in reserving suites are urged to call hotels directly for capacity and price information before submitting their reservation requests to the MMSB.

Deadlines:

- Room lottery qualification: **October 26, 2001**
- Reservations through MMSB: **November 7, 2001**
- Changes/cancellations through MMSB: **December 6, 2001**

Rates:

- Subject to 10.5% state/local tax and a California Commerce fee of $.13
- Only certified students or unemployed mathematicians qualify for student rates.
- See ARH Form for detailed rate structure of each property.
- **Rates at hotels may be subject to an energy surcharge. Participants are not obligated to pay an energy surcharge and may use their own discretion in this decision.**

General Information:

- Check-in: 4:00 p.m./checkout: noon – Embassy Suites, Holiday Inn, and Clarion Bay View (For all others, check-in is at 3:00 p.m., checkout is noon.)
- **Windows do not open** in rooms unless otherwise indicated.
- Children are free, where appropriate, in existing beds only.
- Limited availability of cribs, free of charge

Guarantee Requirements:

- One night deposit by check, or
- Credit cards accepted: VISA, MC, AMEX, and Diners (Cards may be charged one night deposit.)

San Diego Marriott (Headquarters)

(Next door to Convention Center)

333 W. Harbor Drive
San Diego, CA 92101-7700
(619) 234-1500
Bay view - $176 single/double
City view - $156 single/double
Students - $128 single/double

Restaurants; bars; gift shop; heated outdoor pools; health club and exercise room; tennis court; marina; gift shop; parking $18 (valet), $14 (self); all rooms have full amenities (no safes or mini bars) in two towers (North Tower and South Tower); Web TV and data ports in all rooms; windows open in most rooms; children under 18 years free

Embassy Suites

(.75 mile to Convention Center)

601 Pacific Highway
San Diego, CA 92101
(800) 362-2779
(619) 239-2400
Regular - $148 single/double
Bay view - $168 single/double
Students - $138 single/double
(Rates include complimentary cooked-to-order breakfast and evening beverages.)

Restaurant; lounge; fitness center; indoor pool; gift shop; parking $14 (self), $16 (valet); all rooms are suites with parlor rooms and full amenities (no safes) including refrigerator and microwave oven; sleeper sofas in parlors; windows open in rooms; dual phone lines and data ports in all rooms; children under 12 years free

Wyndham San Diego at Emerald Plaza

(1 mile to Convention Center)

400 West Broadway
San Diego, CA 92101
(619) 239-4500
Regular - $147 single/double
Students - $137 single/double

Restaurant; lounge; gift shop; spa; health club; heated outdoor pool; glass elevators; valet parking $18; complimentary airport shuttle; all rooms have full amenities including mini bars; high speed internet access in all rooms; children under 18 years free

Horton Grand

(.38 mile to Convention Center)

311 Island Avenue
San Diego, CA 92101
(800) 542-1886
(619) 544-1886
Regular - $145 single/double
Students - $135 single/double

Historical hotel; restaurant; bar; parking $15 (valet); all rooms have full amenities (no safes or mini bars); majority of rooms have one queen bed; balconies in some rooms; windows open in some rooms; children under 10 years free

The Bristol San Diego

(.75 mile to Convention Center)

1055 First Avenue
San Diego, CA 92101
(619) 232-6141
Regular - $140 single/double
Students - $130 single/double
(Rates include complimentary deluxe continental breakfast.)

Restaurant; health club; parking $12 (valet); all rooms have full amenities (no safes); Web TV available in rooms; windows open in rooms; children under 17 in the same room as parents free

Westin Horton Plaza

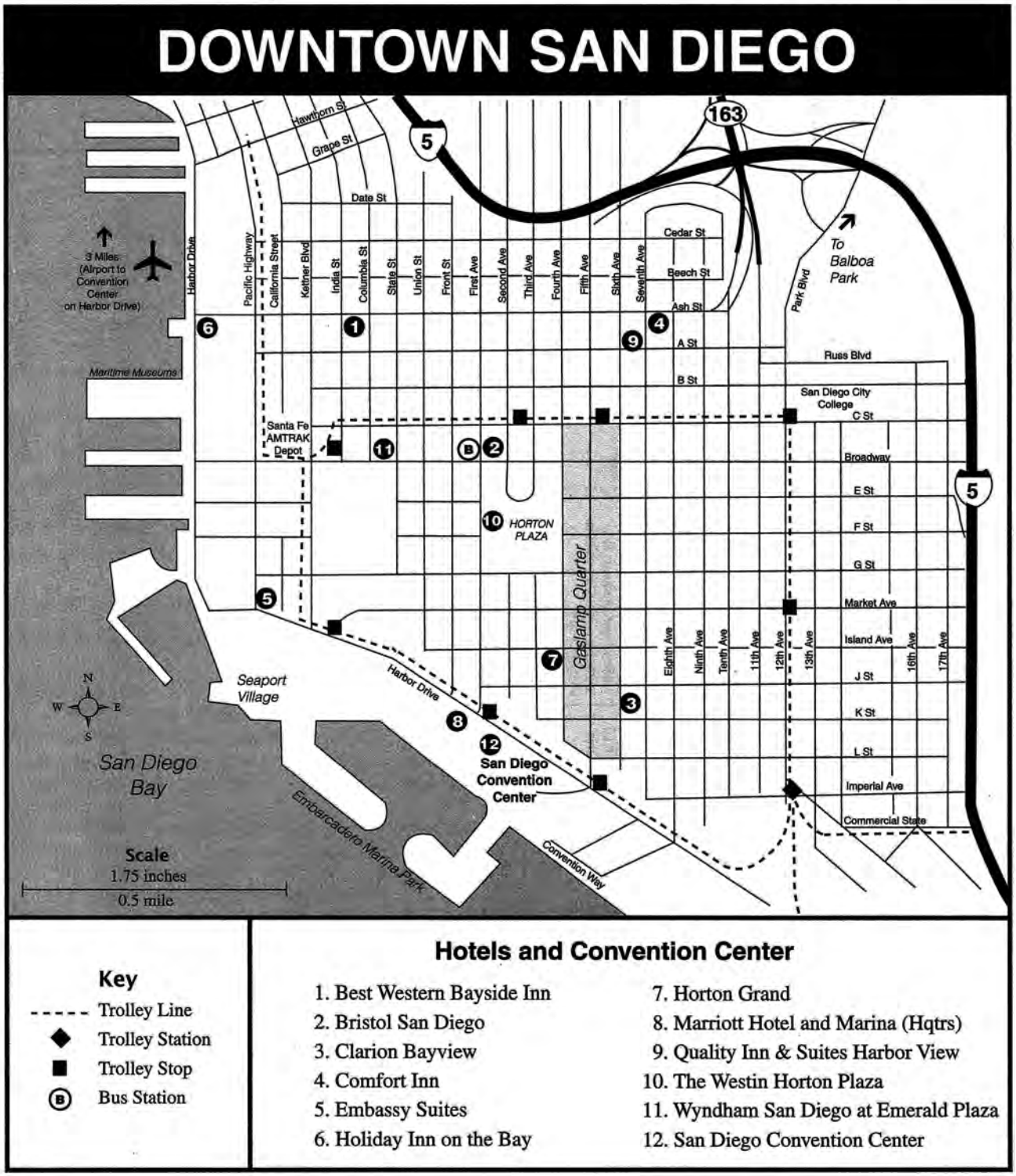
(.5 mile to Convention Center)

910 Broadway Circle
San Diego, CA 92101
(619) 239-2200
Regular - $139 single, $149 double

Restaurants; lounges; gift shop; health club and sauna; heated outdoor pool; parking $18 (valet), $15 (self); all rooms have full amenities (no safes) including refreshment centers; fax/computer data ports in rooms; children under 18 years free

Continued θ

Holiday Inn on the Bay	Clarion Bay View	Best Western Bayside Inn	Quality Inn and Suites	Comfort Inn	Attention Students
(1.6 miles to Convention Center) *(1 block to trolley)* 1355 North Harbor Bay San Diego, CA 92101 (800) 877-8920 (619) 232-3861 Regular $138 single, $148 double Bay view $158 single, $168 double Restaurants; lounge; gift shop; fitness room; heated outdoor pool; parking $13 (self); complimentary airport shuttle; all rooms have full amenities (no safes or mini bars); most rooms have patios; windows open in all rooms; phones with data ports in all rooms; children under 18 years free	*(.38 mile to Convention Center)* 660 K Street San Diego, CA 92101 (800) 766-0234 (619) 696-0234 Regular $138 single/double Student $128 single/double Restaurant; lounge; gift shop; fitness center and spa; parking $10 (self); all rooms have full amenities; some rooms have mini bars; data ports in all rooms; windows open in rooms; children under 18 years free	*(1.25 miles to Convention Center* *(2 blocks to trolley)* 555 W. Ash Street San Diego, CA 92101 (800) 341-1818 (619) 233-7500 Regular $119 single/double Student $109 single/double Restaurant; lounge; outdoor heated pool and spa; complimentary parking; complimentary airport shuttle; all rooms have a private balcony and full amenities (no safes); all rooms have a microwave and refrigerator; some rooms have mini bars; data ports in rooms; children under 12 years free	*(1.8 miles to Convention Center* *(2 blocks to trolley)* 1430 7th Avenue San Diego, CA 92101 (619) 696-0911 Regular $109 single, $119 double (Rates include complimentary continental breakfast.) Restaurant; exercise room; outdoor heated pool; parking $6 (self); complimentary airport shuttle; all rooms with full amenities including in-room coffee; data ports in rooms; windows open in rooms; most rooms have balconies; children under 18 years	*(1.8 miles to Convention Center* *(3 blocks to trolley)* 719 Ash Street San Diego, CA 92101 (619) 232-2525 Regular $91 single/double (Rates include complimentary continental breakfast.) Restaurant; fitness room; outdoor heated spa; complimentary parking; complimentary airport shuttle; **rooms open from outside**; rooms have full amenities including in-room coffee; data ports in rooms; windows open in rooms; children under 18 years	As an alternative housing choice, **Hostelling International-San Diego Downtown** is located on the corner of 5th and Market Street in the soul of the city's Gaslamp Quarter. It is located four blocks from the Convention Center and three blocks from the Bayside Trolley. $18 - $19/day 521 Market Street San Diego, CA 92101 (619) 525-1531 (619) 338-0129 (fax) Please call directly for further information and reservations.


DOWNTOWN SAN DIEGO
Hawthorn St
Grape St
Date St
5
163
3 Miles
(Airport to
Convention
Center
on Harbor Drive)
Harbor Drive
Pacific Highway
California Street
Kettner Blvd
India St
Columbia St
State St
Union St
Front St
First Ave
Second Ave
Third Ave
Fourth Ave
Fifth Ave
Sixth Ave
Seventh Ave
Cedar St
Beech St
Ash St
A St
B St
To
Balboa
Park
Park Blvd
Russ Blvd
San Diego City
College
C St
Broadway
E St
F St
G St
Market Ave
Island Ave
J St
K St
L St
Imperial Ave
Commercial Street
Eighth Ave
Ninth Ave
Tenth Ave
11th Ave
12th Ave
13th Ave
16th Ave
17th Ave
Maritime Museums
Santa Fe
AMTRAK
Depot
HORTON
PLAZA
Gaslamp Quarter
Seaport
Village
Harbor Drive
San Diego
Bay
San Diego
Convention
Center
Embarcadero Marina Park
Convention Way
N
W
E
S
Scale
1.75 inches
0.5 mile
Key
Trolley Line
Trolley Station
Trolley Stop
Bus Station
Hotels and Convention Center
1. Best Western Bayside Inn
2. Bristol San Diego
3. Clarion Bayview
4. Comfort Inn
5. Embassy Suites
6. Holiday Inn on the Bay
7. Horton Grand
8. Marriott Hotel and Marina (Hqtrs)
9. Quality Inn & Suites Harbor View
10. The Westin Horton Plaza
11. Wyndham San Diego at Emerald Plaza
12. San Diego Convention Center

thank Wolfram Research for its generosity in providing this valuable service.

Information Distribution: Tables are set up in the exhibit area for dissemination of general information of possible interest to the members and for the dissemination of information of a mathematical nature not promoting a product or program for sale.

If a person or group wishes to display information of a mathematical nature promoting a product or program for sale, they may do so in the exhibit area at the Joint Books, Journals, and Promotional Materials exhibit for a fee of $55 (posters are slightly higher) per item. Please contact the exhibits manager, MMSB, P.O. Box 6887, Providence, RI 02940, for further details.

If a person or group would like to display material in the exhibit area separate from the Joint Books table, the proponent must reimburse the AMS and MAA for any extra furnishings requested (tables, chairs, easels, etc.) in addition to payment of the $55 per item fee. (This latter display is also subject to space availability.)

The administration of these tables is in the hands of the AMS-MAA Joint Meetings Committee, as are all arrangements for Joint Mathematics Meetings.

Local Information: See `http://www.sandiego.org/` for information about the city.

Petition Table: At the request of the AMS Committee on Human Rights of Mathematicians, a table will be made available in the exhibit area at which petitions on behalf of named individual mathematicians suffering from human rights violations may be displayed and signed by meetings participants acting in their individual capacities. For details contact the director of meetings in the Providence office at 401-455-4137 or by e-mail at `dms@ams.org`.

Signs of moderate size may be displayed at the table but must not represent that the case of the individual in question is backed by the Committee on Human Rights unless it has, in fact, so voted. Volunteers may be present at the table to provide information on individual cases, but notice must be sent at least seven days in advance of the meetings to the director of meetings in the Providence office. Since space is limited, it may also be necessary to limit the number of volunteers present at the table at any one time. The Committee on Human Rights may delegate a person to be present at the table at any or all times, taking precedence over other volunteers.

Any material that is not a petition (e.g., advertisements, résumés) will be removed by the staff. At the end of the exhibits on Wednesday, any material on the table will be discarded, so individuals placing petitions on the table should be sure to remove them prior to the close of exhibits.

Telephone Messages: The most convenient method for leaving a message is to do so with the participant's hotel. Another method would be to leave a message at the meetings registration desk from January 6 through 9 during the hours that the desk is open. These messages will be posted on the Math Meetings Message Board; however, staff at the desk will try to locate a participant in the event of a bona fide emergency. The telephone number will be published in the program.

Travel

San Diego is on Pacific Standard Time. The San Diego Airport (Lindbergh Field) is located in the city and is served by all major airlines.

Official airlines for the meetings are **US Airways, Delta Air Lines,** and **Southwest Airlines.** Given the volatility in airfares because of "fare wars", we cannot guarantee that these will be the lowest fares when you make your arrangements. However, we strongly urge participants to make use of this special deal if at all possible, since the AMS and MAA can earn complimentary tickets. These tickets are used to send meetings' staff (not officers or other staff) to the Joint Mathematics Meetings, thereby keeping the costs of the meetings (and registration fees) down.

The following specially negotiated rates are available only for these meetings and exclusively to mathematicians and their families for the period January 1–12, 2002. Other restrictions/discounts may apply, and seats are limited.

Delta Air Lines is offering special rates which allow you a 5% discount off Delta's published round-trip fares within the continental U.S., Hawaii, Alaska, Canada, Mexico, Bermuda, San Juan, Nassau, the U.S. Virgin Islands, and the Caribbean.

A 10% discount will be offered on Delta's domestic system based on the published unrestricted round-trip coach (Y06) rates. Applicable restrictions must be met, and seats are limited. Booking classes I and U are not eligible for discounts.

No advance reservation or ticketing is required, but if you purchase your ticket 60 days or more prior to departure, you can receive an additional 5% bonus discount.

Special round-trip zone fares are also available to all cities served by Delta and Delta Express. (Two-day minimum stay; no Saturday night stay is required.) Contact Delta at the number below for details.

These discounts are available **only** through the Delta Meeting Network® Reservations number 1-800-241-6760 by you or your travel agent. Reservations may be made between the hours of 8:00 a.m. and 11:00 p.m. Eastern Standard Time; refer to **File Number 179291A.**

Southwest Airlines is offering a 10% discount on most of its already low fares for air travel to and from the event. You or your travel agent may call Southwest Airlines Group and Meetings Reservations at 1-800-433-5368 and reference the **ID Code R6135.** Reservations sales agents are available 8:00 a.m.–5:00 p.m. Monday–Friday, or 9:30 a.m.–3:30 p.m. Saturday and Sunday. You must make reservations five or more days prior to travel to take advantage of this offer.

US Airways offers a 7% discount off First or Envoy Class and any published US Airways promotional round-trip fare. By purchasing your ticket 60 days or more prior to departure, you can receive an additional 3% bonus discount. Or choose a 12% discount off unrestricted coach fares with seven-day advance purchase. By purchasing your ticket 60 days or more prior to departure, you can receive an additional 3% bonus discount.

For reservations call (or have your travel agent call) the US Airways Group and Meeting Reservation Office toll free

at 1-877-874-7687 between 8:00 a.m. and 9:30 p.m. Eastern Standard Time. Refer to **Gold File number 74671953.**

Official car rental companies for the meeting are **Avis** and **Hertz.** All car rentals include unlimited free mileage and are available to renters 25 years and older.

Avis offers special convention rental rates effective December 28, 2001–January 16, 2002:

Car Type	Daily	Weekly	Weekend Daily
Subcompact	$34	$145	$24
Compact	38	160	25
Intermediate	41	170	26
Full-Size 2-Door	45	180	28
Full-Size 4-Door	48	189	29
Premium	51	200	32
Luxury	63	290	43
Minivan	63	290	42
Convertible	67	303	42
Sport Utility	63	290	42

Should a lower qualifying rate become available, Avis is pleased to present a 5% discount on that rate, or if a car size is selected that is not available above, Avis will discount the best available rate by 5%. Rates do not include any state or local surcharges, tax, optional coverages, or gas refueling charges. Renters must meet Avis's age, driver, and credit requirements. The 24-hour toll-free reservation number is 1-800-331-1600; cite **group ID number J098887.** Reservations can also be made online at `www.avis.com`.

Hertz offers special convention rates effective December 30, 2001–January 16, 2002:

Car Type	Daily	Weekly	Weekend Daily
Economy 2-Door	$35	$160	$25
Compact 4-Door	41	175	28
Midsize 2- or 4-Door	44	181	29
Sporty 2-Door	48	195	31
Full-Size 4-Door	50	204	32
Premium	54	215	35
Towncar	66	305	71
Minivan	60	300	70
Convertible	60	300	70
4-Wheel Drive	60	300	70

Meeting rates are subject to availability. Advance reservations are recommended; blackout dates may apply. Government surcharges, taxes, tax reimbursement, airport related fees, vehicle licensing fees, and optional items such as refueling or additional driver fees are extra. Minimum rental age is 25 (exceptions apply.) Standard rental conditions and qualifications apply. The 24-hour toll-free reservation number in the U.S. is 1-800-654-2240, in Canada is 1-800-263-0600; cite **group ID number 022J0510.**

Ground Transportation from the Airport: For each terminal at Lindbergh Field taxicabs are to be found at the ground level across the one-way street in front of the terminal. The fare to the Convention Center is about $10.

There are many shuttle buses to various hotels. The fare on the Cloud Nine Shuttle is $8.90/first fare and $5/second through seventh persons for those sharing a ride. Reservations can be made by calling 800-974-8885.

Driving Directions: From the airport: Go left on Harbor Drive towards downtown. After you pass Seaport Village, the San Diego Marriott will be on your right, followed by the Convention Center. The trip takes about twelve minutes.

From the north: Take Interstate 5 South. Exit to Front Street and follow for approximately one mile.

From the south: Take Interstate 5 North. Take the Civic Center/Pershing Drive exit. Turn left onto "B" Street, then left onto 8th Avenue. Make a right turn onto Market Street, then a left onto Front Street. Follow Front Street to the Convention Center and Marriott.

From the east: Take Interstate 8 West to Highway 163 South. Follow 163 into the city, where it turns into 10th Avenue. Take a right onto Market Street and then a left onto Front Street.

Weather

The temperature ranges from about 48° F. to 65° F. The sun shines during 72 percent of the daylight hours. Average precipitation in January is 2.2 inches. Visit your favorite weather site for up-to-the-minute forecasts, or see `http://www.usatoday.com/weather/basemaps/usaca/nw722900.htm`.

Ann Arbor, Michigan

University of Michigan

March 1–3, 2002

Meeting #974

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: January 2002
Program first available on AMS website: January 17, 2002
Program issue of electronic *Notices*: May 2002
Issue of *Abstracts*: To be announced

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: November 13, 2001
For abstracts: January 8, 2002

Invited Addresses

Lazlo Babai, University of Chicago, *Title to be announced.*

Netts Katz, Washington University, *Title to be announced.*

Alan Reid, University of Texas at Austin, *Title to be announced.*

Lihe Wang, University of Iowa, *Title to be announced.*

Special Sessions

Algebraic Combinatorics (Code: AMS SS H1), **Patricia Hersh**, University of Michigan, Ann Arbor, and **Brian D. Taylor**, Wayne State University.

Algebraic Topology (Code: AMS SS F1), **Robert Bruner**, Wayne State University, and **Igor Kriz**, University of Michigan, Ann Arbor.

Commutative Algebra (Code: AMS SS D1), **Florian Enescu**, University of Michigan, Ann Arbor, **Anurag K. Singh**, University of Utah, and **Karen E. Smith**, University of Michigan, Ann Arbor.

Hyperbolic Manifolds and Discrete Groups (Code: AMS SS E1), **Richard D. Canary**, University of Michigan, Ann Arbor, and **Alan W. Reid**, University of Texas, Austin.

Integrable systems and Poisson geometry (Code: AMS SS C1), **Anthony Block**, University of Michigan, **Philip Foth**, University of Arizona, and **Michael Gekhtman**, University of Notre Dame.

Moduli Spaces (Code: AMS SS G1), **Angela Gibney**, University of Michigan, Ann Arbor.

Quantum Topology in Dimension Three (Code: AMS SS A1), **Charles Frohman**, University of Iowa, and **Joanna Kania-Bartoszynska**, Boise State University.

Topics in Geometric Function Theory (Code: AMS SS B1), **David A. Herron**, University of Cincinnati, **Nageswari Shanmugalingam**, University of Texas, and **Jeremy T. Tyson**, SUNY at Stony Brook.

Atlanta, Georgia

Georgia Institute of Technology

March 8–10, 2002

Meeting #975

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: January 2002
Program first available on AMS website: January 31, 2002
Program issue of electronic *Notices*: May 2002
Issue of *Abstracts*: To be announced

Deadlines

For organizers: August 8, 2001
For consideration of contributed papers in Special Sessions: November 27, 2001
For abstracts: January 22, 2002
For summaries of papers to MAA organizers: To be announced

AMS Invited Addresses

Nigel J. Kalton, University of Missouri, Columbia, *Title to be announced.*

James G. Oxley, Louisiana State University, *Title to be announced.*

Montréal, Quebec, Canada

Centre de Recherches Mathématiques, Université de Montréal

May 3–5, 2002

Meeting #976

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: March 2002
Program first available on AMS website: March 21, 2002
Program issue of electronic *Notices*: July 2002
Issue of *Abstracts*: To be announced

Deadlines

For organizers: October 3, 2001
For consideration of contributed papers in Special Sessions: January 15, 2002
For abstracts: March 12, 2002

Invited Addresses

Nicholas M. Ercolani, University of Arizona, *Title to be announced.*

Lars Hesselholt, Massachusetts Institute of Technology, *Title to be announced.*

Niky Kamran, McGill University, *Title to be announced.*

Rafael de la Llave, University of Texas at Austin, *Title to be announced.*

Special Sessions

Combinatorial and Geometric Group Theory (Code: AMS SS A1), **Olga G. Kharlampovich**, McGill University, **Alexei Myasnikov** and **Vladimir Shpilrain**, City College, New York, and **Daniel Wise**, McGill University.

Combinatorial Hopf Algebras (Code: AMS SS C1), **Marcelo Aguiar**, Texas A&M University, **François Bergeron**, Université du Québec à Montréal, and **Christophe Reutenauer**, Université du Québec à Montréal.

Potential Theory (Code: AMS SS B1), **Paul M. Gauthier**, Université de Montréal, **K. Gowri Sankaran**, McGill University, and **David H. Singman**, George Mason University.

Pisa, Italy

June 12–16, 2002

Meeting #977

First Joint International Meeting between the AMS and the Unione Matematica Italiana.
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses

Luigi Ambrosio, Scuola Normale Superiore, *Title to be announced.*

Luis A. Caffarelli, University of Texas at Austin, *Title to be announced.*

Claudio Canuto, University of Torino, *Title to be announced.*

L. Craig Evans, University of California Berkeley, *Title to be announced.*

Giovanni Gallavotti, University of Rome I, *Title to be announced.*

Sergio Klainerman, Princeton University, *Title to be announced.*

Rahul V. Pandharipande, California Institute of Technology, *Title to be announced.*

Claudio Procesi, University of Rome, *Title to be announced.*

Portland, Oregon

Portland State University

June 20–22, 2002

Meeting #978

Western Section
Associate secretary: Bernard Russo
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: November 20, 2001
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions

Algebraic Geometry and Combinatorics (Code: AMS SS B1), **Eric Babson** and **Rekha Thomas**, University of Washington, and **Sergey Yuzvinsky**, University of Oregon.

Qualitative Properties and Applications of Functional Equations (Code: AMS SS A1), **Theodore A. Burton**, Southern Illinois University.

Boston, Massachusetts

Northeastern University

October 5–6, 2002

Meeting #979

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: August 2002
Program first available on AMS website: August 22, 2002
Program issue of electronic *Notices*: December 2002
Issue of *Abstracts*: To be announced

Deadlines

For organizers: March 5, 2002
For consideration of contributed papers in Special Sessions: June 18, 2002
For abstracts: August 13, 2002

Invited Addresses

Lou P. van den Dries, University of Illinois, Urbana-Champaign, *Title to be announced.*

Diane Henderson, Pennsylvania State University, *Title to be announced.*

Christopher K. King, Northeastern University, *Title to be announced.*

Xiaobo Liu, University of Notre Dame, *Title to be announced.*

Madison, Wisconsin

University of Wisconsin-Madison

October 12–13, 2002

Meeting #980

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: August 2002
Program first available on AMS website: August 29, 2002
Program issue of electronic *Notices*: December 2002
Issue of *Abstracts*: To be announced

Deadlines

For organizers: March 12, 2002
For consideration of contributed papers in Special Sessions: June 25, 2002
For abstracts: August 20, 2002

Invited Addresses

Lawrence Ein, University of Illinois at Chicago, *Title to be announced.*

Eleny Ionel, University of Wisconsin, *Title to be announced.*

Mikhail Safonov, University of Minnesota, *Title to be announced.*

John Sullivan, University of Illinois, Urbana-Champaign, *Title to be announced.*

Special Sessions

Arithmetic Algebraic Geometry (Code: AMS SS A1), **Ken Ono** and **Tonghai Yang**, University of Wisconsin-Madison.

Arrangements of Hyperplanes (Code: AMS SS E1), **Daniel C. Cohen**, Louisiana State University, **Peter Orlik**, University of Wisconsin-Madison, and **Anne Shepler**, University of California Santa Cruz.

Biological Computation and Learning in Intelligent Systems (Code: AMS SS S1), **Shun-ichi Amari**, RIKEN, **Amir Assadi**, University of Wisconsin-Madison, and **Tomaso Poggio**, MIT.

Combinatorics and Special Functions (Code: AMS SS T1), **Richard Askey** and **Paul Terwilliger**, University of Wisconsin-Madison.

Dynamical Systems (Code: AMS SS P1), **Sergey Bolotin** and **Paul Rabinowitz**, University of Wisconsin-Madison.

Effectiveness Questions in Model Theory (Code: AMS SS J1), **Charles McCoy**, **Reed Solomon**, and **Patrick Speissegger**, University of Wisconsin-Madison.

Geometric Methods in Differential Equations (Code: AMS SS H1), **Gloria Mari Beffa**, University of Wisconsin-Madison, and **Peter Olver**, University of Minnesota.

Geophysical Waves and Turbulence (Code: AMS SS M1), **Paul Milewski**, **Leslie Smith**, and **Fabian Waleffe**, University of Wisconsin-Madison.

Group Cohomology and Homotopy Theory (Code: AMS SS G1), **Alejandro Adem**, University of Wisconsin-Madison, and **Jesper Grodal**, Institute for Advanced Study.

Harmonic Analysis (Code: AMS SS C1), **Alex Ionescu** and **Andreas Seeger**, University of Wisconsin-Madison.

Hyperbolic Differential Equations and Kinetic Theory (Code: AMS SS K1), **Shi Jin**, **Marshall Slemrod**, and **Athanassios Tzavaras**, University of Wisconsin-Madison.

Lie Algebras and Related Topics (Code: AMS SS N1), **Georgia Benkart** and **Arun Ram**, University of Wisconsin-Madison.

Multiresolution Analysis and Data Presentation (Code: AMS SS F1), **Amos Ron**, University of Wisconsin-Madison.

Partial Differential Equations and Geometry (Code: AMS SS D1), **Sigurd Angenent** and **Mikhail Feldman**, University of Wisconsin-Madison.

Probability (Code: AMS SS R1), **David Griffeath**, University of Wisconsin-Madison, and **Timo Seppalainen**, Iowa State University.

Ring Theory and Related Topics (Code: AMS SS L1), **Don Passman**, University of Wisconsin-Madison.

Several Complex Variables (Code: AMS SS B1), **Pat Ahern**, **Xianghong Gong**, **Alex Nagel**, and **Jean-Pierre Rosay**, University of Wisconsin-Madison.

Orlando, Florida

University of Central Florida

November 9–10, 2002

Meeting #982

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: September 2002
Program first available on AMS website: September 26, 2002
Program issue of electronic *Notices*: January 2003
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: April 9, 2002
For consideration of contributed papers in Special Sessions: July 23, 2002
For abstracts: September 17, 2002

Baltimore, Maryland

Baltimore Convention Center

January 15–18, 2003

Joint Mathematics Meetings, including the 109th Annual Meeting of the AMS, 86th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 15, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Baton Rouge, Louisiana

Louisiana State University

March 14–16, 2003

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines
For organizers: August 14, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Bloomington, Indiana

Indiana University

April 4–6, 2003
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines
For organizers: September 4, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Seville, Spain

June 25–28, 2003
First Joint International Meeting between the AMS and the Real Sociedad Matematica Española (RSME).
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Binghamton, New York

SUNY-Binghamton

October 10–12, 2003
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines
For organizers: March 10, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Phoenix, Arizona

Phoenix Civic Plaza

January 7–10, 2004
Associate secretary: Bernard Russo
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines
For organizers: April 2, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Athens, Ohio

Ohio University

March 26–27, 2004
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines
For organizers: August 26, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

San Diego, California Timetable

San Diego Convention Center
and San Diego Marriott

FRIDAY, JANUARY 4

9:00 a.m. — 5:00 p.m.	**AMS SHORT COURSE ON SYMBOLIC DYNAMICS**
9:00 a.m. — 5:00 p.m.	**MAA SHORT COURSE ON A SAMPLER OF APPLICATIONS OF GRAPH THEORY**

SATURDAY, JANUARY 5

8:00 a.m. — 10:00 a.m.	**MAA MINICOURSE #1: PART A** *Using interactive labs to explore abstract algebra topics.*
8:30 a.m. — 4:00 p.m.	**MAA BOARD OF GOVERNORS**
9:00 a.m. — 5:00 p.m.	**AMS SHORT COURSE ON SYMBOLIC DYNAMICS**
9:00 a.m. — 5:00 p.m.	**MAA SHORT COURSE ON A SAMPLER OF APPLICATIONS OF GRAPH THEORY**
10:30 a.m. — 12:30 p.m.	**MAA MINICOURSE #2: PART A** *Mathematical algorithms, models, and graphic representations using spreadsheets.*
1:00 p.m. — 3:00 p.m.	**MAA MINICOURSE #1: PART A** *Using interactive labs to explore abstract algebra topics.*
1:00 p.m. — 10:00 p.m.	**AMS COUNCIL**
3:00 p.m. — 7:00 p.m.	**JOINT MEETINGS REGISTRATION**, Exhibit Halls B1 and B2, SDCC
3:30 p.m. — 5:30 p.m.	**MAA MINICOURSE #2: PART A** *Mathematical algorithms, models, and graphic representations using spreadsheets.*

SUNDAY, JANUARY 6

7:30 a.m. — 4:00 p.m.	**JOINT MEETINGS REGISTRATION**, Exhibit Halls B1 and B2, SDCC
7:30 a.m. — 6:00 p.m.	**EMPLOYMENT CENTER** *Registration, orientation, and interview center (see article for specific hours)*, Exhibit Halls B1 and B2, SDCC
8:00 a.m. — 10:55 a.m.	**AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, I**
8:00 a.m. — 10:55 a.m.	**AMS-ASL SPECIAL SESSION ON SET THEORY AND CLASSIFICATION PROBLEM, I**

AMS SPECIAL SESSIONS

8:00 a.m. — 10:55 a.m.	*Symbolic Dynamics, I*
8:00 a.m. — 10:55 a.m.	*Commutative Algebra and Algebraic Geometry, I*
8:00 a.m. — 10:55 a.m.	*Analysis and Application of Quasilinear Partial Differential Equations, I*
8:00 a.m. — 10:55 a.m.	*Computability Theory with Applications, I*
8:00 a.m. — 10:55 a.m.	*Fractal Geometry and Applications: A Jubilee of Benoit Mandelbrot, I*
8:00 a.m. — 10:55 a.m.	*Graph Theory, I*
8:00 a.m. — 10:55 a.m.	*Nonlinear Elliptic Partial Differential Equations, I*
8:00 a.m. — 10:55 a.m.	*Quantum Computation and Information, I*
8:00 a.m. — 10:55 a.m.	*The Theory and Applications of Symmetric Functions, I*
8:00 a.m. — 10:55 a.m.	*Low Dimensional Topology, I*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #13: PART A** *Getting students involved in undergraduate research.*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #3: PART A** *Optimal use of technology in teaching geometry at the college-university level.*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #9: PART A** *The Fibonacci and Catalan numbers.*

SIAM MINISYMPOSIA

8:00 a.m. — 10:55 a.m. *Optimization for Modeling and Simulation: Theory versus Practice*
8:00 a.m. — 10:55 a.m. *Modeling and Simulation for Thin Films*

8:00 a.m. — 10:55 a.m. **AMS CONTRIBUTED PAPER SESSIONS**

MAA CONTRIBUTED PAPER SESSIONS

8:00 a.m. — 10:55 a.m. *History of Mathematics in the Second Millennium, I*
8:00 a.m. — 10:55 a.m. *Mathematics Courses for Teachers, K–12, I*
8:00 a.m. — 10:55 a.m. *Integrating Mathematics and Other Disciplines, I*
8:00 a.m. — 10:55 a.m. *Innovative Uses of the World Wide Web in Teaching Mathematics, I*
8:00 a.m. — 10:55 a.m. *General Contributed Papers, I*

9:00 a.m. — 10:30 a.m. **MAA PANEL DISCUSSION** *AP calculus: Bridges and bumps between school and college.*

9:00 a.m. — 10:30 a.m. **MAA COMMITTEE ON TWO-YEAR COLLEGES PANEL DISCUSSION** *Teaching at two-year colleges: Rewards, research, resources, and recommendations.*

9:00 a.m. — 10:30 a.m. **MAA COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS PANEL DISCUSSION** *A new CUPM curriculum guide.*

10:05 a.m. — 10:55 a.m. **AMS RETIRING PRESIDENTIAL ADDRESS** *Reflections on the future of mathematics.* **Felix E. Browder**

11:10 a.m. — noon **AMS-MAA INVITED ADDRESS** *Helicity of vector fields in geometry, biology, and plasma physics.* **Dennis DeTurck**

12:00 p.m. — 5:30 p.m. **BOOK SALES AND EXHIBITS**, Exhibit Halls B1 and B2, SDCC

1:00 p.m. — 2:00 p.m. **AMS COLLOQUIUM LECTURES: LECTURE I** *Title to be announced.* **L. Craig Evans**

2:15 p.m. — 3:05 p.m. **MAA INVITED ADDRESS** *Old math, new math: Using polynomials to gain insight into the design of cryptosystems.* **Susan Landau**

2:15 p.m. — 6:00 p.m. **AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, II**

2:15 p.m. — 6:00 p.m. **AMS-ASL SPECIAL SESSION ON SET THEORY AND CLASSIFICATION PROBLEM, II**

AMS SPECIAL SESSIONS

2:15 p.m. — 6:00 p.m. *Symbolic Dynamics, II*
2:15 p.m. — 6:00 p.m. *Commutative Algebra and Algebraic Geometry, II*
2:15 p.m. — 6:00 p.m. *Analysis and Application of Quasilinear Partial Differential Equations, II*
2:15 p.m. — 6:00 p.m. *Computability Theory with Applications, II*
2:15 p.m. — 6:00 p.m. *Fractal Geometry and Applications: A Jubilee of Benoit Mandelbrot, II*
2:15 p.m. — 6:00 p.m. *Graph Theory, II*
2:15 p.m. — 6:00 p.m. *Nonlinear Elliptic Partial Differential Equations, II*
2:15 p.m. — 6:00 p.m. *Quantum Computation and Information, II*
2:15 p.m. — 6:00 p.m. *The Theory and Applications of Symmetric Functions, II*
2:15 p.m. — 6:00 p.m. *Low Dimensional Topology, II*

2:15 p.m. — 4:15 p.m. **MAA MINICOURSE #10: PART A** *A dynamical systems approach to the differential equations course.*

2:15 p.m. — 4:15 p.m. **MAA MINICOURSE #14: PART A** *Viewing mathematics via interrelations for undergraduate courses.*

2:15 p.m. — 4:15 p.m. **MAA MINICOURSE #4: PART A** *Environmental mathematics.*

SUNDAY, JANUARY 6 (cont'd)

2:15 p.m. — 6:00 p.m. **AMS CONTRIBUTED PAPER SESSIONS**

2:15 p.m. — 5:15 p.m. **SIAM MINISYMPOSIUM**
Applications of Symmetry in Dynamical Systems

MAA CONTRIBUTED PAPER SESSIONS

2:15 p.m. — 5:15 p.m. *Initiating and Sustaining Undergraduate Research Projects and Programs, I*

2:15 p.m. — 5:15 p.m. *Learning to Prove in Cooperative Learning and Technology-Supported Environments*

2:15 p.m. — 5:15 p.m. *Changing Student Views Regarding the Usefulness of Mathematics in Order to Increase the Number of Mathematics Majors*

2:15 p.m. — 5:15 p.m. *Computational Mathematics in Linear Algebra and Differential Equations, I*

2:15 p.m. — 3:45 p.m. **MAA SPECIAL PRESENTATION** *NCTM's work to improve mathematics education for all students.*

2:15 p.m. — 3:45 p.m. **MAA SPECIAL PRESENTATION** *Session for chairs.*

2:15 p.m. — 3:45 p.m. **MAA PANEL DISCUSSION** *A comprehensive department-based program for the preparation and professional development of graduate teaching assistants (GTAs) in mathematics.*

2:15 p.m. — 3:30 p.m. **MAA PROJECT NExT PANEL DISCUSSION** *Introduction to the hiring process: Preparation, execution, and follow-up.*

3:20 p.m. — 4:10 p.m. **MAA INVITED ADDRESS** *Sophie Germain's grand plan for proving Fermat's Last Theorem.* **David J. Pengelley**

3:20 p.m. — 4:20 p.m. **AWM PANEL DISCUSSION** *Mathematics after high school: How to promote success for more.*

4:00 p.m. — 5:30 p.m. **MAA PANEL DISCUSSION** *Mathematical preparation and support of teachers through rural universities.*

4:00 p.m. — 5:30 p.m. **MAA CUPM SUBCOMMITTEE ON CALCULUS REFORM AND THE FIRST TWO YEARS PANEL DISCUSSION** *Modeling in college algebra.*

4:20 p.m. — 4:50 p.m. **AWM BUSINESS MEETING**

4:30 p.m. — 6:30 p.m. **MAA MINICOURSE #5: PART A** *Using physical and computerized puzzles as models of permutation groups in teaching abstract algebra.*

4:30 p.m. — 6:00 p.m. **AMS COMMITTEE ON THE PROFESSION PANEL DISCUSSION** *How the world sees mathematicians.*

4:30 p.m. — 6:30 p.m. **MAA SECTION OFFICERS**

5:00 p.m. — 6:00 p.m. **AMS-MAA GRADUATE STUDENT RECEPTION**

5:30 p.m. — 7:30 p.m. **MATHEMATICAL SCIENCES INSTITUTES RECEPTION**

6:00 p.m. — 7:00 p.m. **RECEPTION FOR FIRST-TIME PARTICIPANTS**

7:15 p.m. — 8:15 p.m. **YOUNG MATHEMATICIANS NETWORK TOWN MEETING**

8:30 p.m. — 9:30 p.m. **AMS JOSIAH WILLARD GIBBS LECTURE** *Title to be announced.* **Michael V. Berry**

9:30 p.m. — 11:00 p.m. **AWM RECEPTION**

MONDAY, JANUARY 7

7:00 a.m. — 7:30 p.m. **EMPLOYMENT CENTER** *Distribution of schedules, scheduled interviews, and interview center (see article for specific hours),* Exhibit Halls B1 and B2, SDCC

7:30 a.m. — 4:00 p.m. **JOINT MEETINGS REGISTRATION**, Exhibit Halls B1 and B2, SDCC

8:00 a.m. — noon **AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, III**

AMS SPECIAL SESSIONS

8:00 a.m. — noon *Symbolic Dynamics, III*
8:00 a.m. — noon *Commutative Algebra and Algebraic Geometry, III*
8:00 a.m. — noon *Algebraic Coding Theory, I*
8:00 a.m. — noon *Algebras, Forms, and Algebraic Groups, I*
8:00 a.m. — noon *Computability Theory with Applications, III*
8:00 a.m. — noon *Fractal Geometry and Applications: A Jubilee of Benoit Mandelbrot, III*
8:00 a.m. — noon *Graph Theory, III*
8:00 a.m. — noon *Nonlinear Elliptic Partial Differential Equations, III*
8:00 a.m. — noon *Quantum Computation and Information, III*
8:00 a.m. — noon *The Theory and Applications of Symmetric Functions, III*
8:00 a.m. — noon *Low Dimensional Topology, III*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #11: PART A** *Incorporating discrete mathematics in the preparation of K–12 mathematics teachers.*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #15: PART A** *Mathematical finance.*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #6: PART A** *WeBWorK, an Internet-based system for generating and delivering homework problems to students.*

SIAM MINISYMPOSIA

8:00 a.m. — 10:55 a.m. *Partial Differential Equations and Applications*
8:00 a.m. — 10:55 a.m. *Mathematics and Computers in Biology and Medicine*

8:00 a.m. — 10:55 a.m. **AMS CONTRIBUTED PAPER SESSIONS**

MAA CONTRIBUTED PAPER SESSIONS

8:00 a.m. — noon *History of Mathematics in the Second Millennium, II*
8:00 a.m. — noon *Mathematics Courses for Teachers, K–12, II*
8:00 a.m. — noon *Integrating Mathematics and Other Disciplines, II*
8:00 a.m. — noon *Innovative Uses of the World Wide Web in Teaching Mathematics, II*

9:00 a.m. — 9:50 a.m. **AWM EMMY NOETHER LECTURE** *Computing over the reals: Where Turing meets Newton.* **Lenore Blum**

9:00 a.m. — 10:30 a.m. **MAA COMMITTEE ON MATHEMATICS AND THE ENVIRONMENT PANEL DISCUSSION** *The environment: A context for learning.*

9:00 a.m. — 10:30 a.m. **MAA COMMITTEE ON THE MATHEMATICAL EDUCATION OF TEACHERS PANEL DISCUSSION** *Changing attitudes in the elementary education mathematics content courses: What works?*

9:00 a.m. — 10:30 a.m. **MAA PANEL DISCUSSION** *Opportunities for mathematically motivated youth.*

9:00 a.m. — 10:30 a.m. **MAA PROJECT NExT PANEL DISCUSSION** *How to make the most of teaching evaluations.*

9:30 a.m. — 5:30 p.m. **BOOK SALES AND EXHIBITS**, Exhibit Halls B1 and B2, SDCC

10:05 a.m. — 10:55 a.m. **MAA INVITED ADDRESS** *Probability, combinatorics, and physics in analytic number theory.* **Andrew J. Granville**

10:15 a.m. — 12:15 p.m. **MAA MINICOURSE #7: PART A** *Creating and exporting computer animations to the Web.*

10:45 a.m. — 12:15 p.m. **MAA PANEL DISCUSSION** *NSF funding opportunities for learning and teaching in the mathematical sciences.*

10:45 a.m. — 12:15 p.m. **MAA PANEL DISCUSSION** *College credit by examination: The Advance Placement (AP®) and College-Level Examination (CLEP®) Programs.*

10:45 a.m. — 12:15 p.m. **MAA PANEL DISCUSSION** *Life after a math sciences major: Tracking and using alumni career information.*

11:10 a.m. — noon **SIAM INVITED ADDRESS** *Variational PDE models and algorithms in image processing.* **Tony F. Chan**

1:00 p.m. — 2:00 p.m. **AMS COLLOQUIUM LECTURES: LECTURE II** *Title to be announced.* **L. Craig Evans**

1:00 p.m. — 4:20 p.m. **AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, IV**

1:00 p.m. — 4:20 p.m. **AMS-ASL SPECIAL SESSION ON SET THEORY AND CLASSIFICATION PROBLEM, III**

AMS SPECIAL SESSIONS

1:00 p.m. — 4:20 p.m. *Symbolic Dynamics, IV*
1:00 p.m. — 4:20 p.m. *Dynamic Equations on Time Scales, I*
1:00 p.m. — 4:20 p.m. *Commutative Algebra and Algebraic Geometry, IV*
1:00 p.m. — 4:20 p.m. *Algebraic Coding Theory, II*
1:00 p.m. — 4:20 p.m. *Algebras, Forms, and Algebraic Groups, II*
1:00 p.m. — 4:20 p.m. *Analysis and Application of Quasilinear Partial Differential Equations, III*
1:00 p.m. — 4:20 p.m. *Fractal Geometry and Applications: A Jubilee of Benoit Mandelbrot, IV*
1:00 p.m. — 4:20 p.m. *The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, I*
1:00 p.m. — 4:20 p.m. *Wavelets for Undergraduates*
1:00 p.m. — 4:20 p.m. *Low Dimensional Topology, IV*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #12: PART A** *Introduction to mathematical card tricks.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #16: PART A** *Developing the ability to write proofs in high school students and college mathematics majors.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #8: PART A** *Real-world problem solving using technology and student projects.*

1:00 p.m. — 4:00 p.m. **MAA INVITED PAPER SESSION**
Probability and Combinatorics in Analytic Number Theory

1:00 p.m. — 4:00 p.m. **AMS CONTRIBUTED PAPER SESSIONS**

SIAM MINISYMPOSIUM

1:00 p.m. — 4:00 p.m. *Mathematics Models for Image Analysis and Computer Vision*

MAA CONTRIBUTED PAPER SESSIONS

1:00 p.m. — 4:00 p.m. *Initiating and Sustaining Undergraduate Research Projects and Programs, II*
1:00 p.m. — 4:00 p.m. *Computational Mathematics in Linear Algebra and Differential Equations, II*
1:00 p.m. — 4:00 p.m. *Deep Understanding of School Mathematics Needed by Teachers*

1:00 p.m. — 2:30 p.m. **AMS-MAA COMMITTEE ON TEACHING ASSISTANTS AND PART-TIME INSTRUCTORS PANEL DISCUSSION** *Research on TAs: Background, beliefs, attitude, and practice.*

1:00 p.m. — 2:30 p.m. **MAA CUPM SUBCOMMITTEE ON CALCULUS REFORM AND THE FIRST TWO YEARS-MAA TASK FORCE ON THE FIRST COLLEGE LEVEL MATHEMATICS COURSE PANEL DISCUSSION**
Rethinking the preparation for calculus.

1:00 p.m. — 2:30 p.m. **MAA CUPM SUBCOMMITTEE ON UNDERGRADUATE RESEARCH PANEL DISCUSSION**
Providing and promoting opportunities for undergraduates: A win-win situation.

2:00 p.m. — 4:00 p.m. **SIAM MINISYMPOSIUM**
Undergraduate Programs and Research Projects in Applied and Computational Mathematics

2:00 p.m. — 4:00 p.m. **MAA-PROJECT NExT AND YOUNG MATHEMATICIANS NETWORK POSTER SESSION**

2:15 p.m. — 3:05 p.m. **AMS INVITED ADDRESS** *Putting weirdness to work: Quantum information and quantum computation.* **John Preskill**

2:15 p.m. — 3:45 p.m. **MAA-PROJECT NEXT PANEL DISCUSSION** *Successful programs that integrate mathematics with other disciplines.*

2:45 p.m. — 4:15 p.m. **MAA SPECIAL PRESENTATION** *Mathematics preparation of doctorates in mathematics education.*

2:45 p.m. — 4:15 p.m. **MAA CUPM SUBCOMMITTEE ON CALCULUS REFORM AND THE FIRST TWO YEARS PANEL DISCUSSION** *Integrating statistics/data analysis through the core curriculum.*

MONDAY, JANUARY 7 (cont'd)

2:45 p.m. — 4:15 p.m. **SUMMA-MAA COMMITTEE ON MINORITY PARTICIPATION IN MATHEMATICS PANEL DISCUSSION**

3:20 p.m. — 4:10 p.m. **AMS INVITED ADDRESS** *Computational problems in topology: The complexity of unknotting.* **Jeffrey C. Lagarias**

4:25 p.m. — 6:00 p.m. **JOINT PRIZE SESSION AND RECEPTION**

6:30 p.m. — 9:30 p.m. **MER BANQUET**

TUESDAY, JANUARY 8

7:00 a.m. — 8:00 a.m. **JOINT PI MU EPSILON AND MAA STUDENT CHAPTER ADVISORS' BREAKFAST**

7:30 a.m. — 4:00 p.m. **JOINT MEETINGS REGISTRATION**, Exhibit Halls B1 and B2, SDCC

AMS-MAA SPECIAL SESSIONS

8:00 a.m. — 10:55 a.m. *History of Mathematics, I*

AMS SPECIAL SESSIONS

8:00 a.m. — 10:55 a.m. *Dynamic Equations on Time Scales, II*
8:00 a.m. — 10:55 a.m. *Probabilistic Methods in Combinatorics and the Internet, I*
8:00 a.m. — 10:55 a.m. *Computational Topology, I*
8:00 a.m. — 10:55 a.m. *Algebras, Forms, and Algebraic Groups, III*
8:00 a.m. — 10:55 a.m. *Chaos, Stability, and Asymptotics in Difference Equations, I*
8:00 a.m. — 10:55 a.m. *Recent Developments in Analysis and Numerics of Fluid Problems (in memory of Jacques-Louis Lions), I*
8:00 a.m. — 10:55 a.m. *The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, II*
8:00 a.m. — 10:55 a.m. *Partial Differential Equations and Their Applications, I*
8:00 a.m. — 10:55 a.m. *Topology and Its Applications, I*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #13: PART B** *Getting students involved in undergraduate research.*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #3: PART B** *Optimal use of technology in teaching geometry at the college-university level.*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #9: PART B** *The Fibonacci and Catalan numbers.*

8:00 a.m. — 10:55 a.m. **AMS CONTRIBUTED PAPER SESSIONS**

MAA CONTRIBUTED PAPER SESSIONS

8:00 a.m. — 10:55 a.m. *Best Practices in Undergraduate Statistics Education*
8:00 a.m. — 10:55 a.m. *Redefining What a Modern "College Algebra" Experience Means, I*
8:00 a.m. — 10:55 a.m. *Strategies for Increasing the Diversity of Students in Mathematics*
8:00 a.m. — 10:55 a.m. *Using Examples from Sports to Enhance the Teaching of Mathematics*
8:00 a.m. — 10:55 a.m. *SIGMAA on Research on Undergraduate Mathematics Education, I*

8:00 a.m. — 11:00 a.m. **PME COUNCIL**

8:00 a.m. — 7:30 p.m. **EMPLOYMENT CENTER** *Scheduled interviews and interview center (see article for specific hours),* Exhibit Halls B1 and B2, SDCC

9:00 a.m. — 9:50 a.m. **AMS INVITED ADDRESS** *The role of rotation numbers in dynamical systems.* **John M. Franks**

9:00 a.m. — 10:15 a.m. **MAA-PROJECT NExT PANEL DISCUSSION** *Time for your first sabbatical...Now what?*

9:00 a.m. — 10:30 a.m. **MAA SPECIAL PRESENTATION** *Grant-writing workshop for proposals to the NSF Division of Undergraduate Education.*

9:00 a.m. — 10:30 a.m. **MAA PANEL DISCUSSION** *Mathematics in a postmodern age.*

9:00 a.m. — 10:30 a.m. **MAA COMMITTEE ON THE PARTICIPATION OF WOMEN-WOMEN AND MATHEMATICS NETWORK SPECIAL PRESENTATION** *Successful mathematics outreach programs for women and girls.*

9:00 a.m. — 5:00 p.m.	**ASL INVITED ADDRESSES AND CONTRIBUTED PAPERS**
9:30 a.m. — 5:30 p.m.	**BOOK SALES AND EXHIBITS**, Exhibit Halls B1 and B2, SDCC
10:05 a.m. — 10:55 a.m.	**AMS INVITED ADDRESS** *Meromorphic continuation of L-functions.* **Richard L. Taylor**
11:10 a.m. — noon	**AMS-MAA INVITED ADDRESS** *Harmonic numbers and the ABC-conjecture.* **Hendrik W. Lenstra Jr.**
1:00 p.m. — 2:00 p.m.	**AMS COLLOQUIUM LECTURES: LECTURE III** *Title to be announced.* **L. Craig Evans**
	AMS-MAA SPECIAL SESSIONS
1:00 p.m. — 6:00 p.m.	*History of Mathematics, II*
	AMS SPECIAL SESSIONS
1:00 p.m. — 6:00 p.m.	*Dynamic Equations on Time Scales, III*
1:00 p.m. — 6:00 p.m.	*Computational Commutative Algebra and Algebraic Geometry, I*
1:00 p.m. — 6:00 p.m.	*Algebraic Coding Theory, III*
1:00 p.m. — 6:00 p.m.	*Computational Topology, II*
1:00 p.m. — 6:00 p.m.	*Hybrid Systems, I*
1:00 p.m. — 6:00 p.m.	*The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, III*
1:00 p.m. — 6:00 p.m.	*Partial Differential Equations and Their Applications, II*
1:00 p.m. — 6:00 p.m.	*Stochastic Processes and Functional Analysis (in honor of M. M. Rao), I*
1:00 p.m. — 6:00 p.m.	*Topology and Its Applications, II*
1:00 p.m. — 3:00 p.m.	**MAA MINICOURSE #10: PART B** *A dynamical systems approach to the differential equations course.*
1:00 p.m. — 3:00 p.m.	**MAA MINICOURSE #14: PART B** *Viewing mathematics via interrelations, for undergraduate courses.*
1:00 p.m. — 3:00 p.m.	**MAA MINICOURSE #4: PART B** *Environmental mathematics.*
1:00 p.m. — 6:00 p.m.	**AMS CONTRIBUTED PAPER SESSIONS**
	MAA CONTRIBUTED PAPER SESSIONS
1:00 p.m. — 3:15 p.m.	*Classroom Demonstrations and Course Projects That Make a Difference*
1:00 p.m. — 3:15 p.m.	*Environmental Mathematics in the Classroom, I*
1:00 p.m. — 3:15 p.m.	*Who Needs Algebra! Alternative Introductory Mathematics Courses*
1:00 p.m. — 5:00 p.m.	**NAM GRANVILLE-BROWNE SESSION OF PRESENTATIONS BY RECENT DOCTORAL RECIPIENTS IN THE MATHEMATICAL SCIENCES**
1:00 p.m. — 3:00 p.m.	**MAA COMMITTEE ON THE TEACHING OF UNDERGRADUATE MATHEMATICS PANEL DISCUSSION** *The medium and the message: Practical suggestions on student reading and course efficiency using a structured conversation format.*
1:00 p.m. — 2:30 p.m.	**MAA PANEL DISCUSSION** *BIG math: Projects in business, industry, and government.*
1:00 p.m. — 2:30 p.m.	**MAA CUPM SUBCOMMITTEE ON CALCULUS REFORM AND THE FIRST TWO YEARS PANEL DISCUSSION** *Discrete mathematics in the first two years.*
1:00 p.m. — 3:00 p.m.	**MAA POSTER SESSION** *Projects supported by the NSF Division of Undergraduate Education.*
2:15 p.m. — 3:05 p.m.	**MAA INVITED ADDRESS** *From shuffling cards to the roots of randomness.* **Persi W. Diaconis**
2:15 p.m. — 4:10 p.m.	**RMMC BOARD OF DIRECTORS**
2:30 p.m. — 4:00 p.m.	**AMS COMMITTEE ON SCIENCE POLICY PANEL DISCUSSION**
3:15 p.m. — 5:15 p.m.	**MAA MINICOURSE #5: PART B** *Using physical and computerized puzzles as models of permutation groups in teaching abstract algebra.*
3:30 p.m. — 5:00 p.m.	**MAA PRESENTATIONS BY TEACHING AWARD RECIPIENTS**

TUESDAY, JANUARY 8 (cont'd)

4:00 p.m. — 6:30 p.m. **MAA UNDERGRADUATE STUDENT POSTER SESSION**

4:20 p.m. — 5:10 p.m. **AMS COMMITTEE ON SCIENCE POLICY-MAA SCIENCE POLICY COMMITTEE GOVERNMENT SPEAKER** Speaker to be announced.

5:00 p.m. — 7:00 p.m. **MAA INFORMAL SESSION** *Actuarial education.*

5:00 p.m. — 7:00 p.m. **ASSOCIATION FOR RESEARCH ON UNDERGRADUATE MATHEMATICS EDUCATION SIGMAA BUSINESS MEETING AND RECEPTION**

5:00 p.m. — 6:00 p.m. **WELCOME RECEPTION FOR MATHEMATICIANS IN BUSINESS, INDUSTRY, AND GOVERNMENT**

5:30 p.m. — 7:00 p.m. **MAA-YOUNG MATHEMATICIANS NETWORK PANEL DISCUSSION** *Closing the deal: The campus interview and beyond.*

5:30 p.m. — 7:00 p.m. **MAA SPECIAL PRESENTATION** *Carroll College Project InterMath Workshop reunion.*

6:00 p.m. — 9:00 p.m. **NAM RECEPTION, BANQUET, AND COX-TALBOT ADDRESS** *Speaker to be announced.*

6:00 p.m. — 7:00 p.m. **MAA PROJECT NExT-YOUNG MATHEMATICIANS NETWORK SPECIAL PRESENTATION** *Planning ahead for the tenure/promotion process.*

6:00 p.m. — 8:00 p.m. **SIGMAA ON STATISTICS EDUCATION, 2002 BUSINESS MEETING, AND LECTURE**

7:30 p.m. — 8:20 p.m. **MAA STUDENT LECTURE** *Finding and fixing systems' weaknesses: The art and science of engineering risk analysis.* **M. Elisabeth Pate-Cornell**

8:30 p.m. — 10:30 p.m. **MAA PROJECT NExT RECEPTION**

WEDNESDAY, JANUARY 9

7:30 a.m. — 2:00 p.m. **JOINT MEETINGS REGISTRATION,** Exhibit Halls B1 and B2, SDCC

AMS-MAA SPECIAL SESSIONS

8:00 a.m. — 10:55 a.m. *History of Mathematics, III*

AMS SPECIAL SESSIONS

8:00 a.m. — 10:55 a.m. *Probabilistic Methods in Combinatorics and the Internet, II*
8:00 a.m. — 10:55 a.m. *Computational Commutative Algebra and Algebraic Geometry, II*
8:00 a.m. — 10:55 a.m. *Algebraic Combinatorics, I*
8:00 a.m. — 10:55 a.m. *Chaos, Stability, and Asymptotics in Difference Equations, II*
8:00 a.m. — 10:55 a.m. *Recent Developments in Analysis and Numerics of Fluid Problems (in memory of Jacques-Louis Lions), II*
8:00 a.m. — 10:55 a.m. *Hybrid Systems, II*
8:00 a.m. — 10:55 a.m. *Partial Differential Equations and Their Applications, III*
8:00 a.m. — 10:55 a.m. *Research in Mathematics by Undergraduates, I*
8:00 a.m. — 10:55 a.m. *Stochastic Processes and Functional Analysis (in honor of M. M. Rao), II*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #11: PART B** *Incorporating discrete mathematics in the preparation of K–12 mathematics teachers.*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #15: PART B** *Mathematical finance.*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #6: PART B** *WeBWorK, an Internet-based system for generating and delivering homework problems to students.*

8:00 a.m. — 10:55 a.m. **AMS CONTRIBUTED PAPER SESSIONS**

MAA CONTRIBUTED PAPER SESSIONS

8:00 a.m. — 10:55 a.m. *Redefining What a Modern "College Algebra" Experience Means, II*
8:00 a.m. — 10:55 a.m. *Innovative Outcome Assessment in Statistics Education*
8:00 a.m. — 10:55 a.m. *SIGMAA on Research on Undergraduate Mathematics Education, II*

8:30 a.m. — 10:00 a.m. **AMS COMMITTEE ON EDUCATION PANEL DISCUSSION**

8:30 a.m. — 5:00 p.m. **AWM WORKSHOP**

8:30 a.m. — 10:00 a.m. **AMS COMMITTEE ON EDUCATION PANEL DISCUSSION**

9:00 a.m. — 9:50 a.m. **MAA INVITED ADDRESS** *Reforms in mathematics education: Best practices and malpractices.* **Manuel P. Berriozábal**

9:00 a.m. — 10:30 a.m. **MAA PANEL DISCUSSION** *Outreach programs for women: Assessment issues.*

9:00 a.m. — 10:30 a.m. **MAA WORKSHOP** *Want to coach a math modeling team? Where to start and how to finish.*

9:00 a.m. — 9:50 a.m. **NAM PANEL DISCUSSION** *Distance learning.*

9:00 a.m. — 5:00 p.m. **ASL INVITED ADDRESSES AND CONTRIBUTED PAPERS**

9:00 a.m. — noon **BOOK SALES AND EXHIBITS**, Exhibit Halls B1 and B2, SDCC

9:00 a.m. — 1:00 p.m. **EMPLOYMENT CENTER** *Interview center,* Exhibit Halls B1 and B2, SDCC

10:00 a.m. — 10:50 a.m. **NAM BUSINESS MEETING**

10:05 a.m. — 10:55 a.m. **MAA RETIRING PRESIDENTIAL ADDRESS** *The down side of the trapezoid: An immediate past president surveys the Internet.* **Thomas F. Banchoff**

11:10 a.m. — 11:40 a.m. **MAA BUSINESS MEETING**

11:45 a.m. — 12:15 p.m. **AMS BUSINESS MEETING**

1:00 p.m. — 1:50 p.m. **NAM WILLIAM W. S. CLAYTOR LECTURE** *Title to be announced.* **Katherine Okikiolu**

AMS-MAA SPECIAL SESSIONS

1:00 p.m. — 6:00 p.m. *History of Mathematics, IV*

AMS SPECIAL SESSIONS

1:00 p.m. — 6:00 p.m. *Probabilistic Methods in Combinatorics and the Internet, III*
1:00 p.m. — 6:00 p.m. *Computational Commutative Algebra and Algebraic Geometry, III*
1:00 p.m. — 6:00 p.m. *Algebraic Combinatorics, II*
1:00 p.m. — 6:00 p.m. *Chaos, Stability, and Asymptotics in Difference Equations, III*
1:00 p.m. — 6:00 p.m. *Recent Developments in Analysis and Numerics of Fluid Problems (in memory of Jacques-Louis Lions), III*
1:00 p.m. — 6:00 p.m. *Hybrid Systems, III*
1:00 p.m. — 6:00 p.m. *Research in Mathematics by Undergraduates, II*
1:00 p.m. — 6:00 p.m. *Stochastic Processes and Functional Analysis (in honor of M. M. Rao), III*
1:00 p.m. — 6:00 p.m. *Topology and Its Applications, III*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #12: PART B** *Introduction to mathematical card tricks.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #16: PART B** *Developing the ability to write proofs in high school students and college mathematics majors.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #7: PART B** *Creating and exporting computer animations to the Web.*

1:00 p.m. — 6:00 p.m. **AMS CONTRIBUTED PAPER SESSIONS**

MAA CONTRIBUTED PAPER SESSIONS

1:00 p.m. — 5:00 p.m. *Environmental Mathematics in the Classroom, II*
1:00 p.m. — 5:00 p.m. *Who Needs Algebra! Alternative Introductory Mathematics Courses*

1:00 p.m. — 2:30 p.m. **MAA PANEL DISCUSSION** *The mathematics community and public support.*

1:00 p.m. — 2:30 p.m. **MAA CUPM SUBCOMMITTEE ON CALCULUS REFORM AND THE FIRST TWO YEARS PANEL DISCUSSION** *Reflections on the West Point Summary Conference for the CRAFTY Curriculum Foundations workshops.*

2:15 p.m. — 3:05 p.m. **AMS INVITED ADDRESS** *Analytical and topological issues concerning Sobolev mappings.* **Fanghua Lin**

2:45 p.m. — 4:15 p.m. **MAA WORKSHOP** *Enhance undergraduate mathematics courses using globally interactive, live dynamic mathematics on the Web.*

2:45 p.m. — 4:15 p.m. **MAA CUPM SUBCOMMITTEE ON CALCULUS REFORM AND THE FIRST TWO YEARS OPEN DISCUSSION** *Reforming college algebra.*

3:15 p.m. — 5:15 p.m. **MAA MINICOURSE #8: PART B** *Real-world problem solving using technology and student projects.*

6:30 p.m. — 10:00 p.m. **AMS BANQUET**

Mathematical Sciences Employment Center

San Diego Convention Center, San Diego, California
January 6, 7, 8, and 9, 2002

2002 Employment Center Schedule

Sunday, January 6

7:30 a.m.–4:00 p.m. Registration and materials pick-up.

9:00 a.m.–9:30 a.m. Short (optional) orientation session.

9:30–4:00 p.m. Submission of Scheduled Employment Register interview request forms for both Monday and Tuesday interviews. No request forms can be accepted after 4:00 p.m. Sunday.

9:30 a.m.–6 p.m. Interview Center open.

No Scheduled Employment Register interviews are held on Sunday.

Monday, January 7

7:00 a.m.–8:15 a.m. Distribution of interview schedules for both Monday and Tuesday, for those participating in the Scheduled Employment Register.

8:15 a.m.–4:40 p.m. Scheduled Employment Register interviews in 4 sessions: *Session 1:* 8:15 a.m.–9:50 a.m., *Session 2:* 10:00 a.m.–11:35 a.m., *Session 3:* 1:00 p.m.–2:35 p.m., *Session 4:* 3:00 p.m.–4:35 p.m.

8:00 a.m.–7:30 p.m. Interview Center open (doors open at 7:30 a.m.; do not schedule before 8:00 a.m.).

Tuesday, January 8

8:15 a.m.–4:40 p.m. Scheduled Employment Register interviews in 4 sessions: *Session 5:* 8:15 a.m.–9:50 a.m., *Session 6:* 10:00 a.m.–11:35 a.m., *Session 7:* 1:00 p.m.–2:35 p.m., *Session 8:* 3:00 p.m.–4:35 p.m.

8:00 a.m.–7:30 p.m. Interview Center open.

Wednesday, January 9

9:00 a.m.–1 p.m. Interview Center open.

Note: Any participant who plans to use the Scheduled Employment Register must appear at the Employment Center on Sunday by 4:00 p.m. to turn in the Interview Request/Availability Form. If unexpected delays occur while travelling, contact the Employment Center staff by telephone in the Convention Center. The phone number will be sent to registered participants by e-mail when it is available in December.

Overview of the Employment Center

The Employment Center (formerly the Employment Register) serves as a meeting place and information center for employers and Ph.D.-level jobseekers attending the Joint Mathematics Meetings. Most applicants and employers began the search process in the fall, and are looking for an opportunity to meet in person with those with whom they've already had communication. Some, however, use the Employment Center as a way to make some initial contacts, gather information, and distribute their own information. This is a less effective, but common, use of the program. The Employment Center allows everyone to choose a comfortable level of participation, by seeking interviews for any of the open hours, or by limiting schedules to certain days or hours.

The Employment Center is a three-day program which takes place on the Sunday, Monday, Tuesday, and Wednesday (morning only) of the Joint Meetings. Most participants register in advance (by the October 26 deadline) and their brief résumé or job description is printed in a booklet which is mailed to participants in advance.

The Employment Center houses two services: the computer-scheduled interview tables (the Scheduled Employment Register), and the employer-scheduled interview tables (the Interview Center). Use of the Center overall by employers has gone up in recent years. At the 2001 Employment Center, 347 candidates and 139 employers participated, giving an overall applicant-to-employer ratio of 2.5:1 (compared with 390 applicants and 152 employers in 2000, a ratio of 2.6:1). Each applicant ends up with roughly 5 to 15 interviews of various types. Those with the most interviews are those requested most by employers, usually as a result of a careful application process during the months before the Employment Center takes place.

At the January 2002 Employment Center, job candidates will be able to choose how to participate. Two forms of participation will be available:

> All Employment Center services (computer-scheduling system, form posted in *Winter List of Applicants, Winter List of Employers* received by mail, use of Employment Message Center,

availability for employer-scheduled Interview Center).

Message Center and *Winter Lists* only (form posted in *Winter List of Applicants, Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center, BUT NOT use of the computer-scheduling system).

No matter which option is chosen, advance registration works best so that the Applicant Form (received by October 26, 2001) can be printed in the *Winter List* which will be distributed to employers.

Employer forms submitted by registered employers have no connection with the AMS on-line job ads (EIMS). Submitted forms are not available for browsing on the Web. They are reproduced in the *Winter List* booklet for use by Employment Center participants.

The Mathematical Sciences Employment Center is sponsored by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics; it is managed by members of the AMS staff, with the general guidance of the AMS-MAA-SIAM Committee on Employment Opportunities.

Employers: Choose one or both of these tables:

Computer-scheduled Employment Register table

Employer-scheduled Interview Center table

The Employment Register Computer-Scheduling System

Employers register in advance by the October 26 deadline, and their job listings ("Employer Forms") are printed and distributed in mid-December to applicants. Employers receive the book of brief, numbered applicant résumés in mid-December. Participants decide on Sunday, January 6, which of the eight sessions (of five interviews each) they will participate in and submit their Availability/Interview Request Forms by 4:00 p.m. Sunday. Employers can reserve time for other Joint Meetings events by marking "unavailable" for one or more of the eight sessions. Employers can request ten specific applicants per day, assuming they are available for all four sessions that day. Usually those requests will be filled by the scheduling algorithm, provided the applicants are present, except in the case of the few most-requested applicants. The rest of their interviews will be with applicants who ask to see them. Employers should be specific about their requirements on the Employer Form to avoid interviews with inappropriate candidates.

Schedules are distributed for all Monday and Tuesday interviews on Monday morning. The schedule allows 15-minute interviews, with 5 minutes between for note taking. One or more interviewers for the same position(s) may interview at the table separately, together, or in shifts. For follow-up interviews, the scheduled tables will also be available for use until 7:30 p.m. on Monday and Tuesday and on Wednesday morning from 9:00 a.m.–1:00 p.m.

Participation in the scheduling program has become optional for applicants, so employers will notice some applicant résumés in the *Winter List of Applicants* with no applicant number. An employer can arrange to interview such an applicant outside of the scheduled interview sessions—for instance, between 4:40 p.m. and 7:30 p.m. Monday or Tuesday, or on Wednesday morning—or during sessions which they left unscheduled.

Employers who are interviewing for two distinct positions may wish to pay for two tables. See the instructions under "How to Register". Employers should bring school catalogs, corporate reports, or more lengthy job descriptions to the Employment Center early on Sunday for perusal by applicants prior to interviews.

The Employer-Scheduled Interview Center

The Interview Center allows any employer to reserve a table in an area adjacent to the Employment Center. Employers will arrange their own schedule of interviews, either in advance or on site, by using the Employment Message Center. Employers who have never used the Employment Center before might want to try conducting interviews at this convenient location. Since they will be setting their own schedules, employers will have complete control over whom they'll see, for how long, and when they'll be interviewing. This allows employers to pursue other activities at the Joint Meetings.

The Center will be open only during the following hours:

Sunday, January 6,, 2002, 9:30 a.m.–6:00 p.m.
Monday, January 7, 2002, 8:00 a.m.–7:30 p.m.
Tuesday, January 8, 2002, 8:00 a.m.–7:30 p.m.
Wednesday, January 9, 2002, 9:00 a.m.–1:00 p.m.

The fee for use of this area is the same as the normal employer fee. It is requested that all employers fill out an Employer Form for inclusion in the *Winter List*. This should clarify to Employment Center applicants what type of position is being filled. If an employer is unable to accept new applicants because the deadline has passed, that should be stated on the form.

The *Winter List of Applicants*, containing information about the candidates present at the Employment Center, will be mailed to all employers in advance of the meeting.

Employers scheduling interviews in advance should tell applicants to find the table with the institution's name in the Interview Center (not the numbered-table area). Employers can schedule any time during the open hours listed above. To schedule interviews after arriving in San Diego, leave messages for Employment Center applicants in the Employment Message Center. Paper forms will be provided to help speed the invitation process. Each employer will be provided with a box in the Message Center where applicants can leave items.

Employers should have at most two interviewers per table at any time due to space limitations. There will be no outlets or electricity available at the interviewing tables.

About the *Winter List of Applicants*

This booklet contains hundreds of résumés of applicants registered by October 26 for the Employment Center. It will be mailed to all employers who register by October 26 who indicate on their Joint Meetings registration form that they would like their materials mailed. Employers should be aware that there will be hundreds of brief résumés to look through and should be sure to obtain the *Winter List of Applicants* as early as possible.

Employers Not Planning to Interview

Employers who do not plan to participate in the Employment Center at all may display a job description. This description must be submitted on the Employer Form, which appears in the back of this issue, with the appropriate box checked indicating that no interviews will take place. A fee of $50 is charged for this service (paid through the Joint Meetings registration form). The form must be received in the Providence office (with payment or purchase order) by the October 26 deadline, to appear in the *Winter List of Employers*. Forms received in the Providence office after that deadline will be displayed at the meeting. Those wishing to bring a one-page job description to the Employment Center desk for display during the Meetings may do so at no charge.

Employers: How to Register

The interviewer should register and pay for the Joint Mathematics Meetings by:

> Indicating on the Joint Meetings registration form (available electronically at `www.ams.org/amsmtgs/2049_intro.html`, or in the back of the October issue of the *Notices*) that you are also paying the Employment Center employer fee. Indicate your choice of tables. Mark all that apply.
>
> Submitting an Employer (job listing) Form electronically at www.ams.org/emp-reg/, or using the print version in the back of this issue. Be sure the form indicates which type or types of tables will be used. This form will be printed in the *Winter List of Employers*.

It's important to register by the October 26 deadline, in order for your form to be included in the *Winter List of Employers*. However, registration will be accepted up to December 10 for the normal fees or on site in San Diego at the on-site rates. Call 800-321-4267, ext. 4105, with any questions or deadline problems.

Any number of interviewers can sit at a table together or in shifts, and their names should be listed on the Employer Form as a reference point for the applicants. However, Employment Center fees should be paid only for each table required.

In a few unusual cases an institution will be conducting interviews in the Employment Center for two or more distinct positions and will not want to conduct these interviews at one table. In that case two or more Employer Forms should be submitted, and separate tables and employer numbers will be provided. Applicants will then be able to request interviews for the appropriate job by employer number. First and second table fees should be paid.

The fee for all employers to register in advance is $210 for the first table and $60 for each additional table. On-site registration fees (any registrations after 12/10/01) are $300 for the first table and $100 for each additional table. Employers must also register for the Joint Meetings and pay the appropriate Joint Meetings fee.

Employers: Registration on Site

Employers who do not register for the Joint Mathematics Meetings and the Employment Center by December 10 may register on site in San Diego at the Joint Meetings Registration Desk. They must bring their receipt to the Employment Center desk between 7:30 a.m. and 4:00 p.m. on Sunday, January 6, to receive their materials. A typed copy of the Employer Form (found in the back of this issue) can be brought to the Employment Center for posting on site (or the form can be handwritten on site). If registering for the employer-scheduled Interview Center only, registration on Monday is possible.

Applicants: Use of the Computer-Scheduled Program Is Now Optional

In 2002, applicants will be given flexibility in deciding how to participate in the Employment Center. There are two options:

> All Employment Center services (computer-scheduling system, form posted in *Winter List of Applicants*, *Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center).
>
> Message Center and *Winter Lists* only (form posted in *Winter List of Applicants*, *Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center, BUT NOT use of the computer-scheduling system). This option is available at a slightly lower price.

Applicants who participate in the 2002 Employment Center will find themselves talking with employers in two different settings:

1. A computer-scheduling program sets 15-minute interviews in the Employment Register numbered tables. This is the choice that has now become optional for applicants. Applicants do not have to hand in a computer-scheduling form at all.

2. There is also an Interview Center, where employers set their own schedules. These employers do not participate in the scheduling program, so applicants have no automatic access to interviews with them. They determine their own schedules and make their own appointments privately, either in advance or on site using the Employment

Message Center. These interviews have always been "optional" for applicants since they may turn down any written invitation they receive. Applicants are reminded to respond to all invitations promptly.

The Schedule

For applicants using all services, there is a certain scheduling burden placed on them to juggle these simultaneous services. However, computer-scheduled sessions are in small blocks, for a total of eight sessions over the two days of interviews (Monday and Tuesday). This allows applicants, once they receive invitations to interview in the Interview Center, to accept, knowing that when they submit the computer schedule request on Sunday, they can mark that they are unavailable for one or more of these sessions without seriously jeopardizing their chances of obtaining scheduled interviews. Likewise, applicants who are scheduled to give a talk can avoid interviews for that time. Applicants are encouraged to schedule their time in advance in this manner and not wait for the computer schedule to be distributed Monday morning.

Interviews

Applicants should understand that the Employment Center provides no guarantees of interviews or jobs. It is simply a convenient meeting place for candidates and employers who are attending the Joint Meetings. Those who have not yet begun their job search efforts may go unnoticed at the Employment Center (although applicants will likely receive a minimum of between one and three interviews in the scheduled program). Attention generally goes to candidates who already have applied for open positions or to those who are well suited for teaching positions at liberal arts colleges.

Data from recent Employment Centers show that women represent about half of the most sought-after applicants, although they make up less than half of the total Employment Center applicant pool. Those without permanent authorization to work in the United States will find themselves far less requested than U.S. citizens or permanent residents. Newer Ph.D.'s tend to be invited for more interviews than those who have been working longer. Most jobs listed require a doctorate.

Preparations

Candidates just beginning a job search should realize that employers have no method to judge their credentials other than the brief résumé form, and they should make an effort to make it distinct and interesting.

Applicants who register in advance will receive the *Winter List of Employers* in mid-December. If time permits, they should apply for suitable open positions they notice in the *Winter List of Employers* after they receive it. Applicants are advised to bring a number of copies of their vita or résumé so that they may leave them with prospective employers. It is a good idea in the fall for applicants to alert any employer to whom applications are made that they plan to be present at the Joint Meetings. Also, they should bring enough materials with them to accompany requests for interviews they may want to leave in the Message Center boxes of the Interview Center employers.

Applicants are also encouraged to leave some extra copies of their résumés in their own message folders, so that interested employers may find them there. Photocopying costs at a convention are high, so applicants should come prepared with a reasonably large number of copies. A brightly colored form in each folder gives applicants an opportunity to present some information about their availability during the Meetings, for public perusal.

The *Winter List of Applicants* is mailed to all employers in advance, so it is vital that the Joint Meetings registration form, applicant résumé form, and payments be received by the October 26 deadline so the Applicant Form can be printed in the book. This greatly increases an applicant's chances of being invited to the Interview Center.

Applicants should keep in mind that interviews arranged by the Employment Center represent only an initial contact with the employers and that hiring decisions are not ordinarily made during or immediately following such interviews.

Applicants: Register Early

Applicants need to complete the following steps by the advance deadline of October 26, 2001.

1. Pay fees

Register for the Joint Mathematics Meetings (see form in the back of the October issue of the *Notices* or the electronic information at www.ams.org/amsmtgs/2049_intro.html). You cannot participate in the Employment Center unless you are a Meetings participant. Mark one of the two "Employment Center Applicant Fee" boxes on the Joint Meetings registration form and make payments. The fee in advance for applicants is $40, or "Message Center and *Winter List* ONLY" registration is $20.

2. Send form

Submit the Applicant Form (a brief resumé form) electronically at www.ams.org/emp-reg/ or use the print version in the back of this issue.

After Registration

Submission of the Applicant Form electronically will result in an e-mail aknowledgement almost immediately. For registration and payments, the Meetings Service Bureau acknowledges all payment. When payments AND the Applicant Form have been received, another acknowledgement will go out by e-mail, if possible, or by mail. Please allow a week or so for processing, but after that contact staff (AMS 800-321-4267, ext. 4105) if you do not receive acknowledgement from the Employment Center.

Around December 10, the *Winter List of Employers* will be mailed to all registered applicants, unless they request otherwise.

Registering After the Deadline

After October 26, applicants can still register for the Employment Center, at the same prices, until the final

deadline of December 10. However, the Applicant Form will NOT be included in the *Winter List of Applicants*, but will be posted on site at the Employment Center (a serious disadvantage). Those who do not register by December 10 must register on site at the Joint Meetings registration desk and pay higher fees ($75 Employment Center fee; however, the "Message Center and *Winter List* ONLY" fee is always just $20.

It is worthwhile to submit the applicant form even if you miss the October 26 deadline. An unexpected delay in publishing may allow your late form to get into the book. At the very least, your printed-out form will be brought to the Meeting by staff and displayed there (after all the fees have been paid.)

When to Arrive

All participants in the scheduled section of the Employment Center must submit their Interview Request/Availability forms in person between 9:30 a.m. and 4:00 p.m. on Sunday, January 6, 2002, or they will not be included when the interview-scheduling program runs Sunday night. Should unexpected delays occur while travelling, contact the Employment Center staff by telephone at the Employment Center desk in the Convention Center. The phone number will be sent to registered participants by e-mail when it is available in December. Be sure to keep Employment Center materials with you because in an emergency, you can report your interview requests over the phone.

Applicants: Registering on Site

Feel free to enter the Employment Center area first to consult staff about the decision to register on site and to check on which employers are participating. Full registration on site early Sunday is allowed for a higher fee but is severely discouraged. Most employers will not notice an Applicant Form which arrives on Sunday. Therefore, these individuals will receive only a couple of computer-scheduled interviews. Registration on site is advisable only for those who know they will be interviewed in the Interview Center and would like a Message Center folder for employers to leave messages in. This year registering on site for a mailbox only is possible, at the $20 rate, on Sunday and Monday.

Instructions for Applicant and Employer Forms

Applicant forms submitted for the Employment Center by the October 26 deadline will be reproduced in a booklet titled *Winter List of Applicants*. Employer forms submitted by the October 26 deadline will be reproduced for the *Winter List of Employers*.

Please use the electronic versions of Applicant and Employer forms (`http://www.ams.org/emp-reg/`). Paper forms should be submitted only by those who do not have access to the AMS website.

If submitting a paper form, please type carefully. **Do not type outside the box or beyond the lines indicated. Extra type will be omitted.**

All forms must be received by the Society by **October 26, 2001**, in order to appear in the *Winter List*. However, meeting registration (and payment of fees) is required before the forms can be processed.

00 General
01 History and biography
03 Mathematical logic and foundations
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General algebraic systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra, matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 K-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
37 Dynamical systems and ergodic theory
39 Difference and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
49 Calculus of variations and optimal control; optimization
51 Geometry
52 Convex and discrete geometry
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
74 Mechanics of deformable solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum theory
82 Statistical mechanics, structure of matter
83 Relativity and gravitational theory
85 Astronomy and astrophysics
86 Geophysics
90 Operations research, mathematical programming
91 Game theory, economics, social and behavioral sciences
92 Biology and other natural sciences
93 Systems theory; control
94 Information and communication, circuits
97 Mathematics education

EMPLOYER FORM
MATHEMATICAL SCIENCES EMPLOYMENT CENTER
JANUARY 6–9, 2002
SAN DIEGO, CALIFORNIA

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Center information and forms is `http://www.ams.org/emp-reg/`.
2. Paper or electronic forms are due, along with payment and your Advance Registration/ Housing Form, by October 26 (to AMS, P. O. Box 6887, Providence, RI 02940) in order to be included in the *Winter List of Employers.*
3. Please list all potential interviewers, for reference by applicants, but pay fees only for each separate table.
4. Forms will not be processed until registration and payment of fees have been received.

EMPLOYER CODE:

Institution _____

Department _____

Mailing address _____

_____

E-mail address (one only) _____

URL (or other contact info) _____

Name(s) of Interviewer(s) 1. _____

2. _____

3. _____

4. _____

Specialties sought _____

_____

Title(s) of position(s) _____

Number of positions _____

Starting date _____ (Month) / _____ (Year)

Term of appointment _____ (Years)

Renewal

☐ Possible ☐ Impossible

Tenure-track position

☐ Yes ☐ No

Teaching hours per week _____

Degree preferred _____

Degree accepted _____

Duties _____

_____

_____

Experience preferred _____

_____

_____

Significant other requirements, needs, or restrictions which will influence hiring decisions _____

_____

_____

This position will be subject to a security clearance which will require U.S. citizenship: ☐ Yes ☐ No

THE EMPLOYER PLANS TO USE THE FOLLOWING SERVICES (check all that apply):

☐ One or more computer-scheduled Interview Tables

☐ One or more self-scheduled Interview Tables

☐ Placing this form for information only (not using a table)

APPLICANT RÉSUMÉ FORM

MATHEMATICAL SCIENCES EMPLOYMENT CENTER
JANUARY 6–9, 2002
SAN DIEGO, CALIFORNIA

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Center information and forms is `http://www.ams.org/emp-reg/`.
2. Paper or electronic forms are due, along with payment and your Advance Registration/ Housing Form, by October 26 (to AMS, P. O. Box 6887, Providence, RI 02940) in order to be included in the *Winter List of Applicants*.
3. Forms will not be processed until registration and payment of fees have been received.

APPLICANT CODE:

Last name _____ First name _____

Mailing address (include zip code) _____

_____

E-mail address (one only) _____

URL (or other contact info) _____

Specialties _____

_____

(use MR classification codes plus text if possible; applicants will be indexed by first number only)

DESIRED POSITION:

Academic: ☐ Research ☐ University Teaching College Teaching: ☐ 4-year ☐ 2-year

Would you be interested in nonacademic employment? ☐ Yes ☐ No Available mo. _____/yr. _____

Computer skills _____

Significant requirements (or restrictions) which would limit your availability for employment _____

_____

PROFESSIONAL ACCOMPLISHMENTS:

Significant achievements, research or teaching interests _____

_____

_____

_____

_____

Paper to be presented at this meeting or recent publication _____

_____

Degree	Year (expected)	Institution
_____	_____	_____
_____	_____	_____
_____	_____	_____

Number of refereed papers accepted/published _____

PROFESSIONAL EMPLOYMENT HISTORY:

	Employer	Position	Years
1.	_____	_____	_____ to _____
2.	_____	_____	_____ to _____
3.	_____	_____	_____ to _____

References (Name and Institution only)

_____

_____

_____

_____

Work authorization status: (check one) ☐ U.S. Citizen ☐ Non-U.S. Citizen, authorized to work permanently in U.S. ☐ Other

This applicant will be using: ☐ ALL Employment Center services ☐ Message Center and Winter List ONLY

San Diego Joint Meetings Advance Registration/Housing Form

Name _____
(please write name as you would like it to appear on your badge)

Mailing Address _____

_____

Telephone _____ Fax _____

Email Address _____
(Acknowledgment of this registration will be sent to the email address given here, unless you check this box: *Send by US Mail* ☐)

Badge Information: Affiliation for badge _____

Nonmathematician guest badge name _____
(please note charge below)

Membership
✓ all that apply

AMS	☐
ASA	☐
ASL	☐
AWM	☐
CMS	☐
MAA	☐
NAM	☐
SIAM	☐
YMN	☐

☐ **I DO NOT want my program and badge to be mailed to me on 12/14/01.**

Registration Fees

Joint Meetings	**by Dec 10**	**at mtg**	**Subtotal**
☐ Member AMS, ASL, CMS, MAA, SIAM	$185	$241	
☐ Nonmember	$287	$373	
☐ Graduate Student	$ 35	$ 45	
☐ Undergraduate Student	$ 20	$ 26	
☐ High School Student	$ 2	$ 5	
☐ Unemployed	$ 35	$ 45	
☐ Temporarily Employed	$145	$166	
☐ Developing Countries Special Rate	$ 35	$ 45	
☐ Emeritus Member of AMS or MAA	$ 35	$ 45	
☐ High School Teacher	$ 35	$ 45	
☐ Librarian	$ 35	$ 45	
☐ Nonmathematician Guest	$ 5	$ 5	

$_____

AMS Short Course: *Symbolic Dynamics & its Applications (1/4–1/5)*			
☐ Member of AMS or MAA	$ 80	$100	
☐ Nonmember	$110	$130	
☐ Student, Unemployed, Emeritus	$ 35	$ 50	

$_____

MAA Short Course: *A Sampler of Applications of Graph Theory (1/4–1/5)*			
☐ Member of MAA	$125	$140	
☐ Nonmember	$175	$190	
☐ Student, Unemployed, Emeritus	$ 50	$ 60	

$_____

MAA Minicourses (see listing in text)
I would like to attend: ☐ One Minicourse ☐ Two Minicourses
Please enroll me in MAA Minicourse(s) #_____ and/or #_____
In order of preference, my alternatives are: #_____ and/or #_____
(no onsite registration for Minicourses 1 & 2)
Prices: $90 for Minicourses #1-8 and $60 for Minicourses #9-16

$_____

Employment Center
Applicant résumé forms and employer job listing forms will be on e-MATH and in *Notices* in September and October.

Employer—First Table ☐ Regular ☐ Self-scheduled	$210	$300
Employer— Each Additional Table ☐ Regular ☐ Self-scheduled	$ 60	$100
☐ Employer—Posting Only	$ 50	N/A
☐ Applicant (all services)	$ 40	$ 75
☐ Applicant (Winter List & Message Ctr only)	$ 20	$ 20

$_____

Events with Tickets

MER Banquet	$47	#____Regular	#____Veg
NAM Banquet	$47	#____Regular	#____Veg
AMS Banquet	$47	#____Regular	#____Veg

$_____

Other Events (no charge)
☐ Graduate Student Reception (1/6)

Total for Registrations and Events $_____

Payment

Registration & Event Total (total from other column) $_____

Hotel Deposit (only if paying by check) $_____

Total Amount To Be Paid $_____

(Note: A $5 processing fee will be charged for each returned check or invalid credit card. Debit cards are not accepted.)

Method of Payment

☐ Check. Make checks payable to the AMS. Checks drawn on foreign banks must be in equivalent foreign currency at current exchange rates.

☐ Credit Card. VISA, MasterCard, AMEX, Discover (no others accepted)

Card number: _____

Exp. date: _____ Zipcode of credit card billing address: _____

Signature: _____

Name on card: _____

☐ Purchase order # _____ (please enclose copy)

Registration for the Joint Meetings is not required for the Short Courses, but it is required for the Minicourses and the Employment Center.

Other Information

Mathematical Reviews field of interest # _____

How did you hear about this meeting? Check one:

☐ Colleague(s) ☐ *Notices* ☐ Focus ☐ Internet

☐ I am a mathematics department chair.

☐ **Please do not include my name on any promotional mailing list.**

☐ Please ✓ this box if you have a disability requiring special services.

Mail to:

Mathematics Meetings Service Bureau (MMSB)
P. O. Box 6887
Providence, RI 02940-6887
Fax: 401-455-4004
Questions/changes call: 401-455-4143 or 1-800-321-4267 x4143; mmsb@ams.org

Deadlines

For room lottery and/or résumés/job descriptions printed in the *Winter Lists*, return this form by:	**Oct. 26, 2001**
For housing reservations, badges/programs mailed:	**Nov. 7, 2001**
For housing changes/cancellations through MMSB:	**Dec. 6, 2001**
For advance registration for the Joint Meetings, Employment Center, Short Courses, MAA Minicourses, & Tickets:	**Dec. 10, 2001**
For 50% refund on banquets, cancel by:	**Dec. 21, 2001***
For 50% refund on advance registration, Minicourses & Short Courses, cancel by:	**Jan. 2, 2002***

***no refunds after this date**

San Diego Joint Meetings Hotel Reservations

To ensure accurate assignments, please rank hotels in order of preference by writing 1, 2, 3, etc., in the column on the left and by circling the requested room type and rate. If the rate or the hotel requested is no longer available, you will be assigned a room at a ranked or unranked hotel at a comparable rate. Participants are urged to call the hotels directly for details on suite configurations, sizes, and availability; however, suite reservations can only be made through the MMSB to receive the convention rates listed. Reservations at the following hotels must be made through the MMSB to receive the convention rates listed. All rates are subject to a 10.5% sales tax and a California commerce fee of $0.13. Rates at hotels may be subject to an energy surcharge. Participants are not obligated to pay an energy surcharge and may use their own discretion in this decision.

Guarantee requirements: First night deposit by check (add to payment on reverse of form) or a credit card guarantee.

☐ Deposit enclosed ☐ Hold with my credit card Card Number _____ Exp. Date _____ Signature _____

Date and Time of Arrival _____ **Date and Time of Departure** _____

Name of Other Room Occupant _____ **Arrival Date** _____ **Departure Date** _____ **Child (give age(s)** _____

Order of choice	Hotel	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites Starting rates
	San Diego Marriott Hotel & Marina (headquarters)								
	Bay view	$176	$176	$176	$196	(king & cot) $196	$216	N/A	$650
	City view	$156	$156	$156	$176	(king & cot) $176	$196	N/A	$650
	Student	$128	$128	$128	$148	(king & cot) $148	$168	N/A	N/A
	Embassy Suites (Regular Suites)	$148	$148	$148	$168	N/A	$188	N/A	N/A
	Bay view (Suites)	$168	$168	$168	$188	N/A	$208	N/A	N/A
	Student (Suites)	$138	$138	$138	$158	N/A	$178	N/A	N/A
	Wyndham San Diego at Emerald Plaza (Regular Rooms)	$147	$147	$147	$167	(king & cot) $187	$187	N/A	$550
	Student	$137	$137	$137	$157	(king & cot) $177	$177	N/A	N/A
	Horton Grand (Regular Rooms-most rooms have one bed)	$145	$145	$145	N/A	N/A	N/A	N/A	$259
	Student	$135	$135	$135	N/A	N/A	N/A	N/A	N/A
	Bristol San Diego (Regular Rooms)	$140	$140	$140	$150	(king & cot) $160	$160	N/A	N/A
	Student	$130	$130	$130	$140	(king & cot) $150	$150	N/A	N/A
	Westin Horton Plaza (Regular Rooms)	$139	$149	$149	$169	$194	$189	$214	$500
	Holiday Inn on the Bay (Regular Rooms)	$138	$148	$148	$163	$178	$178	$193	N/A
	Bay view	$158	$168	$168	$183	$198	$198	$213	$250
	Clarion Bay View (Regular Rooms)	$138	$138	$138	$158	(king & cot) $158	$178	N/A	$209
	Student	$128	$128	$128	$148	(king & cot) $148	$168	N/A	N/A
	Best Western Bayside (Regular rooms)	$119	$119	$119	$129	$141	$129	$141	N/A
	Student	$109	$109	$109	$119	$131	$119	$131	N/A
	Quality Inn & Suites Harbor View	$109	$119	$119	$129	$144	$139	$154	N/A
	Comfort Inn	$91	$91	$91	$91	$106	$91	$106	N/A

Special Housing Requests:.

☐ I have disabilities as defined by the ADA that require a sleeping room that is accessible to the physically challenged. My needs are: _____

☐ Other requests: _____

☐ If you are a member of a hotel frequent-travel club and would like to receive appropriate credit, please include the hotel chain and card number here: _____

If you are not making a reservation, please check off one of the following:

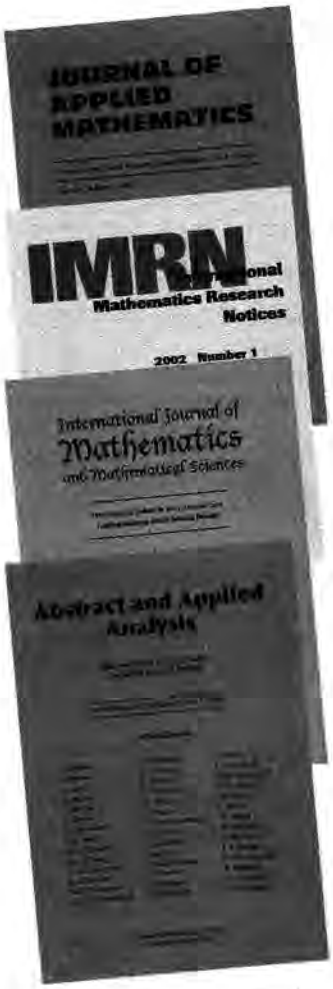
☐ I plan to make a reservation at a later date.

☐ I will be making my own reservations at a hotel not listed. Name of hotel: _____

☐ I live in the area or will be staying privately with family or friends.

☐ I plan to share a room with _____, who is making the reservations.

MATHEMATICS *from* HINDAWI



Abstract and Applied Analysis

Editor-in-Chief: A. G. Kartsatos (University of South Florida)

Aims & Scope: AAA is devoted exclusively to the publication of original research papers in the fields of abstract and applied analysis. Emphasis is placed on important developments in classical analysis, linear and nonlinear functional analysis, ordinary and partial differential equations, optimization theory, and control theory.

Subscription Information (ISSN 1085-3375, 2002, volume 7, 12+ issues): $395.00 (print and electronic), $316.00 (electronic only). Journal's web site: http://aaa.hindawi.com.

International Journal of Mathematics and Mathematical Sciences

Founding Managing Editor: L. Debnath (University of Central Florida)

Aims & Scope: IJMMS is devoted to the publication of original research papers, research notes, and research expository and survey articles with emphasis on unsolved problems and open questions in mathematics and mathematical sciences. All areas listed on the cover of Mathematical Reviews are included within the scope of the journal.

Subscription Information (ISSN 0161-1712, 2002, volumes 29–32, 48 issues): $595.00 (print and electronic), $476.00 (electronic only). Journal's web site: http://ijmms.hindawi.com.

International Mathematics Research Notices

Managing Editor: Morris Weisfeld

Aims & Scope: IMRN provides very fast publication of research articles of high current interest in all areas of mathematics. Articles are judged by their contribution to advancing the state of the science of mathematics. Issues are published as frequently as necessary.

Subscription Information (ISSN 1073-7928, volume 2002, 36+ issues): $1190.00 (print and electronic), $952.00 (electronic only). Journal's web site: http://imrn.hindawi.com.

Journal of Applied Mathematics

Editors-in-Chief: C. Brezinski (Université des Sciences et Technologies de Lille), L. Debnath (University of Central Florida), H. Nijmeijer (Eindhoven University of Technology)

Aims & Scope: JAM is devoted to the publication of original research papers and review articles in all areas of applied, computational, and industrial mathematics.

Subscription Information (ISSN 1110-757X, 2002, volume 2, 4+ issues): $295.00 (print and electronic), $236.00 (electronic only). Journal's web site: http://jam.hindawi.com.

Bundle Subscription: All four journals for $2103.75 (print and electronic), $1683.00 (electronic only).

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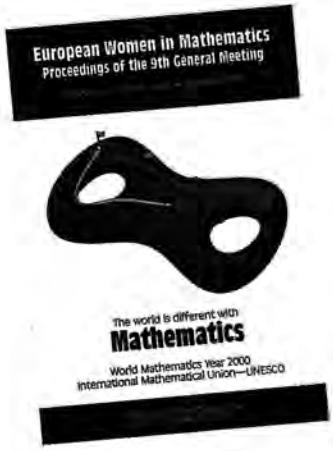

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Meetings and Conferences of the AMS

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The Meetings and Conferences section of the *Notices* gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. **Information in this issue may be dated. Up-to-date meeting and conference information** at www.ams.org/meetings/.

Meetings:

Important Information regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 87 in the January 2001 issue of the *Notices* for general information regarding participation in AMS meetings and conferences.

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Conferences: (See http://www.ams.org/meetings/ for the most up-to-date information on these conferences.)

May 20-25, 2002: 6th International Conference on Clifford Algebras and Their Applications to Mathematical Physics, Cookeville, Tennessee.

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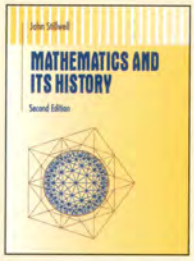

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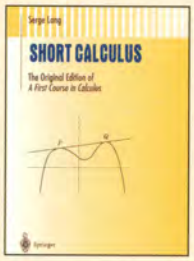

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