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New Titles from the AMS

African Americans in Mathematics
Nathaniel Dean, Bell Laboratories, Murray Hill, NJ, Editor

This volume contains research and expository papers by African-American mathematicians on issues related to their involvement in the mathematical sciences. Little is known, taught, or written about African-American mathematicians. Information is lacking on their past and present contributions and on the qualitative and quantitative nature of their existence in and distribution throughout mathematics. This lack of information leads to a number of questions that have to date remained unanswered. This volume provides details and pointers to help answer some of these questions.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science. Volume 34; 1997; 205 pages; Hardcover; ISBN: 0-8218-4675-0; List $89; Individual member $59; Order code DIMACS/34NT79

The Convenient Setting of Global Analysis
Andreas Kriegl and Peter W. Michor, Universität Wien, Austria

This book lays the foundations of differential calculus in infinite dimensions and discusses those applications in infinite dimensional differential geometry and global analysis not involving Sobolev completions and fixed point theory. The approach is simple: a mapping is called smooth if it maps smooth curves to smooth curves. Up to Fréchet spaces, this notion of smoothness coincides with all known reasonable concepts. In the same spirit, calculus of holomorphic mappings (including Hartogs’ theorem and holomorphic uniform boundedness theorems) and calculus of real analytic mappings are developed. Existence of smooth partitions of unity, the foundations of manifold theory in infinite dimensions, the relation between tangent vectors and derivations, and differential forms are discussed thoroughly. Special emphasis is given to the notion of regular infinite dimensional Lie groups.

Mathematical Surveys and Monographs, Volume 53; 1997; 205 pages; Hardcover; ISBN: 0-8218-0780-3; List $69; All AMS members $55; Order code SURV/53NT79

Elliptic Functions and Elliptic Integrals
Viktor Prasolov, Independent University of Moscow, Russia, and Yuri Solovyev, Moscow State University, Russia

This book is devoted to the geometry and arithmetic of elliptic curves and to elliptic functions with applications to algebra and number theory. It includes modern interpretations of some famous classical algebraic theorems such as Abel’s theorem on the lemniscate and Hermite’s solution of the fifth degree equation by means of theta functions. Suitable as a text, the book is self-contained and assumes as prerequisites only the standard one-year courses of algebra and analysis.

Translations of Mathematical Monographs, Volume 170; 1997; 185 pages; Hardcover; ISBN: 0-8218-0987-6; List $59; Individual member $47; Order code MMONO/170NT79

Introduction to Complex Analysis
Junjiro Noguchi, Tokyo Institute of Technology, Japan

This book describes a classical introductory part of complex analysis for university students in the sciences and engineering and could serve as a text or reference book. It places emphasis on rigorous proofs, presenting the subject as a fundamental mathematical theory. The volume begins with a problem dealing with curves related to Cauchy’s integral theorem. To deal with it rigorously, the author gives detailed descriptions of the homotopy of plane curves.

Translations of Mathematical Monographs, Volume 170; 1997; approximately 254 pages; Hardcover; ISBN: 0-8218-0777-8; List $99; Individual member $59; Order code MMONO/NOGUICI79NT79

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1997, ISBN: 0-8218-0960-5; List $19.95; All AMS members $16; Order code AMSCDN79

Topics in Classical Automorphic Forms
Henrik Iwaniec, Rutgers University, New Brunswick, NJ

The book is based on the notes from the graduate course given by the author at Rutgers University in the fall of 1994 and the spring of 1995. The main goal of the book is to acquaint the reader with various perspectives of the theory of automorphic forms. In addition to detailed and often nonstandard exposition of familiar topics of the theory, particular attention is paid to such subjects as theta-functions and representations by quadratic forms.

Graduate Studies in Mathematics, Volume 17; 1997; approximately 261 pages; Hardcover; ISBN: 0-8218-0777-8; List $39; All AMS members $31; Order code 08218-0777-3NT79

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Forthcoming Winter 1997

Compactlyifiable Symmetric Spaces
Y. Guivarch, L. Ji & J. Taylor, all, McGill University

Symmetric spaces are of central importance in many branches of mathematics. Compactlyifiable spaces have been studied from the points of view of representation theory, geometry, and random walks. This book is devoted to the study of the interrelationships between these various compactifications.

CONTENTS: Preface • Chapter I. Introduction • Chapter II. Structure of parabolic subgroups and subalgebras • Chapter III. Geometrical constructions of compactifications • Chapter IV. The Satake-Furstenberg compactifications • Chapter V. The Karpelevich compactification • Chapter VI. Martin compactifications • Chapter VII. The Martin Compactification • Chapter VIII. The Martin compactification • Chapter IX. Integration • Chapter X. An intrinsic approach to the boundaries of \( X \), Chapter XI. The twisted action and compactification via the ground state • Chapter XII. Harnack inequality, Martin method and the positive spectrum for random walks • Chapter XIII. The Furstenberg boundary and bounded harmonic functions • Chapter XIV. Integral representations of positive eigenfunctions of convolution operators • Chapter XV. Random walks, \( \mathbb{A}^n \) and the Martin compactification • Appendix A. Geometry of \( \mathbb{G} \) • Chapter XV Extension to semi-simple algebraic groups defined over a local field • Appendix B. Bibliography • List of symbols • Index


Forthcoming Fall 1997

Neural Networks and Computational Complexity
H. Siegelmann, Technion, Israel

The primary motivation of this book is the need to understand the theoretical foundations of neural networks as computational devices. Underlying this need is the concept of "connectionism," which is concerned with the computational and learning capabilities of assemblies of simple processors, called artificial neural networks. Many engineering applications have been found through highly idealized and simplified models of neuron behavior. Particular areas of application include: explosives detection in airport security, signature verification, financial and medical time-series prediction, vision, speech processing, robotics, nonlinear control, and signal processing. The focus in all of these models is entirely on the behavior of networks as computers.

1997 APP. 260 pp., Hardcover $49.50 (tor) ISBN 0-8176-3949-7

Forthcoming Fall 1997

Lise Meitner and the Dawn of the Nuclear Age
P. Rifft, University of Hawaii/Manoa

The drama surrounding the discovery of nuclear fission which led directly to the development of the first atomic bomb by the Allies is a true "thriller" in the history of science. The female physicist at the heart of this discovery also led a fascinating life in the midst of the pioneers of 20th century physics: Max Planck, her Berlin mentor; Albert Einstein, her life-long friend and others. This biography elucidates the life and times of Lise Meitner (1878-1989), giving a historical interpretation which will affect our understanding of the themes, events and personalities in early 20th century physics.


Introduction to PDE with MATLAB
J.M. Cooper, University of Maryland

This advanced textbook is an introductory treatment of partial differential equations. It covers the traditional subjects of the heat equation, wave equation and Laplace equation in the traditional manner using the method of separation of variables. However, to give a more varied, up-to-date treatment of the subject, the following material is worked in: nonlinear equations, in particular nonlinear first order equations; dispersive wave equations and the Schrodinger equation; numerical methods for each of the major equations as well as a section on the discrete and fast Fourier transform; and extensive use of MATLAB in the exercises for computation and graphical display of solutions.


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Mathematics Journals Should Be Electronic and Free

Of course I don’t believe what the title says. But I got your attention.

Journals record what we know and preserve our collected knowledge. They establish who proved what. A dean checks journals to verify that a tenure candidate publishes in established, archival forums of good repute. All of these journal functions would be lost if we were immediately to replace all paper journals with electronic media. Are you shocked? Then take heed.

• Nobody knows how to archive electronic media. The expected time value of data stored on a CD-ROM is ten years. Tapes oxidize and decompose. Hard discs crash. Zip cartridges and Jaz cartridges and Bernoulli cartridges are only warranted for one to five years. An individual easily can keep his few megabytes of data alive and on current media; a library would be overwhelmed by the task.

The hardware protocol changes every few years. (If you found an Edison cylinder labeled “Proof of the Riemann Hypothesis”, you could read the label, but how would you access the proof?)

• Imagine presenting a tenure case to your dean (a philologist of Tlingit), and that the candidate’s work is all published in electronic journals. You assert that (i) these are scholarly journals with distinguished editors, (ii) they are refereed and archived. Good luck. Over many years you might educate the dean. But you might not. (You know how difficult it is to get a tenure candidate past even the department if most of his publications are in “unreviewed” conference proceedings; if the publications are in “free” electronic journals, then exponentiate that difficulty.)

• In one hundred years there will be no CD-ROMs, no \TeX, no DOS, no Windows95, and no PCs. Anything stored and archived today will be inaccessible then. Some say, “We’ll plan to change media and software regularly.” Nice thought, but there are few such mechanisms in place; when money gets tight, corners will be cut, and vast amounts of the literature will be lost. You can always pull a book or bound journal off the shelf and read it. You need only a pair of eyes and an education (both time-tested devices). The archival value of printed books, especially those printed on acid-free paper, is well established.

People hear “electronic journal” and think “free journal”. Nonsense. Most of the cost of producing a journal comes from typesetting, formatting, editorial work, clerical work, accessibility, and archiving. Electronic media may save some costs, but they will not change the landscape.

Some argue that mathematicians would be willing to give up a great deal in the quality of journals if such a sacrifice would substantially reduce the price. I find this curious. I do not see many mathematicians driving Yugos, or wearing hopscats, or doing their e-mail and compiling \TeX on a Radio Shack TRS-80 just because it is cheaper. I do not think we are accurately assessing our own values. If you proved Fermat’s Last Theorem, would you want it typed up on a vintage 1915 Underwood, with the mathematical symbols written in by hand, with a ditto master, spiral bound, and dropped in bundles from low-flying planes? I think it is time that we think carefully about what we expect from a journal.

We are slowly being co-opted by electronic media: (i) our papers used to be typeset for us, but now we do it ourselves; (ii) many of us volunteer time to help maintain the departmental computer system; (iii) mathematicians now give

—Steven G. Krantz
On the Harvard Consortium Calculus

The Harvard Consortium Calculus (HCC below) again appears in an article (May 1997, pages 559–563) by David Mumford. He again mentions the purported definition of a continuous function $f$ given in HCC: "the closer $x$ gets to $a$, the closer $f(x)$ gets to $f(a)$." I had once objected because this definition does not take into account the well-known counterexample $f(x) = x \sin(1/x)$ with $f(0) = 0$. Mumford proposes a clarifying footnote to say that "$f(x)$ need not go straight to $f(a)$." Perhaps Professor Mumford was not at the San Diego meeting, where I proposed another counterexample: for $x$ real, with $f(x) = |x| + 1$ when $x \neq 0$ and $f(0) = 0$. Here the trouble is that $f(x)$ does indeed get closer and closer—but not real close! An added footnote to cover this might be risky; who knows what other examples could arise?

The solution is simple. This purported definition is not one; it serves only to mislead and confuse. Texts subsidized by the taxpayers' money need not mislead. That "definition" should be forthwith dropped. Nothing but nonsense is thereby lost; the text on the very next page gives a correct definition in terms of the previously defined notion of limit.

Professor Mumford goes on to argue against epsilon and delta (why not use $e$ and $d$?), when some form of that real definition should be there in every calculus text for the possible instruction of those occasional eager students.

David Mumford, after triumphs in algebra geometry, has gone on to exciting work in applied mathematics, where simulation is used. I admire his initiative, but not his examples. He cites Ed Lorenz, who "simulated his three-dimensional dynamical systems, without anyone being able to rigorously analyze [it]." It so happens that Lorenz, as an undergraduate student at Harvard, had indeed learned rigor in my (and others') courses. Mumford then argues against teaching full rigor; he labels it "logic," so recovering the ancient prejudice against "logic".

Rigor is not just logic. It is precision. Mathematics involves the understanding of precision in thinking. Precision is essential in policy work, as I know at first hand (National Academy of Sciences), and precision is needed in many of the applications of mathematics—in my own experiences in Hamiltonian mechanics, in geometrical optics, in analysis of electric circuits, and with many uses of elementary differential equations (which were vital in my experiences in war research). The HCC has great merit in covering DE (marred only by a sneak preview of Romeo and Juliet). To make it an effective reform text, it is essential that HCC in public renounce and omit all nonsense.

Library at Indian Institute of Technology

A new Indian Institute of Technology (IIT) has been established by the government of India in Guwahati which is located in the State of Assam in the northeast of India. The Institute started functioning in 1995. This IIT will be along the lines of the other IITs in Bombay, Delhi, Kanpur, Kharagpur and Madras and is an institute of national importance.

We are trying to build a very good library. I write this letter to the Notices to seek help from fellow mathematicians of the world to help us augmenting our collections by:

1. Sending us their preprints and reprints,
2. Including our name in their mailing lists,
3. Sending us research reports,
4. Sending us back volumes of different journals from their personal collections which they might wish to dispose of. We shall pay the shipping costs.

At present our mathematics faculty consists of a small but very promising group of seven people. We hope to grow to a strength of about twenty-five faculty members in the next few years. We are planning to develop research groups in mathematics analysis, algebra, CFD, and OR.

We welcome mathematicians from other countries to visit our institute.

Thanking you with kind regards.

P. Bhattacharyya
Indian Institute of Technology
Guwahati
(Received May 14, 1997)

On the COSEPUP Report

Era,\(^1\) on science priorities for the future funding of U.S. mathematics. The report was written by COSEPUP, a joint committee of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. It proposes that the U.S. have a policy of attaining a position of world leadership in all major fields of research.

Dr. Sweedler expresses concern that the case for the funding of mathematics research is undercut by a statement by John Hopcroft suggesting that K-12 math instruction may be more important to the overall health of U.S. science than Ph.D.-level preparation in math.

COSEPUP's report is aimed at helping set national priorities for research funding, not for the broader task of setting the funding levels for mathematics education or other important components of the nation's infrastructure for research. Thus, Hopcroft's observation is extraneous to the COSEPUP criteria, which center on the contributions of a field's research finding to progress in other fields of research.

Lawrence E. McCray
National Academy of Sciences
(Received May 27, 1997)

Funding Not the Problem
In the May 1997 Notices Judy Roitman cites funding restrictions as the obstacle to substantive reform in mathematics education: "While many of us might devoutly wish that better professional education development had preceded curriculum reform, the way in which professional development is funded is the real problem here."

But money is not the real problem. Fresh funding isn't needed to support future teachers as they take appropriate mathematics courses as undergraduates.


A perverse order of priorities is the problem: we habitually view mathematics education as suddenly being in a "crisis" which requires a rapid fix before another generation of students is lost. The usual fix is "quick, a new curriculum"—either more basics or more concepts, more applications or more theory, more emphasis on history or on esthetics. Or it may be a new way to organize the class.

If we put first things first and make sure that future teachers are mathematically well prepared before they enter a professional program, then we can finally improve matters.

On the other hand, if we continue the present course of focusing on curriculum or teaching strategies, I expect that the Standards reform movement will suffer the same fate as the New Math of the 1960s: [It will] gradually fizzle and vanish.

Sherman Stein
University of California, Davis
(Received May 29, 1997)

The Future of Math Departments
The communication on the uncertain future of mathematics departments makes interesting and familiar reading. Professor Conway (Notices, April 1997, pages 439-443) has quite succinctly identified teaching of algorithms as a problem. Fifteen years ago, in 1982, I wrote [1]:

In the laboratory or in industry, the mathematics used in most cases is actually an algorithm for turning a set of data to another set of data and in the coming years such tasks will be increasingly done by magnetic tapes, floppy discs, and plastic cards with the help of silicon chips.

For understanding various problems considered in that communication, the following facts may be of interest to your readers and to those who are concerned. At this college I used to belong to a small but distinguished mathematics depart-
Periodic Solutions of Nonlinear Partial Differential Equations

C. Eugene Wayne

"It seems at first that this fact [the existence of periodic solutions] could not be of any practical interest whatsoever... [however] what renders these periodic solutions so precious is that they are, so to speak, the only breach through which we may try to penetrate a stronghold previously reputed to be impregnable."

—Henri Poincaré

As the existence theory for solutions of nonlinear partial differential equations becomes better understood, one can begin to ask more detailed questions about the behavior of solutions of such equations. Given the bewildering complexity which can arise from relatively simple systems of ordinary differential equations, it is hopeless to try to describe fully the behavior which might arise from a nonlinear partial differential equation. Thus it makes sense to first consider special solutions, in the hope that through a more concrete understanding of them one may gain insight into the behavior of more general solutions. An extremely fruitful avenue of study in the theory of ordinary differential equations has been the construction of periodic orbits: in many circumstances they form a sort of skeleton on which more complicated solutions can be built. It was Poincaré who first realized this possibility, a discovery which prompted the remark quoted above. By a careful analysis of the periodic solutions that occur in the celestial mechanics problem of three gravitationally interacting planets and of the solutions asymptotic to these periodic orbits, he proved the existence of "chaotic" orbits in this system.

For the past thirty years or so there has been an active search for periodic solutions of partial differential equations, employing a variety of methods and motivated, at least in part, by the important role that periodic solutions play in understanding the behavior of ordinary differential equations. My goal in what follows is to describe a new technique for constructing such solutions which both highlights the differences between ordinary and partial differential equations and which also exhibits a surprising connection with problems in quantum mechanics. However, contrary to what Poincaré's quotation might suggest, these periodic solutions are not only of theoretical interest but also have many practical applications. As far as I am aware, the first study of periodic solutions of a nonlinear partial differential equation was in the early 1930s in the work of Vitt ([22], described in [13]), who considered these solutions in the context of problems of electrical transmission. Additional research was carried out in the '30s and '40s, often by physicists; not until the 1960s did mathematicians begin a fairly intensive study of the existence and properties of periodic solutions. (See, for example, [14, 21].) One problem that aroused particular interest was the structure of periodic standing waves on the surface of an inviscid, irrotational fluid. (See [21] and [6].) In particular, Paul Concus [7] pointed out the difference between the existence of periodic solutions for systems of ordinary differential equations and
partial differential equations as he explicitly examined the possible occurrence of "small denominators" in these partial differential equations, a problem which does not arise in the construction of periodic solutions for ordinary differential equations. All of these studies were based on deriving formal power series which were believed to approximate periodic solutions of the partial differential equations. However, while the work of Concus and others identified many important questions, the convergence or divergence of these series was not established, leaving open the question of whether or not such periodic solutions actually existed.

Like these earlier approaches to the construction of periodic solutions, the method I will describe is essentially perturbative in character. As an illustration of the sort of questions one encounters, consider the elementary system of two ordinary differential equations,

\begin{align}
(1) & \quad x_1 = -\omega_1^2 x_1, \\
(2) & \quad \dot{x}_2 = -\omega_2^2 x_2.
\end{align}

Clearly, all solutions of this system of equations are periodic. Suppose that one now adds nonlinear terms to the equations; one would like to use the information about solutions of (1) and (2) to understand the solutions of

\begin{align}
(3) & \quad \dot{x}_1 = -\omega_1^2 x_1 - \frac{\partial V}{\partial x_1}(x_1, x_2), \\
(4) & \quad \dot{x}_2 = -\omega_2^2 x_2 - \frac{\partial V}{\partial x_2}(x_1, x_2),
\end{align}

where \( V(x_1, x_2) \) has a Taylor series at the origin beginning with terms of at least order three. If one chose to add arbitrary nonlinear terms, it would be hopeless to make any general statement about the behavior of solutions of the perturbed equation. For instance, one can easily construct examples in which the resulting equations have no periodic solutions (except for the trivial solution \( x_1 = x_2 = 0 \), a finite number of periodic solutions, or an infinite number. However, the particular form of the nonlinear term in (3)-(4) (which insures that the resulting system of equations can be written as a Hamiltonian system) allows one to analyze small periodic solutions in some detail.

Lyapunov [17] originally derived sufficient conditions to assure that equations like (3) and (4) have periodic solutions which are close to those of the linear equations (1)-(2). As a motivation for what follows, let me sketch a proof of the existence of periodic solutions of (3)-(4), which is somewhat different from standard demonstrations. Any periodic solution must be of the form

\begin{align}
(5) & \quad x_1(t) = \sum_{n \in \mathbb{Z}} e^{i n \Omega t} \hat{x}_1(n), \\
(6) & \quad \dot{x}_2(t) = \sum_{n \in \mathbb{Z}} e^{i n \Omega t} \hat{x}_2(n).
\end{align}

If we substitute these forms of the solutions into (3)-(4), we find that the Fourier coefficients \( \hat{x}_j(n) \) must satisfy

\begin{align}
(7) & \quad -n^2 \Omega^2 \hat{x}_1(n) = -\omega_1^2 \hat{x}_1(n) + \hat{V}_1(\hat{x}_1, \hat{x}_2)(n), \\
(8) & \quad -n^2 \Omega^2 \hat{x}_2(n) = -\omega_2^2 \hat{x}_2(n) + \hat{V}_2(\hat{x}_1, \hat{x}_2)(n),
\end{align}

where \( \hat{V}_j \) is the result of inserting the expansion of \( x_1 \) and \( x_2 \) in Fourier modes into the nonlinear terms in (3)-(4) and expanding the resulting expression as a Fourier series. Exchanging two coupled, nonlinear, ordinary differential equations for infinitely many coupled, nonlinear, algebraic equations may not seem like progress, but this form of the problem turns out to be well suited to the application of the Lyapunov-Schmidt method (see [5]). Define the diagonal, linear operator with matrix elements \( L(n, j) = \omega_j^2 - n^2 \Omega^2 \), and let \( \hat{x} = (\hat{x}_1, \hat{x}_2) \) and \( \hat{V} = (\hat{V}_1, \hat{V}_2) \). Then (7) and (8) can be combined as

\begin{align}
(9) & \quad (L\hat{x})(n, j) = \hat{V}(\hat{x}).
\end{align}

If \( \omega_1 \neq n \omega_2 \) for all integers \( n \)—that is to say, if the two unperturbed oscillators are nonresonant and if the frequency \( \Omega \) of the periodic solution is close to \( \omega_1 \)—then the diagonal, linear operator with matrix elements \( L(n, j) = \omega_j^2 - n^2 \Omega^2 \) will have two small diagonal elements when \( (n, j) = (\pm 1, 1) \) and all other diagonal elements are bounded strictly away from zero. (In defining the nonresonance condition, I assumed that \( \omega_j^2 \leq \omega_k^2 \); otherwise one must also insure that \( \omega_2 \neq n \omega_1 \). Below we will encounter systems of equations with infinitely many frequencies \( \omega_j^2 \). In that case I will always assume that we have ordered the equations so that \( \omega_j^2 \leq \omega_k^2 \) if \( j \leq k \), for similar reasons.)

More precisely, let \( P_1 \) be the projection onto the two-dimensional space spanned by the coefficients \( \{ \hat{x}_1(\pm 1) \} \), and let \( Q_1 = P_1^* \). (We can take the orthogonal projection in the Hilbert space of \( \ell^2 \) sequences of Fourier coefficients.) Now rewrite (9) as a pair of equations by applying \( P_1 \) and \( Q_1 \) to both sides of this equation. Defining \( \hat{\gamma} = P_1 \hat{x} \) and \( \hat{z} = Q_1 \hat{x} \), one has

\begin{align}
(10) & \quad (P_1 L\hat{\gamma})(n, j) = (P_1 \hat{V}\hat{\gamma})(\hat{\gamma}, \hat{z})(n, j), \\
(11) & \quad (Q_1 L\hat{z})(n, j) = (Q_1 \hat{V}\hat{\gamma})(\hat{\gamma}, \hat{z})(n, j).
\end{align}

The point that allows one to solve (11) with relative ease is that because of the observation that the
eigenvalues of $L$ are bounded away from zero if $(n, j) \neq (\pm 1, 1)$, $Q_1 L$ has bounded inverse, so that given $\tilde{y}$, one can solve (11) by the implicit function theorem and obtain $z = z(\tilde{y})$. Inserting this solution into (10), we obtain a pair of equations (recall that the range of $P_1$ is two-dimensional),

$$
(P_1 L \tilde{y})(n, j) = (P_1 \tilde{V}(\tilde{y}, z(\tilde{y}))(n, j),
$$

$$
(n, j) = (\pm 1, 1).
$$

For $\Omega$ close to $\omega_1$ these two equations can be solved "by hand", and the resulting set of Fourier coefficients $\tilde{x} = (\tilde{y}, z(\tilde{y}))$ are the Fourier coefficients of a periodic solution of (3)-(4).

To sum up, this argument shows that there exists an $\eta_0 > 0$ and a smooth curve $\Omega(r)$, defined for $0 \leq r \leq \eta_1$, such that for $r$ in this range there exists a periodic solution of (3)-(4) with amplitude $r$ and frequency $\Omega(\eta_1)$. (One can measure the amplitude of the solution in a number of ways; for definiteness, use the $\ell^2$ norm of the set of Fourier coefficients.)

![Figure 1. The bifurcation diagram for a periodic orbit of a system of ordinary differential equations.](image)

This result is illustrated by Figure 1, which plots the frequency $\Omega$ of the periodic solution as a function of its amplitude $r$. Note that as the amplitude approaches zero, the frequency tends toward the frequency of the linear problem. The bifurcation curve may bend either to the right (as shown) or to the left, depending on the details of the nonlinear terms in the equations, but except in rare cases it will have some nonzero curvature, and hence we will obtain a family of periodic solutions of varying frequency whose frequencies fill an interval.

Despite the existence of results like these for systems of ordinary differential equations, rigorous proofs of the existence of periodic solutions in nonlinear partial differential equations were known only for certain special equations until the work of Paul Rabinowitz [20]. Rabinowitz considered problems of the form:

$$
\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} + f(u), 0 < x < \pi,
$$

$$
u(0, t) = u(\pi, t) = 0.
$$

He proved that under certain (fairly weak) conditions on the nonlinear term $f(u)$, (13) has periodic solutions $u(x, t) = u(x, t + T)$ for any period $T$ which is a rational multiple of $\pi$, the length of the $x$-interval. Note that in light of our discussion of periodic solutions for ordinary differential equations this restriction to solutions of rational period is quite unusual. In the ordinary differential equations case we found a whole interval of allowed periods, including both rational and irrational $T$.

Rabinowitz proved the existence of periodic solutions by constructing a functional on the space of functions which are periodic in time with period $T$ and which satisfy Dirichlet boundary conditions in space. The critical points of the functional are periodic solutions of (13); and although the functional is not well behaved, being in particular unbounded from both above and below, Rabinowitz succeeded in proving the existence of critical points. The restriction to rational periods arises at an intermediate point in the argument, where it is necessary to invert the $d'$Alembertian operator $\Box = \partial_t^2 - \partial_x^2$ on the space of functions periodic in time with period $T$ and satisfying Dirichlet boundary conditions at $x = 0$ and $x = \pi$. It is easy to compute the spectrum of $\Box$ acting on such functions; and one finds that if $T$ is a rational multiple of $\pi$, then the eigenvalues are either zero or else bounded away from zero by some fixed distance, and so $\Box^{-1}$ is bounded on the orthogonal complement of the null space of $\Box$. (In fact, it is compact on appropriate Sobolev spaces.) On the other hand, if $T$ is a typical irrational multiple of $\pi$, then the eigenvalues of $\Box$ will approach arbitrarily close to zero, so that $\Box^{-1}$ is unbounded and Rabinowitz's method no longer applies.

Rabinowitz's work inspired a great deal of additional research into the existence of periodic solutions for nonlinear partial differential equations, much of which is reviewed by H. Brezis in [4]. These investigations showed that while the hypotheses Rabinowitz made about the nonlinear term $f(u)$ could be weakened, the restriction to rational period seemed to be intrinsic to the variational method of constructing solutions. On the other hand, the construction of periodic solutions of (3) and (4) that I described above led to solutions of both rational and irrational period, and I want

1For certain irrational periods $T$ the eigenvalues of $\Box$ will again be bounded away from zero. The existence of periodic solutions for this set of frequencies is discussed (albeit with methods different from those of Rabinowitz) in [18]. However, there are "few" irrational periods with this property (they form a set of measure zero).
next to describe how that Lyapunov-Schmidt approach allows one to circumvent this restriction that arises in the variational approach.

Consider a linear wave equation to which we add a term \( g(x, u) \):

\[
\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} + g(x, u), \quad 0 < x < \pi.
\]

Expand \( g(x, u) \) in a Taylor series to obtain \( g(x, u) = g(x, 0) + g_1(x, 0)u + \mathcal{O}(u^2) \). Assume that \( g(x, 0) = 0 \) so that \( u \equiv 0 \) is a solution of (14). Renaming \( g_1(x, 0) = v(x) \) and assuming for simplicity that the \( \mathcal{O}(u^2) \) terms in the expansion are simply \( u^3 \), we are led to study:

\[
\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} + vu + u^3, \quad 0 < x < \pi.
\]

The methods below generalize to a much wider class of equations (see [10, 2]) and also allow one to choose quite general boundary conditions at \( x = 0 \) and \( x = \pi \), but for simplicity I will assume that \( u(0, t) = u(\pi, t) = 0 \), as in Rabinowitsch's case. If \( \{\phi_j(x)\}_{j=1}^\infty \) and \( \{\omega_j^2\}_{j=1}^\infty \) are the eigenfunctions and eigenvalues of the Sturm-Liouville operator

\[
L = -\frac{d^2}{dx^2} - v(x),
\]

one can find (infinitely) many periodic solutions to the linearized approximation to (15) of the form \( (A \cos(\omega_j t) + B \sin(\omega_j t))\phi_j(x) \). My goal is to seek solutions of the full nonlinear equations which are "close" to these simple solutions. Assume, as we did before for the ordinary differential equation (3)-(4), that there exists a periodic solution of (15) with frequency \( \Omega \), and write it as

\[
u(x, t) = \sum_{j=1}^\infty \sum_{n \in \mathbb{Z}} \tilde{u}(n, j)e^{in\Omega t}\phi_j(x).
\]

Inserting (16) into (15), one finds that the expansion coefficients \( \{\tilde{u}(n, j)\} \) must satisfy the (infinite) system of equations

\[
(\omega_j^2 - n^2 \Omega^2)\tilde{u}(n, j) = \tilde{V}(\tilde{u})(n, j), \quad n \in \mathbb{Z},
\]

\[
j = 1, 2, 3, \ldots,
\]

where \( \tilde{V}(\tilde{u}) \) is the function which results from inserting the expansion (16) for \( u \) into the nonlinear term \( u^3 \) in (15) and then expanding that expression in terms of the eigenfunctions of the Sturm-Liouville operator in \( x \) and the exponentials in \( t \).

Now try to mimic the previous approach to construct a solution of (15) which is "close" to the solution \( u^0(x, t) = \epsilon \sin(\omega_1 t)\phi_1(x) \) of the linear wave equation. Recall that we saw in the case of ordinary differential equations that as the amplitude of the periodic solution varies, so does its frequency. The parameter \( \epsilon \) is inserted in \( u^0 \) to allow us to easily vary the amplitude. If the frequency \( \Omega \) of the periodic solution (16) is close to \( \omega_1 \), then the linear operator on the left-hand side of (17) will have an eigenvalue very close to zero when \( j = 1 \) and \( n = \pm 1 \) and exactly equal to zero if \( \Omega = \omega_1 \). Thus as above define projection operators \( P \) as the projection onto the two-dimensional space spanned by \( (\tilde{u}(\pm 1, 1)) \), and let \( Q = P^\perp \). Applying these projection operators to (17), one obtains two equations very similar to (10) and (11). The only significant difference arises in the "\( Q \)-equation", which becomes

\[
(\omega_j^2 - n^2 \Omega^2)Q\tilde{u}(j, n) = Q\tilde{V}(\tilde{u})(j, n),
\]

\[
n \in \mathbb{Z}\setminus\{\pm 1\}, \quad j = 2, 3, 4, \ldots.
\]

In contrast to the case of ordinary differential equations, in which the linear part of (11) was obviously invertible so long as we avoided the resonant situation, one cannot expect the linear part of (18) to have bounded inverse. Sturm-Liouville theory implies that \( \omega_j^2 \approx j^2 + c \), for some constant \( c \); so in order to invert the linear part of (18), one must deal with expressions like \( 1/(j^2 - \Omega^2 n^2 + c) \), and for "typical" choices of \( \Omega^2 \) there will be a sequence of pairs of integers \( (n_j, j_0) \) for which \( j_0^2 - \Omega^2 n_j^2 + c = 0 \) as \( j \to \infty \). Trying to follow the construction above, these "small denominators" will frustrate any naive attempt to bound the inverse of the linear part of this equation. Thus, in marked contrast to the situation with ordinary differential equations, one encounters small denominators already in the construction of periodic solutions for partial differential equations, whereas for systems of ordinary differential equations they appear only in the construction of quasi-periodic solutions. But the analogy to quasi-periodic solutions of ordinary differential equations also suggests a method of circumventing this difficulty. The Kolmogorov-Arnold-Moser (KAM) theory was developed precisely to overcome small denominator problems in celestial mechanics, and since equation (15) is a Hamiltonian system, the classical KAM approach can be modified to deal with this problem (see [8, 15, 16, 23]). The KAM method starts from the Hamilton-Jacobi approach to integrating the equations of classical mechanics; one looks for a change of coordinates that preserves the Hamiltonian form of the equations of motion but such that after this change of variables the resulting system of differential equations is integrable. With rare exceptions it is impossible to find an explicit form for such a transformation, and the KAM theory uses Newton's method to construct better and better approximations to this change of variables and then shows that at least some of the solutions of these transformed systems converge to yield quasi-periodic solutions of the original equation.

The approach I will describe here, like the KAM theory, is based on Newton's method. However, it
seems to offer certain advantages in searching for solutions of these partial differential equations.

Consider (18) again, and assume that we know an approximate solution \( \tilde{u} \). In the present case, \( \tilde{u} \) will be the Fourier coefficients of \( u(x,t) = \epsilon \sin(2\pi \phi(x)) \), the solution of the linear wave equation, which we hope will approximate the periodic solution of the full nonlinear equation (15). Rewriting (18) as

\[
F(\tilde{u})(n,j) = -Q \tilde{V}(\tilde{u})(n,j) + (\omega_j^2 - \Omega^2) \tilde{u}(n,j) = 0,
\]

one can attempt to improve the approximate solution \( \tilde{u} \) by writing \( \tilde{u} = \tilde{u}^0 + \tilde{v} \), linearizing (19) about \( \tilde{u}^0 \) and then solving for the (presumably small) correction \( \tilde{v} \). This leads to a formula for \( \tilde{v} \) of the form

\[
\tilde{v} = - (D_{\tilde{u}^0} F)^{-1} F(\tilde{u}^0).
\]

Estimating the size of \( F(\tilde{u}^0) \) is not difficult, since \( \tilde{u}^0 \) is an approximate solution of (19). As is usual with Newton’s method, the difficulty lies in estimating the inverse of the linear operator \( D_{\tilde{u}^0} F \). This is a particular problem in the present instance, since it is this factor that contains the small denominators.

Surprisingly, the hint as to how one should control this inverse comes from quantum mechanics! To see why, look a little closer at the form of this operator. It acts on functions defined on the \((n,j)\) lattice, and so its action can be described by its matrix elements, which are:

\[
(D_{\tilde{u}^0} F)(n,j; n', j') = -D_{\tilde{u}^0} Q \tilde{V}(n,j; n', j')
\]

\[
+ \delta_{n,n'} \delta_{j,j'} (\omega_j^2 - \Omega^2).
\]

Denote the diagonal piece by

\[
\mathcal{V}(\Omega)(n,j) = (\omega_j^2 - \Omega^2).
\]

The small denominators arise from \( \mathcal{V}(\Omega) \). The off-diagonal piece \( D_{\tilde{u}^0} Q \tilde{V} \) is more problematic. At first sight it looks as if it has no structure at all. In order to better understand what happens, consider the special case in which \( \mathcal{V}(\Omega) \) (in (15)) is zero. In that case, \( \phi(x) = \sin(jx) \), and \( \tilde{u}^0 = \frac{1}{2} \delta_{j,0}(\delta_{n,1} - \delta_{n,-1}) \). This allows one to compute the nonlinear term in (19) explicitly, and one finds that \( D_{\tilde{u}^0} Q \tilde{V}(n,j;n',j') \):

- is \( O(\epsilon^2) \),
- vanishes if \(|n - n'| + |j - j'| > 2 \).

Another operator with properties similar to \( D_{\tilde{u}^0} Q \tilde{V} \) is the finite difference Laplacian \( \epsilon^2 \Delta \), defined by

\[
e^2(\Delta u)(n,j) = -4\epsilon^2 u(n,j) + \epsilon^2 (u(n+1,j) + u(n-1,j) + u(n,j+1) + u(n,j-1)).
\]

Note that the matrix elements of \( \epsilon^2 \Delta \) are \( O(\epsilon^2) \) and vanish if \(|n - n'| + |j - j'| > 2 \), just like those of \( D_{\tilde{u}^0} Q \tilde{V} \). Therefore, as a model to try to understand the behavior of \( D_{\tilde{u}^0} F \) in (21), consider

\[
H = -\epsilon^2 \Delta + \mathcal{V}(\Omega).
\]

Note that \( H \) is just the Hamiltonian operator of quantum mechanics and that mathematical physicists have developed a host of techniques to study its inverse. W. Faris [11] has surveyed a number of techniques and results related to the inverse of such operators, and one can adapt some of the methods he described there to the present problem. In particular, the techniques developed by Fröhlich and Spencer [12, 19], to invert operators like \( H \) are particularly relevant. Identify the points \((n,j)\) in the two-dimensional lattice at which \( \mathcal{V}(\Omega)(n,j) \) is particularly small as “singular sites.”

More precisely, define the singular sites as the sites \((n,j)\) at which \(|\mathcal{V}(\Omega)(n,j)| < 1/10 \). Let \( S = \{ \text{set of all singular sites} \} \). For \( \epsilon \) sufficiently small, we can invert \( H \) on the complement of the singular sites by a Neumann series, and we see that

\[
(H|_{S^c})^{-1} = \sum_{n=0}^{\infty} \frac{1}{\mathcal{V}(\Omega)} (\epsilon^2 \Delta + \frac{1}{\mathcal{V}(\Omega)})^n.
\]

The convergence of this series follows from the fact that on \( S^c \), \( |1/\mathcal{V}(\Omega)| \leq 10 \), so for \( \epsilon \) sufficiently small, \( \epsilon^2 \Delta \mathcal{V}(\Omega) \) will have norm less than 1. A more careful analysis of the sum in (25) shows that not only does it converge but the matrix elements of \((H|_{S^c})^{-1}\) decay exponentially with separation, i.e.,

\[
(H|_{S^c})^{-1}(n,j;n',j') \approx O(\epsilon^{2|n-n'|+|j-j'|}).
\]

In order to estimate the inverse of \( H \) on the entire lattice, Fröhlich and Spencer incorporate the singular sites inductively. Begin by defining a subset \( S_1 \) of \( S \) as those sites \((n,j)\) at which \( 1/10 \geq |\mathcal{V}(\Omega)| \geq \epsilon \); these are the “not too singular sites”, if you like. Writing

\[
H|_{S^c \cup S_1} = H|_{S^c} \oplus H|_{S_1} \oplus \Gamma,
\]

where \( \Gamma \) describes the matrix elements of \( H \) which connect sites in \( S^c \) to \( S_1 \), one can expand

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The terms in this expansion are estimated with the help of the following remarks: \((H_{s_\infty})^{-1}\) has been estimated above; the operator \((H|_{S_\infty})^{-1}\) has norm bounded by \(\Theta_0\), since we know that \(|1/\sqrt{2}\|\leq 1/c\) at sites in \(S_1\); and finally, since the only off-diagonal terms in \(H\) are those coming from \(\epsilon^2\Delta\), we know that the norm of \(\Gamma\) is bounded by \(C\epsilon^2\). These observations suffice to prove that \((H|_{S_\infty})^{-1}\) is bounded and has matrix elements that decay exponentially, and one proceeds inductively to incorporate more and more singular sites into the region on which one can control \(H^{-1}\).

A potential problem arises when one considers very singular sites, for example, sites \(S_\infty\) at which \(V(\Omega)\approx \Theta(\epsilon^0)\), with \(n \geq 2\). In this case the factors of \((H_{s_\infty})^{-1}\) which appear in the analogue of (28) have norms that are \(\Theta(\epsilon^{-n})\). In order to prove the convergence of the series in this case, Frohlich and Spencer developed a clever alternating expansion in which a factor of \((H|_{S_\infty})^{-1}\) is preceded by a factor of \((H|_{S_\infty})^{-1}\) evaluated at two widely separated lattice sites. The exponential decay of \((H|_{S_\infty})^{-1}\) is then used to offset the large factors of \((H|_{S_\infty})^{-1}\), and the inductive procedure gives estimates of \(H^{-1}\) on larger and larger subsets of the lattice.

In order to be able to separate the factors of \((H|_{S_\infty})^{-1}\) by factors of \((H|_{S_\infty})^{-1}\) evaluated at widely separated lattice sites, the different components of \(S_\infty\) must themselves be far apart. Therefore, to apply the Frohlich and Spencer expansion to estimate \((D_{qF})^{-1}\), one must insure that the singular sites of \(V(\Omega)\) are widely separated. Since \(V(\Omega)(n, j) = \omega_j^2 - n^2\Omega^2\) and since the asymptotics of eigenvalues of Sturm-Liouville operators imply that \(\omega_j^2 \approx j^2 + c\), the singular sites \((n, j)\) are those at which

\[
(29)\quad j^2 - n^2\Omega^2 + c = 0.
\]

For (29) to hold, one must have \(j\) approximately equal to \(\pm \sqrt{n^2\Omega^2 + c} = \pm n\Omega + \Omega (1/n)\); this means that the singular sites must lie near the straight lines \(j = \pm n\Omega\). If, in addition, \(\Omega\) is poorly approximated by rational numbers, one can show that the singular sites occur only at widely separated locations along these lines. This is more than sufficient information to apply the Frohlich-Spencer method, and one finds that the operator \((D_{qF})^{-1}\) in (20) is bounded and decays exponentially away from the diagonal, giving one a good estimate of the corrections \(v\) that arise in Newton's method.

Before leaving this point let me remark that this method does not allow one to control the inverse of \((D_{qF})^{-1}\) for all choices of \(q\) and \(\Omega\), but only for almost all choices. This restriction arises because the singular sites of \(V(\Omega)\) may not be widely separated if \(\Omega\) is well approximated by rational numbers, or \(V(\Omega)(n, j)\) may vanish for certain choices of \(\Omega\) and \((n, j)\). In either case the methods of Frohlich and Spencer no longer apply. In particular, frequencies which are rationally related to some \(\omega_j\) must be excluded.

The fact that this method results in periodic solutions whose frequencies are "poorly approximated" by rational numbers may seem counterintuitive at first sight. One might expect that periodic orbits would correspond to rational frequencies, or at least nearly rational frequencies. However, requiring \(\Omega\) to be poorly approximated by rational numbers really implies that no multiple of \(\Omega\) is too nearly commensurate with any of the other natural frequencies of the nonlinear wave equation (15), i.e., with any of the other \(\omega_j\). Physically, the occurrence of such a resonance or near resonance can lead to an exchange of energy between the periodic solution we are trying to construct and other modes of the system, and this loss of energy can destroy the periodic motion we seek. Indeed, the Kirkwood gaps in the asteroid belt occur for exactly this reason. Resonances between the periods of the orbits of asteroids that would fill these gaps and the period of the orbit of Jupiter prevent periodic orbits from forming in these regions.

One can construct an inductive argument based on the ideas above and show that it converges to a solution of the \(Q\)-equation (18) as one iterates this procedure. Proceeding then as we did for ordinary differential equations, one defines \(\hat{Y} = \hat{P}\hat{U}\) and \(\hat{Z} = \hat{Q}\hat{U}\). The iterative argument just described allows one to construct a smooth function \(\hat{Z} = \hat{Y}(\Omega, \hat{Y})\) which for a set of frequencies \(\Omega\) has large measure solves (18). Inserting this solution into the equation which results when one applies the projection operator \(P\) to (17), one again obtains a pair of equations for the two remaining coefficients \(\hat{Y}\), which one solves "by hand", and one finally obtains (9):

\[\text{Theorem 1.}\]

If the potential \(v(x)\) satisfies a finite number of explicit conditions, then there is a smooth curve \(\Omega = \Omega(r)\) such that for \(r\) in a Cantor set of positive measure, the nonlinear wave equation (15) has a periodic solution with frequency \(\Omega(r)\) and amplitude \(r\).

\[\text{Remark 1.}\]

The conditions imposed on \(v(x)\) are satisfied generically and can be checked for specific
cases. For example, if \( v(x) = m^2 \), the Klein-Gordon equation, these conditions are satisfied for almost every choice of \( m \) (but not for \( m = 0 \)).

\[ \begin{align*}
\text{amplitude} & \quad \Omega(r) \\
\omega_1 & \quad \text{frequency}
\end{align*} \]

**Figure 2.** The bifurcation diagram for a periodic orbit of a nonlinear partial differential equation. The broken parts of the curve represent regions in which points on the graph of \( \Omega(r) \) do not correspond to solutions of the nonlinear wave equation (15).

This theorem is perhaps best illustrated by Figure 2, which highlights both the similarities and differences between the case of partial differential equations and the analogous results for ordinary differential equations illustrated in Figure 1. Just as in Figure 1, one has a smooth curve relating the amplitude of the solution to its period. However, in the present case not every point on the curve corresponds to a solution, but only those which lie in a Cantor set. The points that are excluded are those frequencies which were "too well" approximated by rational numbers in the process of inverting the linear operator to solve the "Q-equation" in the Lyapunov-Schmidt procedure. Note, however, that since the Cantor set of frequencies for which solutions are known to exist has positive measure, there must exist at least some periodic solutions with irrational period. Indeed, these methods are in some sense complementary to the variational techniques pioneered by Rabinowitz, since they fail for the rational periods for which the variational approach is well suited.

The applications of this method have been greatly extended recently, primarily through the work of J. Bourgain [1, 2]. Bourgain has shown in particular that one can use this approach to construct periodic solutions for equations on spatial domains of arbitrary dimension as well as quasi-periodic solutions for equations on one- and two-dimensional domains. There is still no proof of the existence of quasi-periodic solutions on three- (or higher) dimensional spatial domains due to difficulties associated with solving the analogue of the "Q-equation" (18). Note that a key observation used in solving that equation was that the sites \( (n, j) \) at which the quantity \( \omega_j^2 - n^2\Omega^2 \) was small were widely separated in the \( (n, j) \) lattice. Since \( \omega_j^2 = j^2 + \epsilon \), this is essentially a question about the distribution of lattice sites at which the quadratic form \( j^2 - n^2\Omega^2 \) takes on small values, a question that is easy to answer in terms of how well \( \Omega \) is approximated by rational numbers. In order to construct quasi-periodic solutions, one must analyze the distribution of lattice sites at which quadratic forms in larger and larger numbers of variables become small, and for the quadratic forms that arise in three or more dimensions this remains an unsolved problem.

**References**


Random Combinatorial Structures and Prime Factorizations

Richard Arratia, A. D. Barbour, and Simon Tavaré

Introduction

Many combinatorial structures decompose into components, with the list of component sizes carrying substantial information. An integer factors into primes—this is a similar situation, but different in that the list of sizes of factors carries all the information for identifying the integer. The combinatorial structures to keep in mind include permutations, mappings from a finite set into itself, polynomials over finite fields, partitions of an integer, partitions of a set, and graphs.

The similar behavior of prime factorization and cycle decompositions of permutations was observed by Knuth and Trabb Pardo [24]. We attempt to explain why such systems are similar.

We are interested in probability models which pick "a random combinatorial structure of size \( n \)" meaning that each of the objects of that size is equally likely. We also consider the model which picks an integer uniformly from 1 to \( n \). Such models lead to stochastic processes that count the number of components of each conceivable size. What are the common features of these processes?

There are two broad areas of commonality. The first and most basic is essentially an algebraic property. It involves representing the distribution of the combinatorial process as that of a sequence of independent but not identically distributed random variables, conditioned on a weighted sum; see (5). All our combinatorial examples satisfy this exactly. On the other hand, prime factorizations of a uniformly chosen integer cannot be described in terms of conditioning a process of independent random variables on the value of a weighted sum because the value of the weighted sum in this case tells us the value of the random integer. However, by considering conditioning as a special case of the more general construction of "biasing" a distribution, we can view prime factorization as having a very close relative of the conditioning property. Conditioning independent random variables on various weighted sums has a long history; for combinatorial examples we refer the reader to Shepp and Lloyd [29], Holst [20], Kolchin [25], Diaconis and Pitman [13], and Arratia and Tavaré [9].

The second broad area of commonality, shared by some but not all of the examples listed above, is an analytic property. The number of components of size at most \( x \) has, for fixed \( x \), a limit in distribution as \( n \to \infty \), and the expected value of this limit is asymptotic to \( \theta \log x \) as \( x \to \infty \), where \( \theta > 0 \) is a constant. We call combinatorial structures that have this property "logarithmic". For the main examples in this paper the logarithmic structures are permutations, polynomials, mappings, the Ewens sampling formula, and prime factorizations, and the nonlogarithmic structure is that of integer partitions.
Combinatorial Examples

Consider a combinatorial structure which decomposes into components. Let \( p(n) \) be the number of instances of size \( n \). Given an instance of size \( n \), the most basic description reports only the number \( k \) of components. We are interested in a fuller description, the component structure, specifying how many of these \( k \) components are of sizes one, two, three, and so on.

For a given combinatorial structure, the usual approach is to assume that \( n \) is fixed and to count how many of the \( p(n) \) instances of size \( n \) have each particular component structure. Equivalently, one can think of drawing an instance at random from the uniform distribution over all \( p(n) \) possibilities and ask for the probability of each particular component structure. In this random formulation, the counts of components of each size become random variables. We write \( C_{i}(n) \) for the number of components of size \( i \). Thus \( (C_{1}(n), C_{2}(n), \ldots, C_{n}(n)) \) specifies the entire component size counting process, and \( K(n) := C_{1}(n) + C_{2}(n) + \cdots + C_{n}(n) \) is the total number of components. The random variables \( C_{1}(n), C_{2}(n), \ldots \) are dependent, and in fact a certain weighted sum of them is constant:

\[
(1) \quad C_{1}(n) + 2C_{2}(n) + \cdots + nC_{n}(n) = n.
\]

We illustrate the above concepts with four examples from combinatorics and one family of distributions from genetics that plays a unifying role. In this random formulation, the component structure, specifying how many of these \( k \) components are of sizes one, two, three, and so on.

For each example we provide one instance, with exhaustive, but rather pointers to the literature. Equivalently, one can think of drawing an instance at random from the uniform distribution over all \( p(n) \) possibilities and ask for the probability of each particular component structure. For example, these are not intended to be examples from combinatorics and one family of distributions from genetics that plays a unifying role.

**Example 1. Integer partitions** [17, 27]. Partition the integer \( n \) as \( n = l_{1} + l_{2} + \cdots + l_{k} \) with \( l_{1} \geq l_{2} \geq \cdots \geq l_{k} \geq 1 \). For integer partitions, \( p(n) \) is the traditional notation for the number of such partitions, and \( \sum p(n)x^{n} = \Pi_{i \geq 1}(1 - x^{i})^{-1} \). We write \( C_{i}(n) \) for the number of parts which are \( i \), and the component counting structure \( (C_{1}(n), \ldots, C_{n}(n)) \) is an encoding of the partition. An instance for \( n = 10 \) is

\[
10 = 5 + 3 + 1 + 1.
\]

In this instance \( C_{1}(10) = 2, C_{3}(10) = C_{5}(10) = 1 \), the other \( C_{i}(n) \) being zero.

**Example 2. Permutations** [29, 7]. Consider the cycle decomposition of a permutation of the set \( \{1, 2, \ldots, n\} \), with \( C_{i}(n) \) being the number of cycles of length \( i \). The total number of instances of size \( n \) is \( p(n) = n! \), and \( C_{1}(n) \) is the number of fixed points. An instance for \( n = 10 \) is the function \( \pi \) with \( \pi(1) = 9, \pi(2) = 1, \pi(3) = 7, \pi(4) = 4, \pi(5) = 3, \pi(6) = 2, \pi(7) = 5, \pi(8) = 8, \pi(9) = 10, \pi(10) = 6 \), whose cycle decomposition is

\[
\tau = (1 \ 9 \ 10 \ 6 \ 2 \ 3 \ 7 \ 5 \ 4 \ 8).
\]

In this instance \( C_{1}(10) = 2, C_{3}(10) = C_{5}(10) = 1 \).

**Example 3. Mappings** [15, 25]. Consider all mappings from the set \( \{1, 2, \ldots, n\} \) to itself, so that there are \( p(n) = n^{n} \) possibilities. A mapping \( f \) corresponds to a directed graph with edges \( (i, f(i)) \) for \( i = 1 \) to \( n \), and the "components" of \( f \) are precisely the connected components of the underlying undirected graph. An instance for \( n = 10 \) is the function \( f \) with \( f(1) = 9, f(2) = 6, f(3) = 5, \pi(4) = 4, \pi(5) = 3, f(6) = 6, f(7) = 3, f(8) = 8, f(9) = 2, f(10) = 2 \). In this instance \( C_{1}(10) = 2, C_{2}(10) = C_{5}(10) = 1 \). Note that the number of fixed points, 3 in this instance, is not \( C_{1}(10) \).

**Example 4. Polynomials over GF(q)** [16, 3]. Consider monic polynomials of degree \( n \) over the finite field \( GF(q) \). Writing \( f(x) = x^{n} + a_{n-1}x^{n-1} + \cdots + a_{1}x + a_{0} \), we see that there are \( p(n) = q^{n} \) possibilities. These polynomials can be uniquely factored into a product of monic irreducible polynomials, and \( C_{i}(n) \) reports the number of irreducible factors of degree \( i \). For the case \( q = 2 \), an instance with \( n = 10 \) is

\[
f(x) = x^{10} + x^{8} + x^{2} + x + 1 = (x + 1)(x^{3} + x^{2} + 1)(x^{5} + x^{4} + x^{3} + x + 1).
\]

In this instance \( C_{1}(10) = 2, C_{3}(10) = C_{5}(10) = 1 \).

**Example 5. The Ewens Sampling Formula** [14]. The Ewens sampling formula (ESF) with parameter \( \theta > 0 \) is not in general a combinatorial model, but it does play a central role in our story. The model arose originally in population genetics, where the parameter \( \theta \) is a mutation rate. See also Chapter 41 of [21].

For each \( n = 1, 2, \ldots \) and \( \theta > 0 \), the ESF is a distribution for \( (C_{1}(n), C_{2}(n), \ldots, C_{n}(n)) \). It gives the distribution of the cycle structure of a random permutation of \( n \) objects, choosing a permutation with probability biased by \( \theta^{K(n)} \), where \( K(n) \) is the number of cycles. For irrational \( \theta \) these are certainly not models in combinatorics, but for \( \theta = 1, 2, 3, 4, \ldots \) the ESF is the distribution of a "random permutation with colored cycles" in which there are \( \theta \) colors available.

**Independent Random Variables, Conditioned on a Weighted Sum**

One unifying feature of our combinatorial examples is that each has a component structure that can be described in terms of a process of independent random variables \( Z_{1}, Z_{2}, \ldots \), conditioned on the value of a weighted sum. We illustrate this in the example of random permutations.

Cauchy's formula says that for nonnegative integers \( a_{1}, a_{2}, \ldots, a_{n} \) with \( a_{1} + 2a_{2} + \cdots + na_{n} = n \), the number of permutations having \( a_{i} \) cycles of length \( i \), for \( i = 1 \) to \( n \), is \( n! / \Pi [a_{i}! \mu^{i}] \). Pick-
ing a random permutation of \( n \) objects and choosing uniformly over the \( n! \) possibilities, one can say that, for any \( a = (a_1, \ldots, a_n) \in \mathbb{Z}^n \),

\[
P((C_1(n), \ldots, C_n(n)) = a) = \prod_{j=1}^{n} \left( \frac{1}{j} \right)^{a_j} \frac{1}{a_j!}
\]

The formula above uses an indicator function, \( \mathbb{1}(A) = 1 \) if \( A \) is true, and 0 if not.

Now suppose that \( Z_1, Z_2, \ldots \) are independent Poisson random variables with \( \mathbb{E}Z_j = 1/j \). In contrast to (2),

\[
\mathbb{P}(T_n = Z_1 + 2Z_2 + \cdots + nZ_n) = \prod_{j=1}^{n} \mathbb{P}(Z_j = a_j)
\]

Let \( T_n \) be the following weighted sum of the independent random variables:

\[
T_n = Z_1 + 2Z_2 + \cdots + nZ_n.
\]

It follows from (2) and (3) that

\[
\mathbb{P}(T_n = n) = \sum_{a: \sum_1^n a_j = n} \mathbb{P}(Z_1, \ldots, Z_n = a) = \mathbb{E}^{\sum_1^n a_j/n} \mathbb{E}^{a_j} \prod_{j=1}^{n} \left( \frac{1}{j} \right)^{a_j} \frac{1}{a_j!}
\]

Using (4), we see that this ratio simplifies to the expression in (2). This proves that the distribution of \( (C_1(n), \ldots, C_n(n)) \) equals the distribution of \( (Z_1, \ldots, Z_n) \) conditional on the event \( \{T_n = n\} \). All of our combinatorial processes satisfy an identity of this form; that is

\[
\mathcal{L}((C_1(n), \ldots, C_n(n)) = \mathcal{L}((Z_1, Z_2, \ldots, Z_n) | T_n = n).
\]

For a general treatment of (5) for combinatorial structures, see [9].

**Logarithmic Combinatorial Structures**

Some of our examples have a limit in distribution:

(6) \((C_1(n), C_2(n), \ldots, C_n(n), 0, 0, \ldots) \Rightarrow (Z_1, Z_2, \ldots)\).

In those examples where the limit exists, such as random permutations, random mappings, random polynomials over \( GF(q) \), and the Ewens sampling formula, it turns out that the limit process \( (Z_1, Z_2, \ldots) \) has independent coordinates which satisfy (5). For partitions of an integer and for partitions of a set, (6) is not satisfied, and each coordinate \( C_i(n) \) goes off to infinity as \( n \) grows.

There are combinatorial examples, such as random forests, which satisfy both (5) and (6) but which still do not satisfy all our requirements for being "logarithmic". The condition that best characterizes the property of being a "logarithmic combinatorial structure" is that both (5) and (6) hold and, for some constant \( \theta \in (0, \infty) \),

\[
i \mathbb{E}Z_i - \theta, \quad i \mathbb{P}(Z_i = 1) - \theta \quad \text{as} \quad i \to \infty.
\]

The terminology "logarithmic" comes from the relation

\[
\sum_{i \leq x} \mathbb{E}Z_i \sim \theta \log x
\]

as \( x \to \infty \). A logarithmic combinatorial structure of size \( n \) tends to have around \( \theta \log n \) components.

**Continuum Limits for Logarithmic Combinatorial Structures**

**Scale invariant Poisson processes on \((0, \infty)\)**

What happens if we rescale the limit process \( (Z_1, Z_2, \ldots) \) for a logarithmic combinatorial structure? Formally, consider the random measure \( \mathcal{M}_n \) with mass \( Z_i \) at the point \( i/n \), for \( i \geq 1 \). The independence of the \( Z_i \) means that for any system of nonoverlapping subintervals of \((0, \infty)\) the random measure \( \mathcal{M}_n \) assigns independent masses. The logarithmic property implies that the expected mass assigned to an interval \((a, b)\) is

\[
\mathbb{E} \sum_{i/n \in (a, b)} Z_i \sim \sum_{\nu a < i < \nu b} \theta / \log(b/a) = \int_a^b \theta dx / x.
\]

The "scale invariant" Poisson process \( \mathcal{M} \) on \((0, \infty)\) with intensity \( \theta dx / x \) has exactly \( \theta \log(b/a) \) for the expected number of points in any interval \((a, b)\). Like the \( \mathcal{M}_n \), the Poisson process assigns independent masses to nonoverlapping subintervals. It is not hard to show that for any logarithmic combinatorial structure satisfying (8) the random measures \( \mathcal{M}_n \) converge in distribution to \( \mathcal{M} \):

(9) \( \mathcal{M}_n \Rightarrow \mathcal{M} \).

The convergence above is characterized by integrating against continuous functions with com-
impact support. Observe that for the random variable $T_n$ that appears in the conditioning (5) we have

$$T_n = \frac{1}{n} \sum_{i \leq n} Z_i = \int_{(0,1]} x \mathcal{M}_n(dx).$$

Thus it is natural to anticipate from (3) that

$$T_n/n \Rightarrow T$$

where

$$T := \int_{(0,1]} x \mathcal{M}(dx).$$

The limit process $\mathcal{M}$ is simple. Since $\mathcal{M}$ has an intensity measure which is continuous with respect to Lebesgue measure, with probability one $\mathcal{M}$ has no double points. Thus we can identify $\mathcal{M}$ with a random discrete subset of $(0, \infty)$. In particular the points of $\mathcal{M}$ in $(0,1]$ can be labeled $X_i$ for $i = 1, 2, \ldots$ with

$$0 < \cdots < X_2 < X_1 \leq 1.$$  

With this labeling, the integral in (11) is expressed as the sum of locations of all points of the Poisson process $\mathcal{M}$ in $(0,1)$:

$$T = X_1 + X_2 + \cdots .$$

Computation with Laplace transforms shows that the density $g_\theta$ of $T$, with $g_\theta(x) = 0$ if $x < 0$, satisfies

$$xg_\theta(x) = \theta \int_{x-1}^x g_\theta(u)du, x > 0,$$

so that for $x > 0$,

$$xg'_\theta(x) + (1- \theta)g_\theta(x) + \theta g_\theta(x-1) = 0. $$

Equation (15) shows why $\theta = 1$ is special. See Ver­vaat [32], p. 90, and Watterson [33]. For the case $\theta = 1$, the density $g_1$ of $T$ is $g_1(t) = e^{-t} \rho(t)$, where $\gamma$ is Euler's constant and $\rho$ is Dickman's function [31].

The rescaled limit of the large components is the Poisson-Dirichlet process

The limit in (6) inherently focuses on the small components, in that convergence in distribution for infinite-dimensional random vectors is equivalent to convergence for the restrictions to the first $b$ coordinates, for each fixed $b$. How can we discuss the limit distribution for the large components?

One way is to let $L_i(n)$ be the size of the $i^{th}$ largest component of a combinatorial structure of size $n$, with $L_i(n) = 0$ whenever $i > K(n)$, the number of components. Note that the vectors $(C_1(n), C_2(n), \ldots, C_n(n))$ and $(L_1(n), L_2(n), \ldots, L_n(n))$ carry exactly the same information; each can be expressed as a function of the other.

Typically, for any fixed $i$ and $k$, $P(L_i(n) > k) \sim 1$, so it would not be useful to ask for the limit of $(L_1(n), L_2(n), \ldots)$. However, all the examples which satisfy (7) have a limit for the process of large components [18, 5]; rescaling all sizes by $n$,

$$\frac{L_1(n)}{n}, \frac{L_2(n)}{n}, \ldots \Rightarrow (V_1, V_2, \ldots).$$

The distribution of the limit is called the Poisson-Dirichlet distribution with parameter $\theta$, after King­man [22, 23]. It is most directly characterized by the density functions for its finite-dimensional distributions, which involve the density $g_\theta$ of $T$ described in (13)-(15). The joint density of $(V_1, V_2, \ldots, V_k)$ is supported by points $(x_1, \ldots, x_k)$ satisfying $x_1 > x_2 > \cdots > x_k > 0$ and $x_1 + \cdots + x_k < 1$, and at such points has value, in the special case $\theta = 1$,

$$g_\theta \left( \frac{1-x_1-x_2-\cdots-x_k}{x_k} \right) \frac{1}{x_1x_2\cdots x_k}.$$  

where $\rho$ is Dickman's function. For the case of general $\theta > 0$ the expression for the joint density function is [33]

$$g_\theta \left( \frac{1-x_1-\cdots-x_k}{x_k} \right) e^{\gamma \theta} \theta^k \Gamma(\theta) x_k^{\theta-1}.$$  

The Poisson-Dirichlet process arises from the scale invariant Poisson process by conditioning. For all the combinatorial systems in this paper the discrete dependent process $(C_1(n), \ldots, C_n(n))$ comes from the independent process $(Z_1, Z_2, \ldots)$ by conditioning on $T_n = n$, as in (5). Restricting to the logarithmic class, each of the discrete ingredients in this, $(C_1(n), \ldots, C_n(n))$ and $(Z_1, Z_2, \ldots)$, can be rescaled to get a continuum limit in which only the parameter $\theta$ appears. For the dependent system $(C_1(n), \ldots, C_n(n))$, the continuum limit is the Poisson-Dirichlet distribution of $(V_1, V_2, \ldots)$, a dependent process. For the independent system $(Z_1, Z_2, \ldots)$ the continuum limit is the scale invariant Poisson process $\mathcal{M}$, an "independent process". It is most natural to expect to fill in the fourth edge of this square diagram, and relate the dependent and independent continuum systems to each other by conditioning.

Theorem 1 [5]. For any $\theta > 0$, let the scale invariant Poisson process on $(0, \infty)$, with intensity $\theta dx/x$, have its points falling in $(0,1]$ labeled so that (12) holds. Let $(V_1, V_2, \ldots)$ have the Poisson-Dirichlet distribution with parameter $\theta$. Then
Prime Factorizations of Uniformly Chosen Integers

Our primary common theme has been that natural random combinatorial processes arise from independent random variables by conditioning on the value of a weighted sum, as in (5). Our secondary common theme is that many of these processes are "logarithmic", with the limit of the component counting process, viewed from the small end, being a process of independent random variables whose rescaled limit is the scale invariant Poisson process. Also, the logarithmic combinatorial structures, viewed from the large end, have a rescaled dependent process limit, the Poisson-Dirichlet process. How does the prime factorization of a random integer, chosen uniformly from 1 to n, fit into this picture? In brief, the factorization into primes fits the picture perfectly, although there are superficial changes.

As is usual in number theory, the dummy variable p is understood to denote an arbitrary prime, and \( \pi(n) \) is the number of primes \( \leq n \). A positive integer \( i \) has a prime factorization of the form \( i = \prod p^a_p \), which can be viewed as a decomposition

\[
\log i = \sum a_p \log p.
\]

Our probability model is to pick a random integer \( N = N(n) \) uniformly from the \( n \) possibilities 1, 2, ..., \( n \):

\[
\mathbb{P}(N = i) = \frac{1}{n}, \quad i = 1, 2, \ldots, n.
\]

The prime factorization of this random integer,

\[
N(n) = \prod p_{i \in \pi(n)}
\]

defines a process of random variables \( C_p(n) \). The coordinates here are mutually dependent, and we write \( C_p(n) \) to emphasize that we focus on the distribution rather than on the factorization of a particular integer. Taking logarithms in (21) gives

\[
\log N = \sum C_p(n) \log p \leq \log n,
\]

which is similar to (1).

The superficial differences

The first difference between prime factorizations and our decomposable combinatorial structures is that the coordinates are indexed by primes \( p \) rather than by positive integers \( i \). More importantly, the possible component sizes, which show up as the weights on the left-hand side in (1) and (22), are not 1, 2, 3, ..., but rather \( \log 2, \log 3, \log 5, \ldots \).

The second difference is that the overall system size, which shows up on the right-hand sides of (1) and (22), is for prime factorizations not the parameter \( n \), but rather \( \log n \). Thus, for example, the Hardy-Ramanujan theorem, that a "normal" integer \( n \) has around \( \log \log n \) prime divisors, is like the statement that a random permutation of \( n \) objects typically has about \( \log n \) cycles. Both statements say that a system of size \( s \) has typically about \( \log s \) components.

The third difference is that for prime factorizations, the size of a particular random choice within the system of size \( n \) is not constant, but rather

\[
\log N = \sum C_p(n) \log p,
\]

which is uniformly distributed over the set \{0, \log 2, \log 3, \log 4, \ldots, \log n\}. In particular, the analog of (5) cannot be something involving conditioning on the exact value of a weighted sum of independent random variables.

The similarities with other logarithmic combinatorial structures

The first similarity is that prime factorizations satisfy an analog of (6). For primes the independent random variables \( Z_p \) that arise in the limit are geometrically distributed:

\[
\mathbb{P}(Z_p \geq k) = p^{-k},
\]

\[
\mathbb{P}(Z_p = k) = (1 - 1/p)p^{-k}, \quad k = 0, 1, 2, \ldots.
\]

Take the natural enumeration of primes in order of size, \( p_1 = 2, p_2 = 3, p_3 = 5, \ldots \). In the analog of (6), which is

\[
(C_p(n))_p = (Z_p)_p \quad \text{as} \quad n \to \infty,
\]

convergence in distribution means simply that for each fixed \( k \), \( (C_{p_1}(n), \ldots, C_{p_k}(n)) \Rightarrow (Z_{p_1}, \ldots, Z_{p_k}) \) as \( n \to \infty \). This can be easily verified in terms of cumulative distribution functions, as follows. Let \( a_1, \ldots, a_k \in \mathbb{Z}_+ \) be given, and let \( r = 2^{a_1}3^{a_2} \ldots p_k^{a_k} \). Then as events, \( \{C_{p_i} \geq a_i \quad \text{for} \quad i = 1 \text{ to } k\} \Rightarrow \{r|N\} \), with probability \( (1/n)|n/r\). This converges to \( 1/r \), and \( 1/r = \prod p_i^{-a_i} = \prod \mathbb{P}(Z_{p_i} \geq a_i) = \mathbb{P}(Z_{p_1} \geq a_1) \cdots \mathbb{P}(Z_{p_k} \geq a_k \quad \text{for} \quad i = 1 \text{ to } k) \).

A second similarity is that the \( Z_p \) satisfy the analog of (8). Recalling that the "system size" is not \( n \) but rather \( \log n \), the analog of (8) with \( \theta = 1 \) is that

\[
\sum_{\log p \leq \log n} \mathbb{E}Z_p = \sum_{p \leq n} \frac{1}{p-1} \sim \log(\log n).
\]

Note that the analog of (7) would be that \( (\log p)\mathbb{E}Z_p - 1 \), which is not true.

A third similarity is a Poisson-Dirichlet \( (\theta = 1) \) limit for the rescaled sizes of the large components. List the prime factors of our random integer \( N \) as
The random integer \( M(n) \) is free of primes larger than \( n \). This result proved by Billingsley [12]:

\[
\Pr(M(n) = i) = \prod_{p \leq n} \Pr(Z_p = a_p)
\]

\[
= \prod_{p \leq n} (1 - 1/p)^{a_p} = c(n)/i;
\]

with a normalizing constant

\[
c(n) = \prod_{p \leq n} (1 - 1/p).
\]

Thus, to convert from the distribution of the independent process, encoded as the values of \( \Pr(M(n) = i) \), into the distribution of the dependent process, encoded as the values \( \Pr(N = i) = (1/n) 1(i \leq n) \), not only do we condition on \( i \leq n \), which corresponds to conditioning on the event \( \{T_n \leq \log n\} \), but we also bias with a factor proportional to \( i \). In summary, for all positive integers \( i \),

\[
\Pr(N(n) = i) = \frac{\Pr(M(n) = i)}{i} \left( \prod_{\substack{p \leq n \leq \log n \atop p \neq n}} (1 - 1/p)^{-1} \right) 1(i \leq n).
\]

We can view biasing and conditioning in a unified framework as follows. In the context of random elements \( A, B \) of a discrete space \( X \), one says that "the distribution of \( B \) is the \( h \)-bias of the distribution of \( A \)" if for all \( \alpha \in X \), \( \Pr(B = \alpha) = c_\alpha h(\alpha) \Pr(A = \alpha) \), where the normalizing constant \( c_\alpha \) may be expressed as \( c_\alpha = (\mathbb{E} h(A))^{-1} \). Starting from the given distribution for \( A \), one can form this \( h \)-biased distribution if and only if \( h(\alpha) \geq 0 \) for all \( \alpha \) such that \( \Pr(A = \alpha) > 0 \) and \( 0 < \mathbb{E} h(A) < \infty \). Conditioning on an event of the form \( \{A \in S\} \), where \( S \subset X \), is exactly the case of biasing where \( h = \mathbb{1} \), and the normalizing constant is \( c_\alpha = 1/\Pr(A \in S) \). For our examples, let \( A \) be the independent process either \( A = (Z_1, Z_2, \ldots, Z_n) \) for the combinatorial processes, or \( A = (Z_p)_{p \leq n} \), which can be encoded as \( M(n) \), for the prime factorizations. Similarly, let \( B \) be the dependent process: either \( B = (C_1(n), \ldots, C_n(n)) \) for the combinatorial processes, or for the prime factorizations, \( B = (Z_p(n))_{p \leq n} \), which can be encoded as \( N(n) \).

The conditioning relation (5) can be viewed as the statement that the distribution of \( B \) is the \( h \)-bias of the distribution of \( A \), where \( h(A) \) is the indicator function of the event \( \{T_n = n\} \). The relation (27) also says that distribution of \( B \) is the \( h \)-bias of the distribution of \( A \), but now \( h(A) = \mathbb{1}(T_n \leq \log n) \exp(T_n - \log n) \), corresponding to the last two factors of (27).

The close similarity of these two versions of biasing shows in the asymptotics of the normalizing factor. For logarithmic combinatorial structures having \( \theta = 1 \), in particular for our examples 2 and 4, the constant is
\[ c_n = p(T_n - n)^{-1} \sim e^{\gamma} n, \]

i.e. the exponential of Euler’s constant, times the system size. For prime factorizations, the constant is the first factor on the right side of (27), \( c_n = \Gamma[p \log (1 - 1/p)]^{-1} \), with \( c_n \sim e^{\gamma} \log n \) by Mertens’s theorem. Reading this as \( e^{\gamma} \) times the system size, one can see that prime factorizations have exactly the same asymptotics as examples 2 and 4.

**Exploiting the similarity of primes and permutations**

The similarity of logarithmic combinatorial structures having \( \theta = 1 \) (such as permutations) and prime factorizations leads us to try to use one system to study the other. In particular, results for permutations lead to new conjectures in number theory. We describe two examples from [1], one still open, the other recently worked out. We also quote a third conjecture, as (28), without including the somewhat long story of how it relates to permutations.

First, we describe an open problem. Thanks to the “Feller coupling” in [2], we know for permutations that the independent system \((Z_1, \ldots, Z_n)\) can be converted to the dependent system \((C_1(n), \ldots, C_n(n))\) using, on average, \( 2 + o(1) \) changes. More specifically, in the Feller coupling, to convert to \((C_1(n), \ldots, C_n(n))\), one of the coordinates \( Z_j \) is increased by one, and a random selection of coordinates are decreased, with the number of decrements having mean \( 1 + o(1) \). This leads to two versions of a conjecture about prime factorizations according to whether or not some small exceptional probability is allowed.

The first version of the conjecture is that couplings of \( M = M(n) \) and \( N = N(n) \), defined in (26) and (21), exist in which to change from \( M \) to \( N \), one prime factor is inserted into \( M \), and a random number of prime factors are deleted from \( M \). The number of deletions having mean \( 1 + o(1) \). With probability approaching zero, additional prime factors may also be inserted into \( M \).

The second version of the conjecture is a direct translation from the situation for permutations and is simpler to state: simply remove the possibility of inserting more than one prime factor. Thus, the conjecture is that there is a coupling using a single insertion and a random number of deletions. In other words, we conjecture that one can construct, on a single probability space, random integers \( M(n) \) and \( N(n) \) and a random prime \( p_0 \) such that \( N \) always divides \( p_0 M \). The first version is a moral certainty to be true and should be provable using analysis. For the second version we have no strong convictions about whether or not the conjecture is true, but it might actually be neater to prove this stronger conjecture: since it does not involve any \( o(1) \) error bound, conceivably there is a purely algebraic or combinatorial proof.

Second, we tell the story of a conjecture that lasted only half a year before being proved. In the 1950s Kubilius [26] proved his “fundamental lemma”, which may be stated as follows. Let \( u = u(n) \) and \( \beta = 1/u \). Let \( A = A(n) \) be the independent process, observing all primes with \( \log p \leq \beta \log n \), i.e. \( A = (Z_p)_{\log p \leq \beta \log n} \). Similarly, let \( B = B(n) \) be the dependent process, observing all small prime factors of an integer chosen uniformly from 1 to \( n \), where the small primes \( p \) are those with \( \log p \leq \beta \log n \). Kubilius proved that the total variation distance \( d_{TV}(A, B) \) tends to zero if \( \beta \to 0 \), together with an upper bound of the form \( d_{TV}(A, B) = O(\exp(-(u/8)\log u + n^{-1/5}) \). What happens if we do not have \( \beta(n) \to 0 \)? In particular, what happens if \( \beta \) is constant?

The natural conjecture, from [1], is that prime factorizations have the same behavior as random permutations. In [7] an explicit strictly monotone function \( H : [0, 1] \to [0, 1] \) was described, with \( H(0) = 0 \), \( H(1) = 1 \), together with a heuristic argument that for permutations, for the case \( \beta \) constant \( \in [0, 1] \) while \( n \to \infty \), looking at \( A = (Z_1)_{\leq \beta n} \) versus \( B = (C_1(n))_{\leq \beta n} \). A proof of this was given in [30]. A simpler characterization of \( H \), which follows easily from (19), is that \( H(\beta) \) is the total variation distance between the restrictions to \( [0, \beta] \) of the Poisson-Dirichlet process with \( \theta = 1 \) and the corresponding scale invariant Poisson process \( \mathcal{M} \). Finally, it is proved in [10] that for prime factorizations, any constant \( \beta \in [0, 1] \), \( d_{TV}(A, B) = H(\beta) \). In terms of Buchstab’s function \( \omega \) and Dickman’s function \( \rho \) [31], \( H \) can be described as follows: for \( 0 < \beta < 1 \), with \( u = 1/\beta \),

\[
2H(\beta) = e^{\gamma} \mathbb{E}[|\omega(u - T) - e^{-T}|] + \rho(u) = \int_{t<0} |\omega(u - t) - e^{-t}| \rho(t) dt + \rho(u).
\]

**Discussion**

For random combinatorial structures, and for prime factorizations, identifying the limit processes is a first step. The next step involves giving bounds on the rates of convergence, under various metrics on the spaces involved. Estimates for the logarithmic class are studied in [5, 6], Hansen and Schmutz [19], and Stark [30], and applications of such estimates are given in [1, 8, 11].

For comparing the discrete dependent process with its independent discrete limit, it is very effective to consider the total variation distance, as Kubilius did for primes. Even for combinatorial structures which are not logarithmic, such as integer partitions and set partitions, the total variation distance comparisons with independent processes are useful [27, 28].

For the large components of logarithmic combinatorial structures, where the limit is the Poisson-Dirichlet process, the total variation distance method is useless, since as always when compar-
ing a discrete distribution with a continuous distribution the total variation distance is identically one. One way around this is to use the Ewens Sampling Formula with parameter $\theta$ (example 5) as the comparison object in place of the Poisson-Dirichlet distribution with parameter $\theta$. Here the ESF may be considered as the “discrete analog” of the Poisson-Dirichlet, in that both are one parameter families, with no place for “small scale” structure. For example, both random mappings and ESP($\theta = 1/2$) look almost the same at the large end, and this may be quantified by bounds on the total variation distance between their respective processes $(C_{b+1}(n), C_{b+2}(n), \ldots, C_{b}(n))$, observing only large components [5].

Two other metrics are especially useful for the processes in this paper. One is the Wasserstein distance on $\mathbb{Z}_+^2$ or $\mathbb{Z}_+^{(m)}$, which in our context measures the expected number of changes needed to convert the dependent component counting process to its independent limit. Another is the $L_1$ Wasserstein distance on $\mathbb{R}^{\infty}$. In the context of prime factorizations and the Poisson-Dirichlet limit in (24), this is the infimum, over all conceivable couplings, of

\[ \mathbb{E} \sum_{i=1}^{\infty} |\log P_i(n) - \log V_i| . \]

We conjecture that this is $O(1)$; see [1, 4].

References

1996 AMS-IMS-MAA Annual Survey

(Second Report)

Update on the 1996 Survey of New Doctoral Recipients, Faculty Characteristics, Enrollment Profile and Undergraduate Majors, and Graduate Student Profile

Paul W. Davis

This is the Second Report of the 1996 Survey, which includes analysis of data on departmental enrollments, majors, and faculty size as well as an update of the First Report, which appeared in the Notices of the AMS in December 1996, pages 1493-1511. It included a report on the 1995-96 new doctoral recipients, a report on salaries of new doctoral recipients, and salary data on faculty members in four-year colleges and universities.

The 1996 AMS-IMS-MAA Annual Survey represents the fortieth in an annual series begun in 1957 by the Society. The 1996 Survey was under the direction of the AMS-IMS-MAA Data Committee, whose members were Paul W. Davis, Lorraine Denby, John D. Fulton (chair), Malay Ghosh, Don O. Loftsgaarden, James W. Maxwell (ex officio), S. Brent Morris, M. Beth Ruskai, Ann K. Stehney, and Ann E. Watkins. Comments or suggestions regarding the Annual Survey may be directed to the Committee.

Highlights

As of May 1, 1997, U.S. departments reported that they had granted 1,154 doctorates in the mathematical sciences between July 1, 1995, and June 30, 1996, a decrease of 6.7% from the all-time high of 1,237 reported the previous year. The proportion of 1995-96 doctora l recipients who were female decreased slightly from 23% last year to 22% this year.

The final count reported by departments shows 505 U.S. citizens among the 1,147 doctoral recipients whose citizenship was known. This number represents a decrease over the 579 last year. The proportion of 1995-96 new doctoral recipients who are U.S. citizens is 44.0%, down from the reported 47.9% of the past year but equal to the previous two years.

After the prior year's increase of 9.4% in positions under recruitment by mathematics departments, recruitment of new doctoral faculty in 1995-96 fell by 5.6%. Open doctoral positions in departments in Groups I through V increased by 7.1% but fell precipitously by 14.0% in Groups M and B. In spite of the decrease in recruiting, total actual doctoral hires increased slightly. Male hires remained essentially constant, and female hires increased by 6.2%. The unemployment rate for 1995-96 new doctoral recipients fell back to 8.1% after two year at a record high of 10.7%. In addition, 3.4% of the new doctoral recipients took part-time employment, the first decrease since this figure started being reported in 1990-91. The proportion of doctoral recipients accepting positions in government, business, and industry increased to 20.2% in 1995-96 from 17.5% the previous year.

The number of full-time faculty in mathematics departments remained nearly constant, increasing by a mere 0.2% over 1994-95. The number of nonfaculty-track full-time, doctoral faculty increased by 5.7% this year after decreasing by about the same amount the previous year. The number of part-time faculty increased by an alarming 9.8%, much greater than last year's 1.0% increase.

Undergraduate course enrollments rose 1.1%, and graduate course enrollments fell by a similar fraction, dropping 0.9%. The total number of full-time, first-year graduate students in Ph.D.-granting mathematics departments declined 8.9% from fall 1995 to fall 1996, the fifth consecutive year a decline was reported. In addition, the number of female first-year graduate students fell 6.4%, a significant decline.
As has been the case for a number of years, much of the data in these reports is presented for departments divided into groups according to several characteristics, the principal one being the highest degree offered in the mathematical sciences. Doctorate-granting departments of mathematics are further subdivided according to their ranking of "scholarly quality of program faculty" as reported in the 1995 publication Research-Doctorate Programs in the United States: Continuity and Change. These rankings update those reported in a previous study published in 1982. Consequently, the departments that now comprise Groups I, II, and III differ significantly from those used in prior surveys. The reader should keep this in mind when attempting to make comparisons by group with previous Annual Survey reports.

The subdivision of the Group I institutions into Group I Public and Group I Private is new with the 1996 Annual Survey. With the increase in number of the Group I departments from 39 to 48, the AMS-IMS-MAA Data Committee judged that a further subdivision along the lines of public and private would provide more meaningful reporting of the data for these departments.

Brief descriptions of the groupings used for reporting purposes are as follows:

Group I is composed of 48 departments with scores in the 3.00-5.00 range.

Group I Public and Group I Private are Group I departments at public institutions and private institutions, respectively.

Group II is composed of 56 departments with scores in the 2.00-2.99 range.

Group III contains the remaining U.S. departments reporting a doctoral program, including a number of departments not included in the 1995 ranking of program faculty.

Group IV contains U.S. departments (or programs) of statistics, biostatistics, and biometrics reporting a doctoral program.

Group V contains U.S. departments (or programs) in applied mathematics/applied science, operations research, and management science which report a doctoral program.

Group Va is applied mathematics/applied science; Group Vb is operations research and management science.

Group M contains U.S. departments granting a master's degree as the highest graduate degree.

Group B contains U.S. departments granting a baccalaureate degree only.


2These findings were published in An Assessment of Research-Doctorate Programs in the United States: Mathematical and Physical Sciences, edited by Lytle E. Jones, Gardner Lindzey, and Porter E. Coggeshall, National Academy Press, Washington, D.C., 1982. The information on mathematics, statistics, and computer science was presented in digest form in the April 1983 issue of the Notices, pages 257-267, and an analysis of the classifications was given in the June 1983 Notices, pages 9-25.

Introduction
The AMS-IMS-MAA Annual Survey collects information each year about departments, faculties, and students in the mathematical sciences at four-year colleges and universities in the United States. This article reports results from two parts of the 1996 AMS-IMS-MAA Annual Survey. First, we update information about new doctoral recipients reported earlier in the December 1996 issue of the Notices of the American Mathematical Society (see pages 1493-1511). Second, we present results about the characteristics of faculties and of instructional programs at the undergraduate and graduate levels.

In the interest of continuity in the analysis and presentation and to make year-to-year comparisons possible, we report the same kinds of information that were included in last year's Second Report. Details are presented concerning employment patterns for new doctoral recipients, department faculty characteristics, and distribution of enrollments in different types of departments.

We follow the procedure started in the 1991 Second Report of reporting projections of survey responses to the entire population of mathematical sciences departments. The projections of survey responses to the entire population are done within strata defined by the survey groups. For example, on the part of the Departmental Profile Survey concerned with faculty, there were 40 usable responses from the 48 departments in Group I (see Table 3A). The 40 responding departments reported 34 full-time faculty to have retired or died, and this tally was multiplied by 40/48 to obtain the projected value of 41 for the group as a whole.

We caution the reader that survey responses and the proportional projections are potentially biased due to (i) selection bias of the responding departments and (ii) inhomogeneity of departments within the survey groups. The responses and projections for total faculty size are slightly affected by this bias. Nonetheless, the problems of a possible selection bias are mitigated by the generally high response rates to the Annual Survey. In groups with lower response rates (e.g., Groups M and B) there is greater risk of biased projections.

Update on the 1996 Survey of New Doctoral Recipients
Information about recipients of doctoral degrees awarded between July 1, 1995, and June 30, 1996, was collected from doctorate-granting departments in late spring 1996 and from a follow-up census of individual degree recipients. The First Report of the 1996 Annual Survey (December 1996 issue of the Notices of the AMS, pages 1493-1511) presents the survey results obtained about new doctoral recipients up to late September 1996. Here we update the earlier figures on the basis of more complete returns.

The final count of new doctoral recipients (Table 1A) shows a total of 1,154 doctorates in mathematical sciences awarded by U.S. institutions. This number represents a decrease of 9.3\% from the 1,237 doctorates awarded during 1994-95. Table 1B shows the overall and by-genre trends in the spring count of new doctoral recipients from 1985-86 through 1995-96.

Citizenship status is known for 1,147 of the 1,154 new citizens is 505. The percentage of 1995-96 new doctoral recipients who are U.S. citizens is 44.0\%, down from the reported 47.9\% of the past year and equal to the previous two years. The final count of new doctoral
Table 1A: U.S. New Doctoral Recipients, Fall and Final Counts

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<th>Year</th>
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<td>1992-93</td>
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Table 1B: Trend Chart of Final Count of New Doctoral Recipients, 1986-1996

Employment of 1995-96 doctoral recipients by U.S. Ph.D.-granting institutions increased by 2.8% from the corresponding figure for 1994-95. Employment of the 1995-96 doctoral recipients by research institutes, government, and business and industry increased by 7.7% (including a 6.8% increase in employment by business and industry). Foreign academic employment of new doctoral recipients decreased by 12.7%.

Among those 1995-96 doctoral recipients taking employment in the U.S., 30.9% took nonacademic employment (government or business and industry). This percentage was 4 percentage points more than for the 1994-95 doctoral recipients. The fraction of the 1995-96 doctoral recipients taking nonacademic employment varied significantly by field of thesis. Of those whose field of thesis was either algebra/number theory, real or complex analysis, or geometry/topology, 15.9% took nonacademic employment. For probability or statistics, the analogous figure is 46.4%; and for applied math, discrete math/combinatorics/logic/computer science, numerical analysis/approximations, or linear/nonlinear optimization, the analogous figure is 37.7%.

Group I departments continued to award the most doctorates. Of the 1,153 doctoral degrees awarded in the mathematical sciences between July 1, 1995, and June 30, 1996, 43.3% (499) were awarded by Group I departments, more than double the number of any other group.

The fall 1996 unemployment rate for new doctoral recipients, based on information gathered by the time of the Second Report, increased significantly from 6.7% for 1991-92 to 8.9% for 1992-93 to 10.7% for 1993-94 and 1994-95. For 1995-96, this unemployment rate made a significant drop to 8.1%, the lowest rate in three years. The counts on which these rates are determined do not include those new doctoral recipients whose fall employment status was unknown at the time of the Second Report.

Table 2C presents the 1977-78 through 1995-96 trend in the final fall unemployment rate of new doctoral recipients.

Although the lower unemployment rate of 8.1% among the 1995-96 mathematical sciences doctoral recipients is a very promising sign, the job market continues to be a difficult one. The data presented in Tables 2A and 2B do not reflect the fact that 64.1% of the 315 doctoral recipients in 1995-96 who took academic employment responded individually that they assumed academic positions that are not tenure-track, up 4% from last year. Of those non-tenure-track positions, 49.5% have contract durations of two years or less, down from 55% in 1994-95. Of the 242 positions in U.S. Ph.D.-granting departments filled by 1995-96 doctoral recipients, 23.1% were held by new doctoral recipients who received their degree from the same institution.

The names of the 1995-96 doctoral recipients and their thesis titles were published in the January 1996 Notices of the AMS.

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*Non-U.S. citizens who return to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".

### Table 2B: Fall 1996 Employment Status of 1995-1996 U.S. New Doctoral Recipients by Type of Granting Department, Updated May 1997

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<th>TYPE OF EMPLOYER</th>
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<th>ROW SUBTOTAL</th>
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<tr>
<td>Other Academic Depts.</td>
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<tr>
<td>Research Institutes</td>
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<tr>
<td>Government</td>
<td>11</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Business and Industry</td>
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<td>17</td>
<td>33</td>
</tr>
<tr>
<td>Foreign, Academic</td>
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<td>31</td>
<td>27</td>
</tr>
<tr>
<td>Foreign, Nonacademic</td>
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<td>3</td>
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</tr>
<tr>
<td>Not seeking employment</td>
<td>7</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Still seeking employment</td>
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<td>10</td>
<td>28</td>
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<tr>
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<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Unknown (non-U.S.)</td>
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<tr>
<td><strong>Column</strong></td>
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<td>181</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>62</td>
<td>37</td>
<td>41</td>
</tr>
</tbody>
</table>

*Non-U.S. citizens who return to their country of citizenship and whose status is reported as "unknown" or "still seeking employment".*
### Table 2C: Percentage of New Doctoral Recipients Unemployed, as reported in the respective Annual Survey Second Reports, 1978-1996

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>0.7</td>
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<tr>
<td>1979</td>
<td>1.5</td>
</tr>
<tr>
<td>1980</td>
<td>0.9</td>
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<tr>
<td>1981</td>
<td>0.0</td>
</tr>
<tr>
<td>1982</td>
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<td>1983</td>
<td>2.2</td>
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<tr>
<td>1984</td>
<td>2.1</td>
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<td>1985</td>
<td>0.8</td>
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<td>1986</td>
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<td>1987</td>
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<td>1988</td>
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<td>1989</td>
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<td>1994</td>
<td>10.7</td>
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<tr>
<td>1995</td>
<td>10.7</td>
</tr>
<tr>
<td>1996</td>
<td>8.1</td>
</tr>
</tbody>
</table>

#### Faculty Characteristics

The Departmental Profile Survey, sent in fall 1995 to mathematical sciences departments at four-year colleges and universities as part of the Annual Survey, provided information about faculty and instructional programs. In order that more reliable year-to-year comparisons could be made, data for fall 1994 and fall 1995 were gathered, except for data on retirement, deaths, and faculty recruitment. The percent change figures reported in Tables 3E and 3F, Tables 4A and 4D, and Tables 5A, 5C, and 5D are based on these two years of data. The First Report presented information collected earlier about faculty salaries (pages 1507-1511 of the December 1996 issue of the Notices of the AMS).

Table 3A displays losses of full-time mathematical sciences faculty due to retirements or deaths. The fall 1996 mathematical sciences faculty attrition rate for mathematics departments (Groups I, II, III, M & B combined) was 2.3%, an increase from the fall 1995 reported rate of 2.2% but still lower than the fall 1994 reported rate of 2.6%. All three percentages are significantly ahead of the 1.8% faculty attrition rate reported for fall 1991. The increased attrition rates reported for fall 1992 through fall 1996 may reflect the numerous early retirement incentive programs which have occurred in academic institutions during these years. Table 3B depicts the trend in the faculty attrition rates for mathematics departments during the years 1986-1996.

Table 3C displays Departmental Profile Survey information on the number of full-time faculty positions in mathematical sciences departments under recruitment in 1995-96. The number of positions in mathematics departments under recruitment decreased 5.6% from 1994-95. Table 3D presents the trend of steady decrease in positions under recruitment in mathematics departments during 1991 through 1994, followed by an increase in 1995, and then a decrease in 1996. Table 3C of this report as compared with Table 3C of the 1995 Second Report indicates that Groups I and II had significant increases and Group IV had a slight increase in positions under recruitment, while decreases were reported for all other groups.

Table 3C indicates that 87.4% of the positions under recruitment in 1995-96 by mathematics departments were available to new doctoral recipients but only 64.4% were tenured/tenure-track. The number of tenured/tenure-track positions under recruitment by mathematics departments decreased by 4.3% from last year's count.

Tables 3E and 3F describe the makeup of faculties by sex, tenure status, and doctoral/nondoctoral degree in the different groups. Table 3E indicates that the total number of full-time faculty in mathematics departments slightly increased from fall 1995 to fall 1996. After last years reported decrease of 6.5%, the numbers of non-tenure-track, doctoral, full-time faculty in mathematics departments increased by 5.7%. Among all groups except Groups I there were significant decreases in the number of untenured, tenure-track doctoral faculty, with an overall decrease of 3.5% in mathematics departments. The number of non-tenure-track, doctoral, full-time faculty who are females increased by 15.1%.
Table 3A: Faculty Attrition*

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I, II &amp; III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I, II, III, M &amp; B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time faculty who retired or died</td>
<td>41</td>
<td>40</td>
<td>43</td>
<td>124</td>
<td>30</td>
<td>5</td>
<td>136</td>
<td>169</td>
<td>428</td>
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<tr>
<td>Total number</td>
<td>1.7</td>
<td>1.8</td>
<td>2.2</td>
<td>1.9</td>
<td>2.4</td>
<td>0.9</td>
<td>2.6</td>
<td>2.4</td>
<td>2.3</td>
</tr>
<tr>
<td>Usable responses**</td>
<td>40</td>
<td>42</td>
<td>57</td>
<td>139</td>
<td>53</td>
<td>12</td>
<td>127</td>
<td>433</td>
<td>699</td>
</tr>
<tr>
<td>Total number</td>
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<td>75</td>
<td>79</td>
<td>79</td>
<td>66</td>
<td>32</td>
<td>55</td>
<td>47</td>
<td>52</td>
</tr>
</tbody>
</table>

* Number and percentage of full-time faculty who were in the department in fall 1995 but were reported to have retired or died by fall 1996.
** All counts are projected from the survey response to the respective Group as a whole. The number of usable responses varies for different sections of the Departmental Profile survey. The response rates reported here apply to faculty size and recruitment data only.

Table 3B: Percent of Full-time Doctoral Faculty Who Retired or Died in Groups I, II, III, M & B Combined

Table 3C: Recruitment of Doctoral Faculty

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I, II &amp; III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I, II, III, M &amp; B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open doctoral positions</td>
<td>216</td>
<td>140</td>
<td>106</td>
<td>462</td>
<td>78</td>
<td>30</td>
<td>240</td>
<td>444</td>
<td>1147</td>
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<tr>
<td>Total number</td>
<td>78</td>
<td>75</td>
<td>80</td>
<td>232</td>
<td>50</td>
<td>30</td>
<td>205</td>
<td>301</td>
<td>739</td>
</tr>
<tr>
<td>Tenured/tenure-track</td>
<td>155</td>
<td>119</td>
<td>95</td>
<td>368</td>
<td>69</td>
<td>14</td>
<td>226</td>
<td>410</td>
<td>1004</td>
</tr>
<tr>
<td>Open to new doctoral recipients</td>
<td>43</td>
<td>64</td>
<td>69</td>
<td>177</td>
<td>48</td>
<td>19</td>
<td>185</td>
<td>276</td>
<td>638</td>
</tr>
<tr>
<td>Tenured/tenure-track</td>
<td>167</td>
<td>87</td>
<td>64</td>
<td>318</td>
<td>41</td>
<td>16</td>
<td>149</td>
<td>258</td>
<td>725</td>
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<td>Male doctoral hires</td>
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<td>20</td>
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<td>86</td>
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<td>55</td>
<td>100</td>
<td>242</td>
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<td>1</td>
<td>10</td>
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<tr>
<td>Male nondoctoral hires</td>
<td>1</td>
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<td>1</td>
<td>10</td>
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<td>0</td>
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<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>21</td>
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<td>13</td>
<td>43</td>
<td>21</td>
<td>12</td>
<td>40</td>
<td>49</td>
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</table>

*Number of full-time doctoral positions under recruitment in 1995-1996 to be filled for 1996-1997. Subtotals of rounded table values may exhibit rounding errors.
### Table 3E: Faculty Size, Fall 1996, and Percentage Change in Size, Fall 1995 to Fall 1996

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<th>III</th>
<th>I, II &amp; III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I, II, III, M &amp; B</th>
</tr>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total number</td>
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<td>1953</td>
<td>6612</td>
<td>1280</td>
<td>527</td>
<td>5245</td>
<td>7587</td>
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<td>-0.1</td>
<td>-2.6</td>
<td>2.1</td>
<td>-0.5</td>
<td>1.0</td>
<td>0.2</td>
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<tr>
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<td>Total number</td>
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<td>1756</td>
<td>6202</td>
<td>1235</td>
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<td>4266</td>
<td>5811</td>
<td>16278</td>
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<td>Percentage change (%)</td>
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<td>-0.5</td>
<td>1.2</td>
<td>-0.1</td>
<td>-1.7</td>
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<td>0.5</td>
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<td>1.1</td>
</tr>
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<td></td>
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<tr>
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<td>1309</td>
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<td>387</td>
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<td>4028</td>
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<td>816</td>
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<td>-2.2</td>
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<td>6.6</td>
<td>-5.1</td>
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<td>3.5</td>
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<td>-23.6</td>
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</table>

### Table 3F: Female Faculty Size, Fall 1996, and Percentage Change in Size, Fall 1995 to Fall 1996

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I, II &amp; III</th>
<th>IV</th>
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<th>M</th>
<th>B</th>
<th>I, II, III, M &amp; B</th>
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<tbody>
<tr>
<td>Full-time female faculty</td>
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<td>193</td>
<td>68</td>
<td>1262</td>
<td>1900</td>
<td>4003</td>
</tr>
<tr>
<td>Percentage change (%)</td>
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<td>10.9</td>
<td>5.7</td>
<td>-11.7</td>
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<td>0.7</td>
<td>3.6</td>
<td>3.1</td>
</tr>
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<td>Doctoral full-time female faculty</td>
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<tr>
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<td>780</td>
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<td>6.3</td>
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<td>15.2</td>
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<td>7.5</td>
<td>0.0</td>
<td>5.1</td>
<td>3.0</td>
<td>5.1</td>
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<tr>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number</td>
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<td>82</td>
<td>163</td>
<td>60</td>
<td>12</td>
<td>259</td>
<td>437</td>
<td>859</td>
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<td>10.2</td>
<td>5.6</td>
<td>-14.9</td>
<td>24.3</td>
<td>2.9</td>
<td>5.5</td>
<td>4.7</td>
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<td>34</td>
<td>140</td>
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<td>27</td>
<td>33</td>
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<td>269</td>
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<td>22.7</td>
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<td>0.0</td>
<td>-10.0</td>
<td>44.8</td>
<td>15.1</td>
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<td>401</td>
<td>45</td>
<td>0</td>
<td>778</td>
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<td>2522</td>
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<td>13.3</td>
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<td>-21.1</td>
<td>0.0</td>
<td>18.8</td>
<td>7.9</td>
<td>10.7</td>
</tr>
</tbody>
</table>
Enrollment Profile and Undergraduate Majors

The Departmental Profile Survey obtains information about enrollments and distribution of instructional effort in the mathematical sciences departments.

Table 4A indicates that undergraduate mathematical sciences course enrollments increased by 1.1% from fall 1995 to fall 1996. The graduate course enrollments decreased by 0.9% over the same period. A comparison of this Table 4B, which displays fall 1996 undergraduate enrollments distribution, with Table 4B from last year's Second Report, page 855 of the August 1996 Notices of the AMS, shows a similar pattern of enrollment distributions. Changes in make up of Groups I, II and III make individual comparisons to earlier Second Reports unreliable. However, comparisons of Groups I, II, and III combined in Tables 4A and 4B to last year's Second Report show no significant changes.

Table 4D reports that the total number of junior/senior majors in mathematics departments (Groups I, II, III, M, & B combined) decreased by 0.9% from fall 1995 to fall 1996. The number of female junior/senior majors declined by 0.3% during the same period. Groups II, M, and B reported slight increases in female majors, with Group V reporting a sizable increase.

Table 4A: Undergraduate and Graduate Enrollments (thousands), Fall 1996, and Percentage Change in Enrollments, Fall 1995 to Fall 1996

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I, II &amp; III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate course enrollments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands)</td>
<td>214</td>
<td>245</td>
<td>213</td>
<td>672</td>
<td>88</td>
<td>21</td>
<td>589</td>
<td>659</td>
<td>2030</td>
</tr>
<tr>
<td>Percentage change (%)</td>
<td>1.4</td>
<td>1.2</td>
<td>-0.6</td>
<td>0.7</td>
<td>0.9</td>
<td>2.7</td>
<td>1.1</td>
<td>1.4</td>
<td>1.1</td>
</tr>
<tr>
<td>Graduate course enrollments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands)</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>27</td>
<td>18</td>
<td>10</td>
<td>13</td>
<td>2</td>
<td>70</td>
</tr>
<tr>
<td>Percentage change (%)</td>
<td>-9.4</td>
<td>-6.7</td>
<td>3.2</td>
<td>-5.3</td>
<td>2.1</td>
<td>5.7</td>
<td>1.5</td>
<td>10.6</td>
<td>-0.9</td>
</tr>
<tr>
<td>Usable responses*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number</td>
<td>40</td>
<td>40</td>
<td>57</td>
<td>137</td>
<td>45</td>
<td>10</td>
<td>122</td>
<td>418</td>
<td>677</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>83</td>
<td>71</td>
<td>79</td>
<td>78</td>
<td>57</td>
<td>29</td>
<td>52</td>
<td>45</td>
<td>51</td>
</tr>
</tbody>
</table>

* The number of usable responses varies for different sections of the Departmental Profile survey. The response rates reported here apply to Tables 4A through 4C on enrollments only. All counts are projected from the survey response to the respective Group as a whole.

Table 4B: Distribution of Undergraduate Enrollments (thousands), Fall 1996

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I, II &amp; III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remedial mathematics*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands), %**</td>
<td>17</td>
<td>8</td>
<td>18</td>
<td>7</td>
<td>29</td>
<td>14</td>
<td>64</td>
<td>9</td>
</tr>
<tr>
<td>Precalculus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands), %</td>
<td>29</td>
<td>14</td>
<td>52</td>
<td>21</td>
<td>45</td>
<td>21</td>
<td>127</td>
<td>19</td>
</tr>
<tr>
<td>1st-year Calculus (mainstream)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands), %</td>
<td>69</td>
<td>32</td>
<td>49</td>
<td>20</td>
<td>34</td>
<td>16</td>
<td>151</td>
<td>23</td>
</tr>
<tr>
<td>1st-year Calculus (non-mainstream)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands), %</td>
<td>25</td>
<td>12</td>
<td>27</td>
<td>11</td>
<td>18</td>
<td>9</td>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>Statistics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands), %</td>
<td>5</td>
<td>2</td>
<td>11</td>
<td>5</td>
<td>15</td>
<td>7</td>
<td>32</td>
<td>5</td>
</tr>
<tr>
<td>Computer Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands), %</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Other courses for majors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands), %</td>
<td>41</td>
<td>19</td>
<td>34</td>
<td>14</td>
<td>31</td>
<td>14</td>
<td>105</td>
<td>16</td>
</tr>
<tr>
<td>Other undergraduate courses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (thousands), %</td>
<td>27</td>
<td>13</td>
<td>52</td>
<td>21</td>
<td>36</td>
<td>17</td>
<td>116</td>
<td>17</td>
</tr>
</tbody>
</table>

* Arithmetic, high school algebra, geometry.
** "Percent are "column percents" describing relative enrollments within the respective Survey Groups of the different types of undergraduate courses.
Table 4C: Undergraduate and Graduate Enrollments per Full-time Faculty Member, Fall 1996

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate course enrollments per full-time faculty member</td>
<td>88</td>
<td>110</td>
<td>108</td>
<td>69</td>
<td>41</td>
<td>112</td>
<td>93</td>
</tr>
<tr>
<td>Graduate course enrollments per full-time faculty member</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>14</td>
<td>19</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Total course enrollments per full-time faculty member</td>
<td>93</td>
<td>114</td>
<td>112</td>
<td>83</td>
<td>59</td>
<td>115</td>
<td>93</td>
</tr>
</tbody>
</table>

Table 4D: Undergraduate Junior/Senior Majors (hundreds), and Undergraduate Female Junior/Senior Majors (hundreds, Fall 1996, and Percentage Change in Majors, Fall 1995 to Fall 1996

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>B</th>
<th>I, II, III, M &amp; B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junior/senior majors Total number (hundreds)</td>
<td>58</td>
<td>51</td>
<td>47</td>
<td>10</td>
<td>43</td>
<td>214</td>
<td>239</td>
<td>609</td>
</tr>
<tr>
<td>Percentage change (%)</td>
<td>-6.5</td>
<td>0.8</td>
<td>-6.8</td>
<td>-15.1</td>
<td>13.8</td>
<td>1.0</td>
<td>-0.2</td>
<td>-0.9</td>
</tr>
<tr>
<td>Female junior/senior majors Total number (hundreds)</td>
<td>22</td>
<td>20</td>
<td>22</td>
<td>4</td>
<td>13</td>
<td>94</td>
<td>105</td>
<td>263</td>
</tr>
<tr>
<td>Percentage change (%)</td>
<td>-8.1</td>
<td>1.3</td>
<td>-4.7</td>
<td>-22.4</td>
<td>15.6</td>
<td>1.1</td>
<td>0.8</td>
<td>-0.3</td>
</tr>
<tr>
<td>Usable responses* Total number</td>
<td>39</td>
<td>41</td>
<td>54</td>
<td>33</td>
<td>7</td>
<td>113</td>
<td>380</td>
<td>627</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>83</td>
<td>75</td>
<td>76</td>
<td>57</td>
<td>29</td>
<td>48</td>
<td>41</td>
<td>47</td>
</tr>
</tbody>
</table>

* The number of usable responses varies for different sections of the Departmental Profile survey. The response rates reported here apply to undergraduate majors data only. All counts are projected from the survey response to the respective Group as a whole.

Graduate Student Profile

Tables 5A, 5C, and 5D summarize population statistics for graduate students gathered by the 1996 Departmental Profile Survey. Table 5A indicates that the total number of full-time graduate students in mathematics departments (Groups I, II, III & M combined) declined by 4.8% from fall 1995 to fall 1996 and declined in every group except Groups M. Table 5C data show that the total number of female full-time graduate students in mathematics departments decreased by 3.5% and decreased in all groups except Groups M. For the fifth year in a row the Ph.D.-granting mathematics departments (Groups I, II & III combined) reported a decline in the number of full-time, first-year graduate students. The decline of 8.9% between fall 1995 and fall 1996 was more than the 2.0% decline reported last year between fall 1994 and fall 1995. In addition, the number of full-time, first-year female graduate students in Ph.D.-granting mathematics departments decreased by 10.5% after a slight increase was reported last year for the first time in four years. Table 5D indicates a decline of 7.8% in the total number of U.S. citizen full-time mathematics graduate students from fall 1995 to fall 1996.

Tables 5A and 5D show declines in first-year graduate students from fall 1995 to fall 1996 for doctorate-granting mathematics departments. The five successive years of declines for the doctorate-granting mathematics departments are enough to suggest a decline in the number of new doctoral recipients four to five years hence. Table 5B presents the trend in annual percentage change of first-year graduate students in Ph.D.-granting mathematics departments during the years 1986 to 1996.
Table 5A: Full-time Graduate Students, Fall 1996, and Percentage Change in Graduate Students, Fall 1995 to Fall 1996

<table>
<thead>
<tr>
<th>GROUP</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>I, II &amp; III</th>
<th>IV</th>
<th>V</th>
<th>M</th>
<th>I, II, III, &amp; M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time graduate students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number</td>
<td>3847</td>
<td>2839</td>
<td>2088</td>
<td>8774</td>
<td>3242</td>
<td>1743</td>
<td>3155</td>
<td>11929</td>
</tr>
<tr>
<td>Percentage change (%)</td>
<td>-6.3</td>
<td>-7.7</td>
<td>-5.6</td>
<td>-6.6</td>
<td>-4.3</td>
<td>-3.7</td>
<td>0.6</td>
<td>-4.8</td>
</tr>
<tr>
<td>First-year graduate students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number (hundreds)</td>
<td>861</td>
<td>751</td>
<td>644</td>
<td>2256</td>
<td>867</td>
<td>464</td>
<td>1288</td>
<td>3544</td>
</tr>
<tr>
<td>Percentage change (%)</td>
<td>-2.2</td>
<td>-13.1</td>
<td>-12.0</td>
<td>-8.9</td>
<td>-16.7</td>
<td>-10.3</td>
<td>-3.2</td>
<td>-6.9</td>
</tr>
<tr>
<td>Usable responses*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number</td>
<td>42</td>
<td>43</td>
<td>56</td>
<td>141</td>
<td>59</td>
<td>13</td>
<td>106</td>
<td>247</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>88</td>
<td>77</td>
<td>78</td>
<td>80</td>
<td>63</td>
<td>35</td>
<td>45</td>
<td>60</td>
</tr>
</tbody>
</table>

* The number of usable responses varies for different sections of the Departmental Profile survey. The response rates reported here apply to Tables 5A through 5C on graduate student enrollments only. All counts are projected from the survey response to the respective Group as a whole.

Table 5B: Annual Percentage Change in Full-time, First-year Graduate Students in Groups I, II & III Combined, 1986 to 1996

Table 5C: Full-time Female Graduate Students, Fall 1996, and Percentage Change in Female Graduate Students, Fall 1995 to Fall 1996

Table 5D: Full-time U.S. Citizen Graduate Students, Fall 1996, and Percentage Change in U.S. Citizen Graduate Students, Fall 1995 to Fall 1996
Acknowledgments
The Annual AMS-IMS-MAA Survey attempts to provide an accurate appraisal and analysis of various aspects of the academic mathematical sciences scene for the use and benefit of the community and for filling the information needs of the professional organizations. Every year, college and university departments in the United States are invited to respond. The Annual Survey relies heavily on the conscientious efforts of the dedicated staff members of these departments for the quality of its information. On behalf of the AMS-IMS-MAA Data Committee and the Annual Survey staff, I thank the many secretarial and administrative staff members in the mathematical sciences departments for their cooperation and assistance in responding to the survey questionnaires.

Bibliography


Selected data on graduate students and postdoctorates in science and engineering, Fall 1991 (NSF 92-335); Selected Pamphlet No. 11: Institutional listings (NSF 90-324-11); Selected Pamphlet No. 12: Postdoctorates and other nonfaculty research staff (NSF 90-324-12); Washington, DC, 1990.


Surveys in Combinatorics, 1997
R.A. Bailey, Editor
This volume consists of the papers presented by the invited lecturers at the 16th British Combinatorial Conference. This biennial meeting is one of the most important for combinatorialists, attracting leading figures in the field. This overview of up-to-date research will be a valuable resource for researchers and graduate students.
London Mathematical Society Lecture Note Series 261
1997 c.250 pp. 59840-0 Paperback $39.95

Automorphic Forms on $SL_2(\mathbb{R})$
Armand Borel
This book provides an introduction to some aspects of the analytic theory of automorphic forms on $G=SL_2(\mathbb{R})$ or the upper-half plane $X$, with respect to a discrete subgroup $\Gamma$ of $G$ of finite covolume. The topics treated include the construction of fundamental domains, the notion of automorphic form on $\Gamma \backslash G$ and its relationship with the classical automorphic forms on $X$, Poincaré series, constant terms, cusp forms, finite dimensionality of the space of automorphic forms of a given type, compactness of certain convolution operators, Eisenstein series, unitary representations of $G$, and the spectral decomposition of $L_2(\Gamma \backslash G)$.
Cambridge Tracts in Mathematics 130
1997 c.224 pp. 58049-8 Hardback $47.95

Set Theory for the Working Mathematician
Krzysztof Ciesielski
The author describes numerous applications in abstract geometry and real analysis and, in some cases, in topology and algebra. The book begins with a tour of the basics of set theory, culminating in a proof of Zorn's Lemma and a discussion of some of its applications. The author then develops the notions of transfinite induction and descriptive set theory, with applications to the theory of real functions.
London Mathematical Society Student Texts 39
1997 c.240 pp. 59441-3 Hardback $59.95
59465-0 Paperback $19.95

Calendrical Calculations
Nachum Dershowitz and Edward M. Reingold
"One of the most fascinating books I've read all year. Takes chronology into the computer age with impressive erudition and élan. Just finding out what the calendar rules are is usually close to impossible: Calendrical Calculations tell you how to use them too. A must for anyone who worries about days, months, years—and why they never quite fit."
—Ian Stewart
1997 c.160 pp. 56413-1 Hardback $64.95
56474-3 Paperback $22.95

Comparison Geometry
Karsten Grove and Peter Petersen, Editors
The content reflects some of the most exciting activities in comparison geometry during the year and especially of the Mathematical Sciences Research Institute's workshop devoted to the subject. It also provides complete proofs: in one case, a new, unified strategy is presented and new proofs are offered.
Mathematical Sciences Research Institute Publications 30
1997 272 pp. 59222-4 Hardback $47.95

An Introduction to the Mathematics of Neurons
Modeling in the Frequency Domain
Frank C. Hoppensteadt
Beginning with a presentation of the necessary background material in electronic circuits, mathematical modeling and analysis, signal processing, and neurosciences, this text proceeds to applications. Next, Hoppensteadt develops a theory of mnemonic surfaces and presents material on pattern formation and cellular automata. Finally, the text addresses the large networks, such as the thalamus-reticular complex circuit, that may be involved in focusing attention, and the development of connections in the visual cortex.
Cambridge Studies in Mathematical Biology 6
1997 c.240 pp. 59075-2 Hardback $59.95
59929-6 Paperback $22.95

Flavors of Geometry
Silvio Levy, Editor
This is a collection of lectures on four geometrically-influenced fields of mathematics that have experienced great development in recent years. It presents chapters by masters in their fields on hyperbolic geometry, dynamics in several complex variables, convex geometry, and volume estimation.
Mathematical Sciences Research Institute Publications 31
1997 c.200 pp. 62048-1 Hardback $59.95
62962-4 Paperback $19.95

Clifford Algebras and Spinors
P. Lounesto
This book offers a unique introduction to Clifford algebras and spinors. The beginning chapters are aimed at undergraduates; vectors, complex numbers and quaternions are introduced with an eye on Clifford algebras. The next chapters will also interest physicists and include treatments of the quantum mechanics of the electron, electromagnetism and special relativity with a flavor of Clifford algebras.
London Mathematical Society Lecture Note Series 239
1997 306 pp. 59916-4 Paperback $44.95

Representation Theory and Algebraic Geometry
A. Martenskovsky and G. Todorov, Editors
This book contains seven lectures delivered at The Maurice Auslander Memorial Conference at Brandeis University in March 1995. The variety of topics covered at the conference reflects the breadth of Maurice Auslander's contribution to mathematics, including commutative algebra and algebraic geometry, homological algebra and representation theory.
London Mathematical Society Lecture Note Series 238
1997 131 pp. 57789-6 Paperback $34.95

Geometric Galois Actions
Volume 1: Around Grothendieck's Esquisse d'un Programme
Leila Schneps and Pierre Lochak, Editors
The first of two volumes on anabelian algebraic geometry, this book contains the famous manuscript "Esquisse d'un Programme" by Alexander Grothendieck. This work, written fourteen years after his retirement from public life in mathematics, includes the closely related letter to Gerd Faltings, published for the first time in this volume.
London Mathematical Society Lecture Note Series 242
1997 c.400 pp. 59642-4 Paperback $39.95

Available in bookstores or from
A Survey of Four-Year and University Mathematics in Fall 1995: A Hiatus in Both Enrollment and Faculty Increases

Donald C. Rung

Every five years the Conference Board of the Mathematical Sciences (CBMS) conducts a survey of four-year and university departments of mathematics and statistics and two-year college programs in mathematics, with the first survey in 1965 and the latest survey in 1995. Since 1970 these surveys have been supported by the National Science Foundation. The present survey was conducted in fall 1995 with a stratified random sample of 649 departments distributed among 30 different strata; two-thirds responded. Projections were made using standard procedures for stratified random samples. The responding units were distributed across the different strata, insuring a good confidence level for the results.

The survey forms were extensive and generated a plethora of data, which are reported in full in the formal report of this survey, Statistical Abstract of Undergraduate Programs in the Mathematical Sciences in the United States, Fall 1995 CBMS Survey, by Don O. Loftsgaarden, Donald C. Rung, and Ann E. Watkins (1997), published in the MAA Notes Series and available from the Mathematics Association of America. A digest of the important results for four-year college and university departments of mathematics and statistics is given in this article by selecting nine of the most important tables from among the sixty-four tables of data in the survey report. Topics include enrollment in all courses taught by these departments, with special emphasis on first-year calculus data; faculty, including gender and tenure status; and advising practices for departmental majors. A synopsis analyzing the data on the teaching of statistics appears in a separate article by Loftsgaarden and Watkins appearing in The American Statistician.

The phrase "mathematics departments" includes traditional departments of mathematics as well as all multititled departments which feature mathematics together with other related disciplines. Statistics departments are separate departments and are almost entirely departments with Ph.D. programs. The data are presented both in summary form and by type of institution as determined by the highest mathematics degree offered by the institution. Thus a Ph.D. mathematics department is one which offers the Ph.D. degree, an M.A. mathematics department is one which offers as its highest degree a master's degree in mathematics, and a B.A. department of mathematics offers only a bachelor's degree. While departments of statistics are classified by the institution's classification, only two of the responding statistics departments in Ph.D. institutions did not offer a Ph.D. in statistics.

Mathematics courses are aggregated by level: remedial, precalculus, calculus, and advanced. Statistics course levels are elementary and upper, while computer science course levels are lower, middle, and upper. Precalculus-level mathematics courses include both traditional precalculus algebra and trigonometry courses along with courses for nonscience majors, finite mathematics, non-calculus-based business mathematics, and mathematics for prospective elementary school teachers. Calculus-level courses include the traditional
calculus sequence through differential equations together with linear/matrix algebra and discrete mathematics. Advanced mathematics courses are the remaining undergraduate courses not included in the three other categories. Enrollment for each course is given in Appendix I of the survey report. This appendix includes historical data as well. Enrollment includes all students regardless of their status: part-time, full-time, adjunct, graduate, etc.

Instructional faculty are separated into tenured and tenure-eligible, other full-time, part-time, and graduate teaching assistants. Other full-time faculty include all full-time faculty not tenured or tenure-eligible. This category includes postdoctoral appointments, fixed-term instructors, visitors, and so on. Part-time faculty are those with less than full-time appointments within the mathematics or statistics department, regardless of whether they have or do not have other appointments within the institution.

Table 1 shows that while total enrollment in collegiate mathematics courses was little changed from 1990—2,853,000 in fall 1995 as compared to 2,860,000 in 1990—the proportion of mathematics enrollment in two-year colleges continued to climb, so that in fall 1995 two-year colleges had 49% of the mathematics enrollment as compared to 43% in fall 1990. The enrollment for mathematics courses in four-year colleges and universities declined substantially, 9%, from the nighwater marks of 1985 and 1990. The largest decline was in the calculus-level courses. Statistics enrollments, both within mathematical sciences departments as well as within separate departments of statistics, recorded substantial gains. (It should be noted that the 63 Ph.D. statistics departments in the 1995 CBMS survey population was 10 more than the 1990 CBMS survey population of 53, which may account for some of the enrollment increase.)

Enrollment in statistics and computer science courses within mathematics departments includes only that enrollment in courses under the direction of the department. The same is true for non-statistics courses taught by statistics departments. Separate computer science departments, while included in the 1990 CBMS survey, were not included.

### Table 1

<table>
<thead>
<tr>
<th>Course Level</th>
<th>Fall Enrollment (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Four-Year College and University Math Depts</td>
</tr>
<tr>
<td>Remedial</td>
<td>101 242 251 261 222</td>
</tr>
<tr>
<td>Precalculus</td>
<td>538 602 593 592 613</td>
</tr>
<tr>
<td>Calculus</td>
<td>414 590 637 647 538</td>
</tr>
<tr>
<td>Advanced</td>
<td>135 91 138 119 96</td>
</tr>
<tr>
<td>Other (2-year)</td>
<td>171 218 133 144 160</td>
</tr>
<tr>
<td>Total Math</td>
<td>1188 1525 1619 1619 1469</td>
</tr>
<tr>
<td>Stat Courses</td>
<td>Elementary na na na 87 115</td>
</tr>
<tr>
<td></td>
<td>Upper na na na 38 28</td>
</tr>
<tr>
<td>Total Stat</td>
<td>60 na na 125 143</td>
</tr>
<tr>
<td>CS Courses</td>
<td>Lower na na na 134 74</td>
</tr>
<tr>
<td></td>
<td>Middle na na na 12 13</td>
</tr>
<tr>
<td></td>
<td>Upper na na na 34 12</td>
</tr>
<tr>
<td>Total CS</td>
<td>60 na na 160 99</td>
</tr>
<tr>
<td>Grand Total</td>
<td>1308 na na 1924 1711</td>
</tr>
</tbody>
</table>

*The computer science enrollment for 1995 includes only courses taught within mathematics programs. For earlier years it includes estimates of computer science courses taught outside mathematics programs.
in this survey, and these departments' contributions to enrollment totals in past CBMS reports have been excised when it was possible to identify these separate contributions.

Enrollment in all courses offered by mathematics departments fell by 11% from 1990 levels, whereas both statistics department enrollment and two-year college mathematics programs increased, the former by nearly 50% and the latter by almost 8%. In fall 1995 two-year college mathematics programs had 46% of the total mathematical sciences enrollment of 3,277,000.

Table 2 amplifies the enrollment in courses offered by both mathematics and statistics departments in four-year colleges and universities, reporting numbers for fall 1990 and fall 1995 both by level of course and type of institution. During this five-year period calculus-level enrollment fell by 17%, with the largest decline at the Ph.D. universities, 22%. Whether this decline in calculus enrollment is partly the result of the changing gender ratio of undergraduate students is an interesting question. In 1978 undergraduate collegiate enrollment was about 9,800,000, divided 51% female, 49% male. By 1993 overall enrollment had increased by 27% and was now 56% female, 44% male. During this same period, while the number of white males in the undergraduate collegiate population remained nearly constant, their percentage of the total enrollment fell from 40% in 1978 to 33% in 1993.

The increase in precalculus enrollment was largely due to a 20% increase in enrollment in mathematics courses designed primarily for liberal arts students.

Table 3 gives the number of bachelor's degrees awarded to majors within the departments of mathematics and statistics during the period July 1, 1989, to June 30, 1990. From 1989–90 to 1994–95 the overall number of degrees fell by 1,560, or 6%. The largest decline was in the number of computer science degrees, including joint degrees, with a decrease of 2,841. However, this decline was offset somewhat by increased mathematics education degrees within mathematics departments as well as a healthy increase in statistics degrees.

The percentage of mathematics and statistics degrees awarded to women was 45%, little changed from the 46% figure of 1989–90.

Table 4 presents an analysis of mathematics department faculty in fall 1995 by type of appointment, gender, and type of institution. Comparable numbers from the 1990 CBMS report are included when available. While the total number of full-

---

**TABLE 2** Enrollments (thousands) in undergraduate mathematics, statistics and computer science courses in departments of mathematics and in departments of statistics by level of course and type of school: Fall 1995. (Numbers in parentheses are 1990 enrollments.)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Univ (PhD)</td>
<td>Univ (MA)</td>
</tr>
<tr>
<td>Number of Full-Time Faculty 1995</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6221</td>
<td>4765</td>
</tr>
<tr>
<td>Math Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remedial</td>
<td>60</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>(68)</td>
<td>(93)</td>
</tr>
<tr>
<td>Precalculus</td>
<td>222</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>(205)</td>
<td>(202)</td>
</tr>
<tr>
<td>Calculus</td>
<td>264</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td>(337)</td>
<td>(122)</td>
</tr>
<tr>
<td>Adv Math</td>
<td>41</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>(58)</td>
<td>(39)</td>
</tr>
<tr>
<td>Total Math Courses</td>
<td>587</td>
<td>426</td>
</tr>
<tr>
<td></td>
<td>(668)</td>
<td>(446)</td>
</tr>
<tr>
<td>Stat Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elem Stat</td>
<td>23</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>(14)</td>
<td>(27)</td>
</tr>
<tr>
<td>Upper-Level Stat</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(18)</td>
<td>(12)</td>
</tr>
<tr>
<td>Total Stat Courses</td>
<td>33</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>(32)</td>
<td>(39)</td>
</tr>
<tr>
<td>CS Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower CS</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>(9)</td>
<td>(42)</td>
</tr>
<tr>
<td>Middle CS</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(4)</td>
</tr>
<tr>
<td>Upper CS</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(6)</td>
<td>(12)</td>
</tr>
<tr>
<td>Total CS Courses</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>(16)</td>
<td>(58)</td>
</tr>
<tr>
<td>Total All Courses</td>
<td>626</td>
<td>493</td>
</tr>
<tr>
<td></td>
<td>(716)</td>
<td>(543)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Math (except as reported below)</td>
<td>18833</td>
<td>11541</td>
<td>13171</td>
<td>13303</td>
<td>12456</td>
</tr>
<tr>
<td>Math Ed</td>
<td>4778</td>
<td>1752</td>
<td>2567</td>
<td>3116</td>
<td>4829</td>
</tr>
<tr>
<td>Statistics</td>
<td>570</td>
<td>467</td>
<td>538</td>
<td>618</td>
<td>1031</td>
</tr>
<tr>
<td>Actuarial Math</td>
<td>na</td>
<td>146</td>
<td>na</td>
<td>245</td>
<td>620</td>
</tr>
<tr>
<td>Operations Research</td>
<td>na</td>
<td>na</td>
<td>312</td>
<td>220</td>
<td>75</td>
</tr>
<tr>
<td>Joint CS &amp; Math</td>
<td>na</td>
<td>na</td>
<td>2519</td>
<td>960</td>
<td>453</td>
</tr>
<tr>
<td>Joint Math &amp; Stat</td>
<td>na</td>
<td>na</td>
<td>121</td>
<td>124</td>
<td>188</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>794</td>
<td>502</td>
</tr>
<tr>
<td><strong>Subtotal Math, Stat &amp; Joint Degrees</strong></td>
<td>24181</td>
<td>13906</td>
<td>19237</td>
<td>19380</td>
<td>20154</td>
</tr>
<tr>
<td><strong>Number of Women</strong></td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>8847</td>
<td>9061</td>
</tr>
<tr>
<td><strong>Computer Science Degrees</strong></td>
<td>na</td>
<td>na</td>
<td>8691</td>
<td>5075</td>
<td>2741</td>
</tr>
<tr>
<td><strong>Number of Women</strong></td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>1584</td>
<td>532</td>
</tr>
<tr>
<td><strong>Total Degrees</strong></td>
<td>na</td>
<td>na</td>
<td>27928</td>
<td>24455</td>
<td>22895</td>
</tr>
<tr>
<td><strong>Number of Women</strong></td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>10431</td>
<td>9593</td>
</tr>
</tbody>
</table>

TABLE 4  Number of tenured, tenure-eligible, other full-time, and part-time faculty in departments of mathematics by gender and by type of school: Fall 1995. Also some 1990 data.

<table>
<thead>
<tr>
<th>Univ (PhD)</th>
<th>Univ (MA)</th>
<th>College (BA)</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenured</td>
<td>Tenured</td>
<td>Tenured</td>
<td>Tenured</td>
</tr>
<tr>
<td>Full-time</td>
<td>Full-time</td>
<td>Full-time</td>
<td>Full-time</td>
</tr>
<tr>
<td>Elig</td>
<td>Elig</td>
<td>Elig</td>
<td>Elig</td>
</tr>
<tr>
<td>Men</td>
<td>4356</td>
<td>614</td>
<td>491</td>
</tr>
<tr>
<td>Women</td>
<td>335</td>
<td>158</td>
<td>267</td>
</tr>
<tr>
<td>Total 1995</td>
<td>4691</td>
<td>772</td>
<td>758</td>
</tr>
<tr>
<td>Total 1990</td>
<td>4781</td>
<td>1646*</td>
<td>1129</td>
</tr>
<tr>
<td>Women 1990</td>
<td>662**</td>
<td>na</td>
<td>1148**</td>
</tr>
</tbody>
</table>

*This number is the total of tenure-eligible and other full-time.
**This number is the total of tenured, tenure-eligible, and other full-time.

The number of full-time women faculty was nearly the same in 1995, 3,880, as it was in 1990, when it was 3,855. In fall 1995 tenured and tenure-eligible women were 8% of the full-time faculty in Ph.D. mathematics departments as compared to 15% for M.A. full-time faculty declined by about 1,150, it appears that the decline was mostly in the number of faculty who are full-time but not tenured. This can be inferred from the slight increase in tenured faculty reported in this survey as well as other data available from the annual surveys conducted by the joint AMS-IMS-MAA Data Committee.
mathematics departments and 24% for B.A. mathematics departments. Combining all three types of mathematics departments shows that tenured and tenure-eligible women were 16% of the 18,248 full-time mathematics faculty and 18% of the 16,108 tenured and tenure-eligible mathematics faculty.

According to figures from the annual reports of the joint AMS-IMS-MAA Data Committee, the percentage of women among Ph.D.s awarded from July 1, 1980, to June 30, 1995, from United States mathematics and statistics departments was 19%; for the period July 1, 1990, to June 30, 1995, the percentage of women Ph.D.'s was 22%.

Table 5 shows that the distribution of minorities among the full-time faculty differs between the university departments of mathematics and the four-year college departments of mathematics. While this particular table does not contain data from the 1990 CBMS survey, other data from the 1990 CBMS report indicate that there was little change over this five-year period in either the gender or the racial/ethnic distribution of college and university mathematics faculty. (The percentages of women faculty given in Table 5 are slightly smaller than the comparable percentages com-

| TABLE 5 Percentage of gender and of racial/ethnic groups among tenured, tenure-eligible, and other full-time faculty in departments of mathematics by type of school: Fall 1995. |
|----------------------------------|----------------------------------|----------------------------------|
|                                   | Percentage of Faculty            | Number of full-time faculty       |
|                                   | American | Asian | Black, Mexican American, | White, | Alaskan | Islander | Hispanic | Other Hispanic | Hispanic | Known | tenured/tenure-eligible and other |
| Univ(PhD)                          |          |       | not Puerto Rican, not    |        |         |          |          |                |          |       |
| Tenured men                        | 0        | 7     | 1                             | 61     | 1       |          |          |                |          |       |
| Tenured women                      | 0        | 1     | 0                             | 4      | 0       |          |          |                |          |       |
| Tenure-eligible men                | 0        | 3     | 0                             | 6      | 0       |          |          |                |          |       |
| Tenure-eligible women              | 0        | 1     | 0                             | 2      | 0       |          |          |                |          |       |
| Other full-time men                | 0        | 1     | 0                             | 6      | 0       |          |          |                |          |       |
| Other full-time women              | 0        | 1     | 0                             | 4      | 0       |          |          |                |          |       |
| Total full-time men                | 0        | 11    | 1                             | 73     | 1       |          |          |                |          |       |
| Total full-time women              | 0        | 1     | 0                             | 10     | 0       |          |          |                |          |       |
| Univ(MA)                           |          |       |                               |        |         |          |          |                |          |       |
| Tenured men                        | 0        | 6     | 1                             | 48     | 1       |          |          |                |          |       |
| Tenured women                      | 0        | 1     | 0                             | 9      | 0       |          |          |                |          |       |
| Tenure-eligible men                | 0        | 3     | 1                             | 9      | 0       |          |          |                |          |       |
| Tenure-eligible women              | 0        | 1     | 0                             | 4      | 0       |          |          |                |          |       |
| Other full-time men                | 0        | 0     | 1                             | 6      | 0       |          |          |                |          |       |
| Other full-time women              | 0        | 0     | 1                             | 7      | 0       |          |          |                |          |       |
| Total full-time men                | 0        | 9     | 2                             | 62     | 2       |          |          |                |          |       |
| Total full-time women              | 0        | 2     | 1                             | 20     | 1       |          |          |                |          |       |
| Coll(BA)                           |          |       |                               |        |         |          |          |                |          |       |
| Tenured men                        | 0        | 1     | 0                             | 52     | 1       |          |          |                |          |       |
| Tenured women                      | 0        | 0     | 2                             | 12     | 0       |          |          |                |          |       |
| Tenure-eligible men                | 0        | 1     | 0                             | 14     | 0       |          |          |                |          |       |
| Tenure-eligible women              | 0        | 0     | 0                             | 7      | 0       |          |          |                |          |       |
| Other full-time men                | 0        | 0     | 0                             | 5      | 0       |          |          |                |          |       |
| Other full-time women              | 0        | 0     | 0                             | 3      | 0       |          |          |                |          |       |
| Total full-time men                | 0        | 3     | 1                             | 70     | 1       |          |          |                |          |       |
| Total full-time women              | 0        | 1     | 2                             | 23     | 1       |          |          |                |          |       |

0 means less than half of 1%.

*Total for all 6 rows in this block.

**Total for both rows in this block.
puted from Table 3 because of rounding errors in Table 3.)

Table 6 gives the percentage of sections of all courses taught by mathematics and statistics departments by kind of instructor and by type of institution. The total number of sections for each percentage given is also included, which produces the total number of sections taught by tenured and tenure-eligible faculty by type of institution. For example, tenured and tenure-eligible faculty at Ph.D. mathematics departments taught 6,981 sections (.45x15,513) of undergraduate mathematics courses, 608 sections (.61x997) of undergraduate statistics courses, and 222 sections (.81x274) of undergraduate computer science courses, for a total of 7,811 sections. According to figures obtained from the AMS-IMS-MAA Data Committee’s annual report, Ph.D. mathematics departments taught 2,800 sections of graduate mathematics. Thus the total number of sections taught by tenured/tenure-eligible faculty in Ph.D. departments is 10,611. When divided by the 4,989 tenured and tenure-eligible faculty not on leave (obtained from another part of the CBMS survey), the fall 1995 semester (or term) averages 2.13 sections per tenure/tenure-eligible faculty in Ph.D. mathematics departments.

A similar analysis for M.A. departments of mathematics, using an estimate of 1,800 graduate sections from the same joint AMS-IMS-MAA committee report, gives a ratio of 3.08. For the B.A. departments of mathematics the ratio is 3.14.

These numbers can be used to give full-time equivalent (fte) estimates for the sections taught by each of the various types of instructors. In particular, it is possible to obtain an fte estimate for the part-time faculty in mathematics departments. Dividing the number of sections taught by part-time faculty in Ph.D. mathematics departments by the average sections taught by tenure/tenure-eligible faculty in Ph.D. mathematics departments by type of school: Fall 1995.

| TABLE 6 | Percentage of sections of undergraduate mathematics, statistics, and computer science courses taught by tenured and tenure-eligible, other full-time, part-time, and graduate teaching assistants in departments of mathematics and departments of statistics by type of school: Fall 1995. |
|----------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
|          | Percentage of sections of math courses taught by no. of Math sections          | Percentage of sections of stat courses taught by no. of Stat sections          | Percentage of sections of CS courses taught by no. of CS Sections               |
|          | Tenured/ Other Part- Grad tenure- full-time TAs eligible time                  | Tenured/ Other Part- Grad tenure- full-time TAs eligible time                  | Tenured/ Other Part- Grad tenure- full-time TAs eligible time                  |
| Math     |                                                                                 |                                                                                 |                                                                                 |
| Depts    |                                                                                 |                                                                                 |                                                                                 |
| Univ (PhD) | 45 11 12 31 100% 61 3 8 28 15513                                               | 100% 81 7 12 0 997                                                            |                                                                                 |
| Univ (MA) | 54 15 20 10 100% 79 8 10 3 14509                                                | 100% 67 15 17 1 1511                                                         |                                                                                 |
| Coll (BA) | 70 9 21 0 100% 82 3 16 0 20521                                                 | 100% 73 10 17 0 2719                                                         |                                                                                 |
| Total    | 58 11 18 12 100% 77 4 13 6 50543                                                | 100% 72 11 17 0 5227                                                         |                                                                                 |
| Stat     |                                                                                 |                                                                                 |                                                                                 |
| Depts    |                                                                                 |                                                                                 |                                                                                 |
| Univ (PhD) | Too few cases in the sample to make reliable estimates | Too few cases in the sample to make reliable estimates | 100% 64 10 5 21 1324                                                          |
| Univ (MA) | 100% 79 13 8 0 4                                                              | 100% Too few cases in the sample to make reliable estimates 100% 120 |
| Total    | 65 10 5 19 100% 1444                                                            |                                                                                 |                                                                                 |
faculty of 2.13 obtained above gives a part-time fte number of 919 for Ph.D. mathematics departments. Using a similar division for M.A. departments of mathematics gives a part-time fte number of 1,075. For B.A. departments of mathematics the part-time fte number is 1,691. This gives a total fall 1995 part-time faculty fte number of 3,685 for all mathematics departments. Heartening to the actual number of part-time faculty employed, 5,289, gives a conversion ratio from the actual part-time faculty number to its fte equivalent of 3,685/5,289=.697. This suggests that instead of the traditional multiplier, 1/2, used to convert part-time faculty to its fte equivalent, this calculation can be used to give fte-equivalent numbers to other full-time faculty as well.

Table 7 gives a detailed analysis of the various ways that mainstream Calculus I and II were taught in fall 1995, along with the kind of faculty who taught this course. (A calculus course is mainstream if it leads to the usual upper-division mathematical science courses. Otherwise it is classi-
students with graduate assistant instructors was slightly more in the larger sections, 6,160, than in the smaller classes, 5,425.

Table 8 contains comparable data from the 1990 CBMS survey, demonstrating the dramatic increase in pedagogical innovations that have been adopted since 1990. (No information was collected in the 1990 survey on use of "reform" texts.) Again, care should be taken in interpreting the percentages given in this table. As an example of this phenomenon, there were more students enrolled in smaller sections of mainstream Calculus I in B.A. departments of mathematics using a "reform" text—23% of 48,000 or about 11,000 students—than in the larger regular sections—40% of 18,000, or about 7,200 students.

From this table, as well as from other data in the 1995 CBMS report, the total number of four-year and university students in mainstream Calculus I and II and non-mainstream Calculus I using a "reform" text was 81,200 out of a total enrollment of 372,000, or about 22%. The two-year survey did not specifically ask about use of a "reform" text but did ask a somewhat related question about the number of sections which were assigned group projects. Using this as a measure of the use of a "reform" text gives an estimate for these three courses of 22,000 students out of a total enrollment of 117,000, or 19%. Thus, for fall 1995 the total collegiate enrollment using a "reform" text was 103,200 out of a total enrollment of 489,000, or 21%.

For the four-year and university mathematics and statistics departments, both the 1990 and 1995 CBMS four-year and university survey found that their total fall undergraduate enrollment in the previous fall was almost exactly half of the total of the corresponding academic-year undergraduate enrollment. (This question was not asked in the two-year college program survey either in 1990 or 1995.) The usual decline in second-semester enrollment for those departments on a two-semester calendar was exactly offset by the 23% of departments with a different academic calendar. For these departments fall enrollment usually is quite a bit less than their total academic-year enrollment. Using this doubling gives an estimate of 162,400 for the total number of students in four-year and university departments of mathematics using a "reform" text in these three courses during the academic year 1995-96.

Table 9 gives information about advising policies and practices for mathematics departments majors. (Information about advising within statistics departments is available in the CBMS report but is not reported in this article.) This was a "one-time" question, and so no comparative data is available from previous CBMS reports. It should be

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**TABLE 8** Percentage of enrollment in mainstream Calculus I and mainstream Calculus II taught using various reform methods in departments of mathematics by size of sections and type of school: Fall 1995. Also total enrollments (thousands) and average section sizes.

<table>
<thead>
<tr>
<th>Course</th>
<th>Taught from a &quot;reform&quot; text</th>
<th>Using graphing calculators</th>
<th>Having writing assignments</th>
<th>Having required computer assignments</th>
<th>Having assigned group projects</th>
<th>Enrollment (thousands)</th>
<th>Avg. section size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Univ (PhD)</td>
<td>Univ (MA)</td>
<td>Univ Coll (BA)</td>
<td>Univ (PhD)</td>
<td>Univ (MA)</td>
<td>Univ Coll (BA)</td>
<td>Univ (PhD)</td>
</tr>
<tr>
<td>Mainstream Calculus I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large lecture with recitation</td>
<td>30</td>
<td>20</td>
<td>0</td>
<td>25</td>
<td>20</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>Regular section &lt;30</td>
<td>44</td>
<td>39</td>
<td>23</td>
<td>60</td>
<td>52</td>
<td>29</td>
<td>37</td>
</tr>
<tr>
<td>Regular section ≥30</td>
<td>13</td>
<td>24</td>
<td>44</td>
<td>30</td>
<td>37</td>
<td>63</td>
<td>8</td>
</tr>
<tr>
<td>Course Total</td>
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<td>31</td>
<td>29</td>
<td>33</td>
<td>44</td>
<td>39</td>
<td>21</td>
</tr>
<tr>
<td>1990 percent. of sections</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mainstream Calculus II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large lecture with recitation</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Regular section &lt;30</td>
<td>18</td>
<td>22</td>
<td>25</td>
<td>30</td>
<td>33</td>
<td>36</td>
<td>20</td>
</tr>
<tr>
<td>Regular section ≥30</td>
<td>18</td>
<td>18</td>
<td>8</td>
<td>37</td>
<td>31</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Course Total</td>
<td>17</td>
<td>20</td>
<td>22</td>
<td>27</td>
<td>32</td>
<td>32</td>
<td>17</td>
</tr>
<tr>
<td>1990 percent. of sections</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total Mainstream Calculus I &amp; II</td>
<td>24</td>
<td>28</td>
<td>27</td>
<td>31</td>
<td>41</td>
<td>37</td>
<td>20</td>
</tr>
</tbody>
</table>

*The primary text (or set of notes, etc.) generally reflects the pedagogical principles of the reform calculus movement.*
noted that while the percentage of tenured and tenure-eligible faculty in Ph.D. mathematics departments assigned to advise departmental majors is substantially lower than the comparable percentage for the other two types of mathematics departments, faculty in Ph.D. departments have substantial graduate advising which is not included in this survey.

At some institutions students do not declare an official major until sometime in their second year. The survey did ask for information on advising practices and policies for all departmental majors whether intended or declared.

### TABLE 9

Percentage of departments of mathematics assigning departmental advisors by level of departmental majors, frequency of meetings, and type of school. Also percentage of tenured and tenure-eligible faculty assigned to advise departmental majors: Fall 1995.

<table>
<thead>
<tr>
<th>Departments</th>
<th>Univ (PhD)</th>
<th>Univ (MA)</th>
<th>Coll (BA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage of departments where</td>
<td>Percentage of departments where</td>
<td>Percentage of departments where</td>
</tr>
<tr>
<td>Departmental majors are assigned a departmental advisor each year</td>
<td>67</td>
<td>75</td>
<td>53</td>
</tr>
<tr>
<td>Departmental majors are assigned a departmental advisor in their 1st and 2nd years only</td>
<td>5</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Departmental majors are assigned a departmental advisor in their 3rd and 4th years only</td>
<td>16</td>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>Other methods are used to advise departmental majors</td>
<td>12</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Number of Departments</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>169</td>
<td>242</td>
<td>985</td>
</tr>
<tr>
<td>Meetings with departmental advisor:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No meetings are required</td>
<td>36</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>There is at least one required</td>
<td>49</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>There is at least one required meeting in students’ 3rd and 4th years only</td>
<td>16</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Number of Departments</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>169</td>
<td>242</td>
<td>985</td>
</tr>
<tr>
<td>Number of tenured and tenure-eligible faculty</td>
<td>5463</td>
<td>4032</td>
<td>6613</td>
</tr>
<tr>
<td>Percentage of tenured and tenure-eligible faculty assigned to advise undergraduate departmental majors in fall 1995</td>
<td>27</td>
<td>67</td>
<td>68</td>
</tr>
</tbody>
</table>
Rigor means disciplined thinking, the heart of mathematics. One prominent businessman recalled his college mathematics courses in the following way.

I'm not out to convince anyone that calculus, or even algebra and geometry, are necessities in the hotel business. But I will argue long and loud that they are not useless ornaments pinned onto an average man's education. For me, at any rate, the ability to formulate quickly, to resolve any problem into its simplest, clearest form, has been exceedingly useful. It is true that you do not use algebraic formulae but in those three small brick buildings at Socorro I found higher mathematics the best possible exercise for developing the mental muscles necessary to this process.

In later years I was to be faced with large financial problems, enormous business deals with as many ramifications as an octopus has arms, where bankers, lawyers, consultants, all threw in their particular bit of information. It is always necessary to listen carefully to the powwow, but in the end someone has to put them all together, see the actual problem for what it is, and make a decision—come up with an answer. A thorough training in the mental disciplines of mathematics precludes any tendency to be fuzzy, to be misled by red herrings, and I can only believe that my two years at the School of Mines helped me to see quickly what the actual problem was—where the problem is, the answer is. Any time you have two times two and know it, you are bound to have four.

Proof is the soul of mathematics and logic, distinguishing them from all other disciplines. Rigor does not require that every statement you make be accompanied by a proof, but only that the need for a proof be recognized: the status of the proposition as well as that of any supporting discussion be made clear. Tell whether the proposition is a theorem or a conjecture and whether the accompanying discussion is a proof or only a suggestion or an outline of it or just a sketch of the main idea. Rigor also demands emphasizing that theorems have hypotheses: after all, one of Bertrand Russell's definitions of mathematics was as the class of all propositions of the form $P$ implies $Q$. Do not let students get away with saying that every continuous function assumes a greatest value and a least value.

The recognition that a theorem has hypotheses includes requiring students to verify them when invoking the theorem. But be sensible about it. Hypotheses that govern the universe of discourse, once they have been established in the students'
minds, should be taken for granted. A similar consideration applies to invoking a theorem in the course of a proof. A student who has just recently encountered the theorem should quote or refer to it by name, but by the time it has become assimilated into the local culture, a citation is no longer needed. Within a short time after encountering the Pythagorean theorem, the student, having written, "This shows that in triangle ABC, C is a right angle" may pass at once to "therefore \(a^2 + b^2 = c^2\) without further ado.

Rigor also requires students to state definitions correctly, except for hopelessly complicated definitions such as that of limit.

None of this is intended to suggest that all mathematics courses have to be presented at the level of advanced calculus. On the contrary, one should always keep any discussion at a level appropriate to the audience. There is a favorite story in our home about the little boy next door asking his mother where babies come from. Having prepared long since for this very moment, she responded with a flawless rendition of her elegantly crafted reply and asked whether he had any questions. "Yes," he said, "how do you make bricks?" John Kelley put it best back in the New Math days: "Tell them the truth and nothing but the truth, but for God's sake don't tell them the whole truth."

It is fashionable in some circles to portray math as being easy. Now, I certainly believe that ordinary kids can learn standard school math if they work hard at it. But that is not the same as saying math is easy. The notion is ill-considered and dangerous. Consider the effect on students: passing an easy course offers nothing to take pride in, and failing it can shatter one's self-esteem.

Another fashion is to denigrate drill, usually referred to as "mindless" drill, suggesting that mindlessness is something intrinsic to a problem or set of problems. I would say it resides rather in the attitude of the student who sits there thinking about something else or the of teacher who says, "Do these ninety-seven problems" instead of "Do enough of these problems that you feel confident you don't need further practice, then do three more for good measure." Many writers have noted the similarity to music lessons and the recognized need for pupils to practice scales and other exercises. I myself have been practicing the piano for more than seventy years, but still heartily enjoy exercises and continue to invent new ones. Practice and drill are established strategies for honing one's skills. No pianist, from rank beginner to seasoned professional, ever inserts five-finger exercises into a recital program. No football player ever runs through a zigzag of automobile tires in the course of an actual game.

Mathematics teachers are virtually unanimous in vetoing \((\varepsilon, \delta)\) as a fit topic for beginning calculus students. Quantifiers are unfamiliar to students in any case, and the intimidating succession in \((\varepsilon, \delta)\) is well beyond their comprehension. So we try somehow to give them the idea of limit. Unfortunately, the typical attempt is just about as futile. When I was a student, the instructor told us that \(y\) will be as close as you please to \(L\) provided that \(x\) is close enough to \(a\). The entire class, all 12 of us, stared at him with glazed eyes. When, many years later, I gave my freshman students the same description, the entire class, all 120 of them, stared at me with glazed eyes.

I propose the following description of limit. It is equivalent to \((\varepsilon, \delta)\) yet is expressed low-key, in familiar terms. Concentrate for the moment on the limit from the left. Let \(f\) be a function defined on an interval \((u_0, a)\), \(L\) a number, and \(f_1\) a (strictly) increasing function on \((u_0, a)\) whose graph lies everywhere below the level \(L\) but rises above every lower level. In detail, if \(A\) is any number less than \(L\), then \(f_1\) eventually rises above the level \(A\) (and once above, remains above (Figure 1)). It is here, in this relaxed form, that the quantifiers reside. A decreasing function \(f_2\) is described correspondingly. We then say that

---

**Figure 1.**

**Figure 2.**
\[ \lim_{x \to a^-} f(x) = L \]

if there exist functions \( f_1 \) and \( f_2 \) as described satisfying \( f_1(x) \leq f(x) \leq f_2(x) \) for all \( x \) in the interval (Figure 2). Thus, \( f \) "zeros" in on the value \( L \).

The description of the limit as \( x \to a^+ \) is similar, but note that the lower bound \( f_1 \) is now technically a decreasing function. It is less confusing to say that \( f_1 \) increases as \( x \) moves from right to left (or as \( x \) moves towards \( a^- \)). The corresponding remark applies to \( f_2 \). Finally, of course, we say that

\[ \lim_{x \to a} f(x) = L, \]

provided that both one-sided limits exist and equal \( L \) (Figure 3).

The foregoing description would be awkward as an actual working definition of limit. But it is very useful for motivating the simple definition that if \( J \) is any open interval about \( L \), then there is a punctured open interval \( I\setminus a \) that \( f \) takes into \( J \). In fact, this definition can be read off from Figure 3, with \( (A, B) = J \) and \( (u, v) = I \). (If you insist, you may stipulate that \( A \) and \( B \) be equidistant from \( L \) and choose \( u \) and \( v \) to be equidistant from \( a \).) This shows that the description implies the \((\varepsilon, \delta)\) definition. Conversely, if \( f \) is defined on \((u_0, a)\) and \( \lim_{x \to a^-} f(x) = L \) according to \((\varepsilon, \delta)\), then the functions

\[ f_1(x) = \inf_{(x,a)} f - (x - a) \]

and \( f_2 \), defined similarly, have the desired properties. (This proof is not meant for the students.)

The \((\varepsilon, \delta)\) mindset encourages cluttering the page with symbols that serve mainly to distract and invites unnecessary computation. In one of the better advanced calculus books, I read, "There is a number \( \delta > 0 \) such that for \( a - \delta < x < a, f(x) \) has property \( P \)." Why not just, "\( f(x) \) has property \( P \) on an interval \((u, a)\)" or "\( f(x) \) has property \( P \) near \( a^- \)?"

Moreover, the precision offered by \((\varepsilon, \delta)\) proofs can obscure the underlying ideas. I have before me a page from a top-selling calculus text containing a thirty-line, symbol-laden computational proof that if \( f(x) \to L \neq 0 \), then \( 1/f(x) \to 1/L \). At the end, the student has no idea of what went on. Are there instructors who actually present such proofs to a freshman class? In contrast, the proof based on order relations occupies only two lines (with an additional short explanation in case the tactic of replacing the challenge \( (A, B) \) by a suitable subinterval is not yet familiar). The reasoning is on the level that if \( 0 < x < y \), then \( 1/y < 1/x \):

Say \( L > 0 \). Given \( A < 1/L < B \), we may assume \( A > 0 \). Then \( 1/B < L < 1/A \). Since \( f(x) \to L \), \( 1/B < f(x) < 1/A \) near \( a \). Then \( A < 1/f(x) < B \) near \( a \). \( \square \)
The Bible Code
Michael Drosnin
Simon and Schuster
$25.00 hardcover

Michael Drosnin has written a frightening book. Nuclear holocausts, calamitous earthquakes, the Nazi death camps, terrorist bombings, assassinations of world leaders who may have held some hope for humanity—a 182-page catalogue of very real threats to our world.

The Bible Code purports the existence of a hidden code in the Hebrew text of the Old Testament. This code, according to Drosnin, contains information about future events—especially, it would seem, tragic world events of monumental proportions. The book appeals to legitimate fears about irrational, violent forces loose in the world. These fears can lead rational people to hope that God will intervene where humans fail. They may even inspire hope that this book really does provide a way of predicting the future and averting disaster.

The sad fact is that this book is a series of wild, unfounded claims based on stretching statistical evidence to the breaking point. Drosnin, a former reporter for the Washington Post and the Wall Street Journal, says he is simply a journalist in search of the facts: “I started out on the night police beat. I always had a very flat-footed, down-to-earth view of reality. And I was determined to deal with this story the same way I dealt with every other story.” But despite his claims to hard-nosed skepticism, one cannot avoid the conclusion that he lacks the mathematical and statistical background that would bring some depth to his skepticism. He is deluded by his ignorance.

Efforts to extract hidden information from the Bible are as old as the Bible itself. One method is the use of equidistant letter sequences (ELSs), or skip codes: Start with a given letter in the text, and then repeatedly skip a fixed number of letters, ignoring spaces between words. For example, the first sentence of this paragraph, starting with the first letter and using a skip code of 3, would yield the equidistant letter sequence ERORHEFANMBEADHBTF. This process can also be visualized as eliminating all of the spaces between the words in the Bible and arraying the letters into a grid, where the number of letters in any row of the grid is the length of the skip. Vertical lines in the array then constitute ELSs in that skip code.

In the 1940s and 1950s, Rabbi H. M. D. Weismann used skip codes to study the five Books of Moses. His work was the starting point for explorations that resulted in the paper “Equidistant Letter Sequences in the Book of Genesis”, by Doron Witztum, Eliyahu Rips, and Yoav Rosenberg (Statistical Science 9 (1994), 429–438). Witztum is a physicist, and Rosenberg is a computer programmer; Rips is a well-known group theorist at the Hebrew University of Jerusalem. Their paper undertook a serious statistical approach to investigating skip codes in the Book of Genesis. The Bible Code claims to be based on this work but actually mis-
uses the results in ways the authors seem not to have intended.

The paper begins with the following idea. Suppose you have a text in a foreign language and you are given a small set of related words in that language (for example, "hammer" and "anvil"). Can you decide whether the text is meaningful or gobbledygook? The question is not whether you can translate the text; the word list you are given is too short for that. Rather, the question is, Can you use statistical analyses of the proximity of the related words to uncover structure in the text that will tell you whether it has meaning? This is the approach the authors take to the skip-coded material gleaned from Genesis.

They define mathematically a way of measuring the "distance" between encoded words and statistical measures of "how close together" sets of encoded words are. The measures incorporate the notion that encoded words found with close to minimal skips are more significant than those found with very large skips. They ran experiments on two samples: One consisted of the names of 34 historical figures in Judaism and their birth and death dates; the other had the same information for a different set of 32 historical figures. For each sample they created a set of 1,000,000 different permutations of the names with the dates by taking 999,999 random matchings plus the one correct matching. The methods they developed allowed them to measure the "distance" between the list of names and the list of dates in each of the permutations.

The results are striking. For example, with the set of 32 names and dates, only 3 of the 1,000,000 permutations had a shorter "distance" between them than the correct matching of names and dates. Overall, the authors calculate that the probability of obtaining the results they did is 2/10000. The conclusion the authors draw is much more restrained than anything in The Bible Code: "We conclude that the proximity of [equidistant letter sequences] with related meanings in the Book of Genesis is not due to chance."

Because of the unusual nature of the paper, it was put through an especially lengthy review process. After it appeared, Harold Gans, a retired cryptologist with the National Security Agency, independent and confirmed the results and found similar phenomena with other sets of data. However, some have raised questions about the paper. Brendan McKay, a mathematician at Australian National University, has criticized the methodology and says that a correct approach leads to far less impressive results. McKay and three colleagues tried to reproduce the paper's results and obtained insignificant findings (see the Web page http://www.math.gatech.edu/~jkatz/Religions/Numerics/report.html). McKay and Dror Bar-Natan, a mathematician at the Hebrew University of Jerusalem, are preparing a paper detailing their findings (the paper will be submitted to a journal and will also be posted on McKay's home page, http://cs.anu.edu.au/~bdm/).

Whatever the shortcomings of the Statistical Science paper, the authors at least made an effort to formulate a quantitative approach and a well-defined experiment. The Bible Code, while asserting that it is based on the paper, makes no attempt to emulate its rigor and objectivity. Drosnin clearly spent a great deal of time with Eliyahu Rips, who is a major figure in the book. Rips, Witztum, and Gans have publicly denounced the book's conclusions, but Rips has not denied the accuracy of the many passages in which he is quoted. If the descriptions in the book are accurate, Rips, like Drosnin, was enthralled by hunting through the "hidden text" of the Bible for hints about world events. However, Rips avoids asserting that one can predict the future this way. Drosnin tries to add legitimacy by quoting other prominent mathematicians, such as Robert Aumann, David Kazhdan, and Ilya Piatetski-Shapiro. Reading carefully, however, it appears that their statements of surprise at and confirmation of the code pertain to the work of Witztum et al., not that of Drosnin.

The main problem with The Bible Code is that it suffers from the "I-know-it-when-I-see-it" approach. Rather than specifying beforehand what information he is looking for and then assessing what he did and did not find, Drosnin appears to have simply pored over thousands of arrays of skip-codings of the Bible and picked out what seemed interesting and plausible. One of the central examples in the book (dredged up time and again whenever Drosnin feels the need to shore up the reader's confidence in what he is doing) is the "prediction" of the 1995 assassination of Yitzhak Rabin. In 1994 Drosnin found Rabin's name in the code, crossed by the words "assassin will assassinate"; the year corresponding to 1995-96 in the Hebrew calendar appeared nearby.

Through an intermediary, Drosnin communicated a warning to Israeli officials. Certainly they knew that Rabin—the prime minister of a country marked by conflict and bloodshed, the architect of a nascent and highly controversial peace plan—was a potential target for assassination. It was a shock, but not quite a surprise, when he was killed. Although Drosnin's warning seems to have been taken seriously, he had no precise details about when or where or under what circumstances the assassination might take place. Nevertheless, he tries to portray the prediction as highly detailed: "[T]here were details as precise as the story reported on CNN," Drosnin exults: "the full name of Rabin, the name of his assassin, the year he was killed—all but Amir [the name of the assassin] found before it happened." Drosnin also found
references to the assassinations of Robert F. and John F. Kennedy and Anwar el-Sadat. Alas, Wittzum, in his statement denouncing The Bible Code, also points out that one can find the assassination of Winston Churchill similarly encoded.

The Bible Code contains many graphical displays of arrays of Hebrew letters, with the words indicating the predictions circled and translated. Those who do not read Hebrew are at Drosnin’s mercy when it comes to the meaning and interpretation of the words—a particularly worrisome notion given that many Hebrew words have multiple meanings in English. The translations are not even consistent throughout the book. For example, the words accompanying the name “Yitzhak Rabin” are variously translated as “assassin will assassinate”, “assassin that will assassinate”, and “assassin who will assassinate”. In a Web posting Gans asserts that the correct translation is actually “murder” rather than “assassinate” and that one could interpret this finding as implying that Rabin was a murderer—a view that some, rightly or wrongly, did hold.

Another problem with The Bible Code is that Drosnin gives no explanation of how he applied the methods of the Statistical Science paper. For each of the 1,000,000 permutations of the names and dates, the paper provided a ranking based on how “close together” the names and dates appeared. How does this method carry over to calculating the odds of finding “Prime Minister Netanyahu” running across “Surely he will be killed”? “[Netanyahu’s] death was not as clearly predicted as Rabin’s,” Drosnin warns. “The odds that it would be encoded with his name were 100 to 1. The Rabin assassination was encoded against odds of 3000 to 1.” What exactly do these probabilities mean? Later on, in trying to explain that the Bible code does not really predict the future (while spending much of the book trying to persuade us that it does), Drosnin tells us that the code “may be a set of probabilities.” Are these probabilities that actual events will occur? Or are they probabilities that related words will appear near each other in the code? He never makes it clear.

Not all of the predictions in The Bible Code are disastrous. Drosnin found the name “Edison” encoded near “light bulb” and “electricity”, and “Newton” encoded near “gravity”. But such examples are few; Drosnin clearly prefers prophecies of death and destruction. He manages to instill a fearful awe in the reader through this litany of disasters, but he also ends up undercutting his tone of seriousness by a predilection for bloated, portentous statements: “It was like the pieces of a puzzle coming together, slowly, inexorably completing some horrible picture.” “The countdown to what could be the real Armageddon was coming to an end.” “[T]he ultimate danger we face may be the

At http://cs.anu.edu.au/~bdm/BH825.txt/ one can find the full text of the U.N. Convention on the Law of the Sea, signed in 1982. We shall look for messages encoded in this document. To make the experiment somewhat Hebrew-like, we will ignore all vowels and treat upper- and lowercase letters as the same.

This document (stripped down to its consonants) has some remarkable ELSs. The probabilities I will give are those of finding EVEN ONE example in a text formed from this by randomly shuffling the letters.

This Convention is a primary source of international law relating to oceans and waterways. In fact, if you read it, you will find the full text of the

HeaR aLL ThE LaW oF ThE Sea (start=190588, skip=15290, prob=0.000095).

(In other words, the probability that this sentence appears in the document at all is 95 out of one million.)

Many other ELSs of very low probability can be found, but I will content myself with exploring this question: Why was this Convention signed? The cynic might say it was just that

NaTo NeD aN aGReeMeNT oN ThE Sea (start=88311, skip=3404, prob=0.000021),

but the truth is more mundane. After all, the world fishing industry benefits more than anyone. Yes, this was just a

SaFe uN oCeaN CoNVeNTioN To eNClOSe TuNa (start=144491, skip=2066, prob=0.000000001)

(i.e., one in 1 billion).

I have found very good “predictions” of famous assassinations in the English text of Moby Dick (including vowels). This meets a direct challenge by Mr. Drosnin. Included are Trotsky, Ghandi, Robert Kennedy, and ten others. Each is at least as good as Mr Drosnin’s example. Of course, I also have a “prediction” of the murder of Drosnin himself.

Brendan McKay
Computer Science Department
Australian National University

The greatest natural disaster mankind has ever witnessed.”

The major prediction in the book is that World War III will start with a nuclear attack on Israel. Drosnin rightly points out that such an attack is a chillingly real possibility, given that Israel has plenty of enemies and given the increasing availability of the means to create nuclear weapons. He also found in the Bible code the return of the comet Swift in the year 2126, just as astronomers have predicted. He foretells a major earthquake in Los Angeles in 2010—a prediction bolstered by the well-known seismological fact that California is prime earthquake country. Drosnin covers his rear end by sticking to plausible scenarios that everyone already knows could happen.

In fact, the way Drosnin has rigged things, he will turn out to be right no matter what. When his
prediction for an "atomic holocaust" of Israel in 1996 did not pan out, he found the word "delayed" encoded near the prediction. "Why didn't the Bible code just tell the one real future?" he asks. "The answer appears to be that there isn't just one real future; there are many possible futures."

So if Drosnin is right about the future, he is an amazing prophet; if he is wrong, we just happened to get a different future that time. He also tries to bolster these unsupportable ideas with appeals to chaos theory and quantum physics. By the end of the book it becomes clear that, behind the facade of reportorial tough-mindedness and appeals to the objectivity of science and mathematics, Drosnin harbors dreams of becoming the prophet of our age. He believes he is the one to uncover the secrets in the book sealed by the Old Testament figure, Daniel. This is sacrilegious folly.

Drosnin has appeared on Oprah, and he has sold the movie rights to Warner Brothers. The book has hit the bestseller lists of the New York Times, the Times of London, USA Today, and Publisher's Weekly and has been written up in major newspapers and magazines (not to mention getting front-page coverage in the tabloid paper, the National Examiner, along with a story on the marital problems of Frank and Kathie Lee Gifford). There is also a good deal of discussion of The Bible Code on the World Wide Web. Generally the press has not been favorable, but the "reader reviews" on the Simon and Schuster home page were nearly all positive, with an average rating of 7.6 out of 10. (Then again, there are readers like Marilyn Glads, who posted this review: "This book freaked me out. I now know why I hate math and religion.")

Mathematics already has a public relations problem in that many people believe the field is a bag of tricks used to torment schoolchildren. Will readers of The Bible Code now conclude that what mathematics is really good for is doomsday prophecies? Most of them do not have the background in statistics and mathematics to be able to see the holes in Drosnin's arguments. But some may swallow The Bible Code, holes and all, just because it appears to offer a shred of hope for salvation from the many dangers our world faces.

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1 A good place to start is http://yahoo.com/news_and_Media/Current_Events/Bible_Code_Controversy/

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Comments on The Bible Code

Shlomo Sternberg

The Bible Code by Michael Drosnin exploits a hoax perpetrated by two Israelis, E. Rips and D. Witztum, which purports that there are messages about the future encrypted in the Hebrew text of the Bible—codes which can only be deciphered by computer. It is easy to give a concise explanation of why this is a hoax, and so I shall do so here.

First of all, the "decoding of these hidden messages" depends on the letter-for-letter accuracy of the current electronic (Koren) version of the Bible—codes which can only be deciphered by computer. This is not only not true, but a matter of fact: Orthodox Jews, for example, hold the Talmud in extremely high regard. But any serious student of the Talmud knows that there are many citations of the Hebrew Bible which indicate a differing text from the one we have. In the Five Books of Moses these come to about one hundred discrepancies. One of the oldest complete texts of the Bible, the Leningrad codex (from 1009) (also available electronically) differs from the Koren version used by Rips and Witztum in forty-one places in Deuteronomy alone. In fact, the spelling in the Hebrew Bible did not become uniformized until the sixteenth century with the advent of a printed version that could provide an identical standard text available at diverse geographical locations.

Second, "hidden messages" similar to those of Drosnin, Rips, and Witztum can be produced in any sufficiently long actual text, and such have in fact been produced.

These two arguments apply equally well both to Drosnin's book and to the paper that appeared

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in *Statistical Science*, obviously the result of sloppy refereeing and poor editorial policy. So there is no reason to distinguish between the two as Ms. Jackson does in the accompanying article.

What does this sordid affair have to do with mathematics? Nothing, so it would seem. So why does a review of Drosnin's book appear in these pages?

A first possible reason might be that Rips is a professor of mathematics at the Hebrew University. So what? It is not a crime to perpetrate a hoax, at least according to American law with our free market in goods and ideas. Quite the contrary! But even if it were a crime, why should the AMS be interested? For example, the man accused of being the Unabomber holds a Ph.D. in mathematics. I have not seen a campaign mounted in these pages for a defense fund on his behalf so as to spare our community the indignity of having one of our Ph.D.s convicted of murder.

A second possible reason is that three prominent mathematicians—D. Kazhdan, I. Pyatetski-Schaprio, and R. Aumann—are cited in the book as authorities who believe in these "codes". Even if these citations are true, again, so what? If it is not a crime to perpetrate a hoax, it is not a crime to be duped by a hoax or to promulgate it.

I think that I can narrow in on the reason by observing that no academic of remotely comparable credentials in any field other than mathematics is brought as support for these "codes". No linguist, no Bible scholar, no computer scientist, no statistician. The impression given by the book, and reinforced by the massive international publicity campaign surrounding it, is that it is the domain of mathematicians using their mathematics to pass judgment on the veracity of the claims made by the perpetrators.

Are Drosnin and his publicists responsible for the outrageous idea that mathematics is somehow involved in this puerile nonsense? Here, alas, the answer is in the negative. Several years earlier, Witztum published a book (in Hebrew) explaining the "codes". An introduction was written by four distinguished mathematicians: J. Bernstein, H. Furstenberg, D. Kazhdan, and I. Pyatetski-Schaprio. It is true that the enigma given by these eminent men (at least in the English-language version of the introduction) were of a limited nature: "This is serious scholarship, worthy of further investigation, etc." But the very fact that they banded together to form a committee consisting solely of mathematicians in writing their introduction in and of itself has given rise to the widespread notion that this enterprise is supported by mathematics. In so doing they have not only brought shame on themselves, they have disgraced mathematics.
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Companion to Euclid
A course of geometry, based on Euclid's Elements and its modern descendants
Robin Hartshorne, University of California, Berkeley
This book presents Euclidean and non-Euclidean geometries and their relation to modern algebra. Companion to Euclid starts by closely examining the first four books of Euclid's Elements, which students read concurrently. Next, Hilbert's axioms are introduced in the text to give a rigorous basis to the logical structure of Euclid's geometry. Then, a broader perspective to the Elements considers various mathematical questions and subsequent developments that arise naturally from Euclid's geometry.

Euler Products and Eisenstein Series
Goro Shimura, Princeton University, NJ
This volume has three chief objectives: 1) the determination of local Euler factors on classical groups in an explicit rational form; 2) Euler products and Eisenstein series on a unitary group of an arbitrary signature; and 3) a class number formula for a totally definite hermitian form. Though these are new results that have never before been published, Shimura starts with a quite general setting. He includes many topics of an expository nature so that the book can be viewed as an introduction to the theory of automorphic forms of several variables, Hecke theory in particular. Eventually, the exposition is specialized to unitary groups, but they are treated as a model case so that the reader can easily formulate the corresponding facts for other groups.

Fine Regularity of Solutions of Elliptic Partial Differential Equations
Jan Malý, Charles University, Prague, Czech Republic, and William P. Ziemer, Indiana University, Bloomington
The primary objective of this book is to give a comprehensive exposition of results surrounding the work of the authors concerning boundary regularity of weak solutions of second-order elliptic quasilinear equations in divergence form. The structure of these equations allows coefficients in certain L^p spaces, and thus it is known from classical results that weak solutions are locally H"older continuous in the interior. Here it is shown that weak solutions are continuous at the boundary if and only if a Wiener-type condition is satisfied. This condition reduces to the celebrated Wiener criterion in the case of harmonic functions. The work that accompanies this analysis includes the "fine" analysis of Sobolev spaces and a development of the associated nonlinear potential theory. The term "fine" refers to a topology of R^n which is induced by the Wiener condition.

Harmonic Functions on Trees and Buildings
Adam Korányi, CUNY, Herbert H. Lehman College, Bronx
This volume presents the proceedings of the workshop "Harmonic Functions on Graphs" held at the Graduate Center of CUNY in the fall of 1995. The main papers present material from four minicourses given by leading experts: D. Cartwright, A. Figa-Talamanca, S. Sawyer, and T. Steger. These minicourses are introductions which gradually progress to deeper and less known branches of the subject. One of the topics treated is buildings, which are discrete analogues of symmetric spaces of arbitrary rank; buildings of rank are trees. One of the minicourses discusses buildings of automorphic nature and another examines them from the p-adic perspective. The third minicourse provides an introduction to random walks. And the fourth deals with random walks, i.e., with the probabilistic side of harmonic functions on trees.

An Introduction to Algebraic Geometry
Kenji Ueno, Kyoto University, Kyoto, Japan
This introduction to algebraic geometry allows readers to grasp the fundamentals of the subject with only linear algebra and calculus as prerequisites. After a brief history of the subject, the book introduces projective spaces and projective varieties, and explains plane curves and resolution of their singularities. The volume further develops the geometry of algebraic curves and treats congruence zeta functions of algebraic curves over a finite field. It concludes with a complex analytical discussion of algebraic curves.

Mathematics of Stochastic Manufacturing Systems
George Yin, Wayne State University, Detroit, MI, and Qing Zhang, University of Georgia, Athens
This volume presents the proceedings of the 26th AMS-SIAM Summer Seminar in Applied Mathematics, "The Mathematics of Stochastic Manufacturing Systems," held in June 1996 at the College of William and Mary (Williamsburg, VA). In this volume, leading experts in mathematics manufacturing research and related fields review and update recent advances in mathematics of stochastic manufacturing systems and attempt to bridge the gap between theory and applications. The topics covered include scheduling and production planning, modeling of manufacturing systems, hierarchical control for large and complex systems, Markov chains, queueing networks, numerical methods for system approximations, singular perturbed systems, risk-sensitive control, stochastic optimization methods, discrete event systems, and statistical quality control.
Hejhal Receives Gustafsson Prize

Dennis Hejhal of Uppsala University has received the 1997 Göran Gustafsson Prize in Mathematics. These prizes, presented by the Göran Gustafsson Foundation for Scientific and Medical Research to researchers in Sweden, are given in the areas of molecular biology, physics, chemistry, and medicine, in addition to mathematics.

Hejhal was cited "for his research in analytic number theory and quantum chaos." The prize consists of 100,000 Swedish crowns (approximately $13,000) plus annual research support of 850,000 Swedish crowns (approximately $110,000) for three years.

Hejhal currently holds a joint appointment at Uppsala and the University of Minnesota.

—from Royal Swedish Academy of Sciences news release

Menger Prize Committee

The three-person Menger Prize Committee was formed by the American Mathematical Society in 1995 to select the chair of the AMS Judges Panel for the Special Award in Mathematics at the International Science and Engineering Fair (ISEF) and to oversee and participate in the awarding of prizes. The Committee supports the selection process of judges during the year and is an AMS point of contact. Each member of the Committee serves for three years. As a member's term expires, a new member, who has served as chair of the Judges Panel, comes aboard. The members of the Menger Prize Committee are Julian Palmore (chair) and Jerry and Gisele Goldstein of Memphis State University.

The AMS has participated in ISEF for the past ten years. For the past five years—first, in 1993, as a member of the AMS Panel of Judges (in Biloxi, MS), then as chair of the Panel in 1994 (in Birmingham, AL), and finally as chair of the Menger Prize Committee since its inception in 1994—I have had the pleasure to view mathematics exhibits and talk to participants in ISEF. The best work of these high school students, aged fourteen to eighteen, is at a level of graduate study and research in mathematics. To reach ISEF the students have participated in regional science fairs in the U.S. and foreign countries. The number of foreign participants is about 5 percent of approximately 1,000 total ISEF participants. The mathematics participants number about 50, of whom 9 this year were from other than the fifty states.

An interesting connection between the Westinghouse Science Talent Search and the International Science and Engineering Fair arose this year when the third- and fourth-place winners of the Science Talent Search were also the first- and second-place winners of the AMS Special Award in Mathematics at ISEF. Davesh Maulik, the first-place winner this year (in Louisville, KY), was awarded first place from the AMS in 1994 (in Birmingham, AL), in 1995 (in Hamilton, ON), and in 1996 (in Tucson, AZ).

The accompanying article by Marius Nkashama lists all of the prizes awarded this year at ISEF.

—Julian Palmore

AMS Menger Awards at the International Science and Engineering Fair

The 1997 International Science and Engineering Fair (ISEF) was held May 10-16, 1997, in the Commonwealth Convention Center in Louisville, Kentucky. Student winners were among 1,089 ninth- through twelfth-graders who earned the right to compete by winning top prizes at local, regional, state, or (in the case of some foreign students) national science fairs to reach the finals at ISEF. Prizes ranged over plaques, certificates, T-shirts, books, magazine/journal subscriptions, organization memberships, and cash awards. In addition to ISEF recognition, there were special awards made by other groups, including professional and educational organizations, industry, branches
of the military, and colleges and universities. For the first time in its 48-year history, the ISEF offered more than $1 million in tuition grants.

For the tenth time, the AMS has presented the Karl Menger Memorial Awards at ISEF. This year’s AMS panel consisted of six mathematicians: Gisele Ruiz Goldstein and Jerome Goldstein, both of the University of Memphis; Lee Larson of the University of Louisville; Carl Lee of the University of Kentucky (Lexington); Marius Nkashama (chair) of the University of Alabama at Birmingham; and Julian Palmore of the University of Illinois at Urbana-Champaign. The panel considered 50 projects, including all 45 projects entered in mathematics. Each panel member inspected each project, and each student was interviewed by at least two members of the panel. Winners (one first place, two second place, four third place) were given cash prizes, and they and five honorable mention students were given copies of What's Happening in the Mathematical Sciences by Barry Cipra (published by the AMS) and a short intellectual biography of Karl Menger, for whom the awards are named. The Karl Menger Memorial prize winners were as follows.

First Place ($1,000): DAVESH MAULIK, "Ordered Fields", Senior, Roslyn High School, Roslyn Heights, New York. This is the fourth year Maulik has won the first prize, a remarkable achievement.

Second Place ($500 each): NICHOLAS ERIKSSON, “q-Series, Elliptic Curves, and Odd Values of the Partition Function”, Senior, Sentinel High School, Missoula, Montana; JEREMY RAHE, “Prime Factorials”, Sophomore, Bellaire Senior High School, Bellaire, Texas.


As the titles indicate, the projects were remarkable and interesting for their breadth and for the quality of the work by the students. Note how many of the awards went to freshmen, sophomores, and juniors!

—Marius N. Nkashama

1997 USA Mathematical Olympiad Winners

The 1997 edition of the USA Mathematical Olympiad (USAMO) exam consisted of six questions to be solved in six hours. The exam was given on May 1 to 182 students selected as a consequence of their performance on the 1997 American High School and American Invitational Mathematics Examinations.

JOSH P. NICHOLS-BARRER of Newton South High School, Newton Center, MA, is the first-place winner. The other winners are: CARL J. BOSLEY, Washburn Rural High School, Topeka, KS; LI-CHUNG CHEN, Monta Vista High School, Cupertino, CA; JOHN J. CLYDE, New Plymouth High School, New Plymouth, ID; NATHAN G. CURTIS, Thomas Jefferson High School of Science and Technology, Alexandria, VA; KEVIN D. LACKER, Sycamore High School, Cincinnati, OH; DAVESH MAULIK, Roslyn High School, Roslyn Heights, NY; and DANIEL A. STRONGER, Stuyvesant High School, New York, NY.

Four of this year's winners won last year: Bosley, Curtis, Stronger, and Nichols-Barrer. Nichols-Barrer also won in 1995. With the exception of Lacker and Maulik, the group of winners will represent the United States in the International Mathematical Olympiad, which is to be held in Mar del Plata, Argentina, on July 24 and 25. The leader of
the team will be Titu Andreescu from the Illinois Mathematics and Science Academy, the deputy will be Elgin Johnston from Iowa State University, and Walter Mientka will serve as the Official Leader Observer. Travel funds to the site of the IMO are provided by the Army Research Office.

The Mathematical Olympiad Summer Program, which prepares the team for the international competition, includes as participants the top 8 winners and 22 other high-ranking USAMO students. This program is sponsored by the Office of Naval Research and the Matilda Wilson Foundation, with support from the University of Nebraska-Lincoln, the site of the program.

The USAMO is run by American Mathematics Competitions.

—Mathematical Association of America Announcement

Rolf Schock Prizes Awarded

The Royal Swedish Academy of Sciences has announced the names of recipients of the Rolf Schock Prizes. These international prizes honor contributions to logic and philosophy, mathematics, visual arts, and music. The prizes amount to 400,000 Swedish crowns (approximately US$50,000).

Schock Prize in Logic and Philosophy

DANA S. SCOTT received the prize in logic and philosophy “for his conceptually oriented logical works, especially the creation of domain theory, which has made it possible to extend Tarski’s semantical paradigm to programming languages as well as to construct models of Curry’s combinator logic and Church’s calculus of lambda conversion.”

Contemporary logic has diversified into a number of branches. Scott has made fundamental contributions to several of these, notably automata theory, axiomatic set theory, model theory, and modal logic. An especially general interest, however, attaches to his creation of domain theory, which has made it possible to provide programming languages with a compositional semantics of the same kind as was given in the 1930s by the Polish logician Alfred Tarski for more traditional logical languages, like predicate logic and simple type theory. The introduction of the notion of domain also enabled Scott to construct models of Curry’s combinator logic and Church’s calculus of lambda conversion, two closely related formal calculi which had previously resisted all attempts at semantical interpretation and which had therefore only been studied by purely syntactic means. The theory of Scott domains, as they are now called, constitutes the mathematical basis of the branch of computer science which is now generally referred to as “semantics of programming languages” and has been pivotal in establishing “logic and computer science” as a new branch of logic. Scott’s works are marked throughout by their conceptual clarity and formal elegance.

Scott was born on October 11, 1932, in Berkeley, California. He studied as a pupil of Alfred Tarski at the University of California, Berkeley, and obtained his bachelor’s degree there in 1954. He took his doctoral degree at Princeton University in 1958 with Alonzo Church as his thesis advisor. Scott has taught at many universities, among them UC Berkeley (1960-63) and Stanford University (1963-69). He was a professor of philosophy at Princeton University from 1969 until 1972, when he became a professor of mathematical logic at Oxford University. In 1981 he moved from Oxford to Carnegie Mellon University, where he is now professor of computer science, mathematical logic, and philosophy. He holds honorary doctorates from several European universities and is a member of several scientific academies, including the U.S. National Academy of Sciences.

Schock Prize in Mathematics

MIKIO SATO received the prize in mathematics “for his creation of the theory of hyperfunctions. Professor Sato has been the driving force behind a world-leading group of researchers in algebraic analysis. His work in theoretical physics has increased our understanding of the divergences of quantum theory.”

Sato’s theory of hyperfunctions allows much freer calculations than does classical calculus. A function may not have a derivative which is a function, but it does have a derivative which is a hyperfunction. Every function is regarded as a sum of limit values of holomorphic functions, which means that one uses the fact that immediately outside the real numbers there are complex numbers—this is said to reflect the old idea that phenomena in the real world are limits of complex (imaginary, fictitious!) events that lie very close to but are still outside our reach. A rich theory for differential equations has been the result. The theory of hyperfunctions is competing with the so-called theory of distributions and often gives analogous results, but along a different path. In some sense the two theories are equivalent, but there are important differences in mode of attack. One theory is best known in Europe and the Americas, the other in Japan. Sato is deeply interested in and motivated by problems in theoretical physics. His important contributions concern Feynman integrals and integrable systems.

Mikio Sato was born in 1928. He graduated from Tokyo University in 1952. In 1970 he became a research professor at the Research Institute for Mathematical Sciences at Kyoto University. He is now an emeritus professor there.

About Rolf Schock

Rolf Schock was born in France on April 5, 1933. His family emigrated in 1931 and settled in the U.S. He studied geology, psychology, and mathematics at the University of New Mexico and then pursued postdoctoral studies in philosophy, first at the University of California, Berkeley, and then at UCLA. After moving to Sweden he received the Fil. Lic. degree in philosophy from Stockholm University in 1964 and later a Ph.D. from Uppsala University. His dissertation, “Logics without Existence Assumptions”, was an early work in what is now known as free logic and has often been cited
by scholars in the field. Schock wrote many other works in logic and the philosophy of science. He never held a permanent appointment, though he was a lecturer in Sweden for brief periods, and for many years the Royal Institute of Technology provided him with a base. He was also a keen painter, photographer, and traveler. After his death in an accident in December 1986 it came to light that he left a considerable fortune, which he had inherited from his father. Schock bequeathed half of the funds for prizes in the arts and sciences.

— from Royal Swedish Academy of Sciences news release

Wiles Named MacArthur Fellow

ANDREW J. WILES of Princeton University has been selected to receive a fellowship from the John D. and Catherine T. MacArthur Foundation. He is one of 23 scholars, artists, and writers receiving the prestigious fellowships. Wiles will receive over five years a stipend totaling $275,000.

Wiles's 1994 proof of the Shimura-Taniyama conjecture on elliptic curves included a proof of Fermat's Last Theorem, which had challenged number theorists for the past 350 years. The culmination of nearly a decade of work, the proof is part of a broad revolution in algebraic number theory, which arose as a field in its modern form from the numerous failures to prove the Fermat assertion.

Individuals cannot apply for MacArthur Fellowships. Instead, names are proposed to the Foundation by a group of 125 or more designated nominators in a variety of professions and areas of the country. Their nominations are reviewed by a 12-member selection committee, which meets eight times a year. Final approval for MacArthur Fellowships comes from the Foundation's Board of Directors. There is no annual quota of fellows and no predetermined time for naming them.

— from MacArthur Foundation news release

Visiting Mathematicians

(Supplementary List)

Mathematicians visiting other institutions during the 1997-98 academic year were listed in the June/July 1997 issue of the Notices, pp. 715-717. The following is an update to that list (home countries are listed in parentheses).

ERNST GEkELER (Germany), Concordia University, Drinfeld Modules and Drinfeld Modular Curves, 3/98.

HEIDE GLUSING-LUERSSEN (Germany), University of Notre Dame, Applied Mathematics, 8/97-5/98.

LASSE HOLMSTROM (Finland), George Mason University, Computational Statistics, Neural Nets, 8/97-7/98.

JAE KEOL PARK (South Korea), University of Southwestern Louisiana, Ring and Module Theory, 1/98-2/98.

JANA TRGALOVA (Slovak Republic), Concordia University, Mathematics Education, 5/97-4/98.

KONDRAGUNTA VENKATESWARLU (India), Concordia University, Statistics, 1/98-6/98.

Deaths

B. J. BALL, of Austin, Texas, died on December 24, 1996. Born on November 29, 1925, he was a member of the Society for 47 years.

RENATE CARLSSON, of the University of Hamburg, died on April 5, 1997. Born May 1, 1941, she was a member of the Society for 23 years.

EUGENE B. FABES, of the University of Minnesota, died on May 17, 1997. Born on February 6, 1937, he was a member of the Society for 33 years.

ROBERT N. GOSS, of Claremont, CA, died on January 21, 1997. Born on January 7, 1921, he was a member of the Society for 48 years.

W. N. HUFF, of Norman, OK, died on August 11, 1996. Born on December 30, 1912, he was a member of the Society for 59 years.

ED W. HUFFMAN, professor at Southwest Missouri State University, died on November 3, 1996. Born on December 29, 1942, he was a member of the Society for 23 years.

DANIEL C. LEWIS, professor emeritus of Johns Hopkins University, died on June 19, 1997. Born on August 14, 1904, he was a member of the Society for 77 years.

RAYMOND A. LYTLE, professor emeritus of the University of South Carolina, died on April 2, 1997. Born in September 1919, he was a member of the Society for 77 years.

M. EVANS MINROE, professor emeritus of the University of New Hampshire, died in April 1997. Born on October 8, 1918, he was a member of the Society for 55 years.

JOHN M. H. OLMSTED, professor emeritus of Southern Illinois University at Carbondale, died on March 31, 1997. Born on June 28, 1911, he was a member of the Society for 59 years.

D. G. VELESZ, professor emeritus of Quincy University, Quincy, Illinois, died in 1997. Born on April 26, 1909, he was a member of the Society for 51 years.

DANIEL H. WAGNER, of Malvern, Pennsylvania, died on March 12, 1997. Born on August 24, 1925, he was a member of the Society for 48 years.

DAVID ZEITLIN, of Minneapolis, Minnesota, died on November 5, 1996. Born on January 22, 1924, he was a member of the Society for 43 years.

Erratum

One of the death notices in the June/July 1997 issue of the Notices, page 707, gave an incorrect middle initial for the deceased. The correct name is Donald H. Hyers.
Mathematics Opportunities

Travel Grants for ICM-98, Berlin

The American Mathematical Society has applied to several funding agencies for funds to permit partial travel support for U.S. mathematicians attending the 1998 International Congress of Mathematicians (ICM-98) August 18–27, 1998, in Berlin, Germany. In anticipation of the availability of funds, the Society is preparing to administer the selection process, which would be similar to previous programs funded in 1990 and 1994.

Applications for support may be made using the form found in the back of this issue or by using the downloadable form available on e-MATH (at http://www.ams.org/profession/icm98.html). All completed application forms must be mailed to the AMS by October 31, 1997. This travel grants program, if funded, will be administered by the Professional Programs Department, AMS, P.O. Box 6248, Providence, RI 02940; icm98@ams.org; telephone 401-455-4105.

This program is open to U.S. mathematicians (those who are currently affiliated with a U.S. institution). Junior mathematicians (those within six years of their doctorates), women, and members of U.S. minority groups are especially encouraged to apply.

Applications will be evaluated by a panel of mathematical scientists under the terms of a proposal submitted to the National Science Foundation (NSF) by the Society.

Should the proposal to the NSF be funded, the following conditions will apply: mathematicians accepting grants for partial support of the travel to ICM-98 may not supplement them with any other NSF funds. Currently it is the intention of the NSF’s Division of Mathematical Sciences to provide no additional funds on its other regular research grants for travel to ICM in 1998. However, an individual mathematician who does not receive a travel grant may use regular NSF grant funds, subject to the usual restrictions and prior approval requirements.

All information currently available about the ICM-98 program, organization, and registration procedure is located on the ICM-98 Web site at http://elib.zib.de/icm98/.

—AMS Announcement

American Mathematical Society Centennial Fellowships

Invitation for Applications for Awards for 1998–1999

Deadline: December 1, 1997

The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. Recently the AMS Council approved changes in the rules for the fellowships. From 1984-1996 the fellowship program was aimed at midcareer mathematicians. The changes adopted two years ago redirected the fellowship program toward recent Ph.D.s. The eligibility rules are as follows.

Applicants must: (1) be citizens or permanent residents of a country in North America, (2) have held their doctoral degrees for at least two years at the time of the award, (3) not have permanent tenure, and (4) have held less than two years of research support at the time of the award. (Each year of a full-time teaching appointment with teaching load less than four [respectively, five] courses per year on the semester [respectively, quarter] system will count in this respect as one-half year of research support.) Recipients may not hold the Centennial Fellowship concurrently with other research fellowships (e.g., Sloan Foundation Fellowships or National Science Foundation Postdoctoral Fellowships), they may not use the stipend solely to reduce teaching at the home institution, and they are expected to spend some of the fellowship period at another institution that has a stimulating research environment suited to the candidate’s research development.

The stipend for fellowships awarded for 1998–99 is expected to be approximately $36,000, with an additional expense allowance of about $1,500. Acceptance of the fellowship cannot be postponed. Fellowship holders may use their stipend as full support for a year or may combine it...
with half-time teaching and use it as half support over a two-year period.

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. Because of the generosity of the AMS membership, it has been possible to award two to five fellowships a year for the past ten years.

Applications should include a short research plan describing both an outline of the research to be pursued and a program for using the fellowship, including institutions at which it will be used and reasons for the choices. The selection committee will base its decision on both the research potential of the applicant, based upon track record and letters of recommendation, and on the quality and feasibility of the research plan.

The deadline for receipt of applications is December 1, 1997. Awards will be announced in February 1998 or earlier if possible.

For application forms, write to the Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248, or send electronic mail to ams@ams.org, or call 401-455-4103. Application forms are also available via the Internet at URL http://www.ams.org/committee/profession/. Please note that completed application and reference forms should not be sent to the AMS, but to the address given on the forms.

—AMS Announcement

New STC Competition for FY 1998

The National Science Board, the policymaking body for the National Science Foundation (NSF), has approved the initiation of a new competition for Science and Technology Center (STC) grants for fiscal year 1998. The decision came after extensive evaluation of the STC program, which found that the center mode of funding has been a useful component of the NSF's portfolio of programs. The evaluation included reports by the National Academy of Public Administrators, Abt Associates, and the National Research Council.

The STC program began in August 1987 and at its peak funded 25 centers, representing less than 3% of NSF's budget. Two centers were funded in mathematics: The Geometry Center in Minneapolis, which was funded in the first round of STC awards in 1989; and DIMACS (Center for Discrete Mathematics and Theoretical Computer Science) in New Jersey, which was funded in the second round in 1991. NSF plans stipulate closure of the centers after a maximum of eleven years of funding.

After the new competition in fiscal 1998, subsequent competitions will be held at approximately three-year intervals. Each new center will have the possibility of NSF support for a maximum of ten years, and funding will terminate after eleven years unless the center is successful in an open competition.

The program announcement for the new STC competition was not available at the time of this writing. For further information check the Web site http://www.nsf.gov/od/ost1/ or contact Office of Science and Technology Infrastructure, Room 1270, National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230; 703-306-1040; e-mail sti@nsf.gov.

—Allyn Jackson

NSF Mathematical Sciences Postdoctoral Research Fellowships

The Mathematical Sciences Postdoctoral Research Fellowship program of the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) is designed to permit recipients to choose research environments that will have maximal impact on their future scientific development. Awards will be made for appropriate research in pure mathematics, applied mathematics and operations research, and statistics at appropriate nonprofit United States institutions.

The fellowships will be offered only to persons who (1) are citizens, nationals, or lawfully admitted permanent resident aliens of the United States as of January 1, 1998; (2) will have earned, by the beginning of their fellowship tenure, a doctoral degree in one of the mathematical sciences; (3) will have held the doctorate for no more than five years as of January 1, 1998; and (4) will not previously have held any other NSF postdoctoral fellowship. Subject to the availability of funds, it is expected that in fiscal year 1998 twenty-five to thirty awards will be made. The evaluation of applicants will be based in part on ability as evidenced by past research work and letters of recommendation, likely impact on the future scientific development of the applicant, and scientific quality of the research likely to emerge. Applicants' qualifications will be evaluated by a panel of mathematical scientists. Women, underrepresented minorities, and persons with disabilities are strongly encouraged to submit applications.

Copies of the program announcement are available electronically through the World Wide Web at http://www.nsf.gov/mps/dms/dmsdead.htm (the DMS Program Deadline page—look for October 17). For further information, contact the Infrastructure Program, Room 1025, Division of Mathematical Sciences, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; telephone 703-306-1870; e-mail msprf@nsf.gov; or the American Mathematical Society, telephone 401-455-4105, e-mail nsfpostdocs@ams.org.

The deadline for applications is Friday, October 17, 1997.

—DMS Announcement
For Your Information

12th BMS Annual Department Chairs' Colloquium

Each fall the Board on Mathematical Sciences of the National Research Council holds the Mathematics Department Chairs' Colloquium. This year's colloquium will be held Friday-Saturday, November 7-8, in Bethesda, MD. The theme is "Being More Resourceful and Winning More Resources".

The mission, priorities, and expectations of mathematics departments vary with their local academic and geographic community and also vary over time. However, certain themes are consistently of concern to most departments. This year's Colloquium focuses on case studies, "how-they-did-it" examples, and what makes for stronger research and education programs, while preparing for tomorrow's opportunities.

Friday morning workshops spotlight exemplary teacher-preparation improvements, statistics as a laboratory science, Cornell's program readying graduate students to be professors, and the popular practicum for new and future chairs. Friday afternoon plenary sessions open with the Colloquium keynote speaker addressing the national outlook for science. Next come comparative views from four departments (three mathematics, one statistics), followed by an in-depth look at successful evolution in one department's culture. Many federal research and education program managers will be present on Friday.

Saturday morning spotlights a new approach taken by the mathematics department at Rensselaer Polytechnic Institute and places where peer review of mathematical sciences teaching is now used. A panel then discusses the ASA-MAA Committee on Undergraduate Statistics' views on recent guidelines for mathematical sciences programs and departments.

The morning ends with workshops on internships in industry, resources from professional societies, concerns and strategies for small colleges, and leading a department in the next decade. Many of the speakers and panelists will lead luncheon roundtables on Saturday for small-group exchange on session ideas.

Saturday afternoon offers sessions on how core mathematics benefits from other areas, looks ahead by discussing what more is needed, and overviews the newly published Conference Board of the Mathematical Sciences survey of undergraduate mathematical sciences programs (including ones in statistics) and a just-released study on ten years of calculus reform efforts.

Among the organizers and speakers are: Donald Bentley, Pomona College; John Fulton, Virginia Tech; Fan Chung, University of Pennsylvania; Ramesh Gangolli, University of Washington; Susan Ganter, National Science Foundation; Frank Gilfeather, University of New Mexico; Bonnie Gold, Wabash College; Mark Holmes, Rensselaer Polytechnic Institute; Pat Hutchings, University of Wyoming; Douglas Kelly, University of North Carolina, Chapel Hill; James Lightbourne, National Science Foundation; Robert Olin, Virginia Polytechnic Institute; Duong Phong, Columbia University; Samuel Rankin III, AMS; Thomas Rishel, Cornell University; Donald Rung, Pennsylvania State University; Elias Saab, University of Missouri; Fadil Santosa, University of Minnesota; Michael Sharpe, University of California-San Diego; Isadore Singer, Massachusetts Institute of Technology; John Spurrier, University of South Carolina; Philippe Tondeur, University of Illinois at Urbana-Champaign; and Alan Tucker, State University of New York, Stony Brook.

The registration fee is $175. Registration forms must be sent by October 24, 1997. For further information contact: Board on Mathematical Sciences, National Research Council, Room NAS 315, 2101 Constitution Avenue, NW, Washington, DC 20418-0001; telephone 202-334-2421; e-mail bms@nas.edu.

—from BMS Announcement

Authors Needed for NCTM 2000 Yearbook

The Educational Materials Committee of the National Council of Mathematics Teachers is calling all interested writers to submit articles for the 2000 NCTM yearbook, "Learning Mathematics for a New Century". NCTM yearbooks annually explore the range of thinking and discussion on a particular mathematics topic. For 2000 the dialogue will focus on the content of school mathematics needed to launch us into the new century. The yearbook editorial panel is particularly interested in papers that reflect on our past, examine current curricula, and look to the future. Maurice Burke, associate professor of mathematics education at Montana State University, will edit this volume.
Author guidelines are now available and include a complete description of topics to be addressed and instructions for preparing manuscripts. For a copy of the guidelines, write to general editor Frances R. Curcio, Department of Teaching and Learning, School of Education, New York University, 239 Greene Street, Washington Square, New York, NY 10003; e-mail: curcio@is2.nyu.edu. The guidelines can also be found on NCTM’s Web site, http://www.nctm.org, under “Educational Materials/2000Yearbook”. The deadline for receiving manuscripts is March 1, 1998.

—Frances R. Curcio

“The Gardener from the North”—An Ahlfors Celebration

A conference celebrating the life and work of Lars Ahlfors will be held at Stanford University, September 19–21, 1997. Ahlfors, who would have been 90 this year, died late last fall. The goal of the conference is to explore currently active areas of research where he made major—and often seminal—contributions.

The program will include talks by Gerald Alexanderson, Kari Astala, Raoul Bott, James Camon, Phillip Griffiths, Peter Jones, Linda Keen, Robert Osserman, Dennis Sullivan, Paul Vojta, and Michael Wolf.

The conference is sponsored by the American Institute of Mathematics in conjunction with the Mathematical Sciences Research Institute (MSRI) and Stanford University. For more information, see the events listings on the MSRI Website: www.msri.org or send e-mail to announce@gauss.stanford.edu.

—Stanford University

Call for Nominations for AWM Hay Award

The Executive Committee of the Association for Women in Mathematics (AWM) has established the Louise Hay Award for Contributions to Mathematics Education, to be awarded annually to a woman at the Joint Prize Session at the Joint Mathematics Meetings every January. The purpose of this award is to recognize outstanding achievements in any area of mathematics education, to be interpreted in the broadest possible sense.

While Louise Hay was widely recognized for her contributions to mathematical logic and for her strong leadership as head of the Department of Mathematics, Statistics, and Computer Science at the University of Illinois at Chicago, her devotion to students and her lifelong commitment to nurturing the talent of young women and men secure her reputation as a consummate educator. The annual presentation of this award is intended to highlight the importance of mathematics education and to evoke the memory of all that Hay exemplified as a teacher, scholar, administrator, and human being.

The nomination material should include: 1) a one- to three-page letter of nomination highlighting the exceptional contributions of the candidate to be recognized, 2) a curriculum vitae of the candidate not to exceed three pages, and 3) three letters supporting the nomination. It is strongly recommended that the letters represent a range of constituents affected by the nominee’s work.

Send five complete copies of nomination material for this award to: The Hay Award Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, Maryland 20742-2461. For further information call the AWM at 301-405-7892 or send e-mail to awm@math.umd.edu.

Please note that nominations via e-mail or fax are not acceptable. The deadline for nominations is October 1, 1997.

—AWM Announcement

AMS Charitable Remainder Trust Establishes Scholarship

In 1996 Shirley Cashwell and members of the Cashwell family decided to make a meaningful gift to encourage study of mathematics in memory of Dr. Edmond Cashwell, her late husband. Dr. Cashwell, who received his Ph.D. in mathematics from the University of Wisconsin, worked for over thirty years at the Los Alamos National Laboratory.

To create this award, Mrs. Cashwell established a charitable remainder unitrust, with the principal being assigned to the American Mathematical Society. This mechanism permits the donor to donate funds to an eligible organization, receiving a charitable tax deduction at the time of the award’s establishment, as well as permitting an income-producing trust.

With the Cashwell family’s gift the AMS has established the Edmond D. Cashwell Mathematical Scholarship. The scholarship will benefit future New Mexico high school seniors achieving the highest score in the American Invitational Mathematics Examination by providing tuition assistance for undergraduate study.

The Society gratefully acknowledges the thoughtfulness and generosity of Mrs. Shirley Cashwell. Questions relating to charitable remainder trusts or estate planning may be addressed to Tim Goggins, AMS Development and Public Information Officer, tjg@ams.org, 401-455-4110.

—AMS Announcement
Election of Officers for 1998

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Dear Colleagues:

Each year members of the Society are invited to vote for candidates for several of the Society's governing bodies. The candidates for election are presented to the Society in the material that follows. This information, as well as the official ballot, will be sent to you in early September.

The choices you make in the elections directly affect the direction that the Society takes. This may not seem obvious to the casual member. So let me take a few minutes of your time to explain.

The president of the Society (whom you elect every other year) is the most important officer. The president determines, either directly or indirectly, most of the scientific policies of the Society. The direct effect the president has is through personal interactions with members of the Society and outside the organization, for example, in testimony before Congressional committees. Indirect influence occurs because the president appoints the chairs and members of almost all committees of the Society, including the policy committees. The president sits as a member of all the policy committees, is the chair of the Council's Executive Committee, and is ex officio a trustee. The president works closely with all officers and administrators of the Society, especially with the executive director and the secretary, to insure the orderly transaction of the business of the Society. Finally, the president also nominates candidates for election to the Editorial Boards Committee and the Nominating Committee. Thus the president also has a long-term effect on the affairs of the Society.

The vice-president and the members-at-large of the Council who will be elected in this election will serve for three years as one third of the elected members on the Council. The Council is responsible for setting all scientific policy of the Society. The Council determines membership on the editorial boards of the Society, makes nominations of candidates for future elections, appoints the treasurers and members of the Secretariat, creates committees, and determines all scientific policy of the Society. Each of these members of the Council will also serve on a policy committee of the Society.

The trustees, of whom you will be electing one for a five-year term, determine all the fiscal policies of the Society. The Board of Trustees has complete fiduciary responsibility for the Society. The trustees determine the annual budget of the Society, the prices for journals, the salaries of the employees, the dues (in cooperation with the Council), the registration fees for meetings, and the investment policy for the Society's reserves. The person you elect will become the chair of the Board of Trustees in the fourth year of the term.

The candidates presented to you were suggested to the Council by the Nominating Committee or by petition by members. While the Council has the final nominating responsibility, the groundwork is done by the Nominating Committee. Members of this committee are elected by you in this same election. The candidates were nominated by the current president, Arthur Jaffe. The three elected will serve a three-year term. The main work of the Nominating Committee takes place during the Annual Meeting of the Society, during which it has four sessions of face-to-face meetings, each lasting about three hours. The Committee then reports its suggestions to the Council, which makes the final nominations.

The Editorial Boards Committee is responsible for the operation of the editorial boards of the Society. Members are elected for three-year terms from a list of candidates nominated by the president. The Editorial Boards Committee makes recommendations for most of the editorial boards of the Society. Editors of those journals named in the bylaws are appointed by the Council upon recommendation by the Editorial Boards Committee. Associate editors and editors for all other editorial committees are appointed by the president upon recommendation by the Editorial Boards Committee.
From the AMS–Election Special Section

If past elections are a measure, then only 12 percent of you will vote in this election. This participation is in line with voting in other professional organizations. But this is not an excuse for you to throw the ballot into the trash. The other officers and members of the Council join with me in urging you to take a few minutes to review the election material, fill out your ballot, and mail it. The Society belongs to its members. You can influence policy and the directions it takes by voting.

If you are still reading this, then I also urge you to consider other ways to participate in the activities of the Society. The Nominating Committee, the Editorial Boards Committee, and the Committee on Committees are always anxious to learn of members who are willing to serve the Society in various capacities. Names are always welcome (a few added words of recommendation help) and can be sent directly to the secretary.

PLEASE VOTE.

—Robert Fossum
Secretary

List of Candidates–1997 Election

<table>
<thead>
<tr>
<th>Position</th>
<th>Candidates</th>
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<tbody>
<tr>
<td>President-Elect</td>
<td>Jane M. Hawkins</td>
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<tr>
<td>(one to be elected)</td>
<td>Lisa Claire Jeffrey</td>
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<td>Felix Browder</td>
<td>Karen H. Parshall</td>
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<tr>
<td>Srinivasa S. R. Varadhan</td>
<td>Mary Beth Ruskai*</td>
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<tr>
<td>Vice-President</td>
<td>Michael Starbird</td>
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<tr>
<td>(one to be elected)</td>
<td>Abigail A. Thompson</td>
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<tr>
<td>Jennifer Tour Chayes</td>
<td>Deane Yang</td>
</tr>
<tr>
<td>Efim I. Zelmanov</td>
<td>Board of Trustees</td>
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<td>Member-at-Large of the Council</td>
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<tr>
<td>(five to be elected)</td>
<td>(one to be elected)</td>
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<tr>
<td>Edward Aboufadel</td>
<td>Roy L. Adler</td>
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<tr>
<td>Alejandro Adem</td>
<td>Frederic Y. M. Wan</td>
</tr>
<tr>
<td>Ara S. Basmajian</td>
<td>Nominating Committee for 1998</td>
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<tr>
<td>Robert L. Bryant</td>
<td>(three to be elected)</td>
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<td></td>
<td>Michal Misiurewicz</td>
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<td>Catherine L. Olsen</td>
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<td>Paul Rabinowitz</td>
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<td>Elias M. Stein</td>
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<td>Clarence Eugene Wayne</td>
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<td>Sylvia Wiegand</td>
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<td>Editorial Boards Committee for 1998</td>
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<td>(two to be elected)</td>
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<tr>
<td></td>
<td>Jay R. Goldman</td>
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<td>David Jerison</td>
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<td></td>
<td>Abel Klein</td>
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<tr>
<td></td>
<td>Ronald M. Solomon</td>
</tr>
<tr>
<td></td>
<td>Nominated in response to a petition.</td>
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</table>

Election Information

The ballot for election of officers, members of the Council, a trustee, and committee members will be mailed on or shortly after September 10, 1997, in order for members to receive their ballots well in advance of the November 10, 1997, deadline. A list of members of the Council and Board of Trustees serving terms during 1997 appears in the “AMS Officers and Committee Members” section of this issue of the Notices, pp. 973-983 (and will be mailed with the election material sent to all members in September).
REPLACEMENT BALLOTS
There has been a small but recurring and distressing prob­lem concerning members who state that they have not received ballots in the annual election. It occurs for several reasons, including failure of local delivery systems on university or corporate properties, failure of members to give timely no­tice of changes of address to the Providence office, failures of postal services, and other human errors.

To help alleviate this problem, the following replacement procedure has been devised: A member who has not received a ballot by October 10, 1997, or who has received a ballot but has accidentally spoiled it, may write after that date to the Secretary of the AMS, Post Office Box 6248, Providence, RI 02940, asking for a second ballot. The request should include the individual's member code and the address to which the replacement ballot should be sent. Immediately upon receipt of the request in the Providence office, a second ballot, which will be indistinguishable from the original, will be sent by first class or air mail. It must be returned in an inner envelope, which will be supplied, on the outside of which is the following statement to be signed by the member:

The ballot in this envelope is the only ballot that I am sub­mitting in this election. I understand that if this statement is not correct then no ballot of mine will be counted.

signature

Although a second ballot will be supplied on request and will be sent by first class or air mail, the deadline for receipt of ballots will not be extended to accommodate these special cases.

SUGGESTIONS FOR 1998 NOMINATIONS
Each year the members of the Society are given the oppor­tunity to propose for nomination the names of those indi­viduals they deem both qualified and responsive to their views and needs as part of the mathematical community. Cand­idates will be nominated by the Council to fill positions on the Council and Board of Trustees to replace those whose terms expire January 31, 1998. See the “AMS Officers and Committee Members” section of this issue for the list of current members of the Council and Board of Trustees. Members are requested to write their suggestions for such candidates in the appropriate spaces below.

COUNCIL AND BOARD OF TRUSTEES

Vice-President (1)

________________________________________

Members-at-large of the Council (5)

________________________________________

________________________________________

________________________________________

Member of the Board of Trustees (1)

________________________________________

The completed form should be addressed to AMS Nominat­ing Committee, Post Office Box 6248, Providence, RI 02940, to arrive no later than November 10, 1997.
Nominations for President-Elect

Nomination for Felix Browder

Jerry Bona

It is a privilege, as well as a signal honor, for me to place Felix Browder's name in nomination for the presidency of the American Mathematical Society. Felix Browder is one of the charismatic figures in world mathematics, as well as one of the living mathematicians of highest stature in mathematical analysis, a worthy successor of Leray, Schauder, G. D. Birkhoff, and Kellogg. In the last forty years he has been the central figure in the development of nonlinear functional analysis and a major contributor to the application of both linear and nonlinear functional analysis to partial differential equations.

One of Felix's characteristic qualities is his immense breadth of learning, combined with extensive experience in both research and administration. His positive view of the future of mathematics, derived from an exceptionally thorough knowledge of the history of mathematics and combined with a keen awareness of the problems that our field presently faces, makes him a uniquely desirable candidate for the presidency of the American Mathematical Society.

Linear functional analysis had its major development in the first half of this century, starting with the spectral theory of Hilbert and von Neumann and the work of Banach. Nonlinear functional analysis, although rooted in the work of Poincaré in the last century, had its first great upsurge in the work of Leray and Schauder in the 1930s. The subject had its origins in the study of nonlinear ordinary and partial differential equations, but it came to encompass a wider range of questions in all branches of analysis and in differential geometry, in theoretical physics, and in economics. Felix Browder has been the dominant figure in this field since the early 1950s.

In the theory of linear elliptic partial differential equations, the work of Felix Browder and his school went well beyond the techniques first introduced by Russian analysts in establishing completeness theorems for the eigenfunctions of nonselfadjoint elliptic differential operators. Browder's results on these fundamental issues remain definitive to this day.

In nonlinear functional analysis the introduction of monotone and, later, accretive operator theory led to the solution of problems that had heretofore been out of reach. Felix Browder proved a general theorem on monotone operators in reflexive Banach spaces, stating that a coercive continuous monotone operator from a reflexive Banach space to its dual space is subjective. This theorem led to the proof of some deep existence theorems for nonlinear partial differential equations and began a massive development of monotone operator methods and their applications to partial differential equations. It is especially noteworthy that Browder's theory freed us from restrictive compactness assumptions and thereby led to a very sub-
stantial enlargement of the range of nonlinear problems to which exact analysis could be applied.

The elementary contraction-mapping principle states that if a Lipschitz map from a complete metric space to itself has Lipschitz constant less than one, then the mapping has a (unique) fixed point. It is also well understood that this conclusion is false in general if the Lipschitz constant is greater than one. Mappings where the Lipschitz constant is exactly equal to one (so-called nonexpansive mappings) arise in practice, for example, in differential-delay equations, and there the question of whether or not there must be a fixed point is much more delicate. In 1966 Browder proved a result, now known as the Browder-Gohde-Kirk Theorem, stating that a nonexpansive self-mapping of a bounded, closed, convex subset of a uniformly convex Banach space has a fixed point. Indeed, a central theme in Felix Browder’s work has been extensions of fixed-point theory, the concept of fixed-point index, and the related idea of degree of a mapping to mappings in infinite-dimensional spaces. For example, he extended degree theory to pseudo-monotone maps from a reflexive Banach space to its dual space. This result applies to nonlinear elliptic operators in generalized divergence form. In some of his later work Felix Browder developed the theory of nonlinear contraction semigroups, thus bringing his methods to bear upon time-dependent problems in partial differential equations. Again, his work has had a lasting influence.

A vivid memory of mine that gives an indication of Felix Browder’s influence was an international conference in which every single invited speaker acknowledged his or her indebtedness to Felix’s work! Some of his work has become such a part of the fabric of nonlinear analysis that when authors cite it, they do not need to provide the original reference.

Felix Browder has played an active role in the Society throughout his career. He was the Colloquium Lecturer in 1973. The list of committees on which he has served is too long to present here. His unstinting and effective work as editor of the *Bulletin* and his service on the Science Policy Committee have left a permanent mark. He has organized innumerable special sessions at regional and national meetings and was a principal organizer of the meetings that celebrated the heritage of Hilbert, E. Cartan, Poincaré, and Weyl.

More than any other mathematician I know, Felix Browder has striven successfully throughout his career to raise the level of discussion and broaden the range of interaction of mathematics and the sciences. His efforts as chair of the mathematics department at the University of Chicago went a long way to create a dialogue at the highest level between mathematicians, physicists, and geophysicists. His stewardship of the Mathematics Department at Chicago attests to his total and uncompromising dedication to excellence and to his vision of the leading role of mathematics within the sciences. He initiated many appointments of the highest quality, including those of Spencer Bloch, Luis Caffarelli, Charles Fefferman, and Karen Uhlenbeck. As vice president of research at Rutgers University he brought about the appointment of some of the best mathematicians and scientists in the country, including Gelfand, Brezis, Kruskal, Zabuzky, Coleman, Daubechies, and the now-famous string quartet in quantum field theory. This was accomplished despite the very limited portfolio and official power this administrative position carries. At the same time he initiated the successful Science and Technology Center that involved Bell Labs, Rutgers, and Princeton University. He has had extremely close relations with the French school of nonlinear analysis, where the addition of applied mathematics to pure mathematics departments paralleled, and was decisively influenced by, the development of the department of mathematics at the University of Chicago under Felix’s chairmanship.

Felix Browder has been strongly supportive of efforts to improve undergraduate and graduate education in the mathematical sciences. In precolligate mathematics education he was instrumental in bringing about the creation of the AMOCO project in teacher education and curriculum development at the University of Chicago, and lately he has been the main supporter of I. M. Gelfand’s outreach program.

Felix Browder is one of the few mathematicians whose influence and leadership are acknowledged and appreciated in the scientific community at large, as well as among mathematicians. The depth of his mathematical research, his broad vision, as well as the effectiveness of his leadership make him, in my opinion, the candidate who will successfully steer the Society through the difficult years ahead.

### Nomination for Srinivasa S. R. Varadhan

*Daniel Stroock*

In connection with his nomination to become president, the AMS asked me to write an appreciation of my first, and still my closest, mathematical colleague, Srinivasa S. R. Varadhan. I have agreed to do so because I find win-win situations irresistible: If I do a good job and he wins, then I will have done the AMS a great service; if I do a poor job and he loses, then I will have done Varadhan an even greater service.

Varadhan, whom everyone else calls Raghu, came to these shores from his native India in the fall of 1963. He was, officially, age 23; he was, in fact, 22. In any case, like many other postwar immigrants to this country, he arrived by plane at Kennedy Airport (or was it Idlewild?)

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*Daniel Stroock is professor of mathematics at the Massachusetts Institute of Technology. His e-mail address is dws@math.mit.edu.*

1. I have been told, but cannot reconstruct, what the “S” and “R” denote.
and proceeded to Manhattan by bus, past twenty miles of uninterrupted cemeteries. For a Hindu from Madras accustomed to tidier procedures for disposing of the dead, it is understandable that the trip from the airport remains the most vividly remembered part of his journey. His destination in Manhattan was that famous institution with the modest name The Courant Institute of Mathematical Sciences, where, at the behest of Monroe Donsker, he had been given a postdoctoral fellowship. Actually, in spite of its moniker Courant had not yet moved out of the hat factories to which NYU had originally consigned Richard Courant’s reincarnation of Göttingen. Thus, when I, a humble graduate student from the opulent Rockefeller Institute, first met Varadhan, he was sequestered in one of the many dingy, windowless offices out of which flowed a remarkably large fraction of the postwar mathematics of which America (or at least the American mathematical community) is justly proud.

Varadhan had completed his Ph.D. at the Indian Statistical Institute in Calcutta. As much as any other institution, ISI is responsible for the (apparently incorrect) rumor that the Indian term for statistician is "Rao". Thus, it was a surprise to no one that Varadhan came equipped with a superb grounding in statistics (a subject about which few other probabilists know anything at all). But CIMS was hoping for more. Varadhan’s own arrival at CIMS had been preceded by that of V. S. Varadarajan, another renowned graduate of ISI, whose extraordinary mathematical erudition was already evident in the much-coveted set of notes which he produced during his sojourn there.

Within a year or so Varadhan demonstrated that he certainly could and probably would fulfill or exceed any of the hopes that Donsker and the rest of CIMS might have for him. Because no less a figure than K. Itô had found most of the results slightly earlier, Varadhan never published the research done during his first year at CIMS, yet within a few months of his arrival his promise was never in doubt. Rather than pine over his misfortune, Varadhan dropped the project on which he had spent a year and took up, mastered, and brought to fruition an idea of Donsker’s which made its first appearance in the beautiful thesis of Donsker’s student, M. Schilder. The general idea in Schilder’s thesis was that one should attempt Laplace-type methods to develop asymptotics for the evaluation of Wiener integrals. Although, thinking in terms of Feynman integral representations for solutions to Schrödinger’s equation, physicists had made somewhat casual reference to related ideas in order to justify Ehrenfest’s “theorem” (the one which asserts that quantum mechanics becomes classical mechanics as Planck’s constant goes to 0), Schilder seems to have been the first mathematician to come to grips with the challenge presented by carrying out Laplace asymptotics in an infinite-dimensional setting. However, Schilder’s treatment was somewhat primitive, and its applicability was severely limited. In particular, it was only after Varadhan took up the problem that it became clear that Schilder had been studying a very special example of what statisticians call the theory of large deviations.

The study of large deviations goes back to the work of Khinchine and Cramér, but the term theory is not an accurate description of what those august gentlemen had produced. In fact, if there is, even now, something which deserves the name, the theory of large deviations was born in Varadhan’s famous 1966 article on the subject, in vol. XIX no. 3 of the CIMS journal C.P.A.M. It was in that article that he clarified the analogy between large deviations and the theory of weak convergence of measures, an analogy on which he based his formulation of the large deviation principle in terms of an upper bound for closed sets and a lower bound for open sets. Of course, a formulation does not a theory make. But Varadhan provided the theory as well. Namely, as summarized to me by a Japanese friend, the theory of large deviations consists of two steps: the first step requires you to prove either the upper or lower bound yourself; the second step requires you to get on the telephone and ask Varadhan how to prove the other bound.

As anyone who has followed his career will confirm, large deviations has been a recurring theme in Varadhan’s mathematics. For one thing, Varadhan has had an uncanny ability to understand that large deviations are manifest in all sorts of situations where nobody else even suspected their presence. To me, the most spectacular example of his special insight lies in his realization that M. Kac’s old formula for the first eigenvalue of a Schrödinger operator can be interpreted in terms of the large deviations. Like those in Schilder’s thesis, the large deviations here involve Wiener measure. However, whereas Schilder dealt with large deviations of Brownian (typical Wiener) paths over a very short interval, the explanation for Kac’s formula must be sought in the large deviations of Brownian paths from ergodic behavior over very long intervals. So far as I know (and I was one of his students), Kac himself, much less anyone else, had never guessed that such an interpretation might exist. Furthermore, I suspect that not even Varadhan anticipated the wealth of results to which systematic exploitation of his insight has led over the last twenty years. His insight not only underlies the profound applications which appear in his own famous work with Donsker but also accounts for the subsequent (possibly overabundant) effusion of articles by others (including me) on the topic.

Toward the end of the period when Varadhan was polishing off the program initiated in Schilder’s thesis, he and I began the discussions which eventually led to our formulation of diffusion theory in terms of what we called the martingale problem. Those discussions took place nearly thirty years ago, but they remain in my mind as the single experience which makes me most grateful to have entered mathematics. Of course, the pleasure of participating in what turned out to be a successful enterprise was great. But I think that I am being honest when I assert that the ultimate success of our collaboration was only part of the pleasure which I derived from it. The other part was my getting to know Varadhan. I was a young man who had been afforded every advantage: I had educated, prosperous parents who paid my passage through the best schools in America. Here was a man my own age whose parents, though certainly educated, were far from prosperous. He had won his passage by outperforming all but a handful of the literally millions of Indians his age. (Actually, the con-
fusion about his age, alluded to earlier, means that he outperformed people a year older than he.)

I am not going to claim that Varadhan does not enjoy his success; he does. Nor am I about to say that he is some sort of saint; we could never have become friends if he were. Nonetheless, what distinguishes Varadhan from nearly all the other gifted people whom I have met is the remarkable command he exercises over his own gift. In particular, he has learned how to prevent his unusual intellectual powers from poisoning his relations with lesser intellects. For example, Varadhan can tolerate being wrong, at least occasionally.1

In addition, he is not one of the many mathematical princes who espouse the notion that all their obligations to humanity can be met through their contributions to mathematical research. Varadhan has already carried more weight to take his turn at the common princes who espouse the notion that all their obligations to humanity can be met through their contributions to mathematical research. Varadhan has already carried more weight to take his turn at the common

I hope that the preceding remarks help to explain why I believe Varadhan to be the best choice for the president who will guide the AMS into the twenty-first century. He is as talented, caring, and effective an individual as I have ever encountered. If he cannot improve the reputation that our subject has in America, then I must doubt that anyone can.

2In fact, he is sometimes wrong on purpose. I recall his claiming one fall afternoon in the CIMS coffee lounge that Indians do not suffer from allergies. Needless to say, this announcement was greeted with some skepticism, especially from a few hay fever-ridden colleagues like Louis Nirenberg. At the Christmas party that year, when Varadhan’s wife Vasu thoroughly undermined his claim by discussing her own allergies, Varadhan smiled and admitted that he had been led to exaggeration in a mild fit of Indian chauvinism.

3Be that as it may, it has yet to be determined whether his acceptance means that he will relinquish his privilege, as a member of the Indian Mathematical Society, to pay negligible annual dues to the AMS.

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3Be that as it may, it has yet to be determined whether his acceptance means that he will relinquish his privilege, as a member of the Indian Mathematical Society, to pay negligible annual dues to the AMS.
Biographical information about the candidates has been verified by the candidates, although in a few instances prior travel arrangements of the candidate at the time of assembly of the information made communication difficult or impossible. A candidate had the opportunity to make a statement of not more than 200 words on any subject matter without restriction and to list up to five of her or his research papers.

Abbreviations: American Association for the Advancement of Science (AAAS); American Mathematical Society (AMS); American Statistical Association (ASA); Association for Computing Machinery (ACM); Association for Symbolic Logic (ASL); Association for Women in Mathematics (AWM); Canadian Mathematical Society, Société Mathématique du Canada (CMS); Conference Board of the Mathematical Sciences (CBMS); Institute of Mathematical Statistics (IMS); International Mathematical Union (IMU); London Mathematical Society (LMS); Mathematical Association of America (MAA); National Academy of Sciences (NAS); National Academy of Sciences/National Research Council (NAS/NRC); National Aeronautics and Space Administration (NASA); National Council of Teachers of Mathematics (NCTM); National Science Foundation (NSF); Operations Research Society of America (ORS); Society for Industrial and Applied Mathematics (SIAM); The Institute of Management Sciences (TIMS).

Each candidate had the opportunity to supply a photograph to accompany her or his biographical information.

A candidate with an asterisk (*) beside his or her name was nominated in response to a petition.

President-Elect
Srinivasa S.R. Varadhan

Professor of Mathematics, Courant Institute of Mathematical Sciences, New York University.

Born: January 2, 1940, Madras, India.


Statement: We are facing a period of uncertainty. To remain strong and attractive as a profession, we have to learn to exert a stronger influence on the outside world by our research as well as educational activities. In addition to training the next generation of research mathematicians, we should consider it a serious responsibility to train our graduates to play an important role as professional mathematicians in a nonacademic environment. If elected, I will work with the Council and the committees of the Society to do my best to achieve these goals.

Felix E. Browder

University Professor of Mathematics, Rutgers University.
Born: July 31, 1927, Moscow, FSU.


Fellowships and other lectures: Procter Fellowship, Princeton University, 1947–1948; Guggenheim Memorial Fellow,
From the AMS-Election Special Section


Statement: This is the best of times and the worst of times. Mathematical research flourishes, and its applications have never been more essential to the survival of civilization as we know it. Yet the institutions that support mathematical research are under unprecedented attack. The AMS is the focal organization of the American mathematics community. It is charged with responsibility for the survival of our field. Employment of young mathematicians, mathematical education at all levels, research funding, recruitment of mathematical talent, public appreciation of mathematics, and underrepresentation of women and minorities in the profession are among the pressing problems the AMS must deal with. We must face these difficult challenges without complacency or defeatism and develop realistic policies that will break the present deadlock in the politics of science. As in the Rochester crisis, we will seek alliances with colleagues and organizations in the sciences. We will involve a larger sector of the mathematics community in our efforts to ensure a healthy future for mathematics. Recall Benjamin Franklin's maxim: "If we do not hang together, we shall surely all hang separately." We will reach out to all mathematicians, especially teachers at all levels. We must stand ready for resolute, broadly supported action.

Vice-President
Jennifer Tour Chayes

Professor of Mathematics, University of California, Los Angeles, and Manager, Theory Group, Microsoft Research.
AMS Committees: Western Section Program Committee, 1996-1997 (chair, 1997).


Statement: The mathematics community faces both challenges and opportunities in the coming years. We must respond to decreasing and shifting research funding in a way which both preserves the integrity of conventional fundamental research and provides leadership for research in new interdisciplinary fields. We must assume an active role in educating not only our own students but also the general public, with an eye to promoting understanding and appreciation of the role of mathematics in our society. We must encourage the participation of highly qualified women and minorities in mathematics, and of course we must actively support and develop employment opportunities for all mathematicians.

As an interdisciplinary mathematician with experience in both academia and industry, I would appreciate the opportunity to serve the AMS in facing these challenges and realizing these goals.

Efim Zelmanov


Statement: I think that the primary mission of the AMS is to encourage mathematical research. The AMS is also well suited to address issues that are important for the whole mathematical community, such as mathematical education, employment, research funding, and public appreciation of mathematics.

Member-at-Large of the Council

Edward F. Aboufadel

Assistant Professor, Grand Valley State University.


Additional Information: Co-founder, Young Mathematicians Network, 1993; Participant and Presenter, University of Wyoming/NSF/Rocky Mountain Mathematics Consortium Conference on Differential and Difference Equations and Recent Developments in Population Biology, July 1994; Member: MAA, AAAS.


Statement: As a member of the AMS Council, I would represent the views of younger mathematicians and of faculty members at schools without doctoral programs. I have lived through two job searches and am keen to the issues of the job market. I have also been concerned about other issues pertinent to young mathematicians, such as the challenge of establishing a research program, finding one's place in the world of calculus reform, and improving the availability of child care and inexpensive housing at AMS meetings.

At my school we face the same questions the mathematical community is facing: striking the right balance between teaching and research, both in time spent and in rewards to faculty; determining the role of technology, teaching standards, and curriculum reforms in our classrooms; convincing those in power that faculty really do work hard. I am active in discussions about these issues, both at my school and the AMS Organizing Committee.
school and nationally, with an eye towards getting at the truth of matters and trying to solve problems. With my background I hope to be a thoughtful and effective member of the Council.

Alejandro Adem

Professor, Mathematics Department, University of Wisconsin-Madison.
Born: November 24, 1961, Mexico City, Mexico.
Additional Information: NSF Young Investigator Award, 1992.
Statement: If I am elected to the Council, my main objective would be to ensure the adequate representation of the diverse viewpoints held by the AMS membership. As qualifications I can mention my extensive experience as faculty member and student at a variety of universities in the U.S. and Mexico, which has given me firsthand knowledge of a number of difficult issues which our community has been facing. I have no personal agenda except to relay the opinions of the AMS membership to the Council in a constructive manner.

Ara S. Basmajian

Associate Professor, University of Oklahoma.
Born: March 1, 1958, New York, New York.
Selected Addresses: AMS-IMS-SIAM Summer Research Conference on the Geometry of Riemann Surfaces and Discrete Groups, Arcata, July 1989; Fifteenth Nevmanlima Colloquium (survey lecture), University of Michigan, Ann Arbor, June 3–9, 1993; Analytic and Geometric Aspects of Hyperbolic Geometry, Durham, England, July 4–10, 1993; Conference on the Geometry of 3-Manifolds and Funda-

mental Groups, Tokyo Institute of Technology, February 7–10, 1994; Special Session on Hyperbolic Geometry and Discrete Groups, New York, April 1996.


Robert L. Bryant

J. M. Kreps Professor of Mathematics, Duke University.
Born: August 30, 1953, Kipling, North Carolina.
Selected Addresses: Special Session on Nonlinear PDE in Physics and Geometry, Toronto, August 1982; Invited Address, Laramie, August 1985; Special Session on Equivalence Problems and Applications, New Orleans, January 1986; International Congress of Mathematicians, Berkeley, 1986; Special Session on Recent Results in Gauge Field Theory

Additional Information: NSF Postdoctoral Research Fellowship, 1979–1980; Alfred P. Sloan Fellowship, 1982–1984; Presidential Young Investigator Award, 1984–1989; Trinity College Distinguished Teaching Award, 1992; MAA Southeastern Region Distinguished Teaching Award, 1993; Member: AMS, MAA.


Statement: I believe in supporting the central role of the AMS in promoting research in mathematics, and this should always be its main concern. This does not mean that the AMS should focus only on what immediately benefits professional research mathematicians. Not only must we be concerned with educating the general public about the fundamental nature of mathematics and its practical importance in our increasingly technological lives, but we must also be involved in shaping the level and contents of mathematics education, not only at the college and university level, but earlier as well.

I believe that we can and should continue our growth in traditional areas of mathematics, but at the same time we should take advantage of new interdisciplinary opportunities that will enliven our own research programs and simultaneously increase employment opportunities for our students. The next several years will present major challenges to any business-as-usual approach to the AMS. Changing demographics, funding structures, and employment opportunities will affect the professional lives of all mathematicians. I look forward to a chance to study these problems and contribute what I can to finding creative solutions.

Jane M. Hawkins
Professor, University of North Carolina at Chapel Hill.


Additional Information: Marshall Scholar, University of Warwick, 1976–1979; Mathematical Sciences Research Institute Visiting Member, 1984; Co-PI of NSF Grant for a Special Year in Ergodic Theory and Dynamical Systems, University of North Carolina at Chapel Hill, 1991–1992; Co-organizer, Special Session on Ergodic Theory and Dynamical Systems, Tuscaloosa, March 1982; Associate Chair, Department of Mathematics, University of North Carolina at Chapel Hill, 1993–1996; Member: AMS, AWM.


Statement: The AMS should vigorously support the research mathematics being done by mathematicians at state universities (in all fifty states), small colleges, and diverse private institutions (including nonacademic) to accurately reflect the last decade of changes in the job market. Extremely talented research mathematicians are no longer concentrated in just a few locations in the country. Journal editorial policy, grant and conference support, and invited conference speakers should reflect this diversity.

A serious problem which the AMS should address is that only a very small percentage of mathematicians receive any government grant support. Many excellent researchers and educators are being excluded from critical conference activities as a consequence. The AMS should work closely with the other professional organizations (like MAA, AWM, and SIAM) to support advances in mathematics education from the elementary schools through graduate school. The AMS should continue to pursue policies of encouraging underrepresented groups to get into mathematics and of helping them achieve success once they become mathematicians.
Lisa Claire Jeffrey

**Associate Professor, Department of Mathematics, McGill University.**

**Born:** January 5, 1965, Fort Collins, Colorado.

**Ph.D.:** Oxford University, 1991.

**Selected Addresses:** Geometry Festival, New York, New York, April 1992; Special Session on Geometry, Topology, and Quantum Field Theory, Boston, MA, October 1995; Special Session on Moduli Spaces of Vector Bundles over Curves with or without Additional Structure, Lawrenceville, NJ, October 1996; Special Session on Lie Groups and Physics, Columbia, MO, November 1996; Invited Address, College Park, MD, April 1997; Organizer, Special Session on Symplectic Geometry, Moduli Spaces and Integrable Systems, College Park, MD, April 1997.


**Statement:** The primary goal of the AMS is to foster high-quality research in mathematics. It should also pay attention to the following issues:

1. developing and monitoring employment opportunities for young mathematicians,
2. increasing the representation of underrepresented groups in mathematics, and
3. fostering interaction and dialogue between mathematics and other scientific disciplines.

Karen V. H. Parshall

**Associate Professor of Mathematics and History, University of Virginia.**

**Born:** July 7, 1955, Virginia Beach, Virginia.

**Ph.D.:** University of Chicago, 1982.

**AMS Committees:** AMS-MAA Joint Archives Committee, 1992-; AMS Representative to Section L of the AAAS, 1996-; AMS-MAA Joint Program Committee for the Baltimore Meeting, January 7-10, 1996.


**Statement:** Looking back at past sheets of mission statements, one sees the following repeated in a variety of phrasings: "The main mission of the AMS is the promotion of mathematical research." This is certainly true, but this mission seems consistently compromised by an inability to convey to legislators and to the broader public just exactly why mathematical research merits promotion and support. Astronomers with their comets and supernovae, physicists with their quarks, biologists with their human genome project—all captivate the public imagination and win broader support. As an AMS Council member, I would like to work toward devising a short-term as well as a long-range strategy for effectively addressing the fundamental public relations problems of the mathematical community.

Mary Beth Ruskai

**Professor, University of Massachusetts, Lowell.**

**Born:** February 26, 1944, Cleveland, Ohio.

**Ph.D.:** University of Wisconsin, 1969.

**AMS Committees:** Research Fellowships Committee, 1986-1988; Committee on Fellowship Policy, 1988-1989; AMS-ASA-AMS-IMA-MAA-NCTM-SIAM Joint Committee on Women in the Mathematical Sciences, 1990-1996 (chair,
AMS can be most effective in these areas by avoiding duplication of effort and working collaboratively with other organizations and other disciplines.

In the Washington arena it is important that groups within the mathematics community find ways to work out their differences and present a strong consensus position. In the case of employment opportunities the AMS needs to address the loss of academic positions due to exploitive employment practices and the reassignment of mathematics teaching responsibilities to faculty in other departments. Finally, particularly in view of the fact that many promising young mathematicians are trying to develop research careers in difficult circumstances, the AMS must strengthen its commitment to support research mathematicians in all types of environments, including those at nondoctoral institutions.

*Nominated in response to a petition.

Michael Starbird

Associate Dean for Undergraduate Education, College of Natural Sciences, and Professor of Mathematics, University of Texas at Austin.

Born: July 10, 1948.


Additional Information: Visiting Member, Institute for Advanced Study, 1978–1979; Minnie Stevens Piper Professor (awarded to 10 professors each year in the state of Texas), 1984; President’s Associates Teaching Excellence Award, 1989; UT Recreational Sports Super Racquets Champion, 1989; Associate Dean, College of Natural Sciences, University of Texas at Austin, 1989–1997; Mathematicians and Education Reform (MER) Network, Member of the Board, 1992–; MER Task Force on the Departmental Network, 1993–; Jean Holloway Award for Teaching Excellence, 1995.


Statement: The future vitality of the mathematics profession will be determined largely by decisions made by non-

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mathematicians. As associate dean, I attended a meeting at which nationally prominent deans were asked to describe their departments of mathematics. "Insular" was the word most commonly used by the other deans. They stated that their mathematics departments were largely uninterested in strategic planning, general education, or connections with other departments.

As I return to the department after an eight-year stint in college administration, I am keenly aware of the perceptions of mathematics held by faculty members in other departments, by administrators, by donors, and by the nonacademic community. We mathematicians must learn how to listen to these external voices and better meet their needs. Mathematics is exciting, useful, and one of the ongoing, crowning achievements of human thought—an expanding adventure to which nonmathematicians could be welcomed. This outward-looking perspective shapes ideas on funding of research and teaching, revisions of graduate and undergraduate curricula, outreach activities, inclusion of underrepresented populations, and building an infrastructure for systematically bringing mathematical research activity within the grasp of many. Mathematics has far more to give the whole society than we have traditionally offered.

Abigail A. Thompson

Associate Professor, University of California, Davis.
Born: June 30, 1958, Norwalk, Connecticut.
Ph.D.: Rutgers University, 1986.

Statement: The primary purpose of the AMS is and should be to promote mathematical research. To maintain the health of the current and future research community, there are two areas in which the AMS should play an important advocacy role. The first is in improving the difficult job situation for new Ph.D.s. The second is in ensuring a high level of primary and secondary mathematics education.

Deane Yang

Professor, Polytechnic University.
Ph.D.: Harvard University, 1983.


Statement: The mathematics community has never been more productive and vibrant than now. We have witnessed in recent years amazing developments in a wide range of areas. We have also seen mathematics used more and more extensively, not only in science and engineering, but also in business and finance.

Yet the mathematics community is in a state of crisis. Too many outside of mathematics do not understand its value and importance. Support for research is declining. Many people are questioning the necessity and quality of the mathematics education we provide.

A Ph.D. in mathematics is becoming an increasingly devalued commodity. We must either stop producing more Ph.D.s than are needed by our colleges and universities or restructure the degree so that a Ph.D. in mathematics is as important outside of the academy as it is in it.

The Society must assume a leading role in addressing these issues. We must demonstrate to the public the value of mathematical research. A serious educational effort must be mounted in Washington. But most of all, we must develop internal strategies that will build a viable future for mathematics and mathematicians.
Trustee

Frederic Y. M. Wan

Vice Chancellor for Research,
Dean of Graduate Studies, Professor of Mathematics, University of California, Irvine.

Born: January 7, 1936, Shanghai, China.


AMS Committees: Committee on Committees, 1995-1996; Committee on Science Policy, 1995--.

Selected Addresses: The Third IUTAM Shell Symposium, Tbilisi (ISU), 1978; European Mechanics Colloquium on Flexible Shells, Munich, Germany, 1983; European Mechanics Colloquium on Localized Effects in Structures, Cachan, France, 1984; Symposium of Asymptotic and Computational Analysis in honor of Frank Olver, Winnipeg, 1989; International Symposium on Methods and Applications of Analysis, Shatin, Hong Kong, 1994.


Statement: As vice chancellor for research and dean of graduate studies at University of California at Irvine, I am intimately involved in issues pertaining to research and graduate education in general and in the mathematical sciences in particular. Through the University of California system, I also have the benefit of learning about the positions and approaches of the other eight campuses on these same issues through quarterly meetings of the deans and the research vice chancellors.

At Research and Graduate Studies at UCI, I am responsible for an office with a budget of over $20 million. I am an ex officio member of the UCI budget team, which hears budget presentations and requests for new resources by all academic units, reviews the requests, and assists the executive vice chancellor (provost) in allocating available resources. These experiences should be useful in the management of the Society's $17 million budget.

Prior to coming to UCI, I served as a department chair and the divisional dean for all natural and mathematical sciences at the University of Washington (with a budget of $30 million). In those capacities I had to deal with an even wider range of issues on undergraduate and graduate education, including personnel, space renovation, and academic building construction. These experiences will also be valuable to the Board of Trustees of the Society.

Finally, I gained from my three years of service at the National Science Foundation considerable experience with and insight into the federal government, particularly regarding support for research and education for the mathematical sciences. The Society recognized the value of this experience when it appointed me to its Committee on Science Policy immediately after the completion of my two-year term as division director of DMS at NSF. With my term on the CSP ending on December 31, 1997, I am in a position to provide a bridge between the Trustees and that committee.

Roy L. Adler

Research Staff Member,
Thomas J. Watson Research Center, IBM.

Born: February 22, 1931, Newark, New Jersey.

Ph.D.: Yale University, 1961.


Statement: We face challenging times. The AMS must carry out its principal activity, dissemination of scientific information via meetings and publications, in the face of a host of other problems affecting our profession: scarce funding, high unemployment, dramatic technological change, lopsided representation with regard to sex and race, educational reform, pressure for change in the tenure system, etc. The Society must balance all its activities against the sine qua non to remain solvent. During my first term I have tried my best to see that the Society is run wisely. I will continue to do so if elected to a second.

Nominating Committee
Michał Misiurewicz

Professor, Department of Mathematical Sciences, Indiana University-Purdue University, Indianapolis.
Born: November 9, 1948, Warsaw, Poland.
Selected Addresses: Invited Address, International Congress of Mathematicians, Warsaw, Poland, 1983; IUPUI SOS and SOLA Faculty Spotlight Lecture, Indianapolis, IN, 1994; Invited Address, Iowa City, IA, 1996.

Additional Information: Four awards from the Polish Academy of Sciences; three awards from the Minister of Higher Education, Science, and Technics of Poland; three awards from the Polish Mathematical Society; Member, Main Committee of the Polish Mathematical Olympiad, 1976–1990.


Statement: The Nominating Committee should seek out candidates with broad views, with their own opinions on the problems facing the mathematical community, but also with a willingness to listen to others. Diversity of opinions is important; usually the best solutions emerge from a discussion among people who look at the same problem from different angles.

Catherine L. Olsen
Professor, State University of New York at Buffalo.

Born: September 24, 1942, Valley City, North Dakota.
Ph.D.: Tulane University, 1970.


Additional Information: State University of New York Chancellor's Award for Excellence in Teaching, 1978; Member: AMS, AWM, MAA.

Statement: In the current time of change and problems for the discipline and profession of mathematics, it is crucial that the AMS should continue to be a vital organization. This requires officers who are highly qualified, energetic, and representative of the broad spectrum of the profession.

Paul H. Rabinowitz

Professor, University of Wisconsin-Madison.

Born: November 15, 1939, Newark, New Jersey.


Additional Information: CBMS Lectures, 1984; CBMS Regional Panel, 1985–1987; Member, Board of Trustees and Steering Committee, Mathematical Sciences Research Institute, 1987–1993; Visiting Committees at the University of Chicago, University of Kentucky, and the Weizmann Institute; Currently serve on editorial boards of six journals.


Statement: The AMS and the profession face increasing challenges from many issues, such as unemployment, support for research, educational reform, the uses of technology, and the development of links to other fields. It is crucial that the Nominating Committee energetically seek out a wide variety of highly qualified candidates to provide the leadership the Society needs to address these matters.

Elias M. Stein

Professor, Princeton University.

Born: January 13, 1931, Antwerp, Belgium.


Clarence Eugene Wayne

Professor of Mathematics, The Pennsylvania State University (after September 1, 1997: Professor of Mathematics, Boston University).

Born: June 5, 1956, Moundsville, West Virginia.


Additional Information: Vice Chair, SIAM Activity Group in Dynamical Systems, 1992–1995; Chair, Committee on Electronic Communication and Publications, International Association of Mathematical Physics, 1994–; MAA Allegheny Mountain Section Award for Outstanding College and University Teaching, 1997; Member: AMS, APS, MAA, SIAM.

Sylvia M. Wiegand

Professor of Mathematics, University of Nebraska-Lincoln.

Born: March 8, 1945, Cape Town, South Africa.


Statement: The American Mathematical Society has given outstanding service to the mathematical community on many fronts. For example, the Society's recent terrific efforts to promote mathematics may have a wonderful effect on funding for mathematics and other sciences. I would like more mathematicians to be involved in the great work of the Society and to continue the tradition that has been started. Specifically, I hope to assist in making nominations which tap a broad spectrum of previously unused talent (although not necessarily excluding the previously used talents which have brought us this far).

Editorial Boards Committee

Jay R. Goldman

Professor of Mathematics, University of Minnesota, Minneapolis.

Born: August 2, 1940, Brooklyn, New York.


Selected Addresses: Special Session on Knots and Topological Field Theory, Dayton, October 1992; Massachusetts Institute of Technology, Fall 1994; University of Montreal at Quebec, November 1994; Smith College Combinatorics Day, Winter 1995; Conference in Honor of Gian-Carlo Rota, Massachusetts Institute of Technology, April 1996.

Additional Information: Lester R. Ford Award, MAA, 1976; Former member, NSF panel to evaluate the use of bibliographic tools in research and public policy decisions.


Statement: I believe that the major problem facing the Editorial Boards Committee relates to electronic journals with no corresponding paper version. The increased cost of adding extra papers to such journals is probably quite small. Thus it is very important to find editors who will do their best to maintain the highest quality journals.

David Jerison

Professor of Mathematics, Massachusetts Institute of Technology.

Born: November 12, 1953, Lafayette, Indiana.


Selected Addresses: Midwest PDE Conference, University of Illinois at Chicago, 1982; Invited Address, Salt Lake City,
Abel Klein

Professor and Chair, Department of Mathematics, University of California, Irvine.

Born: January 16, 1945, Rio de Janeiro, Brazil.


Statement: The American Mathematical Society was created to further mathematical research and scholarship. The journals it publishes are the face the AMS presents to the world. The Editorial Boards Committee has the responsibility of monitoring the Editorial Committees and of submitting nominations of members for these committees to the Council. It is essential that the Editorial Boards Committee ensures that the editorial boards of the AMS journals maintain the high standards of excellence to which the AMS is committed and also reflect the broad diversity of mathematical research conducted by AMS members. Electronic publishing is rapidly changing the way journals are published. At the same time most of our libraries are going through severe financial problems, caused in large part by the proliferation of journals and the increasing high cost of some journals. (Many mathematics departments are being asked by their libraries to cut journals in an unpleasant yearly ritual.) The AMS has been a leader in electronic publishing, and it is also a low-cost publisher. It is very important that the AMS continues its leadership in electronic publishing and also addresses the problem of high-cost journals.

Ronald Solomon

Professor, The Ohio State University.


Ph.D.: Yale University, 1971.

AMS Committees: Proceedings Editorial Committee, 1991-.


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
   2.0.1. Officers of the AMS
   2.0.2. Representatives of Committees
   2.0.3. Members-at-Large
3. Board of Trustees

1. Officers

President Arthur M. Jaffe 1998
Ex-President Cathleen S. Morawetz 1997
Vice-Presidents Michael Aschbacher 1998
H. Blaine Lawson, Jr. 1999
Gian-Carlo Rota 1997
Secretary Robert M. Fossum 1998
Associate Secretaries* Robert J. Daverman 1998
Susan J. Friedlander 1997
William A. Harris 1997
Lesley M. Sibner 1998
Treasurer Franklin P. Peterson 1998
Associate Treasurer B. A. Taylor 1998

1.1. Liaison Committee

All members of this committee serve ex officio.

Chair
Hyman Bass
Robert M. Fossum
Arthur M. Jaffe
Franklin P. Peterson

2. Council

2.0.1. Officers of the AMS

President  Arthur M. Jaffe 1998
Ex-President Cathleen S. Morawetz 1997
Vice-Presidents Michael Aschbacher 1998
H. Blaine Lawson, Jr. 1999
Gian-Carlo Rota 1997
Secretary Robert M. Fossum 1998
Associate Secretaries* Robert J. Daverman 1998
Susan J. Friedlander 1997
William A. Harris 1997
Lesley M. Sibner 1998
Treasurer Franklin P. Peterson 1998
Associate Treasurer B. A. Taylor 1998

2.0.2. Representatives of Committees

Bulletin David Eisenbud 1998
Colloquium Susan J. Friedlander 1998
Executive Committee John B. Conway 2000
Executive Committee Steven George Krantz 1998
Executive Committee Andrew M. Odlyzko 1999
Executive Committee Marc A. Rieffel 1997
Journal of the AMS William Fulton 1998
Mathematical Surveys and Monographs Hugh L. Montgomery 1998
Mathematics of Computation Lars B. Wahlbin 1997
Proceedings Clifford J. Earle, Jr. 2000
Transactions and Memoirs Peter B. Shalen 1999

2.0.3. Members-at-Large

Francis Bonahon 1999 Jerrold E. Marsden 1997
David M. Bressoud 1998 Andrew M. Odlyzko 1998
Gail A. Carpenter 1998 Gail D. L. Ratchiff 1999
John B. Conway 1998 Cora S. Sadosky 1997
David B. A. Epstein 1997 Alice Silverberg 1997
Frederick P. Gardiner 1999 Joel H. Spencer 1999
James M. Hyman 1997 Karen Vogtmann 1999
Krystyna M. Kuperberg 1998

* 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

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3. Board of Trustees

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4. Committees

4.1. Committees of the Council

**Standing Committees**

4.1.1. Editorial Boards

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Terms begin on January 1

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**Special Committees**

4.1.3. Search Committee for the Editor of the Notices

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4.2. Editorial Committees

4.2.1. Abstracts Editorial Committee

All members of this committee serve ex officio.

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### Officers and Committee Members

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#### 4.2.13. Proceedings

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#### 4.2.14. Proceedings of Symposia in Applied Mathematics

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AMS staff contact: R. Keith Dennis.
4.2.15. Transactions and Memoirs

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4.2.17. Translation from Japanese

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4.2.21. Representation Theory

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4.2.23. e-Journal Review Committee

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4.3. Committees of the Board of Trustees

4.3.1. Agenda and Budget

All members of this committee serve ex officio.

- Hyman Bass
- Robert M. Fossum
- Arthur M. Jaffe
- Franklin P. Peterson
- Marc A. Rieffiff
- B. A. Taylor

4.3.2. Appeals Committee on Discounted Subscriptions

AMS staff contact: Cheryl Marino.

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4.3.3. Audit

All members of this committee serve ex officio.

AMS staff contact: Gary G. Brownell.

- Hyman Bass
- Franklin P. Peterson

4.3.4. Endowment and Planned Giving

AMS staff contact: Timothy J. Goggins.

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4.3.5. Investment

AMS staff contact: Gary G. Brownell.

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4.3.6. Salaries

All members of this committee serve ex officio.

- Hyman Bass
- Donald E. McClure
- Franklin P. Peterson
- B. A. Taylor
4.3.7. Staff and Services
All members of this committee serve _ex officio_.

Roy L. Adler
Franklin P. Peterson
Chair
B. A. Taylor

Special Committee

4.3.8. Institutional Membership
Consultant Carol-Ann Blackwood _ex officio_
Paul Chambers
Ramesh A. Gangolli
Chair
Frederick W. Gehring
William A. Veech

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.

Hyman Bass
John H. Ewing
Robert M. Fossum
Arthur M. Jaffe
Chair
Steven George Krantz
Andrew M. Odlyzko
Franklin P. Peterson

4.4.2. Nominating
All members of this committee serve _ex officio_.

Michael G. Crandall
Eric M. Friedlander
Donald E. McClure
Andrew M. Odlyzko
Marc A. Rieffel
Chair

4.5. Internal Organization of the American Mathematical Society
Standing Committees

4.5.1. Archives
Chair
Karen Parshall 1999
Everett Pitcher 1997
John W. Weigel III 1997

4.5.2. Committee on Committees
Sun-Yung Alice Chang 1998
Robin Forman 1998
Robert M. Fossum _ex officio_ 1998
Arthur M. Jaffe _ex officio_ 1998
Andrew M. Odlyzko 1998
Marc A. Rieffel 1998
Iakov G. Sinai 1998
Chair
Daniel W. Stroock 1998
Floyd Williams 1998
Ruth J. Williams 1998

4.5.3. Library Committee
Co-chair
Nancy Anderson 1997
Bruce C. Berndt 1997
Lawrence S. Husch 1999
Carol Hutchins 1999
Dorothy McGarry 1997
James J. Tattersall 1999
Martha Tucker 1999
Hung-Hsi Wu 1999

4.5.4. Publications
Chair
Donald G. Babbitt _ex officio_
Sun-Yung Alice Chang 1998
John R. Conway 1998
Michael G. Crandall 1998
John H. Ewing _ex officio_ 1998
Robert M. Fossum _ex officio_ 1998
Arthur M. Jaffe _ex officio_ 1998
Steven George Krantz ‘1997
Elliott H. Lieb 1998
M. Susan Montgomery 1999
Robert O'Malley 1998
Gail D. L. Ratchford 1999
Alice Silverberg 1997
Srinivasa S. R. Varadhan 1999

4.6. Program and Meetings
Standing Committees

4.6.1. Meetings and Conferences
AMS staff contact: H. Hope Daly.

Chair
Roy L. Adler 1997
Bettye Anne Case 1997
John H. Ewing _ex officio_ 1997
Robert M. Fossum _ex officio_ 1997
Isom H. Herron 1998
Evan G. Houston 1998
James M. Hyman 1997
Arthur M. Jaffe _ex officio_ 1997
Jerrold E. Marsden 1997
Chair
Joel H. Spencer 1999
Karen Vogtmann 1999
Sylvia Wiegand 1999

4.6.2. Program Committee for National Meetings

Ingrid Daubechies 1997
Chair
Carolyn S. Gordon 1998
Isom H. Herron 1999
Joseph Lipman 1997
Chau-Lian Terng 1997
Dan Voiculescu 1999

4.6.3. Short Course Subcommittee

Chair
Mark J. Ablowitz 1998
Lenore Blum 1998
Michael J. Kallaeher 1998
Jeffrey C. Lagarias 1997
Patrick D. Mcracy 1997
Jane Cronin Scanlon 1998
James A. Sethian 1999

4.6.4. Central Section Program Committee

Brian Conrey 1998
Susan J. Friedlander _ex officio_ 1998
Chair
Steven E. Hurder 1997
Gail D. L. Ratcliff 1997
Michael I. Weinstein 1998

4.6.5. Eastern Section Program Committee

Anthony Knapp 1998
Yanyan Li 1998
Chair
Steven Rosenberg 1997
Lesley M. Sibner _ex officio_ 1997
Joel Spruck 1997
4.6.6. Southeastern Section Program Committee

Chair
Robert J. Daverman
Krystyna M. Kuperberg
Abdulalim A. Shabazz
James D. Stasheff
Lawrence E. Thomas

4.6.7. Western Section Program Committee

Chair
Bruce Blackadar
Jennifer Tour Chayes
William A. Harris
Nicolai Reshetikhin
John Sylvester

4.6.8. Agenda for Business Meetings

Chair
Robert M. Fossum
John M. Franks

4.6.9. Arnold Ross Lecture Series Committee

Chair
Harvey B. Keynes
Robert Osserman
Karl Rubin
Paul J. Sally, Jr.

4.6.10. Colloquium Lecture

Chair
William Browder
Shlomo Sternberg

4.6.11. Gibbs Lecturer for 1997 and 1998, Committee to Select

Chair
Ronald L. Graham
Charles Samuel Peskin
Thomas Crawford Spencer


Chair
Richard A. Askey
Spencer Bloch
Felix E. Browder
Charles L. Fefferman
Peter D. Lax
Robert MacPherson
David Mumford
Gian-Carlo Rota
Peter Sarnak
Audrey A. Terras
Srinivasa S. R. Varadhan
Edward Witten

4.6.13. Progress in Mathematics

Chair
Michael Aschbacher
Constantine M. Dafermos
Richard M. Schoen

4.7. Status of the Profession

Standing Committees

4.7.1. Academic Freedom, Tenure, and Employment Security

Chair
Sheldon Axler
Murray Gerstenhaber
Rhonda J. Hughes
Robert Eugene Megginson
Arlan B. Ramsay
Seymour Schuster

4.7.2. Education

AMS staff contact: Samuel M. Rankin III.

Chair
Michael Aschbacher
Hyman Bass
Francis Bohnon
Robert E. Bozeman
David M. Bressoud
David B. A. Epstein
John H. Ewing
Robert M. Fossum
Daniel L. Goroff
Arthur M. Jaffe
Harvey B. Keynes
William James Lewis
Andy R. Magid
Judith Roitman
Alan H. Schoenfeld
Alan C. Tucker

4.7.3. Human Rights of Mathematicians

Chair
Paul Sally, Jr.
Harold M. Edwards
Troels Jorgensen
Neal I. Koblitz
Tsit-Yuen Lam
Joel L. Lebowitz
Robert MacPherson
William V. Velez
M. V. Wicherhauser

4.7.4. Pi Mu Epsilon Liaison Committee

Chair
Thomas Bylowski
Dennis DeTurck
Marc A. Perlstadt
Robert Sefton Smith
Janet C. Talvacchia
James G. Timourian
William A. Webb

4.7.5. Profession

AMS staff contact: James W. Maxwell.

Chair
Curtis D. Bennett
Gail A. Carpenter
Annalisa Crannell
John H. Ewing
Robert M. Fossum
Frank L. Gilfeather
Arthur M. Jaffe
Antoni Kosinski
Krystyna M. Kuperberg
H. Blaine Lawson, Jr.
Joseph Lipman
Donald E. McClure
Ronald J. Stern
James Clarence Turner
Steven H. Weintraub

4.7.6. Professional Ethics

Chair
Simon Hellerstein
Jerry Kaminker
Marian B. Pour-El
Louise A. Raphael
Claus C. Schochet
Hale F. Trotter
4.7.7. Science Policy
AMS staff contact: Samuel M. Rankin III.

Hyman Bass 1999
Felix Browder 1998
John H. Ewing 1999
Richard Ewing 1998
Robert M. Fossum 1999
Frederick Gardiner 1999
William H. Jaco 1998
Arthur M. Jaffe 1998
William James Lewis 1997
William A. Massey 1998
Cathleen S. Morawetz 1997
Cora S. Sadosky 1997
Frederic Y. M. Wan 1997

4.7.8. World Mathematical Year 2000, Blue Ribbon Committee for

Chair
Felix E. Browder
Robert M. Fossum
Ronald L. Graham
Peter D. Lax
Cathleen S. Morawetz
Peter Sarnak
Audrey A. Terras
William P. Thurston

Special Committee

4.7.9. Task Force on Excellence in Mathematics Scholarship

AMS staff contact: Raquel E. Storti.

Thomas R. Berger
Carl Cowen
John B. Garnett
Ettore Infante
Raymond L. Johnson
Barbara Lee Keyfitz
Joan P. Leitzel
William James Lewis
Douglas Lind
Morton Lowengrub
Donald E. McClure
Alan Newell
Alan C. Tucker
David A. Vogan, Jr.

4.8. Prizes and Awards

Standing Committees

4.8.1. Award for Public Service, Committee to Select the Winner of the

Chair
Ronald L. Graham 2000
Harvey B. Keynes 1997
Peter D. Lax 2001
Everett Pitcher 1999
Isadore M. Singer 1998

4.8.2. Centennial Fellowships
Terms expire on June 30

Chair
David E. Barrett 1998
Robert Calderbank 1998
Fanghua Lin 2000
Terry Loring 1998
Shmuel Weinberger 1998

4.8.3. Menger Prize Committee
Terms expire on May 31

Chair
Gisele Goldstein 1999
Peter V. O'Neil 2000
Julian Palmore 1998

4.8.4. National Awards and Public Representation

Chair
Robert M. Fossum 1999
Frederick W. Gehring 1997
Ronald L. Graham 1997
Arthur M. Jaffe 1998
Cathleen S. Morawetz 1998

4.8.5. Satter Prize for 1998, Committee to Select the Winner of the

Sun-Yung Alice Chang 2000
Peter Sarnak 1999
Carol S. Wood 1998

4.8.6. Steele Prizes
Terms expire on June 30

Richard A. Askey 1998
Ciprian Foias 1999
H. Blaine Lawson, Jr. 1998
Andrew J. Majda 1998
Louis Nirenberg 1999
Jonathan M. Rosenberg 2000
John T. Tate 1999

4.8.7. Automatic Theorem Proving, Committee to Recommend Winners of Prizes for

Chair
Ronald L. Graham 1999
Oscar Lanford
David Mumford

4.8.8. Bôcher Prize

Chair
Richard V. Kadison 1998
Dan Voiculescu

4.9. Institutes and Symposia

Standing Committees

4.9.1. Liaison Committee with AAAS

Hyman Bass 1999
Lenore Blum 2000
Evans M. Harrell 1998
Deborah Hughes Hallett 1998
David Isaacs 1997
Warren Page 1998
Richard S. Palais 1998
Karen H. Parshall 1997
Charles Radin 1997
Joel H. Spencer 1997
Frances Yao 1997

4.9.2. Summer Institutes and Special Symposia
Terms expire on February 28

Chair
Michael D. Fried 1999
Victor Klee 1998
Robert Osserman 1999
Jeffrey B. Rauch 2000
Leon Takhtajan 2000
Ruth J. Williams 1999
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.

- Martha Allaga (ASA) 1997
- Ann S. Almgren (SIAM) 1999
- Stella Roberson Ashford (AMS) 1998
- Lily Christ (MAA) 1997
- Mary Flahive (MAA) 1997
- Ena Gross (NCTM) 1999
- Deborah Lockhart (SIAM) 1998
- Harriet M. Lord (MAA) 1997

Chair
- Margaret A. M. Murray (AMS) 1997
- Mina Ossiander (IMS) 1997
- Connie Page (IMS) 1998
- Tamar Schlick (SIAM) 1999
- Sanford Segal (NCTM) 1999
- Peter Komjath (AMS) 1999
- Marie Vitulli (AWM) 1997
- Patricia Wozniak (ASA) 1999

4.10.2. AMS-ASL-IMS-SIAM Committee on Translations from Russian and Other Slavic Languages

ASL Subcommittee Members

Terms expire on January 1

- Marat Arslanov 1999
- Sergei Artemov 1999
- Oleg Belegradek 1999
- Peter Komjath 1999
- Jan Krajicek 1999

Chair
- Steffen Lempp 1999

IMS Subcommittee Members

Chair
- M. I. Freidlin
- B. Pittel
- A. Rukhin
- W. J. Studden

4.10.3. AMS-IMS-MAA Data Committee

indexData Committee AMS staff contact: James W. Maxwell.

Chair
- Paul W. Davis (AMS) 1999
- Malay Ghosh (IMS) 1998
- Mary Gray (MAA) 1999
- Don Loftsgaard (MMA) 1999
- James W. Maxwell (AMS) 1999
- M. Beth Ruskai (AMS) 1998
- Ann K. Stehney (AMS) 1998
- Ann E. Watkins (MAA) 1999

Chair

4.10.4. AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences

Terms expire on June 30

- Alejandro Adem (AMS) 1997
- Katalin A. Benczath (AMS) 1997
- Mary Ellen Bock (IMS) 1998
- Percy Alec Deift (AMS) 1998
- James W. Demmel (AMS) 2000
- Alan F. Karr (AMS) 2000

Chair
- Barbara L. Keyfitz (AMS) 1998
- Andrzej Manitius (SIAM) 1997
- Bart S. Ng (SIAM) 1997
- Doug Simpson (IMS) 1997
- Clifford Taubes (AMS) 1997

4.10.5. AMS-MAA Committee on Cooperation

All members of this committee serve ex officio.

Chair
- Gerald L. Alexanderson (MAA) 1997
- John H. Ewing (AMS) 1997
- Robert M. Fossum (AMS) 1997
- Arthur M. Jaffe (AMS) 1997
- Cathleen S. Morawetz (AMS) 1997
- Kenneth A. Ross (MAA) 1997
- Martha J. Siegel (MAA) 1997
- Marcia P. Sward (MAA) 1997

4.10.6. AMS-MAA Committee on Research in Undergraduate Mathematics Education (CRUME)

- Hyman Bass (AMS) 1999
- Thomas P. Dick (MAA) 1998
- Joan Ferrini-Mundy (NCTM) 1998
- Daniel L. Goroff (AMS) 1999
- James J. Kaput (MAA) 1999
- George S. Monk (MAA) 1997
- Warren Page (AMATYC) 1998
- Alan H. Schoenfeld (AMS) 1998
- John Selden (AMS) 1997
- Robert S. Smith (MAA) 1997

4.10.7. AMS-MAA Committee on Teaching Assistants and Part-time Instructors (TA/PTI)

- Curtis Bennett (AMS) 1999
- Kevin E. Charlowood (AMS) 1997
- Reuben C. Drake (MAA) 1997

Chair
- Suzanne Lenhart (AMS) 1998
- Richard D. Ringseis (AMS) 1997
- Stephen B. Rodi (MAA) 1997
- Raymond O. Wells (MAA) 1998

4.10.8. AMS-MAA Joint Archives Committee

Chair
- Victor Katz (MAA) 1997
- John McCleary (MAA) 1999
- Karen Parshall (AMS) 1999
- Everett Pitcher (AMS) 1997
- James J. Tattersall (MAA) 1998
- John W. Weigel III (AMS) 1997

4.10.9. AMS-MAA Joint Meetings Committee

All members of this committee serve ex officio.

Consultant
- H. Hope Daly
- John H. Ewing
- Robert M. Fossum
- Marcia P. Sward

Chair
- Donovan H. Van Osdol
4.10.10. AMS-MAA Exhibits Advisory Subcommittee

Chair

- H. Hope Daly
- Louise Decker
- Robert M. Fossum
- Martin Lapidus
- Elaine Pedreira-Sullivan
- Penny Pina
- David Tranh
- Donovan H. Van Osdol

4.10.11. AMS-MAA Arrangements Committee for the Baltimore Meeting January 7-10, 1998

Chair

- J. Michael Boardman
- Leonore J. Cowen
- Nathaniel Knox
- Elaine H. Koppelman
- George B. Mackiw
- Daniel Q. Naiman
- Anne L. Young

4.10.12. AMS-MAA Joint Program Committee for the Baltimore Meeting

Chair

- Carolyn S. Gordon (AMS)
- Yanyan Li (AMS)
- M. Susan Montgomery (MAA)
- Karen Parshall (MAA)

4.10.13. AMS-MAA-SIAM Joint Administrative Committee

All members of this committee serve ex officio.

- Gerald L. Alexanderson (MAA)
- James M. Crowley (SIAM)
- John H. Ewing (AMS)
- Robert M. Fossum (AMS)
- Samuel Gubins (SIAM)
- John Guckenheimer (SIAM)
- Franklin P. Peterson (AMS)
- Martha J. Siegel (MAA)
- Marcia P. Sward (MAA)

4.10.14. AMS-MAA-SIAM Joint Committee on Employment Opportunities

AMS staff contact: James W. Maxwell.

Chair

- James W. Bond (AMS) 1999
- Frank R. DeMeyer (AMS) 1997
- James Kister (AMS) 1997
- James W. Maxwell ex officio 1999
- S. Brent Morris (MAA) 1997
- Thomas W. Rishel (MAA) 1999
- Leon H. Seitelman (SIAM) 1997
- Mark W. Winstead (MAA) 1997
- (SIAM) 1998

4.10.15. AMS-MAA-SIAM Committee on Mathematicians with Disabilities

Chair

- David M. James (AMS) 1998
- Carlos E. Kenig (AMS) 1998
- Eileen Polami (MAA) 1997
- Jon Wilkin (MAA) 1999
- (SIAM) 1998
- (SIAM) 1999


4.10.17. AMS-MAA-SIAM Morgan Prize Committee for Outstanding Research in Mathematics by an Undergraduate Student

- Kelly J. Black (SIAM) 1997
- Frank Morgan (AMS) 1997
- Catherine A. Roberts (SIAM) 1999
- Robby Robson (MAA) 1999
- Martha J. Siegel (MAA) 1997
- Trevor Wooley (AMS) 1999

4.10.18. AMS-SIAM Committee on Applied Mathematics

Chair

- James W. Demmel 1998
- Tai-Ping Liu 1998
- Juan C. Meza 1997
- Tamar Schlick 1999

4.10.19. AMS-SIAM Committee to Select the Winner of the Birkhoff Prize for 1998

Ivo Babuska

Chair

- S. R. S. Varadhan

4.10.20. AMS-SIAM-SMB Committee on Mathematics in the Life Sciences

Chair

- Lisa Fauci 1997
- Charles Samuel Peskin 1997
- Michael S. Waterman 1998
- Carla Wofsy 1998
- ________ 1999

4.10.21. AMS-SMM Joint Program Committee

Chair

- Josefina Alvarez
- Charles Boyer
- Mauricio Gutierrez
- Lesley M. Silber
- John Smillie

Special Committees

4.10.22. Advisory Board of the AMS-SIAM Project: "Employment and the U.S. Mathematics Doctorate: Connections with Non-Academic Opportunities"

Chair

- Robert Calderbank (AMS)
- Peter Castro (SIAM)
- Paul Davis (SIAM)
- Avner Friedman (SIAM)
- Donald E. McClure (AMS)
- Kenneth Millett (AMS)
- Polly Moore (AMS)
- Margaret Wright (SIAM)

4.10.23. Program Committee for the Joint AMS-SAMS Meeting in South Africa

Chair

- Steven Bradlow
- Susan J. Friedlander
- Harvey B. Keynes
- Peter Sarnak
5. Representatives

5.0.1. American Association for the Advancement of Science
Terms expire on February 21

Section A  Lenore Blum  1998
Section B  Evans M. Harrell  1998
Section L  Karen H. Parshall  1998
Section Q  Deborah Hughes Hallett  1998
Section T  Frances Yao  1998

5.0.2. Commission on Professionals in Science and Technology
Ann K. Stehney  1999

5.0.3. Committee on the American Mathematics Competition
Term expires on June 30
Richard P. Stanley  1997

5.0.4. Conference Board of the Mathematical Sciences
Arthur M. Jaffe  1998

5.0.5. Fulkerson Prize Committee
Ronald L. Graham

5.0.6. MAA Committee on Undergraduate Program in Mathematics
Peter Hinman  1999
Judith Roitman  1999

5.0.7. MAA-NCTM Task Force on Mathematical Competitions
Peter W. Shor

5.0.8. U.S. National Committee on Theoretical and Applied Mechanics
Term expires on October 31
Philip John Holmes  2000

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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 1996. Section II, Review of 1996 Operations, contains more detailed information regarding the Society's operations. Section III, Summary Financial Information, presents information regarding the operations, financial condition, and long-term investments of the Society in financial statement format. Section IV discusses the assets and liabilities of the Society.

The Society segregates its net assets, and the activities that increase or decrease net assets, into three types. Unrestricted net assets are those which 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 which 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 revenue in excess of unrestricted expenses for the year ended December 31, 1996, totaled approximately $4,980,000. Of this amount, net returns on the unrestricted portion of the long-term investment portfolio totaled $4,185,000, and net income from operations totaled $795,000. Exceptionally strong financial markets in the U.S. during the year contributed to returns on our long-term portfolio that approximated 21%, a return which is comparable to the very highest of university endowments. These and other matters are discussed in more detail in the next section.

The Society's net assets totaled $29,592,000 at December 31, 1996. $1,279,000 is permanently restricted, consisting principally of donor restricted gifts and bequests received by the Society. $1,540,000 is temporarily restricted by some donor-imposed limitations, which will lapse upon the passage of time or the use of the asset for its intended purpose. $26,773,000 is unrestricted, of which $21,344,000 has been designated by the Board of Trustees, principally in the form of the Economic Stabilization Fund. This fund's purpose is to provide a source of cash in the event of a financial crisis. It has met the target established by the Board of Trustees of 75% of operating expenses plus the unfunded liability for post-retirement benefits. Assets underlying this fund are long-term investments whose performance is monitored to ensure that the target is maintained. The remaining unrestricted net assets consist of $6,117,000 invested in fixed assets and an undesignated cumulative deficit of $678,000. This undesignated deficit has resulted from the fact that, historically, cash projected not to be required in the near future for continuing operations has been designated as part of the Economic Stabilization Fund.
II. Review of 1996 Operations

1996 was a very good year. In terms of operating income and total revenues over expenses (the equivalent of a for-profit's net income), the Society exceeded all of its expectations (See Chart 1):

1995 was the final year in which the Society published four translation journals (Izvestiya, Sbornik, Steklov, and Doklady). Revenues from these journals were about $1,500,000 in 1995. The challenge facing the Society (from a financial point of view) in 1996 was recovering from this very significant revenue loss without hurting the other operations of the Society. I am happy to report that this goal was accomplished. We were fortunate to have increased revenues in other areas (sales of books, sales of MathSciDisc, and the introduction of MathSciNet), and we managed to decrease costs in many areas. As a result, our operating income was slightly increased over 1995. In fact, as 1996 began we were expecting an operating loss, so finishing the year with an operating surplus is even more noteworthy. I would be remiss if I did not point out that much of the cost savings in 1996 was the direct result of the hard work and ingenuity of the Society’s staff.

Sales Trends

Charts 2 and 3 show sales trends from 1992 through budgeted 1998, first in historical dollars and second in constant dollars (using 1996 as the base year and adjusting other years for actual or projected inflation).

MATH REVIEWS: MR has been a financially healthy operation for the past several years. In terms of sales trends, the first graph shows a generally upward trend with a slight flattening in 1994. The second graph (constant dollars) reveals 1994 to
be a more pronounced falloff in revenues, with 1996 looking more like a recovery year. 1994 was the year we revised the pricing of MR by establishing the data access fee (DAF) and charging separate, much lower amounts for paper subscriptions and MathSciDisc (MSD). One of the results of this revision was a reduction in the cost of MR for several institutions. After 1994 both DAF revenues and MSD revenues have increased each year. In addition to these trends in the older products, MathSciNet (MSN) was made available in 1996 and added about $245,000 to the total MR revenues. For 1997 and 1998 we are budgeting revenue increases about in line with inflation (flat on 1995 1996 $615 Travel—Staff and Volunteers 3%
$1,047 Outside Printing 5%
$846 Postage 4%
$1,824 Building and Equipment Related
$10,975 Personnel Costs 58%
$3,763 All Other Expenses 20%

1996
$532 Travel—Staff and Volunteers 3%
$1,034 Outside Printing 6%
$900 Postage 5%
$1,679 Building and Equipment Related
$10,823 Personnel Costs 60%
$3,152 All Other Expenses 17%

Chart 4.

Major Expense Categories
The pie charts in Chart 4 show the major expense categories for 1995 and 1996. The biggest component of costs is personnel related. There is an opportunity for significant savings by holding vacant positions open for a time before filling them and evaluating open positions to determine whether the Society can do without the position. On the other hand, fairness to staff results in a continuation of providing competitive salaries and benefits and means that savings beyond open positions are difficult. Personnel cost as a percentage of total cost increased in 1996. Note, however, that the 1996 pie is smaller than the 1995 pie (by almost a million dollars) and personnel dollars decreased.

III. Summary Financial Information
The Treasurer presents to the membership the following financial information 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.
STATEMENTS OF ACTIVITIES (IN 000'S)
Unrestricted Net Assets
Years Ended December 31, 1996, and 1995

<table>
<thead>
<tr>
<th>Operating Revenue</th>
<th>1996</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess of operating revenue over operating expenses</td>
<td>795</td>
<td>576</td>
</tr>
<tr>
<td>Long-term investment income (losses)</td>
<td>4,185</td>
<td>4,626</td>
</tr>
<tr>
<td>Cumulative effect of a change in accounting principle (post-retirement benefits)</td>
<td></td>
<td>(1,080)</td>
</tr>
<tr>
<td>Increase in unrestricted net assets</td>
<td>4,980</td>
<td>4,122</td>
</tr>
<tr>
<td>Unrestricted net assets, beginning of year</td>
<td>21,793</td>
<td>17,671</td>
</tr>
<tr>
<td>Unrestricted net assets, end of year</td>
<td>$26,773</td>
<td>$21,793</td>
</tr>
</tbody>
</table>

| Membership and professional services, including assets released from restrictions of $466 and $360 in 1995 and 1994, respectively: |
|-------------------|------|------|
| Meetings | 730 | 5% | 745 | 3% |
| Dues and membership services | 3,266 | 16% | 3,254 | 16% |
| Grants, prizes and awards | 1,067 | 5% | 953 | 5% |
| Total membership and professional services revenue | 5,063 | 26% | 4,952 | 24% |
| Short-term investment income | 239 | 1% | 317 | 2% |
| Other | 207 | 1% | 217 | 1% |
| Total operating revenues | $19,862 | 100% | $20,562 | 100% |

<table>
<thead>
<tr>
<th>Operating Expenses</th>
</tr>
</thead>
</table>
| Publication:
| Mathematical Reviews and related activities | $5,224 | 27% | $4,982 | 25% |
| Journals (excluding MR) | 1,101 | 6% | 1,640 | 8% |
| Books | 1,919 | 10% | 1,738 | 9% |
| Total publication expense | 10,174 | 53% | 10,619 | 53% |
| Membership and professional services:
| Dues and member services | 2,534 | 13% | 2,544 | 13% |
| Grants, prizes and awards | 1,020 | 6% | 1,000 | 5% |
| Meetings | 724 | 4% | 730 | 4% |
| Governance | 427 | 2% | 448 | 2% |
| Divisional Indirect | 273 | 1% | 269 | 1% |
| Total membership and professional services expense | 4,978 | 26% | 4,991 | 25% |
| Interest portion of post-retirement benefits | 96 | 0% | 91 | 0% |
| Miscellaneous | 316 | 2% | 338 | 2% |
| Membership and customer services | 853 | 4% | 917 | 5% |
| General and administrative | 2,650 | 15% | 3,050 | 15% |
| Total operating expenses | $19,067 | 100% | $19,986 | 100% |

BALANCE SHEETS (In 000's)
December 31, 1996, and 1995

<table>
<thead>
<tr>
<th>Assets</th>
<th>1996</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash and cash equivalents</td>
<td>$708</td>
<td>2%</td>
</tr>
<tr>
<td>Short-term investments</td>
<td>7,939</td>
<td>18%</td>
</tr>
</tbody>
</table>
| Receivables:
| Customers, less allowance | 1,052 | 2% | 928 | 3% |
| Grants and other | 527 | 1% | 520 | 1% |
| Deferred pre-publication costs | 397 | 1% | 412 | 1% |
| Completed books | 982 | 2% | 1,012 | 3% |
| Prepaid expenses and deposits | 832 | 2% | 904 | 2% |
| Land, buildings and equipment, net | 6,117 | 14% | 6,405 | 16% |
| Long-term investments | 26,347 | 59% | 21,960 | 56% |
| Total assets | $44,901 | 100% | $39,097 | 100% |

<table>
<thead>
<tr>
<th>Liabilities and Net Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liabilities:</td>
</tr>
<tr>
<td>Accounts payable</td>
</tr>
</tbody>
</table>
| Accrued expenses:
| Severance and study leave pay | 878 | 2% | 757 | 2% |
| Vacation and sick pay | 508 | 1% | 445 | 1% |
| Payroll, benefits & other | 710 | 2% | 793 | 2% |
| Deferred revenue:
| Subscriptions | 8,533 | 19% | 8,199 | 21% |
| Dues | 1,444 | 3% | 1,402 | 4% |
| Other | 576 | 1% | 526 | 1% |
| Post-retirement benefit obligation | 1,375 | 3% | 1,219 | 3% |
| Total liabilities | 15,309 | 34% | 14,615 | 37% |

Net assets (deficit):
Unrestricted:
| Undesignated | (679) | -2% | (2,256) | -5% |
| Designated | 21,335 | 48% | 17,644 | 45% |
| Invested in Fixed Assets | 6,117 | 14% | 6,405 | 16% |
| Temporarily restricted | 1,540 | 3% | 1,447 | 4% |
| Permanently restricted | 1,279 | 3% | 1,242 | 3% |
| Total net assets | 25,592 | 66% | 24,482 | 63% |

Total liabilities and net assets | 44,901 | 100% | $39,097 | 100% |
LONG TERM INVESTMENT INFORMATION
Allocation to Net Asset Types and Related Subfunds
December 31, 1996, and 1995

<table>
<thead>
<tr>
<th>Asset Types</th>
<th>1996</th>
<th>1995</th>
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</thead>
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<tr>
<td>Unrestricted net assets:</td>
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<tr>
<td>Undesignated</td>
<td>$2,915,022</td>
<td>$2,465,651</td>
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<tr>
<td>Designated:</td>
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<tr>
<td>Economic Stabilization Fund</td>
<td>21,158,630</td>
<td>17,502,715</td>
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<tr>
<td>Friends of Math</td>
<td>123,572</td>
<td>123,572</td>
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<tr>
<td>Charitable Annuities</td>
<td>10,602</td>
<td>11,945</td>
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<tr>
<td>Journal Archive Fund</td>
<td>23,500</td>
<td>23,500</td>
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<tr>
<td>Russian Royalties</td>
<td>17,829</td>
<td>17,945</td>
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<tr>
<td>Total allocated to unrestricted net assets</td>
<td>$24,249,155</td>
<td>$20,109,883</td>
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<tr>
<td>Temporarily restricted net assets, principally net gains on income-restricted endowment funds</td>
<td>$818,990</td>
<td>$608,261</td>
</tr>
<tr>
<td>Permanently restricted net assets:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrestricted use of Income:</td>
<td>$548,223</td>
<td>$548,223</td>
</tr>
<tr>
<td>Robert Henderson</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Joseph Fels Ritt</td>
<td>47,521</td>
<td>22,521</td>
</tr>
<tr>
<td>Eliakim Hastings Moore</td>
<td>2,575</td>
<td>2,575</td>
</tr>
<tr>
<td>Total allocated to permanently restricted net assets</td>
<td>$698,319</td>
<td>$673,319</td>
</tr>
<tr>
<td>Restricted use of Income:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prize Funds</td>
<td>$214,218</td>
<td>$213,834</td>
</tr>
<tr>
<td>Trjitzinsky Memorial Scholarship Fund</td>
<td>$195,780</td>
<td>$195,780</td>
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<tr>
<td>Centennial Research Fund</td>
<td>$52,000</td>
<td>$52,000</td>
</tr>
<tr>
<td>Pooled Income Fund</td>
<td>$5,000</td>
<td>$5,000</td>
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<tr>
<td>Karl Menger Fund</td>
<td>$3,550</td>
<td>$2,550</td>
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<tr>
<td>Arnold Ross Lectures</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>C.V. Newsom Fund</td>
<td>$580,548</td>
<td>$569,164</td>
</tr>
<tr>
<td>Total investment portfolio, at market</td>
<td>$26,347,012</td>
<td>$21,960,627</td>
</tr>
</tbody>
</table>

IV. Assets and Liabilities
So far this report has dealt with sources of revenue 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 above 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 Long-Term Investment Information shows the allocation of the portfolio among the three types of net assets as well as related subfunds.

The Society’s fiscal year coincides with the period covered by subscriptions and dues. 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 $8,647,000 and $6,956,000 at December 31, 1996 and 1995, respectively. The recorded liability for the revenues received in advance was about $10,553,000 and $10,127,000 at December 31, 1996 and 1995, respectively. The difference can be thought of as having been invested in the Society's other assets, principally the long-term investment portfolio. Effectively, the Society borrows from its subscribers to finance current operations and long-term investments. This is a common practice in the publishing industry and allows the Society to operate free of short-term or long-term bank debt.

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.

Respectfully submitted,
Franklin P. Peterson
Treasurer
Acknowledgment of Contributions

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The AMS, founded in 1888 to further the interests of mathematical research and scholarship, serves the national and international community through its publications, meetings, advocacy, and other programs, which
• promote mathematical research, its communication and uses,
• encourage and promote the transmission of mathematical understanding and skills,
• support mathematical education at all levels,
• advance the status of the profession of mathematics, encouraging and facilitating full participation of all individuals,
• foster an awareness and appreciation of mathematics and its connections to other disciplines and everyday life.

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The Executive Committee and Board of Trustees have established the Thomas S. Fiske Society to honor those who have made provisions for the AMS in their estate plans. For further information contact Tim Goggins at 800-321-4AMS, or tjg@ams.org.

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Memorial and commemorative gifts are a distinctive and thoughtful way to memorialize or honor a colleague, friend, or family member, and to support the Society's work to promote mathematical scholarship and research.

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To determine the size of payments, multiply the rate by the value of the asset used to create the gift annuity. For example, a seventy-five-year-old giving $100,000 receives 8.4 percent, or $8,400, annually for life.
Add this Cover Sheet to all of your Academic Job Applications

How to use this form

1. Using the facing page or a photocopy, (or a TeX version which can be downloaded from the e-math "Employment Information" menu, http://www.ams.org/profession/employ.html), fill in the answers which apply to all of your academic applications. Make photocopies.

2. As you mail each application, fill in the remaining questions neatly on one cover sheet and include it on top of your application materials.

The Joint Committee on Employment Opportunities has adopted the cover sheet on the facing page as an aid to job applicants and prospective employers. The form is now available on e-math in a TeX format which can be downloaded and edited. The purpose of the cover form is to aid department staff in tracking and responding to each application.

Mathematics Departments in Bachelor's, Master's and Doctorate granting institutions have been contacted and are expecting to receive the form from each applicant, along with any other application materials they require. Obviously, not all departments will utilize the cover form information in the same manner. Please direct all general questions and comments about the form to emp-info@ams.org or call the Professional Programs and Services Department, AMS, at 800-321-4267 extension 4105.

JCEO Recommendations for Professional Standards in Hiring Practices

The JCEO believes that every applicant is entitled to the courtesy of a prompt and accurate response that provides timely information about his/her status. Specifically, the JCEO urges all institutions to do the following after receiving an application:

(1) Acknowledge receipt of the application—immediately; and
(2) Provide information as to the current status of the application, as soon as possible.

The JCEO recommends a triage-based response, informing the applicant that he/she
(a) is not being considered further;
(b) is not among the top candidates; or
(c) is a strong match for the position.
Academic Employment in Mathematics

AMS STANDARD COVER SHEET

Last Name ____________________________ First Name ____________________________
Middle Names ____________________________

Address through June 1998 ____________________________ Home Phone ____________________________
                                              ________________________________________
                                              ________________________________________
Current Institutional Affiliation ____________________________
                                              ________________________________________
                                              ________________________________________

Highest Degree and Source ____________________________
Year of Ph.D. (optional) ____________________________
Ph.D. Advisor ____________________________

If the Ph.D. is not presently held, date on which you expect to receive ____________________________

Indicate the mathematical subject area(s) in which you have done research using, if applicable, the 1991
Mathematics Subject Classification printed on the back of this form. 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.

________________________________________

Most recent, if any, position held post Ph.D.

University or Company ____________________________
Position Title ____________________________ Dates ____________________________

Indicate the position for which you are applying and position posting code, if applicable ____________________________

If unsuccessful for this position, would you like to be considered for a temporary position?

☐ Yes  ☐ No  If yes, please check the appropriate boxes.

☐ 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 recom-
mendation if asked. Mark the box provided for each individual whom you have already asked to send a letter.

☐ ____________________________

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Reciprocity Agreements

Africa

**Egyptian Mathematical Society**
Apply to: Prof. Dr. B. I. Bayoumi (Honorary Secretary of ETMS) c/o Prof. Dr. A. S. F. Obada, Al-Azhar Univ., Fac. of Sci., Dept. of Math., Nasr City 11884, Cairo, Egypt.
Dues: U.S. $15, payable to Egyptian Mathematical Society, Al-Azhar Univ., Fac. of Sci., Dept. of Math., Nasr City 11884, Cairo, Egypt.
Privilages: Receive a 60% discount on the prices of ETMS publications, a 50% discount on the publication charge per printed page in *ETMS Journal*, and reduced charge for participating at ETMS conferences.
Officers: A-S. F. Obada (President), M. Asaad (Vice-President), F. F. Ghaleb (Treasurer), B. I. Bayoumi (Secretary).

**Nigerian Mathematical Society**
Apply to: Jerome A. Adepoju (Secretary), Nigerian Mathematical Society, Department of Mathematics, Faculty of Science, University of Lagos, Akoka, Yaba, Nigeria.
Privilages: *Journal of the Nigerian Mathematical Society* at the price normally charged to individual members.
Officers: R. F. A. Abiodum (President), G. O. S. Ekhuaguer (Vice-President), A. U. Afuwape (Treasurer), J. A. Adepoju (Secretary).

**South African Mathematical Society**
Address for mail: G. Geldenhuys, Department of Applied Mathematics, Private Bag X1, Matieland, 7602, South Africa.

Apply to: Prof. L. M. Venter, Computer Science Department, Potchefstroom University, P. O. Box 1174 Vanderbijlpark, 1900, South Africa.
Dues: U.S. $12, payable to Prof. N. T. Bishop, Department of Mathematics, Unisa, P. O. Box 392, Pretoria, 0003, South Africa.
Privilages: (1) The right to present papers at meetings of the Society; (2) the right to receive at no additional cost: (i) the *Notices of the SAMS*, (ii) the journal *Quaestiones Mathematicae*.
Officers: N. Sauer (President), T. G. Schultz (Vice-President), N. T. Bishop (Treasurer), G. Geldenhuys (Secretary).

Asia

**Allahabad Mathematical Society**
Apply to: Mona Khare, Treasurer, Allahabad Mathematical Society, 10, C. S. P. Singh Marg, Allahabad 211001, India.
Dues: U.S. $60 (category "A"), U.S. $40 (category "B"), payable to Allahabad Mathematical Society at above address.
Privilages: Members have to pay only half of the above dues.
Officers: D. P. Gupta (President), A. M. Vaidya and P. C. Joshi (Vice-Presidents), Mona Khare (Treasurer), U. K. Saxena (Secretary).

**Calcutta Mathematical Society**
Apply to: R. N. Sen, Secretary, Calcutta Mathematical Society, AE-374, Sector-I, Salt Lake City, Calcutta 700 064, India; telex: 021-5380 BID IN; fax: (0091)33-376290.

The American Mathematical Society has "reciprocity agreements" with a number of mathematical organizations around the world. A current list appears here.

These reciprocity agreements provide for reduced dues for members of these organizations who choose to join the AMS and who reside outside of the U.S. and Canada. Reciprocally, members of the AMS who reside in the U.S. or Canada may join these organizations at a reduced rate. Summaries of the privileges available to AMS members who join under the terms of reciprocity agreements are given on the following pages. Members of these organizations who join the AMS as reciprocity members enjoy all the privileges available to ordinary members of the Society. AMS dues for reciprocity members are $67 for 1997 and $64 for 1998. Each organization was asked to review and update its listing in the spring. An asterisk (*) after the name of an organization indicates that no response to this request had been received when the September *Notices* went to press. A bullet (*) before the name of an organization indicates that application forms for that organization may be obtained by writing the American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940-6248.
Indian Mathematical Society*
Apply to: S. P. Arya, Administrative Secretary, Indian Mathematical Society, Department of Mathematics, Ma- treyi College, Bapu Dham Complex, Chanakyapuri, New Delhi 110021, India.
Dues: U.S. $50, payable to M. K. Singal, Hon. Treasurer, IMS, A-1, Staff Residences, CCS University, Meerut 250005, India.
Privileges: Free copy of the Mathematics Student.
Officers: N. K. Thakare (President), M. K. Singal (Hon. Treasurer), S. P. Arya (Administrative Secretary), H. P. Dikshit (Academic Secretary), H. C. Khare (General Secretary), R. P. Agarwal (Editor, JIMS), V. M. Shah (Editor, Mathematics Student), K. S. Padmanabhan (Hon. Librarian).

The Korean Mathematical Society
Dues: U.S. $30, payable to The Korean Mathematical Society.
Privileges: Members will receive four volumes of Journal of the KMS and of Bulletin of the KMS each year.
Officers: Kun Soo Chang (President), Hong-Jae Lee, Hong Oh Kim (Vice-Presidents), Jae Moon Ahn (Treasurer), Yong-Seung Cho (Secretary).

Malaysian Mathematical Society
Apply to: Mohd Salmi Mo Noorani, Hon. Secretary, Jabatan Matematik, Fakulti Sains Matematik, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia.
Dues: U.S. $7.50, payable to Malaysian Mathematical Society at the above address.
Privileges: MMS Newsletter, Bulletin of the Malaysian Mathematical Society* (two issues per year), reduced rate for Menemui Matematik (three issues per year).
Officers: Shaharir Mohamad Zain (President), Abu Osman Md. Tap (Vice-Presidents), Bachok Taib (Treasurer), Mohd Salmi Md Noorani (Hon. Secretary).

Mathematical Society of Japan*
Apply to: Chiharu Kanasaki, Secretary, Mathematical Society of Japan, 25-9-203, Hongo 4-chome, Bunkyo-ku, Tokyo 113, Japan.
Officers: Kazuo Okamoto (President), Yuko Mizutani (Treasurer), Chiharu Kanasaki (Secretary).

Mathematical Society of the Republic of China
Apply to: Professor Dr. Young-Ye Huang, Secretary, Mathematical Society of the Republic of China, c/o Department of Mathematics, National Tsing Hua University, Hsinchu, Taiwan 30043, Republic of China.
Officers: Yuh-Jia Lee (President), Wen-Fong Ke (Treasurer), Young-Ye Huang (Secretary).

Mongolian Mathematical Society
Apply to: R. Enhbat, Secretary, Mongolian Mathematical Society, P. O. Box 46/635, Ulaanbaatar, Mongolia.
Dues: U.S. $20; payable to R. Enhbat, address above.
Privileges: Right to receive the Journal of MMS for free and to publish in Journal of MMS, participate in activities of MMS.
Officers: Ts. Dashdorj (President), B. Bayasgalan (Vice-President), R. Enhbat (Secretary).

Nepal Mathematical Society
Apply to: S. R. Pant, Secretary, Nepal Mathematical Society, Department of Mathematics, Tribhuvan University Kirtipur, Kathmandu, Nepal.
Dues: U.S. $10, payable to P. M. Bajracharya (Treasurer), Department of Mathematics, Tribhuvan University Kirtipur, Kathmandu, Nepal.
Privileges: All privileges enjoyed by an ordinary member, which includes purchasing NMS publications on concessional price. This does not include the purchasing of Nep. Math. Sc. Report (Nepali Research Journal) on concessional rate.
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Apply to: Khalid Latif Mir, Secretary, Punjab Mathematical Society, Department of Mathematics, University of the Punjab, Quaid-I-Azam Campus, Lahore 54590, Pakistan.

Dues: U.S. $25 for life membership, payable to Secretary or Treasurer.

Privileges: Mathematics Forum; proceedings of the conferences, symposia, and seminars arranged by the Society.

Officers: F. D. Anjum Roomani (President), Khalid Saleem, Maqbool Ahmad Ch. (Vice- Presidents), Muhammad Ashraf Jajja (Treasurer), Khalid Latif Mir (Secretary).

Ramanujan Mathematical Society*

Apply to: Dr. N. Jayasankaran, Director, RMS, Bharathidasan Institute of Management, P. O. Box 12, BHEL Complex, Tiruchirapalli 620 014, Tamil Nadu, India.

Dues: U.S. $20 (annual), $200 (life), payable to C. V. Venkatachalam, Prof. of Math., Manipal Institute of Technology, Manipal 576 199, India.

Privileges: Journal of Ramanujan Mathematical Society.

Officers: J. Gopalakrishna (President), M. Rajagopalan (Vice-President), C. V. Venkatachalam (Treasurer), N. Jayasankaran (Secretary).

Southeast Asian Mathematical Society*

Apply to: Southeast Asian Mathematical Society, c/o Department of Mathematics, Chinese University of Hong Kong, Shatin, N.T., Hong Kong.

Dues: U.S. $10, payable to Southeast Asian Mathematical Society.


Officers: Mari-Jo P. Ruiz (President), Polly Wee Sy (Treasurer), Luz R. Nochefranca (Secretary).

Vijnana Parishad of India

Apply to: H. M. Srivastava, Foreign Secretary, VPI, Department of Mathematics, University of Victoria, Victoria, British Columbia, V8W 2Y2 Canada, or R. C. Singh Chandel, Secretary, VPI, Department of Mathematics, D. V. Postgraduate College, Orai-285001, U. P., India.


Privileges: Jñānabha (an interdisciplinary mathematical journal currently published once a year), back volumes available at 25% discount.

Officers: J. N. Kapur (President), B. S. Rajput, M. K. Singal, G. S. Niranjan (Vice- Presidents), R. C. Singh Chandel (Secretary-Treasurer), H. M. Srivastava (Foreign Secretary).

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Apply to: O. A. Veliev, Department of Mechanics and Mathematics, Baku State University, Baku, Azerbaijan, 370145.


Privileges: All privileges of ordinary members plus 50% discount on all AzMS publications.

Officers: O. A. Veliev (President), F. A. Abdullaev (Treasurer), V. A. Gasimov (Secretary).

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Apply to: Dr. Heinrich Begehr, Fachbereich Mathematik FU, Arnimallee 2-6, D-14195 Berlin, Germany.

Dues: (Individual Members) DM 24, (Nonindividual Members) DM 200 minimum, payable to Gerhard Preuss, Institut für Mathematik 1, FU Berlin, Arnimallee 3, D-14195 Berlin, Germany.

Privileges: One free copy of Sitzungsberichte der BMG.

Officers: Heinrich Begehr (President), Erhard Behrends (Vice-President), Gerhard Preuss (Treasurer), Ernst J. Thiele (Secretary).

Croatian Mathematical Society

Apply to: Aleksandra Čižmešija, Bijenička cesta 30, 10000 Zagreb, Croatia; e-mail: hmd@cromath.math.hr.


Privileges: Vjesnik HMD (in Croatian) free of charge; the scientific journal Glasnik Matematički at the reduced rate of U.S. $15 per volume. All publications of the CMS, and fees for conferences organized by CMS, reduced by at least 25%.

Officers: Sanja Varošanec (President), Zvonimir Šikić (Vice-President), Šime Ungar (Treasurer), Aleksandra Čižmešija (Assistant Secretary).

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Address for mail: P. O. Box 5675, Nicosia, CY1311, Cyprus.

Apply to: Gregory Makrides, 6 Kitiyo Str., Dasoupolis, Nicosia, C42028, Cyprus.

Dues: U.S. $20, payable to Cyprus Mathematical Society, P. O. Box 5675, Nicosia, C41311, Cyprus.

Privileges: Will receive the annual periodical Magimatiko BHMA in Greek. Invitations to conferences organized in Cyprus, invitations to "Summer Math School" organized in Cyprus every year near the end of June.

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Reciprocity Agreements

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Apply to: Mogens Esrom Larsen, Treasurer, Dansk Matematisk Forening, Universitetsparken 5, 2100 København Ø, Denmark.
Dues: Dkr. 50, payable to Treasurer.
(Members of the American Mathematical Society do not have to join Dansk Matematisk Forening to obtain these journals. Subscription orders should be sent directly to the journals: *Normat*, Universitetsforlaget, Avd. for tidsskrifter, Postbox 2959 Tøyen, Oslo 6, Norway; *Mathematica Scandinavica*, Matematisk Institut, Aarhus Universitet, 8000 Aarhus C, Denmark.)
Officers: Christian Berg (President), Hans Plesner Jakobsen (Vice-President), Mogens Esrom Larsen (Treasurer), Hans-Jørgen Munkholm, Sten Markvorsen (Secretaries).

Deutsche Mathematiker-Vereinigung e.V.
Apply to: Deutsche Mathematiker-Vereinigung e.V., Mohrenstr. 33, D-10117 Berlin, Germany.
Dues: DM 88.
Officers: I. Kersten (President), J. Brüning (Treasurer), Dirk Ferus (Secretary).

Edinburgh Mathematical Society
Apply to: The Honorary Secretary, Edinburgh Mathematical Society, James Clerk Maxwell Building, King's Buildings, Mayfield Road, Edinburgh, EH9 3JZ, Scotland.
Dues: U.S. $12 (preferably £5 sterling), payable to the Honorary Secretary.
Privileges: *Proceedings* at reduced rate of U.S. $20 (preferably £9 sterling) per annum.
Officers: C. Maclachlan (President), P. F. Smith (Vice-President), N. K. Dickson (Treasurer), P. Heywood, C. J. Smyth (Secretaries).

Gesellschaft für Angewandte Mathematik und Mechanik (GAMM)
Address for mail: V. Ulbricht, Institut für Festkörpermechanik Technische Universität Dresden, D-01062 Dresden, Germany.
Apply to: L. Gaul, Institut A für Mechanik, Universität Stuttgart, Pfaffenwaldring 9, D-70550 Stuttgart, Germany.
Dues: DM 100, payable to G. Alefeld, Institut für Angewandte Mathematik Universität Karlsruhe, Englerstr. 2, D-76131 Karlsruhe, Germany.
Privileges: Regular publications of GAMM and participation in scientific meetings at a reduced rate.
Officers: F. Ziegler (President), R. Mennicken (Vice-President), G. Alefeld (Treasurer), V. Ulbricht (Secretary).

Glasgow Mathematical Association
Apply to: Frances Goldman, Glasgow Mathematical Association, Department of Mathematics, University of Glasgow, 15 University Gardens, Glasgow G12 8QW, Scotland.
Dues: £2.50, payable to Frances Goldman, Glasgow Mathematical Association.
Privileges: *Glasgow Mathematical Journal* available, current price to members £32.
Officers: A. Craw (President), D. McLaren (Vice-President), F. H. Goldman (Treasurer), A. Payne (Secretary).

Hellenic (Greek) Mathematical Society
Apply to: Maria Georgoudi, Hellenic Mathematical Society, 34 Panepistimiou Street, GR-10679 Athens, Greece.
Dues: U.S. $20, payable to Hellenic Mathematical Society at above address.
Privileges: The *Bulletin of HMS*, News-Bulletin (Enimerosi), discounts which are available to all members.
Officers: T. S. Bolis (President), G. Dimakos (Vice-President), A. Angelis (Treasurer), I. Tirlis (Secretary).

Icelandic Mathematical Society
Apply to: Robert Magnus, Icelandic Mathematical Society, Dunhaga 3, 107-Reykjavik, Iceland.
Dues: U.S. $10, payable to Ragnar Sigurdsson, at above address.
Privileges: Reduced subscription rate on *Mathematica Scandinavica* and *Nordisk Matematisk Tidsskrift (Normat)*; subscription orders should be sent directly to the journals.
Officers: Robert Magnus (President), Ragnar Sigurdsson (Treasurer), Birgir Gudjonsson (Secretary).

Irish Mathematical Society
Address for mail: M. Golden, Department of Mathematics, Dublin Institute of Technology, Kevin Street, Dublin, Ireland.
Apply to: J. Pulé, Treasurer, Irish Mathematical Society, Department of Mathematical Physics, University College Dublin, Belfield, Dublin 4, Ireland.
Dues: U.S. $10, payable to J. Pulé, Treasurer, IMS, at above address.
Privileges: Free copy of the *Bulletin of the Irish Mathematical Society* (two times per year), free registration at IMS annual conference (September).
Officers: C. Nash (President), D. Armitage (Vice-President), J. Pulé (Treasurer), P. Mellon (Secretary).
Reciprocity Agreements

János Bolyai Mathematical Society*
Apply to: Vice-Secretary General, Cecilia Szabados, János Bolyai Mathematical Society, Budapest, Fő utca 68, Hungary H-1027.
Dues: Are voluntary but should minimally cover duplication and mailing costs; for reciprocity members (residing outside Hungary) suggested fee is 1/8 of one percent of the member's net income; sponsoring members pay at least U.S. $180 or equivalent per year.
Privileges: Upon request, Matematikai Lapok (twice a year), Középiskolai Matematikai Lapok (monthly). If sufficient interest is expressed, a bulletin in English will be available. In addition, the JBMS is negotiating to obtain discounts for its reciprocity and sponsoring members on several serial publications and periodicals appearing in Hungary. Contact the JBMS secretary for more information regarding this and other privileges of membership.
Officers: András Hajnál (President), Gyula Katona (Secretary General), Cecilia Szabados (Vice-Secretary General), András Récsk (Treasurer).

Jednota českých matematiků a fyziků
Address for mail: Union of Czech Math & Phys., Žitná 25, 117 10 Praha 1, Czech Republic.
Dues: U.S. $20, payable to Jednota českých matematiků a fyziků.
Privileges: (i) A discount of 20% in the conference fees for conferences, symposia, summer schools, and similar events organized (or coorganized) by the JČMF; (ii) newsletter.
Officers: Jaroslav Kurzweil (President), Štefan Schwabik, Štefan Zajac, Eduard Fuchs (Vice-Presidents), Štefan Zajac (Treasurer), Mílada Kočandrová (Secretary).

Jednota slovenských matematikov a fyzikov (JSMF) (Union of Slovak Mathematicians and Physicists)*
Apply to: Hilda Draškovičová, Sekretariát JSMF, MFF UK, Mlynská dolina, 842 15 Bratislava, Slovakia.
Privileges: A discount of 20% in conference fees for conferences, symposia, summer schools, and similar events organized by the Society JSMF.
Officers: Peter Lukáč (President), Stanislav Jendrol (Vice-President), Hilda Draškovičová (Treasurer), Hilda Draškovičová (Secretary).

London Mathematical Society
Apply to: Miss S. M. Oakes, London Mathematical Society, Burlington House, Piccadilly, London W1V ONL, United Kingdom.
Dues: £8.50, U.S. $17.00, payable to London Mathematical Society. (New members should not send payment until elected.)
Officers: J. M. Ball (President), W. A. Hodges, A. J. Macintyre (Vice-Presidents), A. O. Morris (Treasurer), J. S. Pym (Council and General Secretary), D. J. H. Garling (Meetings and Membership Secretary), E. C. Lance (Publications Secretary).

Norsk Matematisk Forening*
Apply to: Inger Jansen, Norsk Matematisk Forening, Matematikk Institutt, Postboks 1053 Blindern, N-0316 Oslo 3, Norway.
Dues: Nkr. 50 or Nkr. 500 for permanent membership, payable to Inger Jansen, Norsk Matematisk Forening.
Privileges: Reduced subscription rate on Mathematica Scandinavica and NORMAT (Nordisk Matematisk Tidskrift), free monthly information bulletin Infomat about the activities of the Society.
Officers: Bent Birkeland (President), John Rognes (Vice-President), Erik Low (Treasurer), Jon Reed (Secretary).

Österreichische Mathematische Gesellschaft
Address for mail: Technische Universität WIEN, Wiedner Hauptstrasse 8-10, A-1040 Wien, Austria.
Apply to: Gilbert Helmberg, Universität Innsbruck, Technikerstrasse 13, A-6020 Innsbruck, Austria.
Dues: ÖS 200, payable to ÖMG (PSK acct. nr. 7823.950), Karlsplatz 13, A-1040 Wien, Austria.
Privileges: Internationale Mathematische Nachrichten (IMN), reduction of fees at our congresses and meetings.
Officers: Gilbert Helmberg (President), Ludwig Reich (Vice-President), Inge Troch (Treasurer), Hans-Christian Reichel (Secretary).

Polskie Towarzystwo Matematyczne
Apply to: President of Polish Mathematical Society, ul. Sniadeckich 8, 00-950 Warszawa, Poland.
Dues: U.S. $20, payable to Polskie Towarzystwo Matematyczne, Zarząd Główny, ul. Sniadeckich 8, 00-950 Warszawa, Poland.
Privileges: Participation in scientific conferences organized by the Polish Mathematical Society and in its scientific sessions; in addition, members receive one of the following four series of the publication Annales Societatis Mathematicae Polonae: Commentationes Mathematicae in congress languages, Wiadomości Matematyczne (Mathematical News) in Polish, Matematyka Stosowana (Applied Mathematics) in Polish and congress languages,
Reciprocity Agreements

Dyndaktyka Matematyki (Didactics of Mathematics) in Polish.

Officers: Kazimierz Goebel (President), Lech Górniwicz, Jerzy Muszyński (Vice-Presidents), Łukasz Stettner (Treasurer), Jan Butkiewicz (Secretary), Janusz Kowalski (Vice-Secretary).

Real Sociedad Matemática Española

Apply to: J. Llovet, Secretario General de la Real Sociedad Matemática Española, Dept. Matematicas, Universidad Alcala, 28871 Alcala Henares (Madrid), Spain.

Dues: U.S. $30, payable to Secretario, R.S.M.E.

Privileges: Gaceta Matematica and Revista Matematica Ibero Americana.

Officers: J. M. Aroca (President), Juan Llovet Verdugo (Secretary).

Sociedade Portuguesa de Matemática

Apply to: J. F. Rodrigues, Sociedade Portuguesa de Matemática, Av. da República 37 4ª, 1050 Lisboa, Portugal.

Dues: 3500 PTE. The reciprocity members are asked to pay half of this amount.

Privileges: Boletim da Sociedade Portuguesa de Matemática; Bolha informativa da Sociedade Portuguesa de Matemática; discount of 70% in subscription of Portugaliae Mathematica.

Officers: G. N. de Oliveira (President), J. A. Dias de Silva (Vice-President), F. Veiga de Oliveira (Treasurer), M. R. Grossinho, J. Júdice (Secretaries).

Societat Catalana de Matemàtiques

Apply to: Secretari de la Societat Catalana de Matemàtiques, Carrer del Carme 47, 08001 Barcelona, Spain.

Dues: 1500 pessetes for members of the AMS, payable to the Societat Catalana de Matemàtiques.

Privileges: Butlleti de la Societat Catalana de Matemàtiques (two times a year) plus SCM/Notices (six issues a year).

Officers: Sebastià Xambó-Descamps (President), Joaquim Ortega-Aramburu (Vice-President), Xavier Martínez-de-Albéniz (Treasurer), Antoni Gomà-Nassarre (Secretary).

Societatea Matematicienilor din Romania

Apply to: Horia I. Ene, Calea Grivitei 21, P. O. Box 1-764, 70700 Bucharest, Romania.

Dues: U.S. $10, payable to Societatea Matematicienilor din Romania, address same as above.

Privileges: Reduced rates for participation in scientific conferences organized by SMR, Bulletin Mathématiques (four times per year) free.

Officers: Horia I. Ene (President), Nicolae Popa (Vice-President), Serban Barcanescu (Treasurer), Radu Purice (Secretary).

Société Mathématique de Belgique

Apply to: J. Leroy, Secretary, Société de Mathématique de Belgique, C.P. 218/01, Campus Plaine, Bd du Triomphe, 1050 Bruxelles, Belgium; e-mail: LEROY@ULB.AC.BE.

Dues: 500 Bef (around U.S. $15), payable to Société Mathématique de Belgique, preferably by International Money Order, VISA, MasterCard, or American Express.

Privileges: Bulletin of the Belgian Mathematical Society-Simon Stevin (five issues per year), newsletter.

Officers: F. Dumortier (President), J. Schmets (Vice-President), S. Caenepeel (Treasurer), J. Leroy (Secretary).

Société Mathématique de France

Apply to: Société Mathématique de France, Attn. Claire Ropartz, Institut Henri Poincaré, 11 Rue Pierre et Marie Curie, 75231 Paris cedex 05, France.

Dues: U.S. $40, payable to American Mathematical Society or SMF.


Officers: Jean-Jacques Risler (President), F. Blanchard, P. Béard, J. Camus (Vice-Presidents), P. L. Hennequin (Treasurer), M. Loday-Richaud, P. Schapira (Secretaries).

Société Mathématique Suisse

Apply to: G. Wanner, Secretary, SMS, Case postale 240, CH-1211 Geneve 24, Switzerland.

Dues: SFr. 25, for members of the AMS residing outside Switzerland, payable to G. Wanner, SMS Secretary, at above address.

Privileges: Commentarii Mathematici Helvetici (reduced price), information concerning activities of SMS.

Officers: F. Sigrist (President), H. Jarchow (Vice-President), G. Wanner (Treasurer-Secretary).

Société de Mathématiques Appliquées et Industrielles

Apply to: Société de Mathématiques Appliquées et Industrielles (SMAI), Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France.

Dues: Fr. 220 francs (for AMS members), payable to Société de Mathématiques Appliquées et Industrielles at above address.

Privileges: Free subscription to Matapli (four issues a year), free membership list (every two years).

Officers: A. Damlamian (President), F. Murat (Treasurer), B. Prum (Secretary).

Society of Associations of Mathematicians and Computer Scientists of Macedonia

Apply to: Boro Piverevski, President SAMCSM, Pirinska B.B., 91000 Skopje, Macedonia.
Dues: $5, payable to SDMI na MAKEONIA, acc. 40120-678-10217, Pirinska B.B. 91000 Skopje, Macedonia.

Privileges: Receive the Bulletin of SANCSM and take part in SAMCSM activities.

Officers: Boro Piperevski (President), Borko Ilievski (Vice-President), Kosta Misevski (Treasurer), Vasilje Markcevski (Secretary).

Society of Mathematicians, Physicists, and Astronomers of Slovenia

Address for mail: DMFA, Jadranska 19, P.P. 2964, 1001 Ljubljana, Slovenia.

Apply to: Peter Legia, FMF, Jadranska 19, P.P. 2964, 1001 Ljubljana, Slovenia.

Dues: U.S. $30, payable to SKB banka, Ajdovscina 4, 1000 Ljubljana, Slovenia.

Privileges: Subscription to Obzornik za matematiko in fiziko (surface mail).

Officers: Andrej Cadz (President), Nada Razpet (Vice-President), SEL d.o.o (Treasurer), Janez Krušič (Secretary).

Suomen matemaattinen yhdistys

Apply to: Jari Taskinen, Secretary, Department of Mathematics, P.O. Box 4, Yliopistonkatu 5, FIN-00014 University of Helsinki, Finland.

Dues: FIM 80, payable to Aatos Lahtinen, Treasurer, Department of Mathematics, P.O. Box 4 (Yliopistonkatu 5), FIN-00014 University of Helsinki, Finland.

Privileges: Archimedes (four issues a year) and Eukleides (newsletter), Mathematica Scandinavica at reduced rate.

Officers: Antti Kupiainen (President), Sören Illman (Vice-President), Aatos Lahtinen (Treasurer), Jari Taskinen (Secretary).

Svenska Matematikersamfundet

Apply to: Andrejs Dunkels, Dept. of Mathematics, Luleå Technical University, S-97187 Luleå, Sweden.

Dues: 50 SKr., payable to Svenska Matematikersamfundet, Britt-Marie Stocke, Department of Mathematics, University of Umeå, S-90187 Umeå, Sweden.

Privileges: Mathematica Scandinavica and Nordisk Matematisk Tidsskrift at reduced rate, information about the meetings of the Society.

Officers: Lars-Erik Persson (President), Ulf Persson (Vice-President), Britt-Marie Stocke (Treasurer), Andrejs Dunkels (Secretary).

Union of Bulgarian Mathematicians

Apply to: Sava Ivanov Grozdev, Secretary, Union of Bulgarian Mathematicians, Acad. G. Bonchev Str., Block 8, P.O. Box 155, BG-1113 Sofia, Bulgaria.

Dues: Voluntary, payable to Union of Bulgarian Mathematicians, Account #185-7808, State Savings Bank/DSK/ code 421-121-817-001-1, BNB, Sofia City Branch.

Privileges: The right to attend all events organized by the UBM free of registration fees and to present papers at them; the right to attend other events in Bulgaria with a 30% discount on registration fees, and the right to purchase all UBM editions with the same subscription discount.

Officers: Ch. Lozanov (President), L. Davidov (Treasurer), S. Grozdev (Secretary General).

Unione Matematica Italiana

Apply to: Enrico Obrecht, Treasurer, Segreteria della Unione Matematica Italiana, Dipartimento di Matematica, Piazza Porta S. Donato, 5-40126 Bologna, Italy.

Dues: 75,000 lire, payable to Unione Matematica Italiana.

Privileges: Free Notiziario dell'UMI (monthly), Bollettino dell'UMI, Ser. A (three issues a year), and membership list.

Officers: Alberto Conte (President), Carlo Sbordone (Vice-President), Enrico Obrecht (Treasurer), Giuseppe Anichini (Secretary).

Wiskundig Genootschap*

Address for mail: Wiskundig Genootschap, Delft University of Technology, Faculty of TWI, P. O. Box 5031, 2600 GA Delft, The Netherlands.

Apply to: Membership Department, Wiskundig Genootschap, University of Utrecht, Postbus 80010, 3508 TA Utrecht, The Netherlands.

Dues: Hfl 55., payable to Amro Bank, Utrecht, The Netherlands, account 45.65.88.167, Penningmeester Wiskundig Genootschap.

Privileges: Nieuw Archief Voor Wiskunde (three issues a year containing articles and a problem section), Mededelingen (nine issues a year containing announcements and book reviews), Proceedings of the Royal Academy of Sciences—"Indagationes Mathematicae" (can be obtained at a reduced subscription rate of Hfl 185).

Officers: A. van der Shuis (President), E. G. F. Thomas (Vice-President), J. D. Stegeman (Treasurer), R. W. Goldbach (Secretary).

Latin America

Sociedad Colombiana de Matemáticas*

Apply to: Ernesto Acosta, Sociedad Colombiana de Matemáticas, Apartado Aéreo 2521, Bogotá, D.C., Colombia.

Dues: U.S. $22, payable to Sociedad Colombiana de Matemáticas.

Privileges: Either Revista Colombiana de Matemáticas (two issues a year) or Lecturas Matemáticas (two issues a year).

Officers: Ernesto Acosta (President), Diego Escobar (Vice-President), Joaquín Luna (Secretary) Fernando Bernal (Treasurer).
Reciprocity Agreements

**Sociedad de Matemática de Chile**

*Apply to:* Secretario, Sociedad de Matemática de Chile, Casilla 16164, Correo 9 Santiago, Chile.

*Dues:* U.S. $20, payable to Sociedad de Matemática de Chile.

*Privileges:* Receive *Gaceta de la Sociedad, Notas de la Sociedad de Matemática de Chile*.

*Officers:* Rolando Rebolledo (President), Víctor Cortés (Vice-President), Hernán Burgos (Treasurer), Rodrigo Ramón (Secretary), Alicia Labra, Sergio Plaza, Myrna Wallace (Directors).

**Sociedad Matemática de la República Dominicana*-

*Apply to:* Isidro Rodríguez, Sociedad Matemática de la República Dominicana, P. O. Box 797-2, Santo Domingo, Dominican Republic.

*Dues:* U.S. $10, payable to Isidro Rodríguez, Sociedad Matemática de la República Dominicana.

*Privileges:* Right to receive *Notimat* (bimonthly newsletter) and *Revista Matemática Dominicana* (twice a year).

*Officers:* Amado Reyes (President), David Castillo (Vice-President), Isidro Rodríguez (Treasurer), Luis Leclerk (Secretary).

**Sociedad Matemática Mexicana*-

*Apply to:* Rosa Sánchez, Apartado Postal 70-450, 04510-México, D. F. México.

*Dues:* U.S. $25, payable to Sociedad Matemática Mexicana.

*Privileges:* To be a regular member paying half of the regular fee for persons living outside of Mexico. Newsletter, *Bulletin of the Mexican Mathematical Society*, or *Miscelanea Matematica*.

*Officers:* José Carlos Gómez-Larrañaga (President), Roberto Martínez (Vice-President), Ernesto Vallejo (Treasurer), Federico Sabina (Executive Secretary), Francisco Mírabal (Secretary), Salvador García-Ferreira and Isabel Puga (Associate Secretaries).

**Sociedad Uruguaya de Matemática y Estadística**

*Address for mail:* IMERL, Facultad de Ingeniería, CP 30, Montevideo, Uruguay.

*Apply to:* Jorge Blanco, Secretario de SUME, Facultad de Ciencias Económicas y de Administración, Av. G. Ramírez 1926, Montevideo, Uruguay.

*Dues:* Contact Sociedad Uruguaya de Matemática y Estadística for dues information; payable to: Miguel Galmés, Facultad de Ciencias Económicas y de Administración, Av. G. Ramírez 1926, Montevideo, Uruguay.

*Officers:* José L. Massera (President), Miguel Galmés (Treasurer), Jorge Blanco (Secretary).

**Sociedade Brasileira de Matemática*-

*Apply to:* Diretoria da SBM, Estrada Dona Castorina—110, Jardim Botânico, Rio de Janeiro, RJ, Brazil, 22.460.

*Dues:* U.S. $50, payable to Sociedade Brasileira de Matemática.

*Privileges:* *Boletim da SBM* (two issues per year), *Revista Matemática Universitária* (two issues per year); *Ensaios* and other publications can be purchased at a 25% discount.

*Officers:* Marcio G. Soares (President), Mario J. Dias Carneiro (Vice-President), Pedro Mendes (Treasurer), Maria Elasir S. Gomes (Secretary).

- **Sociedade Brasileira de Matemática Aplicada e Computacional*-

*Apply to:* Comissão de Admissão da SBMAC, Rua Lauro Müller 455, 22290, Botafogo, Rio de Janeiro, RJ, Brasil.

*Dues:* U.S. $30, payable to Sociedade Brasileira de Matemática Aplicada e Computacional.

*Privileges:* *SBMAC Bulletin* and *SBMAC Notices*.

*Officers:* Ricardo S. Kubrusly (President), Cristina Cunha (Vice-President), Jaime M. Rivera (Treasurer), Rolci Cippolati (Secretary).

- **Sociedade Paranaense de Matemática*-

*Apply to:* C. Pereira da Silva, Sociedade Paranaense de Matemática, Caixa Postal 1261, 80001-970, Curitiba-PR, Brasil.

*Dues:* U.S. $12, payable to Sociedade Paranaense de Matemática.

*Privileges:* *Boletim da Sociedade Paranaense de Matemática* (two issues per year), *Monografias da Sociedade Paranaense de Matemática*.

*Officers:* C. Pereira da Silva (President), R. J. B. De Sampiao (Vice-President), E. Andretta (Treasurer), A. Moser (Secretary).

- **Unión Matemática Argentina**

*Apply to:* Isabel Dotti, FaMAF Ciudad Universitaria, 5000 Córdoba, Argentina; tel. 54-51-334051; fax. 54-51-334054; e-mail: uma@mate.uncor.edu.

*Dues:* U.S. $40, payable to Isabel Dotti, FaMAF Ciudad Universitaria, 5000 Córdoba, Argentina.

*Privileges:* Free subscription to *Noticiero UMA* and one of either *Revista de la Unión Matemática Argentina* or *Revista de Educación Matemática*.

*Officers:* Juan A. Tirao (President), Felipe Zo (Vice-President), Isabel Dotti (Treasurer), Jorge Vargas (Secretary).

Middle East

**Iranian Mathematical Society**

*Apply to:* Rashid Zaare-Nahandi (Secretary of the IMS), P. O. Box 13145-418, Tehran, Iran.

*Dues:* U.S. $20, Iranian Mathematical Society, P.O. Box 13145-418, Tehran, Iran.
Privileges: *Bulletin of the Iranian Mathematical Society, Farhang va Andisheh Raei*azi (a mathematical journal in Persian, if applicable), newsletter (in Persian, if applicable), and reduced rate for participation in the annual Iranian mathematics conferences and other seminars organized by IMS.

Officers: A. Riyazi (President), E. Babolian (Treasurer), R. Zaare-Nahandi (Secretary).

• **Israel Mathematical Union**
  
  Apply to: Jeremy Schiff, Secretary, Dept. of Mathematics and Computer Science, Bar-Ilan University, Ramat-Gan 52900, Israel.
  
  Dues: U.S. $10, payable to Ron Adin, Treasurer, Dept. of Math. and Computer Science, Bar-Ilan University, Ramat-Gan 52900, Israel.
  
  Privileges: Participation in meetings and all other privileges enjoyed by an ordinary member.

  Officers: Lawrene Zalcman (President), Ron Adin (Treasurer), Jeremy Schiff (Secretary).

• **Palestine Mathematical Society**
  
  Address for mail: P. O. Box 1862, Ramallah, West Bank, via Israel.
  
  Apply to: Fawzi Yagoub, Department of Mathematics and Computer Science, SUNY College at Fredonia, Fredonia, NY 14063.
  
  Dues: U.S. $30, payable to Fawzi Yagoub, see address above.
  
  Privileges: Free issues of the *PSMS Newsletter*; 50% reduction on all PSMS conference fees; 50% reduction on all PSMS publications.

  Officers: Marwan Awartani (President), Tahseen Mughrabi (Vice-President), Abdul-Hamid Aburrub (Treasurer), Haiganoush Preisler (Secretary).

• **Saudi Association for Mathematical Sciences**
  
  Apply to: Sameer Klub, Secretary of SAMS, Department of Mathematics, College of Science, King Saud University, P. O. Box 2455, Riyadh 11451, Saudi Arabia.
  
  Dues: U.S. $30, payable to Saudi Association for Mathematical Sciences, Dept. of Math., College of Science, King Saud University, at above address.
  
  Privileges: Reduction in membership fee from U.S. $40 to U.S. $30; proceedings of conferences, symposia, and seminars arranged by the Association.

  Officers: Fawzi A. Al-Thukair (President), Abdul Rahman Abu Ammah (Vice-President), Tahseen Ghazal (Treasurer), Sameer Kloub (Secretary).

• **Australian Mathematical Society Inc.**
  
  Address for mail: Australian Mathematical Society, Department of Mathematics, University of Tasmania, GPO Box 252-37, Hobart, Tasmania 7001, Australia.

Apply to: A. Howe, Treasurer, Australian Mathematical Society, Mathematics Department, Australian National University, Canberra ACT 0200, Australia.

Dues: $Aust 34, payable to the Australian Mathematical Society Inc., c/o A. Howe at the above address.


Officers: A. J. van der Poorten (President), A. L. Carey, D. W. Robinson & E. O. Tuck (Vice-Presidents), A. Howe (Treasurer), D. Elliott (Secretary).

• **New Zealand Mathematical Society**
  
  Address for mail: NZ Mathematical Society, C/- Dr. Stephen Joe (NZMS Secretary), Department of Mathematics, University of Waikato, Private Bag 3105, Hamilton, New Zealand; tel: +64-7-856-2899, ext. 8363; fax: +64-7-838-4666; e-mail: stephenj@math.waikato.ac.nz.

Apply to: John A. Shanks, Department of Mathematics and Statistics, University of Otago, P. O. Box 56, Dunedin, New Zealand.

Dues: NZ $16, payable to John A. Shanks, Department of Mathematics and Statistics, University of Otago, P. O. Box 56, Dunedin, New Zealand.

Privileges: *Newsletter of the NZMS* (three per year).

Officers: Douglas Bridges (President), Rob Goldblatt (Incoming Vice-President), Mick Roberts (Treasurer), Stephen Joe (Secretary), John Shanks (Membership Secretary).
Reference

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.

Upcoming Deadlines

September 15, 1997: Deadline, NSF Division of Mathematical Sciences Research Experiences for Undergraduate Sites. Inquiries: reu.dms@nsf.gov.


December 1, 1997: Deadline for receipt of applications for AMS Centennial Fellowships. For application forms, write Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248; 401-455-4103; e-mail ams@ams.org. Forms are also available at http://www.ams.org/committee/profession/.

December 5, 1997: Deadline for submission of manuscripts to be considered for Ferran Sunyer i Balaguer Prize. For further information, consult the Web site http://crm.es/info/ffsb.htm.

December 9, 1997: Deadline for proposals for NSF Professional Opportunities for Women in Research and Education (POWRE) for fiscal year 1998. Denise Caldwell, telephone 703-306-1807, dcaldwe1@nsf.gov.

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Mathematics Research Institutes
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American Mathematical Society

History of Mathematics

The Way I Remember It
Walter Rudin, University of Wisconsin, Madison
Volume 12; 1997, reprinted 1997; 191 pages; Softcover; ISBN 0-8218-0633-5; List $29; All AMS members $23; Order code HMATH/12NA

Poincaré and the Three Body Problem
June Barrow-Green, The Open University, Milton Keynes, UK
Volume 11; 1997, reprinted with corrections 1997; 272 pages; Softcover; ISBN 0-8218-0367-4; List $49; All AMS members $39; Order code HMATH/11NA

Sources of Hyperbolic Geometry
John Stillwell, Monash University, Clayton, Victoria, Australia
Volume 10; 1996; 153 pages; Hardcover; ISBN 0-8218-0632-7; List $59; All AMS members $47; Order code HMATH/10NA

Ramanujan: Letters and Commentary
Bruce C. Berndt, University of Illinois, Urbana, and Robert A. Rankin, University of Glasgow, Scotland
... a very valuable addition to the literature on Ramanujan. —Choice
... delightful reading ... —Zentralblatt für Mathematik
... British contemporaries of Ramanujan have combined perfectly to produce this book.
—American Mathematical Monthly
Volume 9; 1995, reprinted 1996; 347 pages; Hardcover; ISBN 0-8218-0287-9; List $59; All AMS members $47; Order code HMATH/9NA

The Emergence of the American Mathematical Research Community, 1876–1900: J. J. Sylvester, Felix Klein, and E. H. Moore
Karen Hunger Parshall, University of Virginia, Charlottesville, and David E. Rowe, University of Mainz, Germany
... fine and extensive account of the growth of mathematics in the United States ...
—Isis
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Henk J. M. Bos, Mathematics Institute, Utrecht, Netherlands
Volume 7; 1993; 197 pages; Hardcover; ISBN 0-8218-9001-8; List $86; Individual member $62; Order code HMATH/7NA

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Smilka Zdravkovska, Mathematical Reviews, and Peter L. Duren, University of Michigan, Ann Arbor, Editors
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G. W. Mackey, Harvard University, Cambridge, MA, Editor
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—Mathematical Reviews
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—Zentralblatt für Mathematik
Volume 5; 1992; 370 pages; Hardcover; ISBN 0-8218-9004-2; List $82; Individual member $31; Order code HMATH/5NA

Operations Analysis in the United States Army Eighth Air Force in World War II
Charles W. McArthur, Tallahassee, FL

A Century of Mathematics in America, Parts I, II, III
Peter Duren, University of Michigan, Ann Arbor, Editor
Part I; 1988, reprinted 1991; 905 pages; Hardcover; ISBN 0-8218-0136-0; List $93; Individual member $56; Order code HMATH/3NA

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Mathematics Calendar

September 1997


Program: The program will involve a visitor program, a series of international workshops, graduate courses, and seminars. Groups active in dynamical systems, operator theory, and pattern formation in Amsterdam, Delft, Groningen, Leiden, and Utrecht will be involved in organizing different workshops.

Organizing Committee: L.A. Peletier (Leiden) and S.M. Verduyn Lunel (Amsterdam).

Workshops: Finite dimensional dynamical systems (week 40); Multi-bump solutions (week 41); Dynamics of differential equations with delay (week 42); Operators and dynamical systems (week 43); Interactions in space: improving the mean field approximation (week 44); Interfaces and parabolic regularization (week 46).

Kloosterman Lecture Series: During the fall semester J.K. Hale of Georgia Institute of Technology will be Kloosterman Professor at Leiden University. He will give a graduate course entitled Diffusivity and Dynamics.

Fellowships: There is a limited number of fellowships available. Applications should be submitted before April 15, 1997, to: Lorentz Center, attn: Professor G. van Dijk, director, Leiden University, P.O. Box 9512, 2300 RA Leiden, The Netherlands.

Sponsors: Financial support for the program is provided by a SWON Centraal Haarlemme, the Lorentz Center, NWO and the research schools Thomas Stieltjes Institute for Mathematics and the Mathematical Research Institute.

Information: Contact the organizers via e-mail: peletier@wis.leidenuniv.nl or verduyn@fwi.uva.nl.


Organizer: M.-P. Chen.

Scientific Committee: S. Elaydi (Trinity), G. Ladas (Rhode Island), M.-P. Chen (Academia Sinica).

Topics: Mathematical biology, nonlinear dynamics, numerical analysis, oscillation theory, asymptotic theory, stability and control theory, computational linear algebra, orthogonal polynomials and special functions, combinatorics and other areas that lie under the scope of the Journal of Difference Equations and Applications.

Main Speakers (tentative): B. Aulbach (Augsburg), R. L. Graham (AT&T Bell Labs), V. Kolmanovskii (Moscow), G. Ladas (Rhode Island), D. Trigiani (Florence), J. A. Yorke (Maryland), Yu (China), D. Zeilberger (Temple).

Deadlines: Deadline for submitting papers for the proceedings is October 1, 1997. Papers may be submitted to any member of the scientific committee. Deadline for submission of abstracts and registration forms: March 15, 1997.

Information: To receive a registration form and more information about the conference, please contact M.-P. Chen, Institute of Mathematics, Academia Sinica, Taipei, Taiwan 11529; tel: office 02-785-1211 ext. 414; (home) 02-782-4734; fax: 02-782-7432; e-mail: maapo@cc.urcuc.sinica.edu.tw.


Information: Gr. Stamilov, University of Sofia, Faculty of Mathematics and Informatics, Blvd. James Bourchier 5, 1164 Sofia, Bulgaria, e-mail: stamilov@mai.unisofia.bg.

1-10 Advanced Course on Stochastic Analysis, Centre de Recerca Matematica, Campus de l'Universitat Autonoma de Barcelona, Bellaterra, Spain. (Jan. 1997,
2–4 International Colloquium in Sub-Riemannian Geometry, Instituto de Matematica e Estatistica, Universidade de Sao Paulo, Brazil.

Sponsors: University of Sao Paulo (USP), Ecole Normale Superieure de Paris (ENS), and Comite Francais d’Evaluation de la Cooperation Universitaire avec le Bresil (COFECUB).

Organizing Committee and Information: C. Gorodski (gorodski@ime.usp.br), E. Falbel (falbel@math.jussieu.fr), and J.J. Risler (risler@dma.ens.fr).

Description: This colloquium is intended to bring together researchers interested in various aspects of sub-Riemannian geometry and its applications (e.g., control theory, hypoelliptic operators, Cauchy-Riemann structures). It is simultaneous to the congress “Science, Nature and Society”, organized by USP and ENS.

Submissions: Please contact the organizing committee via e-mail.

4–9 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.


Organizer: J. Guckenheimer.

Information: Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.


Scientific Committee: W. Benz (Hamburg), R. Ger (Katowice), J. Ratz (Bern), L. Reich (Graz).

Local Organizers: D. Gronau, J. Schwaiger, L. Reich (University of Graz).

Information: Participation is by invitation only. Those who wish to be invited should write to one of the local organizers (Institut fur Mathematik, Universitat Graz, Heinrichstrasse 36, A-8010 Graz; e-mail: isfe@ktunigraz.ac.at).


Topics: Emphasis is on the interactions between several aspects of discrete mathematics, mathematical optimization, and theoretical computer science.


Contributed Lectures: If you plan to give a contributed talk (25 min), please prepare an abstract no longer than one page. Please do not forget to include the title of your talk on the registration form. The final deadline for the submission of abstracts is June 15. Please send a hard copy of the abstract to the address below and, if possible, also send a LaTeX-version of your abstract by e-mail.

Registration: Registration deadline is June 15. The registration fee for participants is DM 100. Students pay a reduced price of DM 50, and for accompanying persons the fee is DM 40. The registration fee covers the cost of conference materials (not including the special issue of Discrete Applied Mathematics) as well as admission to social events (boat excursion, organ recital).

Information: For further information including registration form, list of participants, etc., see our WWW page (URL given below) or write to: ODSA’97, Universitaet Rostock, FB Mathematik, 18051 Rostock, Germany; fax +49 1801 1520; e-mail: odsa97@neptun.math.uni-rostock.de; http://ftp://neptun.math.uni-rostock.de/www/odsa97.html.


Call for Papers: The program of the conference will include invited 50-minute lectures and 20–minute communications. If you are interested in giving a communication, please send a 15-line abstract. All invited lectures and communications can be published in the conference proceedings.

Invited Plenary Speakers: D. N. Arnold (USA), I. Babuska (USA), G. H.-Bock (FRG), G. Girod (USA), W. Le Tallec (France), A. Quarteroni (Italy), Ch. Schwab (Switzerland), J. Struckmeier (FRG), A. Valli (Italy), W.-L. Wendland (FRG), J.-R. Whiteman (Great Britain).

Topics: Fluid dynamics; non-Newtonian and viscoelastic flows; porous media flows; material, structures and optimization; structural mechanics.

Fees: The basic fee is US $500. The basic fee for accompanying persons is US $250. Some reduction of the conference fee will be possible for a limited number of Ph.D. students and participants from East European countries.

Important Dates: February 28, 1997: submittal of the registration form and 15-line abstract; April 30: notification of acceptance of the communication; May 31: payment of the conference fee; September 7: arrival; registration; September 8–11: scientific program; September 11 or 12: departure.

Information: M. Feistauer, Charles University Prague, Faculty of Mathematics and Physics, Institute of Numerical Mathematics, Malostranske nam. 25, 118 00 Praha 1, Czech Republic; e-mail: mfeist@elf.elf. cuni.cz; tel: +42-2-21914223, +42-2-533258; fax: +42-2-533229.


Organizers: Organized in cooperation with SIAM, the Society for Industrial and Applied Mathematics.

Focus: Applications of mathematics to industry, technology, science and society.

Information: http://math.umn.edu/COFE/PanAm.html; e-mail: pana97@mat.ufrgs.br.

9–12 1997 World Conference on the Boundary Element Method, University of Rome, Italy. (Feb. 1997, p. 266)

Organizing Committee: S. Corradi, G. Konoumopulos, M. Marchetti, D. Vahedi.

Conference Secretariat: L. Kerr, BEM 19, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, S040 7AA, UK; tel: 44-0-1703-29223; fax: 44-0-1703-29285; e-mail: liis@wessex.wit.ac.uk.

Conference Objective: The practical applications of structural optimization techniques which are well recognized by industry offer important advantages in the design of aircraft and are used in the analysis of automotive, civil, and mechanical engineering components. Computer-aided structural design is enhanced by adding optimization software, and its influence cannot be overestimated. By linking both techniques, integrated packages for structural optimization are obtained. The objective of this conference is to bring together researchers and engineers in order to communicate recent advances in structural optimization and also to demonstrate how optimization can be applied in engineering practice.

Topics: Elastodynamics, fracture mechanics & fatigue, inelastic problems, composite materials, plates and shells, contact mechanics, geomechanics, material processing and metal forming, soil dynamics, electromagnetics, biomechanics, fundamental principles, computational techniques, refinement methods & adaptive techniques, sensitivity analysis, inverse problems, applications in optimization, industrial applications, heat transfer, fluid dynamics & aerodynamics, compressible & incompressible flow, viscous flow, non-Newtonian flow, groundwater flow, interfacial & free surface flow, transport problems, wave propagation problems, acoustics, high performance computing, algorithms for parallelization & vectorization of BEM, massively parallel processing, expert systems in BEM.

Local Organization: J.-M. Müller.

Purpose: SCAN-97 will provide a forum for the presentation of the latest research and developments in theory, algorithmic and arithmetic design for validated numerics, demonstration of new software available for validated numerics, reporting of interesting case studies in industrial and scientific applications of validated numerics, and for the discussion of new directions in research and development suggested by other advances in scientific computing. Potential new directions are the use of parallel architectures for the implementation of validation algorithms and the use of validation ideas in computer algebra. Furthermore, the conference should help in the dissemination of the ideas and potentials of validated numerics to interested scientists from other areas of scientific computing. Within the scope of SCAN-97, there is no restriction regarding the mathematical or application background of the problems to be reported: algebra, analysis, optimization, probability, etc., are equally welcome.

11–13 XVth International Congress of Mathematical Biology, Paris, France.

Program: Artificial Intelligence, intelligence of living phenomena.

Paper Submission: An abstract of one page in French or English is required before July 15. Send to the Secretariat of the Congress, 11 bis av de la Providence, 92160 Antony, France.

Fee: 250 FF.

11–13 Workshop on Algorithm Engineering, Venice, Italy. (Feb. 1997, p. 266)

Aim: The workshop is devoted to researchers and developers interested in the practical aspects of algorithms and their implementation issues. In particular, it will bring together researchers, practitioners, and developers in the field of algorithm engineering to foster cooperation and exchange of ideas.

Themes: Relevant themes of the workshop are the design, experimental testing and tuning of sequential, parallel, and distributed algorithms to the point where they are readily available for practical deployment.

Sponsor: The workshop will be partly sponsored by ALCOM-IT, a European Union ESPRIT LTR Project.

Submissions: Authors should submit an extended abstract (max 10 pages). Authors are strongly encouraged to submit their extended abstracts electronically. A detailed description of the electronic submission process will be available on the World Wide Web and will be accessible through the WAE 97 Web page listed below. Authors who do not wish to submit electronically are invited to send 6 copies (printed double-sided if possible) of an extended abstract and a cover letter to G. F. Italiano at the address below.

Information: G. F. Italiano, Dipartimento di Matematica Applicata e Informatica, Università "Ca Foscari" di Venezia, via Torino 155, 30172 Venezia Mestre, Italy; tel: +39-41-2906427; fax: +39-41-2906419; e-mail: wae97@dsi.unive.it; http://www.dsi.unive.it/~wae97/.

13–14 The Ontario Analytic Geometry Seminar, University of Waterloo, Waterloo, Ontario, Canada.

Information: http://www.math.uwo.ca/~larsson.

15–19 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.


Information: Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

15–19 Numerical Methods for Bifurcation Problems, University of Minnesota, Minneapolis, MN.

Organizers: W.-J. Beyn, E. Doedel, B. Fiedler, Y. Kevrekidis, J. Lorenz.

Short Description: While computational techniques for low-dimension local bifurcations in few-degree-of-freedom systems are in advanced state of development, much work remains to be done on the numerical treatment of higher-dimension singularities. More importantly, there is a pressing need for the development of numerical methods for computing global objects in phase space, their interactions and bifurcations. In this workshop we will bring together mathematicians, numerical analysts, and computer scientists working on these problems and study a selected set of important applications. Particular topics we will consider include the numerical computation of invariant manifolds (including invariant tori, homoclinic and heteroclinic manifolds as well as inertial manifolds), the detection of their bifurcations, and their visualization.

Contact Information: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street S.E., Minneapolis, MN 55455; tel: 612-624-6966; fax: 612-624-7370; e-mail: staff@ima.umn.edu; http://www.ima.umn.edu.

15–19 Stochastic Partial Differential Equations (Includes Measure Valued Diffusions), Mathematical Sciences Research Institute, Berkeley, CA.


Information: e-mail: spde@msri.org or by regular mail to: Stochastic Partial Differential Equations, Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, CA 94720-5070. The workshop has a home page (accessible via Netscape, Mosaic, Lynx, etc.) at MSRI's WWW site at the URL http://www.msri.org/.

15–October 5 Analysis and Geometry on Complex Homogeneous Domains and Related Topics, Capital Normal University, Beijing, China. (Mar. 1997, p. 379)

Program: Invited lecturers will give survey lectures on current and future trends in their research fields.

Topics: Analysis and geometry on complex symmetric domains, related algebraic structures; reproducing kernels, heat kernels, Hua equations; compactifications, analysis on pseudo-hermitian symmetric spaces.

Scientific Committee and Lecturers: J. Facart (Paris, France), S. Kaneyuki (Tokyo, Japan), A. Koranyi (New York), Q. Lu (Beijing, China), G. Roos (Poitiers, France), W. Yin (Beijing, China).


Information: wae97@dsi.uni we.it; http://www.dsi.uni we.it/~wae97/.

17–19 Second International Conference on Simulation and Design of Microsystems and Microstructures (MICROSIM'97), Lausanne, Switzerland. (Feb. 1997, p. 267)

Purpose: MICROSIM '97 is being organized to promote cooperation among scientists and engineers involved in the design and simulation of microsystems and microstructures.

Call for Papers: Papers are invited on any of the topics listed below or others related to the theme of the meeting, with particular emphasis on applications of the techniques proposed. Participants are encouraged to critically review existing ideas and explore new research ideas. Submit 4 copies of your draft paper to the conference secretariat as soon as possible and no later than December 13, 1996. Your paper should not exceed 10 pages including figures, diagrams, and tables, with text size measuring 135 mm wide by 225 mm high in 12 point. The final version of the paper will be due no later than May 16, 1997.

Topics: Design, simulation and analysis, optimization, material modeling, fabrication and manufacturing processes, correlation with experimentation, integration, CAD, processes (i.e., etching), measurement problems.

Application Areas: Microelectronics, mechatronics, micro-electrical-mechanical systems, engineering, automotive and aerospace, medicine and biology, transducers, environmental, computers & information processes.
Information: C. Day, MICROSIM 97 Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, UK SO40 7AA; tel: +44-1703-293-223; fax: +44-1703-292-853; e-mail: cday@wessex.ac.uk. Or go to Web page: http://www.wessex.ac.uk/ and click on the conference information link.

17-21 International Congress on Biomedical Peer Review and Global Communications, Prague Atrium Hotel, Prague, Czech Republic. (Apr. 1997, p. 480)

Information: A. Flanagan, Peer Review Congress, 515 N. State Street, Chicago, Illinois 60610; tel. +312-464-2432; fax: +312-464-5824; e-mail: jans-peer@ama-assn.org. For more information visit the Peer Review Congress Web site at http://www.ama-assn.org/peer/.

18-23 The Third International Workshop on Differential Geometry and Its Applications and the First German-Romanian Seminar on Geometry, Sibiu, Romania.

Main Topics: Riemannian and pseudo-Riemannian geometry, complex and quaternionic geometry, symplectic and contact geometry, convex geometry, topological aspects.

Program: 45-minute and 30-minute invited talks. A limited number of short oral or poster communications are also planned. Note: The talks of the First German-Romanian Seminar on Geometry will be delivered in the first half of each afternoon.

Call for Papers: Deadline for abstracts, July 1, 1997.

Information: M. Craioveanu, West Univ. of Timisoara, Faculty of Mathematics, Bd. V. Parvan 4, 1900, Timisoara, Romania; fax: 0040-56-194002; e-mail: craiov@tim1.wnt.ro; R. Iordanescu, Institute of Mathematics of the Romanian Academy, P.O. Box 1-764, 70700, Bucharest, Romania; fax: 0040-1-2229826; e-mail: riordan@imar.ro; T. Zamfirescu, Univ. of Dortmund, Institute of Mathematics, 44221, Dortmund, Germany; fax: 0049-231-7555307; e-mail: Tudor.Zamfirescu@Mathematik.Uni-Dortmund.DE.

18-29 Eighth Crimean Fall Mathematical School-Symposium on Spectral and Evolutionary Problems and on Mathematical Problems in Economics, Crimea, Ukraine. (Feb. 1997, p. 267)

Topics: The following sections and subsections will be represented at the symposium: 1. Spectral problems: nonselfadjoint operators; spectral theory of operator bundles. 2. Evolutionary problems: differential and operator equations; boundary value problems. 3. Game theory and economical behaviour: game theory; economical behaviour.

Organizers: Simferopol State University, Crimean Academy of Science and Crimean Mathematical Foundation.

Speakers: M. S. Agranovich (Moscow), T. Ya. Azizov (Voronezh), A. T. Baskakov (Voronezh), N. A. Britov (Donetsk), K. I. Chernyshov (Voronezh), L. Feichtinger (Austria), M. N. Feller (Kiev), M. L. Gorbachuk (Kiev), V. Khatskevich (Israel), N. D. Kopachevsky (Simferopol), S. N. Naboko (S.-Petersburg), V. Ovchinnikov (Voronezh), B. A. Plamenevsky (S.-Petersburg), Ya. L. Roitberg (Chernigov), A. G. Rutkas (Kharovk), Yu. S. Samoilenko (Kiev), Z. G. Sheftel (Chernigov), A. A. Shkalikov (Moscow), A. L. Skubachevsky (Moscow), T. A. Suslona (S.-Petersburg), V. V. Vlasov (Moscow), Zadorozhnii, V. I. Zhukovsky (Moscow).

Deadline: April 1, 1997.

20-21 Midwest Partial Differential Equations Seminar, University of Kentucky, Lexington, Kentucky.

Speakers: E. di Benedetto (Northwestern Univ.), W. Gangbo (Georgia Tech.), N. Garofalo (Purdue Univ.), S. Hofmann (Univ. of Missouri), M. A. Horn (Vanderbilt Univ.), Z. Luhart (Univ. of Tennessee), Y. Lou (Univ. of Chicago), S. Magnusson (Taylor Univ. of North Carolina), R. Temam (Indiana Univ.).

Information: http://www.ms.uky.edu/~rbrown/waps/e or write to R. Brown, Department of Mathematics, University of Kentucky, Lexington, KY 40506-0027, or rbrown@ms.uky.edu to be put on the mailing list for conference announcements.

20-21 Wabash Modern Analysis Miniconference, Indiana University-Purdue University, Indianapolis, Indiana.

Organizers: Wabash Extramural Modern Analysis Seminar, with support from the National Science Foundation and the Mathematical Sciences Department at IUPUI.

Program: Invited speakers include I. Daubechies (Princeton), S. Ferguson (Purdue), C. Fefferman (Princeton), D. S. Lubinsky (Georgia Tech), D. Larson (Texas A&M), and C. Phillips (Oregon). There will be opportunity for twenty-minute contributed talks.

Information: For more information about the program, preregistration, submission of abstracts, hotels, etc., visit the Wabash Seminar home page at http://www.math.purdue.edu/~cowen/Wabash.html or phone or send e-mail to C. Cowen at 765-494-1943 or cowen@math.purdue.edu.

22-26 VIII Simposio Sobre Polinomios Ortogonales y Aplicaciones, Departamento de Análisis Matemático, Universidad de Sevilla, Sevilla, Spain. (Jan. 1997, p. 59)

Scope: The aim of the symposium is to provide a common meeting ground for specialists in general systems of orthogonal polynomials, special families of orthogonal polynomials, special functions, and other related topics (moment problems, Padé approximants, orthogonal matrix polynomials, etc.), as well as in the rich variety of scientific applications of these objects.


Information: In January 1997 there will be a mailing which will include information about accommodations, registration fees, etc. Further information contact the VIII Simposio sobre polinomios ortogonales y aplicaciones, Dpto. Análisis Matemático, Universidad de Sevilla, Aptd. de Correos 1160, 41080-Sevilla, Spain; e-mail: sapoa@obelix.ica.cia.es; fax: 34-5-455-79-72; Web site: http://www.us.es/leuven/v8sim/applied/walter/sevilla.html.


Organizers: Complex analysis team of the Mathematical Institute of University Pierre et Marie Curie Paris VI and European Network Analyse Complexe et Géométrie Analytique.

Organizing Committee: P. Dolbeault, G. M. Henkin, A. Iordan, H. Skoda, J.-M. Trépreau. Invited Speakers: E. Bedford (Univ. of Indiana), J.-P. Demailly (Univ. of Grenoble), K. Diederich (Univ. of Wuppertal), J. Duval (Univ. of Toulouse), C. Kiselman (Univ. of Uppsala), L. Lempert (Purdue Univ.), R. Shiffman (Johns Hopkins Univ.), N. Sibony (Univ. Paris XI), J. Siciak (Univ. of Krakow), Y.-T. Siu (Harvard Univ.).

Information: e-mail: conf.complexanalysis@math.jussieu.fr.

22-26 Österreichische Mathematische Gesellschaft, XIV. Austrian Congress of Mathematics, University of Salzburg, Austria.

Aims: During the Congress the following workshops are planned: Operator Theory and Functional Analysis (organizers: H. Langer, TU-Wien, and R. Mennicken, Univ. Regensburg), System and Control Theory (organizers: U. Helmke, Univ. Würzburg, and F. Kappel, Univ. Graz), Pseudo- and Quasi-Random Point Sets (organizers: P. Hellekalek and G. Larcher, Univ. Salzburg), Information and Communication (organizers: M. Gröttschel, TU-Berlin, and P. W. Michor, Univ. Wien). Recipients of the 1995 and 1996 mathematical research grants of the ÖMG will present the results of their scientific work. Furthermore, there will be a day on didactics that will be coordinated by F. Schweiger (Salzburg).

Information: Institute for Mathematics, J. Czermak (for the local organizing committee), Hellbrunnerstrasse 34, A-5020 Salzburg, Austria, or turn to WWW page at http://www.mat.ubg.ac.at/.

22-28 9th International Symposium on Classical Analysis, Kazimierz Dolny, Poland. (Jan. 1997, p. 60)
Topics: Results and problems in such fields as: several complex variables (especially \( L^p \)-methods); Riemannian and Hermitian geometry; spectral theory in Hilbert spaces; probability; mathematical physics. Particular consideration will be given to the interrelation of ideas from different areas and to promoting wider knowledge of some important classical theories.


Call for Papers: Original research contributions as well as expository papers. The scientific program will consist of invited lectures and 30 (45)-min. scientific communications in the English language.

Information: Information about registration fee, accommodation costs, and submission of manuscripts for the Proceedings of the Symposium will be presented in the second announcement.


Topics: Topics of the 1997 conference are: 1. nonlinear boundary-value problems (with special attention to continuation methods and bifurcation); 2. generalized eigenvalue problems and singular-value decomposition; 3. numerical treatment of financial models.

Information: Apply to the secretary of the organizing committee: J. Kok, CWI-Centrum voor Wiskunde en Informatica, Organizing Committee Woudschoten Conference, P.O. Box 94079, NL-1090 GB Amsterdam; e-mail: Jan.Kok@ewi.cwi.nl. Conference URL: http://www.cwi.nl/~jankok/woudschoten.html (English) or http://www.cwi.nl/~jankok/woudschoten.html (Dutch).

24-26 Int'l. Sympos. on Theoretical Aspects of Computer Software (TACS'97), Tohoku University, Sendai, Japan. (Nov. 1996, p. 1384)

Topics: Theoretical aspects of the design, semantics, analysis, and implementation of programming languages and systems; calculi and models of concurrency and parallel computation; categories and types in computer science; formalisms, methods, and systems for program specification, verification, synthesis, and optimization; constructive, linear, and modal logics in computer science; logics of programs.


Program Chairs: M. Abadi, Systems Research Center, Digital Equipment Corporation, Palo Alto, CA 94301; e-mail: masapa.dee.com; T. Ito, Dept. of Computer and Mathematical Sciences, Graduate School of Information Sciences, Tohoku University (Aoba yama campus), Sendai, 980, Japan; e-mail: iito@itee. ecei.tohoku.ac.jp.

Submissions: By e-mail to TACS97-submission@itee. ecei.tohoku.ac.jp. The length limit is 6,000 words. Deadline: January 10, 1997.

Inquiries: TACS97@itee.ecei.tohoku.ac.jp.

25-27 19th International Conference on Group Theory Devoted to the Memory of S. N. Chernikov, Perm State University, Russia.

Topics: Finite groups, infinite groups, applications of group theory.

Abstracts: (Not more than one page) may be sent no later than May 15, 1997, via e-mail.

Information: A. Makhnev, 16 Kovalevskoy Str., Institute of Mathematics and Mechanics, Ekaterinburg, 620219, Russia; tel./fax: +7(3432)415258; e-mail: maktop@im .intec.ru; or Ya. D. Polovitsky, 15 Bukirev Str., Perm State University, Perm 614600, Russia; e-mail: mecmath@psu.ac.ru.


Program: Math at Work.

Principal Speakers: T. Herdman (Virginia Tech and SIAM), A. Sterrett (Denison Univ. and MAA), W. Pulleyblank (IBM T. J. Watson Research Center).

Call for Papers: Abstracts for 20-minute contributed papers should be sent by September 1, 1997, to C. Holmes, Dept. of Mathematics and Statistics, Miami University, Oxford, OH 45056; fax: 513-529-5818; e-mail: mathwork@ gr.mohio.edu. Web site: http://miavx1.mohio.edu/~mstcwis/events.html.

Information: The conference programs will include invited papers and will be available after August 1, 1997, from the above address.

Student Conference: The Ohio Delta Chapter of Pi Mu Epsilon will hold its twenty-fourth annual Student Conference September 26-27, 1997. Undergraduate and graduate students are invited to contribute 15- or 30-minute papers and should send abstract or request for information to M. Cox, Dept. of Mathematics and Statistics, Miami University, Oxford, OH 45056; fax: 513-529-1493; e-mail: mathwork@gr.mohio.edu.

Information: The conference programs will include invited papers and will be available after August 1, 1997, from the above address.

Program: Math at Work.

Information: The conference programs will include invited papers and will be available after August 1, 1997, from the above address.

Program: The third International Conference on Technology in Mathematics Teaching will bring together classroom practitioners, curriculum developers, mathematical education researchers and university lecturers, all of whom share a desire to improve the quality of student learning. Keynote lectures and invited lectures by distinguished speakers will be complemented by a program of specialist short talks and workshops.

Information: The conference languages will be English and German. The conference fee will be DM 200 (payment before 01.07.1997) and will include the cost of lunches, coffees, teas, and the proceedings published on a CD-ROM. Further details may be obtained from W. Fraunholz, Universitaet - Mathematisches Institut, Rheinufer 1, D-56075 Koblenz, Germany; tel.: +49-261-9119650; fax: +49-261-9119652; e-mail: w.fraunhofer@uni-koblenz.de. You will find this announcement on WWW at http://euclid.math.jussieu.fr/~ziviol/.

29-October 2 Third International Conference on Technology in Mathematics Teaching, University of Koblenz, Germany. (Apr. 1997, p. 480)

Program: The third European International Conference on Technology in Mathematics Teaching will bring together classroom practitioners, curriculum developers, mathematical education researchers and university lecturers, all of whom share a desire to improve the quality of student learning. Keynote lectures and invited lectures by distinguished speakers will be complemented by a program of specialist short talks and workshops.

Information: The conference languages will be English and German. The conference fee will be DM 200 (payment before 01.07.1997) and will include the cost of lunches, coffees, teas, and the proceedings published on a CD-ROM. Further details may be obtained from W. Fraunholz, Universitaet - Mathematisches Institut, Rheinufer 1, D-56075 Koblenz, Germany; tel.: +49-261-9119650; fax: +49-261-9119652; e-mail: w.fraunhofer@uni-koblenz.de. You will find this announcement on WWW at http://euclid.math.jussieu.fr/~ziviol/.
Program: IMA Workshop: Large Scale Dynamical Systems.

Short Description: The numerical study of low-dimensional dynamics in large-scale sets of ODEs and discretizations of PDEs necessitates the development of special-purpose algorithms for simulation, stability, and bifurcation analysis. This workshop will address development and application of special iterative methods for large-scale systems that exploit local stability properties of the linearized system. It will also consider global model reduction schemes for PDEs such as approximate inertial manifolds and lattice dynamics. Applications of special interest include selected problems arising in fluid flow and nucleation in alloys.

Organizers: L. Tuckerman, E. Titi, H. B. Keller, D. Aronson.

Information: Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.


Objectives: The ENUMATH conferences were established in 1995 in order to provide a forum for discussion on recent aspects of numerical mathematics. They seek to convene leading experts and young scientists, with special emphasis on contributions from Europe. Recent results and new trends in the analysis of numerical algorithms as well as their application to challenging scientific and industrial problems will be discussed. Apart from theoretical aspects, a major part of the conference will be devoted to numerical methods for interdisciplinary applications.

Invited Speakers: A. Bachem (Germany), N. Forvelez (France), R. Hiptmair (Switzerland), A. Quarteroni (Italy), P. van Dooren (Belgium), J. Douglas (USA), C. M. Elliott (UK), G. Leugering (Germany), M. Luskin (USA), P. Maǐs (Germany), G. A. Mikhailov (Russia), K. W. Morton (UK), J. Sethian (USA), P. L. Tallec (France).

Planned Minisymposia: Finite elements on nonmatching grids, spectral finite element methods, least squares methods for PDE, stabilization methods, optimization in PDE, multiscale analysis, computational electromagnetics, new materials, benchmarking, numerical education.

Submission of Contributions: Abstracts of papers and posters (1–2 pages) may be submitted until February 28, 1997, to be considered for presentation. Abstracts will be subject to evaluation directly after submission, and the authors will be informed about acceptance as soon as possible, but no later than April 15, 1997.

Information: ENUMATH 97, Universität Heidelberg, Im Neuenheimer Feld 294, D-69120 Heidelberg; http://gaia.iwr.uni-heidelberg.de/ENUMATH.html; enumath@iwr.uni-heidelberg.de.

30–October 2 Logic and Mathematical Reasoning, Mexico City, Mexico (May 1997, p. 603)

Plenary Lecturers: J. Dhommes (Univ. de Nantes), S. Fefferman (Stanford Univ.), M. Otto (Univ. of Bielefeld), H. Sinaeur (CNRS Paris), J. M. SanzSantiago (Univ. de Lille), and D. Struppa (George Mason Univ.).

Information: C. Alvarez, Depto de Matemáticas, Fac. de Ciencias, UNAM, Ciudad Universitaria, 04510 México D.F.; e-mail: alvarj@servidor.unam.mx; or M. Panza, Centro F. Viète, Univ. de Nantes, Fac. des Sciences, 2 rue de la Houssinière, 44072 Nantes 03, France; e-mail: panza@unantes.univ-nantes.fr.

October 1997

4 AMS Western Sectional Meeting (Joint with MAA), University of California-Davis, CA. (Apr. 1997, p. 480)

Information: W. Drady, vad@ams.org.

6–11 INCOMWASCOM 97–9th International Conference on Waves and Stability in Continuous Media, Bari, Italy. (May 1997, p. 603)

Objective: The main goal of the meeting is to provide a forum for the exchange of ideas, methods, and results about the recent advances in Waves and Stability in Continuous Media.

Program: The general program will include about thirty main lectures delivered by 15 Italian and 15 foreign invited speakers and a limited number of short communications. The contributions of the lectures and the communications will be published in a Proceedings volume.

Information: M. Maiellaro and A. Labianca, fax +39 -080 · 5460612, e-mail: ARCLABS SUN. DI. UNIBA IT.


Speakers (partial list): L. Quintas (New York Academy of Science Mathematics Section), S. B. Karmarkar (New York area liaison for the Calculata Mathematical Society), A. Chermak (Princeton Univ.), and D. Choudhury (Polytechnic Univ.).

Information: C. S. Felicitas, New York Institute for Trauma Studies, Inc., 527 Third Avenue, Room 263 #177, New York, NY 10016; tel. and fax: 212-684-2779.

11–12 Pacific Northwest Geometry Seminar Fall Meeting, Portland State University, Oregon.

Information: http://www.math.washington.edu/“lee/PNGS or e-mail: lee.math@wash­ington.edu.

13–15 DIMACS Workshop on Massive Data Sets in Telecommunications, DIMACS Center, Rutgers University, Piscataway, New Jersey.

Organizers: J. Feigenbaum, jf@research.att.com.

Contacts: J. Feigenbaum, AT&T Labs, tel: 973-360-8442, jf@research.att.com.

Local Arrangements: P. Pravato, DIMACS Center, pravato@dimacs.rutgers.edu, 732-445-3929.

Information: http://dimacs.rutgers.edu/Workshops/index.html.


Information: This meeting will consist of six one-hour lectures given by B. Cockburn (Minnesota), C. M. Elliott (Sussex), T. Hou (Cal. Tech.), P. L. Lions (Paris), R. C. Ran­nacher (Heidelberg), E. Suli (Oxford). The meeting will be held at the Scientific Societies’ Lecture Theatre, New Burlington Place, London W1, UK. All interested are very welcome (no registration fee). There will be a dinner on Friday evening (details/cost to be arranged). A list of moderately priced hotels will also be available at a later date.

17–19 (**NEW DATES**) AMS Southeastern Sectional Meeting, Georgia Institute of Technology, Atlanta, Georgia. (Dec. 1996, p. 1560)

Information: R. Cascella, rge@ans.org.

18–19 Sixth West Coast Operator Algebra Seminar, University of California, Santa Barbara, California.


Information: Via WWW at http://www.math.ucsb.edu/“bisch/wcoas97.html or contact D. Bisch at beachmath.ucsb.edu or 805-893-2076.

18–20 Commutative Algebra, Combina­torics and Representation Theory Conference in Honor of David A. Buchsbaum, Northeastern University, Boston, Massachu­setts.

Organizing Committee: D. Eisenbud, de@math.rutgers.edu; A. Alexeev, ala@math.rutgers.edu; and J. Weyman, weyman@math.rutgers.edu. Abstracts: There will be both hour addresses and 20-minute talk sessions. Abstracts of proposed talks are invited. Selected abstracts (probably more than the number of talks) will appear in a volume to be distributed at the conference. It is hoped there will be a special issue of a journal devoted to papers in Buchsbaum’s honor. The deadline for abstracts is July 30, 1997.

Speakers: C. DeConcini (Rome), D. Eisenbud (MSRI), W. Fulton (Chicago), M. Haiman (San Diego), C. Huneke (Purdue), A. Lascoux (Paris), C. Ringel (Bielefeld), G.-C. Rota (MIT), R. Stanley (MIT), B. Sturmfels (Berlin), J. Weyman (Northeastern), and A. Zelevinsky (Northeastern).

Information: Limited funds are available to aid with travel and lodging. To apply for such funds or to get onto our mailing list for future announcements, please send e-mail to J. Weyman. Abstracts should be Mathematics Calendar

September 1997

NOTICES OF THE AMS 1021
20-21 Harmonic Analysis, Potential Theory and Geometric Measure Theory, Mathematical Sciences Research Institute, Berkeley, CA.
Information: e-mail: harmsc@msri.org or by regular mail to: Harmonic Analysis, Potential Theory and Geometric Measure Theory, Mathematical Sciences Research Institute, 100 Centennial Drive, Berkeley, CA 94720-5070.

23-24 Oscillatory Integrals and Applications to PDE, Mathematical Sciences Research Institute, Berkeley, CA.
Organizers: M. Christ, C. Kenig, and G. Ponce.

Description: This workshop will focus on current developments in network modeling, simulation, and algorithmic techniques which take into account the observed and measured behavior of networks. An intense program of invited talks is anticipated.
Organizers: S. Bhatt, Bell Communications Research, sbhatt@bellcore.com; A. Ern, DIMACS and WINLAB, Rutgers, ato@winlab.rutgers.edu.
Invited Speakers: D. Goodman (WINLAB); M. O’Dell (UUNET); D. Estrin (USC) – TBC; R. Fujimoto (Georgia Tech); M. Gerla (UCLA); T. Leighton (MIT) – TBC; S. Plotkin (Stanford) – TBC; F. Reichter (Ericsson); W. Willinger (AT&T Research); R. Yates (Rutgers). (TBC = To Be Confirmed)
Contacts: A. T. Ogielski, DIMACS and WINLAB, Rutgers, ato@winlab.rutgers.edu.
Local Arrangements: S. Barbu, Princeton University, barbu@cs.princeton.edu, 609-258-3571.
Information: http://dimacs.rutgers.edu/Workshops/index.html.

Principal Speakers: G. W. Stewart (Univ. of Maryland), N. J. Higham (Univ. of Manchester), C. R. Johnson (College of William and Mary), C. Van Loan (Cornell Univ.), H. Wolkowicz (Univ. of Waterloo).
Program: Participation of both specialists and non-specialists interested in matrix analysis and its applications to other fields is invited. Graduate students are welcome!
Preceding the symposium at 4 p.m. on October 23, 1997, will be a University Visiting Scholar lecture by G. W. Stewart. A banquet is planned for the evening of October 24, 1997.
Deadlines: Abstracts for 20-minute contributed talks should arrive by August 15, 1997. Abstracts may be e-mail to nil1.mackey@wmich.edu.
Organizers: N. Mackey, J. Petro, T. Richardson, Western Michigan Univ.
Information: N. Mackey (n1.mackey@wmich.edu), Dept. of Mathematics and Statistics, Western Michigan University, Kalamazoo, MI 49008; tel: 616-387-4594, fax: 616-387-4530.

24-26 Central Section, University of Wisconsin, Milwaukee, Wisconsin. (Dec. 1996, p. 1560)

26-29 INFORMS Dallas Fall 1997, Hyatt Regency, Dallas, Texas.
Information: General chair: P. Jensen, Univ. of Texas, Dept. of Mechanical Engineering, MC C2200, Austin, Texas 78712; tel: 512-471-6495.

27-30 DIMACS Workshop on Networks in Distributed Computing, DIMACS Center, Rutgers University, Piscataway, NJ.
Sponsor: DIMACS.
Description: The workshop is intended to bring together researchers from both academia and industry who specialize, as either theoreticians or practitioners, in the field of networks in distributed computing. Currently, network-related research is quite large and active within distributed computing. Our main objective is to provide a snapshot of major themes of current technological significance on the design, use, influence, efficiency, and performance of networks in distributed computing.
Organizers: M. Mavronicolas (Univ. of Cyprus, mavronic@cs.ucy.ac.cy), M. Merritt (AT&T Labs-Research, mischu@research.att.com), N. Shavit (MIT & Tel Aviv Univ., shani@theory.cs.tau.ac.il).
Information: M. Mavronicolas, Univ. of Cyprus, mavronic@cs.ucy.ac.cy; or P. Pravato, DIMACS Center, pravato@dimacs.rutgers.edu, 908-445-5929; or WWW information: http://dimacs.rutgers.edu/Workshops/index.html.

27-31 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.
Program: IMA Workshop: Multiple-Time-Scale Dynamical Systems.
Information: Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

29–November 1 Sixth SIAM Conference on Applied Linear Algebra, Snowbird Ski and Summer Resort, Snowbird, Utah. (June 1996, p. 702)
Sponsor: Sponsored by SIAM Activity Group on Linear Algebra.
Organizer: J. A. George (Univ. of Waterloo, Canada).

November 1997

Sponsor: Sponsored by SIAM Activity Group on Geometric Design.
Organizer: L. Schumaker (Vanderbilt Univ.).

Program: The program will begin on Friday at 7:00 p.m. with sessions for student speakers. Following these, about 9:00 p.m., Paul Humke, from St. Olaf College, will give the first of his invited addresses, "A Voyage from the Fourth Dimension". On Saturday morning there will be student presentations from about 9:00 until 11:00. At 11:00 Professor Humke will give his second address, "Fractionating Fractal Facts".
Information: The conference is free and open to the public. Students who wish to attend can receive free housing, provided they bring their own sleeping bags. An announcement with further details will be mailed out to interested parties sometime in September.

7–9 Third Midwest–Southeastern Atlantic Joint Regional Conference on Differential Equations, Vanderbilt University, Nashville, Tennessee. (May 1997, p. 603)
Aim: This is the third in a series of joint conferences on differential equations, combining the activities of two conference series which have been held for many years in the southeastern and midwestern regions of the country.

Invited Speakers: A. Bertozzi (Duke Univ.), C. Chicone (Univ. of Missouri), P. Fife (Univ. of Utah), J. Goldstein (Univ. of Memphis), and L. Markus (Univ. of Minnesota).
Program: In addition to the five plenary talks, the conference program will include contributed sessions and special sessions.
Organizing Committee: M. Horn (chair), U. Mayer, G. Simonett, and G. Webb.
Information: Differential Equations, Department of Mathematics, Vanderbilt University, Nashville, TN 37240; tel: 615-322-6672; fax 615-343-0215; e-mail: diffeq@math.vanderbilt.edu; Web: http://math.vanderbilt.edu/diffeq/

7–9 1997 Midwest Algebraic Geometry Conference, University of Notre Dame, Indiana. (Mar. 1997, p. 380)
Invited Principal Speakers: L. Ein (Univ. of Illinois at Chicago), E. Friedlander (Northwestern Univ.), W. Fulton (Univ. of Chicago), A. Geramita (Queen's Univ./Universita di Genova), J. Harris (Harvard Univ.), C. Heunke (Purdue Univ.), K. Smith (Univ. of Michigan/MIT).
Call for Contributed Short Talks: Please send an abstract by August 15, 1997.
Information: To register, send an abstract, or just ask a question, send e-mail to magc97@kenna.math.nd.edu. A Web page with up-to-date information can be found at http://www.science.nd.edu/magc97/.

8–9 AMS Western Sectional Meeting, University of New Mexico, Albuquerque, New Mexico. (Dec. 1996, p. 1560)
Information: W. Drady, wd@ams.org.

9–11 Bijaoa and His Region through the Ages, History, History of Mathematics, Society, Sciences, Culture, University of Bijaoa, Alberta.
Sponsors: Acadimie Universitaire d'Alger and UNESCO.
Deadlines: For abstracts: July 15, 1997; for complete texts: September 1, 1997.
Send to: D. Aossani, Association GEHIMAB, Laboratoire LAMOS, Université de Bijaoa, 06000 Bijaoa, Algeria.
Topics: History; history of mathematics, society, sciences, culture.
Information: michel.ballieu@skynet.be.

13–14 Workshop on Stochastic Processes in Financial Markets, Borsa de Barcelona, Spain.
Organizers: Centre de Recerca Matematica and Borsa de Barcelona.
Information: crm@crm.es, or you can also use the Web site: http://crm.es/info/sdds.htm.

17–21 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.
Program: IMA Workshop: Dynamics of Algorithms.
Information: Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

17–22 Advanced Course on Statistical Inference for Mathematical Finance, Centre de Recerca Matematica, Bellaterra, Spain.
Speakers: M. Sorensen, Aarhus Univ. (Statistical Inference for Diffusion-Type Models) and J. Nielsen, Aarhus Univ. (Pricing and Hedging in Continuous-Time Finance).
Format: The lectures will be held in the morning; afternoons will be devoted to complementary activities (problem sessions, expository talks, seminars).
Coordinates: J. del Castillo and P. Vinyolos.
Further Information: WWW http://crm.es/info/sdds.htm or e-mail: crm@crm.es.

19–21 Mal'tsev Meeting, Novosibirsk, Russia. (Apr. 1997, p. 480)
Organizers: The Mal'tsev Meeting is organized by the Siberian Foundation for Algebra and Logic together with the Institute of Mathematics (Siberian Branch of the Russian Academy of Sciences) and the Research Institute for Mathematical and Information Basis of Education (Novosibirsk State University).
Program: The conference will take place at the Institute of Mathematics. Reports from all fields of algebra and mathematical logic are invited. The program includes one-hour and half-hour lectures as well as sectional talks. Preliminary list of sections: group theory, ring theory, model theory, and universal algebra, computability theory.
Abstracts: Abstracts of talks (up to 800 words) or in hard copies should be sent to the secretary. The deadline is May 1, 1997.
Information: D. Evgenievičh Pal'čunov, Russia, 630090, Novosibirsk, Universitetskaya str. 24, Institute of Mathematics SB RAS; tel: +7(3832)-235-08-50; fax: +7(3832)-235-06-52; e-mail: paltch@math.nsc.ru.

24–29 7th International Conference "Intelligent Systems and Computer Sciences", Moscow State University, Russia.
Information: e-mail: conference@eatis.math.msu.su; http://mech.math.msu.su/~manuilov/inv97.html.

30–December 4th Conference of the Association of Asia-Pacific Operational Research Societies (APORS'97), Melbourne, Victoria, Australia.
Information: APORS'97, PR Conference Consultants Pty Ltd., P.O. Box 326, Balwyn, Victoria 3103, Australia; e-mail: APORS97@sci.monash.edu.au.

December 1997

December International Symposium on Mathematical Physics in Memory of...
1-6 Neural Information Processing Systems—Natural and Synthetic, Marriott Hotel, Denver, Colorado.

Information: This is the twelfth meeting of an interdisciplinary conference which brings together cognitive scientists, computer scientists, neuroscientists, physicists, and mathematicians interested in all aspects of neural processing and computation. The conference will include invited talks and oral and poster presentations of refereed papers. The conference is single-track and highly selective. Preceding the main session, there will be one day of tutorial presentations (Dec. 1), and following will be two days of focused workshops on topical issues at a nearby ski area (Dec. 5–6). Major categories for paper submission, with example subcategories (by no means exhaustive), are as follows:

- Algorithms and Architectures: supervised and unsupervised learning algorithms, model selection algorithms, feedforward and recurrent network architectures, localized basis functions, online learning algorithms, active learning algorithms, algorithms for combining classifiers, belief networks, combinatorial optimization.
- Applications: handwriting recognition, DNA and protein sequence analysis, expert systems, fault diagnosis, financial analysis, medical diagnosis, music processing, time series prediction.
- Artificial Intelligence: inductive reasoning, problem solving and planning, natural language understanding, hybrid symbolic-subsymbolic systems.
- Cognitive Science: perception and psychophysics, development, neuropsychology, cognitive neuroscience, language, human learning and memory, attention.
- Implementation: analog and digital VLSI, optical neurocomputing systems, novel neuro-devices, simulation tools, parallelism.
- Neuroscience: functional imaging, systems physiology, neural coding, synchrony, synaptic plasticity, neuromodulation, dendritic computation, calcium dynamics, inhibition, computational models.
- Reinforcement Learning and Control: exploration, dynamic programming, planning, navigation, robotic motor control, process control, Markov decision processes.
- Speech and Signal Processing: speech recognition, speech coding, speech synthesis, rapid adaptation, robust processing, auditory scene analysis, models of human speech perception.
- Theory: computational learning theory, statistical mechanics of learning, dynamics of learning algorithms, learning of dynamical systems, approximation and estimation theory, combining predictions, model selection, complexity theory.
- Visual Processing: image processing, image coding and classification, object recognition, stereopsis, motion detection and tracking, visual psychophysics.

Information: T. Bell, e-mail: tony@alk.edu.

4-7 3rd Joint Meeting of the AMS and the Sociedad Matematica Mexicana, Oaxaca, Mexico. (Dec. 1996, p. 1560)

Information: W. Drady, wad@ams.org.

8-9 Workshop on Quantum Coherence and Information Processing, Adelaide, South Australia.

Information: M. Hamilton, Dept. of Physics and Mathematical Physics, Univ. of Adelaide, Adelaide, SA 5005, Australia; e-mail: mwh@physics.adelaide.edu.au.

13-17 8th Meeting of European Women in Mathematics, Trieste, Italy. (Mar. 1997, p. 380)

Program: Mathematical program of the meeting: 1. a session on representations of groups, organized by M. Vergne (France); 2. a session on p-adic numbers, organized by C. Goldstein (France); 3. an interdisciplinary session on symmetries, organized by I. Kersten (Germany) and S. Psycha (France).

Nonmath Topic: The "nonmathematical" topic of the meeting will be a roundtable discussion on women and mathematics in East-West-North-South, organized by M. Demlova (Czech Republic) and M. Naatanen (Finland). There will also be a poster session, where all participants are encouraged to present their work and to contribute an abstract to the proceedings of the meeting.

Information: E. Branner, Dept. of Mathematics, Building 303, Technical University of Denmark, DK-2800 Lyngby, Denmark; e-mail: branner@mat.dtu.dk; fax: +44-45-88-13-99.

28-January 1 International Symposium on Mathematical Physics in Memory of S. Chandrasekhar with Special Session on Abdus Salam, Calcutta, India.

Program: The program will include invited lectures by distinguished scientists from India and abroad as well as contributed papers. Many scientists from different parts of the world already have expressed their interest in participating in the symposium.

Contacts: R. N. Basu, N. C. Ghosh (joint directors), International Symposium on Mathematics in Memory of S. Chandrasekhar with a Special Session on A. Salam, Calcutta, India.
Mathematical Society, AE-374, Sector-I, Salt Lake City, Calcutta-700 064, India; tel: 033-337-8882; fax: 0901-33-3376290.

Registration Fee: Rs. 400.00 for Indians; Rs. 600.00 (Indian rupees) for persons from SARC countries; $400.00 for others. Registration fee includes symposium material, breakfast, lunch, and local transport. All payments should be made in favor of Calcutta Mathematical Society.

January 1998

3-6 Ninth International Conference on Approximation Theory, Nashville, TN.

Topics: This conference is a continuation of the earlier conferences on approximation theory held in Austin and in College Station, TX. It will cover all aspects of approximation theory and applications.

Invited Speakers: P. Barvitien (Dallhouse), D. Donoho (Stanford), T. Goodman (Univ. Dundee), F. Naccowich (Texas A&M), A. Ron (Univ. Wisconsin), E. Saff (Univ. of Florida), M. Wheeler (Univ. Texas). In addition, there will be a lecture by the 1998 Vasil A. Popov Prize winner, to be announced at the meeting.

Participation: Sessions will be organized for contributed talks. Abstracts should be sent to AT98, Dept. of Mathematics, Vanderbilt Univ., Nashville, TN 37240, by October 1, 1997. (Sending a TeX file to the e-mail address would be even better.) Sufficient funding to help with the expenses of graduate students and other underfunded participants is hoped for.

Information: The conference home page is at http://math.vanderbilt.edu/events/approx.html, or by e-mail at the address at98@math.vanderbilt.edu.

4-6 Fifth International Symposium on Artificial Intelligence and Mathematics, Fort Lauderdale, Florida.

Goal: The International Symposium on Artificial Intelligence and Mathematics is the fifth of a biennial series. The goal is to foster interactions among mathematics, theoretical computer science, and artificial intelligence.

Invited Talks: R. Aumann (Hebrew Univ., Israel), J. Halpern (Cornell Univ.), P. Hayes (Univ. of West Florida), S. Kirkpatrick (IBM, Yorktown Heights), W. McCune (Argonne National Laboratory).

Submissions: Authors must e-mail a short abstract (up to 200 words) in plain text format to ama1@rutcor.rutgers.edu by September 23, 1997, and either e-mail PostScript files or TeX/\LaTeX source files (including all necessary macros) of their extended abstracts (up to 10 double-spaced pages) to ama1@rutcor.rutgers.edu, or send five copies to E. Boros, RUTCOR, Rutgers University, P.O. Box 5062, New Brunswick, NJ 08903, to be received by September 30, 1997. Authors will be notified of acceptance or rejection by October 31, 1997. The final versions of the accepted extended abstracts, for inclusion in the conference volume, are due by November 30, 1997. Authors of accepted papers will be invited to submit within one month after the symposium a final full-length version of their paper to be considered for inclusion in a thoroughly refereed volume of the series Annals of Mathematics and Artificial Intelligence, J. C. Balcër Scientific Publishing Co.

Sponsors: The symposium is partially supported by the Annals of Math and AI, Florida Atlantic University, and the Florida-Israel Institute. Other support is pending. If additional funding is secured, partial travel subsidies may be available to junior researchers.

Information: Further information and future announcements can be obtained from the conference Web site at http://rutcor.rutgers.edu/ama1 or by e-mail to H. Hoffman, Department of Mathematics, Florida Atlantic University, P.O. Box 3091, Boca Raton, FL 33431; e-mail: Hoffman@ace.fau.edu.

7-10 Joint Mathematics Meetings, Baltimore, Maryland (including the annual meetings of the AMS, AWM, MAA, and NAM), (Dec. 1995, p. 1570)


Goal: The scope of brain research has moved well beyond the confines of any one discipline. Major advances have been made toward understanding better the brain and how its parts work by medical and life scientists, engineers, computer scientists, and mathematicians. Mathematical and computer sciences and engineering have played important roles in these studies up to now, and they will contribute significantly in the future. The proposed meeting is timely in helping to reduce barriers to cross-disciplinary work in understanding the brain. It is important to have meetings that bring together mathematical scientists with engineers, computer scientists, and medical/life scientists working to understand the organization and function of the brain. Particularly important are integrated models of parts of the brain, engineering of neuromechanical interfaces that can be used in prosthetics, and general mathematical studies of large networks to guide and suggest experiments.

In addition there is a need to interface neurophysiologists and computational neuroscientists. Many computational models of the brain developed in the past have limited practical relevance because they do not integrate biological knowledge into the computational structure. An important goal of this meeting is to initiate and facilitate such interfaces.

Funding: It is expected that the conference will be supported by funds from federal and other agencies. A special invitation is extended to junior scientists. To request an invitation and to apply for support funds, please provide the following information to DLS@AMS.ORG, or send to AMS-SIAM Summer Seminar, C/O AMS, PO Box 6887, Providence, RI 02940, NO LATER THAN FEB. 1, 1997: Full name, mailing address, telephone and fax numbers, e-mail address, scientific background relevant to the conference, and whether or not financial assistance is requested (please indicate a requested dollar amount).

Information: Invitations including specific offers of support, information on housing, and program developments to date will be sent in March 1997.

12-16 Introductory Workshop on Model Theory of Fields, Mathematical Sciences Research Institute, Berkeley, CA.


Topics: (I) Model theory of Fields (algebraically closed, real closed, valued, differential, finite); (II) Geometry (algebraic, arithmetic, real, rigid); (III) Dimension theory in model theory (stability theory, o-minimality, simple theories).


Information: E-mail: modintro@msri.org or by regular mail to: Introductory Workshop on Model Theory of Fields, Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, CA 94720-5070. The workshop has a home page (accessible via Netscape, Mosaic, Lynx, etc.) at MSRI's WWW site at the URL http://www.mari.org/.

12-23 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.

Program: IMA Workshop: Computational Neuroscience.


Information: Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

19-23 First Pacific Rim Conference on Mathematics, City University of Hong Kong, Hong Kong. (Apr. 1997, p. 481)

Objectives: This conference is to provide a forum for mathematical scientists to present their latest research on various areas and aims to bring senior scientists and young researchers together for personal interaction and dialogue.

Session Topics: Analytic number theory, applied analysis, calculus of variations, combinatorics, computational complexity,
geometric analysis, optimization, PDEs, pulse dynamics, probability.

**Speakers:** Plenary Speakers and Invited Speakers will be featured in these sessions, along with contributed papers. Plenary speakers: M. Blum (City Univ. of Hong Kong), K. Burdzy (Univ. of Washington), F.-W. Chung (Univ. of Pennsylvania), J. Friedlander (Univ. of Toronto), M. Giaqunina (Univ. of Pisa), P. L. Lions (Universite de Paris-Dauphine), M. Mimura (Univ. of Tokyo), M. Wright (Bell Laboratories), S.-T. Yau (Harvard University).

**Call for Papers:** Titles and abstracts of contributed papers must be received by July 31, 1997. The abstracts should be typed in LATEX, not to exceed one page, and sent to F. Cucker by e-mail or on a floppy disk.

**Information:** F. Cucker, Dept. of Math., City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong; e-mail: mainf@cityu.edu.hk; fax: (852)2788-8561.

## February 1998

### 2-4 33 Years of Gr"obner Bases, RISC-Linz, Hagenberg, Austria.

**Program:** The institute RISC-Linz of the Johannes Kepler Universit"at in Linz, Austria, sponsors the conference. Since the invention of Gr"obner bases by Buchberger in 1965, this new method in polynomial ideal theory and algebraic elimination theory has become one of the standard methods in computer algebra. There exists by now a considerable amount of theoretical work on Gröbner bases, every major computer algebra system has an implementation of Gröbner bases, and the field of applications ranges from algebraic geometry and computer aided geometric design to chemical structure analysis. The aim of the conference is to assess the state of the art in the theory and practice of Gröbner bases. In addition to the regular program of the conference there will be a software exhibition.

**Workshop Topics:** Theoretical development of the algebraic theory of Gröbner bases, numerical aspects of the computation and use of Gröbner bases, applications of Gröbner bases in science and engineering, implementations and issues of software design in connection with Gröbner bases.

**Deadlines:** Submission: June 30, 1997; Notification: September 30, 1997; Camera-ready: October 31, 1997.

**Information/Authors:** are invited to submit papers of about 12 pages to the Secretary of the Conference: Secretary of the International Conference on Gröbner Bases, RISC-Linz, Johannes Kepler Universität, A-4040 Linz, Austria; phone: +43 7326 3231 39; fax: +43 7326 3231 30; e-mail: gb-conf@risc.uni-linz.ac.at. Preferably submissions should be sent by e-mail. Paper submissions must be sent in triplicate. Submissions are to be written in LATEX. For further information see http://www.risc.uni-linz.ac.at/conference/GB/GBconf.html.

### 5-6 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.

**Program:** IMA Tutorial: Calcium Dynamics in Cells.

**Organizer:** J. Keizer.

**Information:** Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

### 9-13 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.

**Program:** IMA Workshop: Calcium Dynamics in Cells.

**Organizers:** J. Keizer, J. Rinzel, A. Goldbeter.

**Information:** Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

### 9-13 Seventh International Conference on Hyperbolic Problems: Theory, Numerics, Applications, ETH Zurich, Switzerland.

(Febr. 1997, p. 267)

### March 1998

### 9-14 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.

**Program:** IMA Short Course & Workshop: Cardiac Rhythms.

**Organizers:** J. Collins, J. Keener, C. Peskin, R. Winslow.

**Information:** Institute for Mathematics and its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

### 12-14 Spring Topology and Dynamics Conference, George Mason University, Fairfax, Virginia.

**Information:** jma@leaza.gmu.edu.


**Invited Speakers:** C. Adams, R. Ghrist, V. Jones, X.-S. Lin, W. Menasco, J. Przytycki, C. Series, A. Thompson, V. Turaev.

**Organizers:** V. Arnold, D. Bayer, E. Finkelstein, R. Friedman (Chair), J. Gilman, V. Jones, X.-S. Lin, R. Mangum, W. Menasco. The organizing committee has applied for support from the NSF.

**Information:** http://www.math.columbia.edu/conf/birman/.

### 20-21 AMS Southeastern Sectional Meeting, University of Louisville, Louisville, Kentucky.

(Dec. 1996, p. 1550)

**Information:** R. Cascella, rc@ams.org.

### 23-25 DIMACS Workshop on Discrete Mathematical Chemistry, DIMACS Center, Rutgers University, Piscataway, New Jersey.

**Organizers:** P. Fowler, H. Hansen, M. Zheng.

**Contacts:** P. Hansen, pierreh@t.umontreal.ca.


**Organizers:** D. Elworthy, J. F. Le Gall, and J. Rosen.

**Scope:** This workshop will cover two topics which have some overlap through such topics as diffusions on fractals. The workshop will stand in place of the Seminar on Stochastic Process for 1998. Topic 1, Geometric Stochastic Analysis; Topic 2, Fine Properties of Stochastic Processes.

**Information:** e-mail: geomstot@math.berkeley.edu or by regular mail to: Geometric Stochastic Analysis and Fine Properties of Stochastic Processes, Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, CA 94720-5070. The workshop has a home page (accessible via Netscape, Mosaic, Lynx, etc.) at MSRI’s WWW site at the URL http://www.msri.org/.

### 25-28 Global Analysis 30 Years Later, University of Cincinnati, Cincinnati, Ohio.

(Nov. 1996, p. 1384)

**Purpose:** This meeting looks back to the 1968 AMS Summer Mathematics Institute on Global Analysis. The 1968 meeting was dominated by Smale’s lectures on hyperbolic systems and was a major event in shaping the modern developments of dynamical systems. The 1998 meeting will explore the impact of these lectures on the last 30 years in dynamical systems.

**Program:** This four-day conference will mainly consist of hour lectures, but some sessions for shorter contributed papers will be included. Many of the original participants will be plenary speakers. A social event is planned.

**Funding:** This conference is funded by grants from the Taft Foundation and the National Science Foundation.

**Information:** For additional information contact C. McCord or K. Meyer at De...
department of Mathematics, University of Cincinnati, Cincinnati, OH, 45221-0025, or GLOBALMATH.UC.EDU.

27–28 Central Section, Kansas State University, Manhattan, KS.

Information: W. Draay, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: wsd@math.ams.org.

30–April 3 European Joint Conferences on Theory and Practice of Software (ETAPS), Preliminary announcement and call for satellite events, Lisbon, Portugal. (Nov. 1996, p. 1385)

Aim: What is ETAPS? Starting in 1998, a new annual meeting covering a wide range of topics in software science will take place in Europe each spring in the slot currently occupied by CAAP/ESOP/CC and TAPSOFT. The European Joint Conferences on Theory and Practice of Software (ETAPS) will be a loose and open confederation of existing and new conferences and other events. The overall aim is to create a popular annual meeting that will act as a strong magnet for academic and industrial researchers working on topics related to software science.

Topics: The events that comprise ETAPS will address various aspects of the system development process, including specification, design, implementation, analysis, and improvement. The languages, methodologies, and tools which support these activities are all well within its scope. Different blends of theory and practice will be represented, with an inclination towards theory with a practical motivation on one hand and soundly based practice on the other. Many of the issues involved in software design apply to systems in general (including hardware systems), and the emphasis on software is not intended to be exclusive.

Satellite Events: People interested in organizing satellite events should contact: J. Fiadeiro, Dep. of Informatics, Faculty of Sciences, University of Lisbon, Campo Grande, 1700 Lisbon, Portugal; tel: 351-1-7500123; fax: 351-1-7500084; e-mail: fiadeiro@di.fc.ul.

Participating Conferences: 1. Foundations of Software Science and Computation Structures (FoSSaCS): The scope of FoSSaCS is syntactic, algebraic, logical, and semantic methods for describing, analyzing, transforming, and verifying programs and systems. The focus is on foundational aspects of such methods rather than on their applications. Topics included: computational and syntactic foundations of software science, transition systems and models of concurrency, data structures and types, domain theory and denotational (fixed-point) semantics. Program Committee Chair: M. Nielsen (Paris).

2. Fundamental Approaches to Software Engineering (FASE): To enhance software quality, the software production process requires systematic methods, firmly grounded on scientifically justified techniques. Fundamental approaches are sought, possibly integrating so-called formal and informal aspects, providing the bridge between theory and practice and aimed at producing engineering methods and tools for the various phases of software development. FASE is intended to provide a forum where different fundamental approaches to problems of software specification, development, validation and verification are presented, compared, and discussed. Topics include: methods for the production of provably correct software and its verification; integration of informal and formal methods; formal approaches for real-time, concurrent, distributed and object-oriented systems; scientifically sound approaches to testing and measurement; fundamental aspects of the specification, design and verification of hardware components and hybrid systems; reports on the engineering or scientific lessons gained from industrial experiences in the use of formal and semiformal methods. Program Committee Chair: E. Astesiano (Genova).

3. European Symposium on Programming (ESOP): ESOP is devoted to fundamental issues in the specification, analysis, and implementation of programming languages and systems. It particularly welcomes research that bridges the gap between theory and practice: for example, practical studies based on theoretical developments and theoretical developments with a clearly identified potential for practical application. Topics include: programming paradigms and their integration, including functional, logic, concurrent and object-oriented; semantics facilitating the formal development and implementation of programming languages and systems; advanced-type systems; program analysis; program transformation. Program Committee Chair: C. Hankin (London).

4. International Conference on Compiler Construction (CC): CC is a forum for presenting and discussing recent developments in compiler construction, language implementation, and language design. Its scope ranges from compilation methods and tools to implementation techniques for specific requirements of languages and target architectures and includes language design and programming environment issues related to language translation. Topics include: tools for any phase of compilation, methods for code generation and optimization, compilation for parallel architectures, translation of computer languages (imperative, functional, logic, object-oriented, parallel, etc.); translation of application and specification languages; other tools closely related to compiler construction—e.g., debuggers, data flow analyzers, etc. Program Committee Chair: E. K. Riedy (Cambridge, MA).

5. Tools and Algorithms for Construction and Analysis of Systems (TACAS): Many similar tools and algorithms have been independently developed in various areas of computer science like automata and language theory, verification and synthesis of hardware and software systems, type and proof theory, and logic. TACAS is a forum for discussion of the principles and application-independent features of such algorithms and their implementation, with the aim to increase the reliability, flexibility, and efficiency of current tools by highlighting common problems, heuristics, data structures, and solutions. TACAS overlaps with the other events of ETAPS and is intended to attract contributions that stimulate discussions among the various communities. Program Committee Chair: R. Steffen (Passau).


April 1998


Information: R. Cascella, rge@ams.org.

16–18 Twenty-Second Arkansas Spring Lectures in the Mathematical Sciences, Fayetteville, Arkansas.

Topic: Combinatorial methods in algebra.

Principal Speaker: E. I. Zelmanov (Yale Univ.).


Program: The meeting will consist of at least five sessions: morning and afternoon sessions on Thursday and Friday and a morning session on Saturday. Each session will begin with a lecture by Professor Zelmanov, followed by two or three talks by invited speakers or contributed papers.

Funding: A proposal has been submitted to the National Science Foundation for funds to assist graduate students and young researchers with expenses.

Call for Papers: Contributed papers should be submitted before Feb. 18, 1998.

Information: V. Retakh or S. Tabachnikov, Dept. of Mathematical Sciences, SCEN 301, University of Arkansas, Fayetteville, Arkansas 72701, or e-mail: vretakh@comp.uark.edu or asrg6@comp.uark.edu.


Information: W. Draay, wsd@ams.org.

27–29 Conference on Real Numbers and Computers, Pierre et Marie Curie University, Paris, France.

Topics: The topics covered by the conference are: Algorithms and architectures for "serial" and "on line" arithmetic; relations among number theory, automata theory, and computer arithmetic; number systems; floating point arithmetic; calculability; symbolic manipulation of numbers; algorithms for "exact" computing; multi-precision, interval arithmetic, stochastic arithmetic, etc.; accuracy problems in various fields (geometry, physics, etc.) and proposed solutions.
**Mathematics Calendar**

**Deadline:** For submission of manuscripts: January 1, 1998. You can submit a full paper (not an abstract) to: RRC361p6.fr, preferably in TeX. Please request a pattern TeX file from the above address.

If you cannot use TeX, send four copies of a printed version to J.-M. Chesneau, Laboratoire LIP6, Université Pierre et Marie Curie, 4 place Jussieu, 75252 Paris Cedex 05, France.

**Information:** [http://www-anp.lip6.fr/RRC3/](http://www-anp.lip6.fr/RRC3/) Questions can also be sent to the e-mail address: Jean-Marie.Chesneau@lip6.fr.

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**27-May 1 Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.**

**Program:** IMA Workshop: Nonlinear Identification and Control.

**Organizers:** Y. Kurzhanskiy, E. Ydstie, P. S. Krishnapasad.

**Information:** Institute for Mathematics and Its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

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**29-May 1 Nonlinear Problems in Aviation and Aerospace, Daytona Beach, Florida.**

**Sponsor:** International Federation of Nonlinear Analysts.

**Program Scope:** Conference sponsors seek a spectrum of theoretical, computational, and experimental inquiries concerned with aviation, aerospace, aeronautics, and astronautics. This program will include keynote addresses, invited lectures, and contributed lectures, and will involve communication with remote sites. Nonlinear means not necessarily linear. Topics concerned with linear problems are also welcome.

**Call for Papers:** To organize sessions, please submit a two-page proposal by July 31, 1997. Collaborative/Interdisciplinary proposals are encouraged. Deadline for papers is January 15, 1998.

**Information:** IC N PAA-98, 206 Church St. SE, Minneapolis, MN 55455.

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**June 1998**

1-5 **Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.**

**Program:** IMA Workshop: Animal Locomotion and Robotics.

**Organizers:** J. Collins, D. Koditschek.

**Information:** Institute for Mathematics and Its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

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1-5 **Fifth International Conference on p-Adic Functional Analysis, A. Mickiewicz University of Poznań, Poland.**

**Program:** Research talks concerning analysis over valued fields other than the real or complex numbers (such as p-adic numbers field).

**Topics:** Fréchet and Banach spaces, locally convex spaces and modules, operators, spaces of continuous and analytic functions, distributions and measure, functional theory, classical and harmonic analysis. Applications in mathematical physics.

**Organizers:** J. Kakol and W. Wnuk (Poznań).

**Scientific Committee:** N. De Grande-De Kimpe (Brussels, Belgium), J. Kakol (Poznań, Poland), C. Perez-Garcia (Santander, Spain).


**Information:** J. Kakol, e-mail: jkakol@math.su. edu.pl and W. Wnuk, e-mail: wnuk@sowi.math.su. edu.pl; addresses: Faculty of Mathematics and Computer Science, A. Mickiewicz University, Matejki 48/49, 60-769 Poznań, Poland.

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**9-11 1998 International Conference on Dynamic Systems and Differential Equations, Shanghai Jiao Tong University, Shanghai, The People's Republic of China.**

**Organizers:** Shanghai Jiao Tong University, University of Wisconsin-La Crosse.

**Scope:** The development of the theory and application of dynamical systems and differential equations has undergone a period of rapid growth during recent years. The main purpose of the conference is to provide a forum for researchers and practitioners from around the world to discuss recent development and exchange ideas in these fields.

**Topics:** General topics of interest will include, but not be limited to: theory of dynamical systems, ordinary differential equations, partial differential equations, functional equations, applications in the sciences and engineering.

**Abstracts:** To present a talk at the conference, submit a one-page, double-spaced abstract in English containing your address (e-mail and office), phone, and fax numbers. Deadline for submission of abstract: January 31, 1998.

**Invited Speakers:** S. Hu (Southwest Missouri State Univ.), R. C. Buck (Northeastern Univ.), H.-O. Walther (Univ. Giessen), Z. Xia (Western Univ.), W. Zhang (Shanghai Jiao Tong Univ.).

**Coordination:** All participants from the People's Republic of China should contact: X. Ma, Department of Applied Mathematics, Shanghai Jiao Tong University, Shanghai, The People's Republic of China; tel: 86-21-62813558; fax: 86-21-62829425; e-mail: sryang@jtu.edu.cn. Participants from other countries should contact: I. Z. Du, Department of Mathematics, Kennesaw State University, Kennesaw, GA 30144; tel: 770-423-6669; fax: 770-423-6629; e-mail: jiaxunma1@kennesaw.edu. More detailed information will be announced later.


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17-23 6th Purdue International Symposium on Fluid Dynamics, Simon Fraser University, Burnaby, British Columbia, Canada.

**Information:** C. Graham, gac@cs.sfu.ca.

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**31-June 6th International Spring School "Nonlinear Analysis, Function Spaces and Applications", Prague, Czech Republic.**

**Program:** The school will concentrate on survey lectures in topics mentioned in the title. The invited speakers will deliver a series of four lectures each. In addition to the main lectures there will be a limited possibility of short communications and a poster session.

**Invited Speakers:** V. I. Burenkov (Cardiff, UK), F. Cobos (Madrid, Spain), V. G. Maz’ya (Linkoping, Sweden), L. Pick (Prague, Czech Republic), C. Sbordone (Naples, Italy), H. Triebel (Jena, Germany), L. E. Vekslyts (Columbia, MO, USA), W. P. Ziemer (Bloomington, IN, USA).

**Information:** For registration and for further information please contact A. Kulner (Chairman of the Organizing Committee) or L. Pick (Secretary). Mathematical Institute, Academy of Sciences, Zitna 25, 115 67 Prague 1, Czech Republic; e-mail: pick@mbox.cesnet.cz.

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**May 1998**

11-15 **Emerging Applications of Dynamical Systems, University of Minnesota, Minneapolis, Minnesota.**

**Program:** IMA Workshop: Pattern Formation in Continuous and Coupled Systems.

**Organizers:** M. Golubitsky, D. Luss, S. Strogatz.

**Information:** Institute for Mathematics and Its Applications, University of Minnesota, 206 Church St. SE, Minneapolis, MN 55455.

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**28-31 19th Annual Meeting of Canadian Applied Mathematics Society (CAMS/SCMA) and 13th Canadian Symposium on Fluid Dynamics, Simon Fraser University, Burnaby, British Columbia, Canada.**

**Information:** C. Graham, gac@cs.sfu.ca.
sium on Statistics, West Lafayette, Indiana. Workshops: The symposium will begin with the workshops "Interfaces between Statistical Paradigms" and "Nutrition and Statistics," held simultaneously June 17–19. The workshop "Statistical Genetics: An Inter-disciplinary Future" will be held on June 21–23. A conference titled "Statistical Decision Theory and Related Topics" will be held June 19–21 and will include invited and contributed paper sessions. Information: Contact the Symposium chair, S. Gupta (sgupta@stat.purdue.edu), or the co-chair, M. E. Bock (abock@stat.purdue.edu), Sixth Purdue Symposium on Statistics, Statistics Department, Purdue University, West Lafayette, IN 47907-1399; tel: 765-494-6030.

21–24 LICS’98 (The Thirteenth Annual IEEE Symposium on Logic in Computer Science, Indiana University Conference Center, Indianapolis. Information: D. Leivant, Dept. of Computer Science, Indiana University, Bloomington, IN 47405; e-mail: leivant@cs.indiana.edu.

21–26 Thirteenth U. S. National Congress of Theoretical & Applied Mechanics, University of Florida, Gainesville, Florida. Focus: Sessions are being planned for general lectures, symposia, and contributed papers covering all aspects of research which are of general interest to the applied mechanics community. Contributed research papers will be selected from 300-500-word summaries, which must be submitted for consideration by September 15, 1997, to the conference chair (Eisenberg).

Information: Inquiries regarding the congress may be addressed to: M. A. Eisenberg, e-mail: meiws@eng.ufl.edu, tel: 719-333-4034; N. D. Cristescu, e-mail: cristescu@ufl.edu, tel: 352-392-6747; or R. J. Adrian, e-mail: r-adrian@iuuc.indiana.edu, tel: 217-333-1793. Mail addresses for M. A. Eisenberg and N. D. Cristescu: AeMES Department, University of Florida, P. O. Box 116250, Gainesville, FL 32611-6250; mail address for R. J. Adrian: 216 Talbot Lab., University of Illinois, 104 S. Wright St., Urbana, IL 61801.

Organizers: The United States National Congress of Applied Mechanics is organized by the United States National Committee on Theoretical and Applied Mechanics under the general sponsorship of the National Academy of Sciences and the National Academy of Engineering.

22–26 The Eighth International Conference on Fibonacci Numbers and Their Applications, Rochester, New York. Sponsors: This conference will be sponsored jointly by the Fibonacci Association and the Rochester Institute of Technology. Submissions: Papers on all branches of mathematics and science related to the Fibonacci numbers and generalized Fibonacci numbers, as well as papers related to recurrences and their generalizations, are welcome. Manuscripts, which should be sent in duplicate to F. T. Howard at the address below, are due by May 1, 1998. The first page of the manuscript should contain only the title, the author's name and address, and an abstract of the paper. In all other respects, authors should follow the guidelines for submission of articles found on the inside cover of any recent issue of The Fibonacci Quarterly.

Information: F. T. Howard, Box 117, 1959 N. Peace Haven Road, Winston-Salem, NC 27106; e-mail: howard@math.csc.wfu.edu.

22–27 Third Siberian Congress on Industrial and Applied Mathematics (INPRIM-98) dedicated to the memory of S. L. Sobolev (1908–1989), Novosibirsk Akademgorodok, Russia. Sponsors: The Sobolev Institute of Mathematics, the Institute of Informatics Systems, the Institute for Computational Technology, and the Computer Center of the Siberian Branch of the Russian Academy of Sciences, together with Novosibirsk State University, Novosibirsk State Technical University, and the Siberian Society for Promotion of Science and Education (SIBOS) convene the International Congress INPRIM-98.

Information: V. Vaskevich, the Sobolev Institute of Mathematics, 630090 Novosibirsk, Russia, phone: +7-3832-351560, fax: +7-3832-350582, e-mail: vask@math.nsc.ru.

July 1998

*8–10 Twenty-Third Australasian Conference on Combinatorial Mathematics and Combinatorial Computing, The University of Queensland, Brisbane, Australia.

Information: The conference will be held in Brisbane, Australia, July 8–10, 1998. The program will include special sessions, invited talks, and contributed papers. Further information will be published in a later date.


Conference: Chairmen: S. A. Alfa, tel: 204-474-9803, fax: 204-275-7507, e-mail: alfa@cc.umanitoba.ca; S. Chakravarty, tel: 313-762-7906, fax: 810-762-9796, e-mail: schakra@novona.gmi.ca.

Conference Secretary: B. Dunlop, tel: 204-474-6630, fax: 204-275-7507, e-mail: buelbol@bldeng.lanl.umanitoba.ca.

August 1998


Program Committee: D. Dawson (Fields), G. Grimmett (Cambridge), T. Lyons (Imperial), T. Kurtz (Wisconsin), M. Madras (York), E. Perkins (U.B.C.), T. Salisbury (York), G. Slade (McMaster), S. R. S. Varadhan (Courant).

Topics of Concentration: Probability and Physics, Probability and Communications.

Information: Approximately eight workshops are planned. Graduate courses are
planned. The program includes a monthly series of distinguished lectures, to be called the Kolmogorov Lectures. Funding will be available for visitors, postdoctoral fellows, and graduate students. As it becomes available, information will be posted on the program's Web site. Consult the home page of The Fields Institute, http://www.math.toronto.ca, send email to organizers@fields.utoronto.ca, or write to: The Fields Institute for Research in Mathematical Sciences, 222 College Street, Second Floor, Toronto, Ontario, M5T 3J1, Canada; tel: 416-972-5000; fax: 416-972-5022.

10-14 From Individuals to Populations, Ceske Budejovice, Czech Republic.
Topics: The workshop is an interdisciplinary meeting of biologists and mathematicians focused on effects of individual behavioral decisions of animals on population dynamics. Such decisions include, for example: optimal prey selection, optimal patch selection, ideal free distribution, optimal antipredatory behavior, effect of refuge on population dynamics, various trade-offs in behavior of parasitoids, and other game-theoretical models.
Scientific Committee: P. Antonelli, C. Clark, D. Cohen, Ch. Godfray, W. Gurney, M. Man- ggel, W. Murdoch, G. Nachman, R. Nisbet, D. Rubenstein, A. Stewart-Oaten, W. Sutherland.
Information: Current information on the workshop, including registration form, can be found at the WWW home page: http://www.fitop.ento.ca.cz/. Please address any other inquiries to V. Krivan, Institute of Entomology AS CR, Branisovska Z. 370 05 Ceske Budejovice, Czech Republic; e-mail: krivan@ento.ca.cz.

13-17 Seventh International Colloquium on Numerical Analysis and Computer Science with Applications, Plovdiv, Bulgaria.
Topics: Acceleration of convergence, numerical simulation, numerical approximation, numerical methods in complex analysis, numerical methods in linear algebra, interval arithmetic, numerical algebraic or transcendental equations, mathematical programming, optimization and variational techniques, numerical analysis for ordinary differential equations, numerical analysis for partial differential equations, computer arithmetic and numerical analysis, computer aspects of numerical algorithms, parallel and distributed algorithms, concurrent and parallel computations, computer networks, discrete mathematics in relation to computer science, computer-aided design, theory of data, image processing, pattern recognition, communication systems, manufacturing systems, database management systems, software engineering, applications in mathematics, physics, chemistry, biology, technology, and economics.
Organizers: The colloquium is organized by the International Federation of Nonlinear Analysts, the Japan Mathematical Society, UNESCO, and other prestigious national and international mathematical institutions.
Call for Papers: Abstracts for contributed papers should be received by March 1, 1998.
Information: D. Bainov, P.O. Box 45, 1504 Sofia, Bulgaria.

18-27 International Congress of Mathematicians (ICM98), Berlin, Germany. (June 1996, p. 702)
Information: Up-to-date information on the International Congress of Mathematicians can be found in the ICM98 server. Its URL is http://www.math.toronto.ca/ICM98/. The ICM98 server contains a forms page for "preliminary preregistration". This is not a formal registration yet. Everybody preregistered for ICM98 will be informed in the future automatically about the progress of the organization of the congress by e-mail and will receive the final registration material, etc., this way. Please encourage your colleagues interested in ICM98 to preregister for the congress. Whoever does not have the possibility to use the advanced Internet tools can send e-mail to the following address: icm@icm98@zib-berlin.de and writing PRELIMINARY PREREGISTRATION on the subject line.
International Congresses of Mathematicians take place every four years. They are supported and assisted by the International Mathematical Union (IMU). The IMU server has the URL: http://www.math.ubc.ca/ICM98/. This WWW home page serves several purposes. The first is to inform all members of the international mathematical community of what the IMU is doing. Second, they can find there descriptions of various programs from which they can benefit. Third, the IMU server is also a collection of data that everyone can use to find the addresses of the main mathematical organizations of the world. It is planned to extend the scope of the IMU server so that it will become a true "home page of the world of mathematics". You can already find a number of links to mathematical and mathematics-related information offered around the world. Just look at the "Links to the Mathematical World" in the IMU server.

30-September 5 Algebraic Number Theory and Diophantine Analysis, Graz, Austria.
Organizers: F. Halter-Koch (Univ. of Graz) and R. F. Tichy (Graz Technical Univ).
Program: A satellite conference of ICM-98, Berlin. Topics include algebraic number theory, diophantine equations, transcendence, uniform distribution as well as computational and analytic aspects. There will be one-hour survey lectures as well as 20-minute contributed talks (open to everybody) and a special session on diophantine equations.
Information: e-mail: nt98@e1.math.tugraz.ac.at.

31-September 6 International Conference on Mathematics and Applications Dedicated to the 90th Anniversary of L. S. Pontryagin, Steklov Mathematical Institute of the Russian Academy of Sciences and Moscow State (Lomonosov) University, Moscow, Russia.
Organizers: Steklov Mathematical Institute.
of the Russian Academy of Sciences and Moscow State (Lomonosov) University. 

September 1998
* 1-9 Fourth International Workshop on Complex Structures and Vector Fields, St. Constantine resort (near Varna), Bulgaria. 
Goal: The aim of this workshop is to bring together experts in complex analysis, differential geometry, mathematical physics, and related fields to assess recent developments in these areas and to stimulate research in intermediate topics. 
Organizers: S. Dimiev (chair), I. M. Mladenov (Sofia), K. Sekigawa (Niigata), H. Hashimoto (Saitama).

Information: S. Dimiev, sdimiev@bgearn.acad.bg, or I. M. Mladenov, mladenov@bgcict.acad.bg.

12-13 Central Sectional Meeting, DePaul University, Chicago, IL.
Information: W. Drady, wsd@ams.org.

October 1998
* 9-10 AMS Southeastern Sectional Meeting, Wake Forest University, Winston-Salem, North Carolina.

24-25 AMS Eastern Sectional Meeting, Pennsylvania State University, State College, PA.
Information: R. Cascella, rgc@ams.org.

November 1998
14-15 AMS Western Sectional Meeting, University of Arizona, Tucson, AZ.
Information: W. Drady, wsd@ams.org.

January 1999
Organizing Committee: D. Dawson (Fields), N. Madras (York), T. Salisbury (York), G. Slade (McMaster).
Program Committee: D. Dawson (Fields), G. Grimmett (Cambridge), T. Lyons (Imperial), T. Kurtz (Wisconsin), N. Madras (York), E. Perkins (UBC), T. Salisbury (York), G. Slade (McMaster), S. R. S. Varadhan (Courant).

Topics of Concentration: Probability and biology, probability and finance. 
Information: Approximately eight workshops are planned. Graduate courses are planned. The program includes a monthly series of distinguished lectures, to be called the Kolmogorov Lectures. Funding will be available for visitors, postdoctoral fellows, and graduate students. As it becomes available, information will be posted on the program’s Web site. Consult the home page of The Fields Institute, http://www.fields.utoronto.ca/, send e-mail to probability@fields.utoronto.ca, or write to: The Fields Institute for Research in Mathematical Sciences, 222 College Street, Second Floor, Toronto, Ontario, M5T 3J1, Canada; tel: 416-348-9710; fax: 416-348-9385.


March 1999
18-21 AMS Central Sectional Meeting, University of Illinois-Urbana, Urbana, Illinois.

April 1999
10-11 AMS Western Sectional Meeting, University of Nevada, Las Vegas, NV.
Information: W. Drady, wsd@ams.org.

24-25 AMS Eastern Sectional Meeting, State University of New York, Buffalo, NY.
Information: R. Cascella, rgc@ams.org.

October 1999
2-3 AMS Eastern Sectional Meeting, Providence College, Rhode Island.
Information: R. Cascella, e-mail: rgc@ams.org.

8-10 AMS Central Sectional Meeting, University of Texas, Austin.
Information: W. Drady, e-mail: wsd@ams.org.

January 2000

April 2000
7-9 AMS Central Sectional Meeting, University of Notre Dame, Notre Dame, Indiana.
Information: W. Drady, e-mail: wsd@ams.org.

January 2001

October 2001
13-14 AMS Eastern Sectional Meeting, Williams College, Williamstown, Massachusetts.
Information: R. Cascella, e-mail: rgc@ams.org.
New Publications Offered by the AMS

General and Interdisciplinary

Preventing for Careers in Mathematics
Annalisa Crannell, Franklin & Marshall College, Lancaster, PA, Organizer


This video presents an edited version of a panel discussion that took place at the Joint Mathematics Meetings in Seattle in August 1996. The panel, sponsored by the AMS Committee on the Profession, discussed how Ph.D. students in mathematics can prepare themselves for finding jobs once they finish their degrees. The panelists ranged from new Ph.D.s who had recently been on the job market, to senior mathematicians in academia and industry. Among the topics discussed are how to start preparing for a job search while still a graduate student, specific job search strategies, tips on interviewing, and perspectives on what academic and industrial employers are looking for in a job applicant. The video ends with a look at the range of employment resources offered by the AMS.


Mathematics Subject Classification: 00, List $15, Order code VIDEO/99N

Some Points of Analysis and Their History
Lars Gårding, Lund University, Sweden

This book is a collection of small essays on the history and proofs of some important and interesting theorems of analysis in this century. Most of the results in classical analysis and the theory of partial differential operators are associated with Swedish mathematicians. Also included are the Tarski-Seidenberg theorem and Wiener's classical results in harmonic analysis and a delightful essay on the impact of distributions in analysis. All mathematical points are fully explained, but some require a certain mature understanding from the reader. This book is a well-written, simple work that offers full mathematical treatment, along with insight and fresh points of view.

This book is co-published with Higher Education Press (Beijing) and is distributed worldwide, except in the People's Republic of China, by the American Mathematical Society.

Contents: Picard's great theorem; On Holmgren's uniqueness theorem; The Phragmén-Lindelöf principle; Nevanlinna theory; The Riesz-Thorin interpolation theorem; The mathematics of Wiener's Tauberian theorem; The Tarski-Seidenberg theorem; Intrinsic hyperbolicity; Hypoellipticity; Dirichlet's problem and Gårding's inequality; A sharp form of Gårding's inequality; The impact of distributions in analysis.

This text will also be of interest to those working in analysis.

University Lecture Series, Volume 11

Discovering Modern Set Theory. II: Set-Theoretic Tools for Every Mathematician

Winfried Just, Ohio University, Athens, and Martin Weese, University of Potsdam, Germany

This is the second volume of a two-volume graduate text in set theory. The first volume covered the basics of modern set theory and was addressed primarily to beginning graduate students. This second volume is intended as a bridge between introductory set theory courses and advanced monographs that cover selected branches of set theory, such as forcing or large cardinals. The authors give short but rigorous introductions to set-theoretic concepts and techniques such as trees, partition calculus, cardinal invariants of the continuum, Martin's Axiom, closed unbounded and stationary sets, the Diamond Principle (◊), and the use of elementary submodels. Great care has been taken to motivate the concepts and theorems presented.

The book is written as a dialogue with the reader. The presentation is interspersed with numerous exercises. The authors wish to entice readers into active participation in discovering the mathematics presented, making the book particularly suitable for self-study. Each topic is presented rigorously and in considerable detail. Carefully planned exercises lead the reader to active mastery of the techniques presented. Suggestions for further reading are given. Volume II can be read independently of Volume I.

Contents: Notation; Filters and ideals in partial orders; Trees; A little Ramsey theory; The Δ-system lemma; Applications of the continuum hypothesis; From the Rasiowa-Sikorski lemma to Martin's Axiom; Martin's Axiom; Hausdorff gaps; Closed unbounded sets and stationary sets; The ◊-principle; Measurable cardinals; Elementary submodels; Boolean algebras; Appendix: Some general topology; Index; Index of symbols.

Graduate Studies in Mathematics

Cyclic Cohomology and Noncommutative Geometry

Joachim J. R. Cuntz, University of Heidelberg, Germany, and Masoud Khalkhali, University of Western Ontario, London, Canada, Editors

Noncommutative geometry is a new field that is among the great challenges of present-day mathematics. Its methods allow one to treat noncommutative algebras—such as algebras of pseudodifferential operators, group algebras, or algebras arising from quantum field theory—on the same footing as commutative algebras, that is, as spaces. Applications range over many fields of mathematics and mathematical physics.

This volume contains the proceedings of the workshop on "Cyclic Cohomology and Noncommutative Geometry" held at The Fields Institute (Waterloo, ON) in June 1995. The workshop was part of the program for the special year on operator algebras and its applications.

Features:
- Contributions by originators of the subject who are leaders in the field.
- Survey articles not previously available.
- Expository articles geared toward the larger mathematical community.


Fields Institute Communications, Volume 17


Cyclic Cohomology

The aim of the articles is to treat representation theory with these two subjects, written by some of the world's physicists to guide the reader who wants more detail. Robert Langlands on the current status of functoriality. All Sciences address, and the authors have supplied extensive bibliographies to fill a natural transitivity assumption, called k-connected set transitivity (k-CS-transitivity), are analyzed in some detail. Classification in many of the interesting cases is given. This work generalizes Droste's classification of the countable k-CS-transitive trees (k ≥ 2). In a CFPO, the structure can branch downwards as well as upwards, and can do so repeatedly (though it never returns to the starting point by a cycle).
Mostly it is assumed that \( k \geq 3 \) and that all maximal chains are finite. The main classification splits into the sporadic and skeletal cases. The former is complete in all cardinalities. The latter is performed only in the countable case. The classification is considerably more complicated than for trees, and skeletal CFPOs exhibit rich, elaborate and rather surprising behavior.

Features:
- Lucid exposition of an important generalization of Droste’s work
- Extended introduction clearly explaining the scope of the memoir
- Visually attractive topic with copious illustrations
- Self-contained material, requiring few prerequisites

Contents: Extended Introduction; Preliminaries; Properties of \( k\)-CS-transitive CFPOs; Constructing CFPOs; Characterization and isomorphism theorems; Classification of skeletal CFPOs (Part 1); Classification of skeletal CFPOs (Part 2); Sporadic cycle-free partial orders.

Memoirs of the American Mathematical Society, Volume 129, Number 614

Individual member $27, List $45, Institutional member $36, Order code MEMO/129/614N

Analysis

Homeomorphisms in Analysis
Casper Goffman, Purdue University, West Lafayette, IN,
Togo Nishiura, Wayne State University, Detroit, MI, and
Daniel Waterman, Dickinson College, Carlisle, PA

... The book is well written, packed with information and makes a novel contribution to the literature. Much of what is in the book is important material that is now for the first time readily accessible ... readers will appreciate the many comments that provide historical or motivational perspectives ...

—Andrew Bruckner, University of California, Santa Barbara

This book features the interplay of two main branches of mathematics: topology and real analysis. The material of the book is largely contained in the research publications of the authors and their students from the past 50 years. Parts of analysis are touched upon in a unique way, for example, Lebesgue measurability, Baire classes of functions, differentiability, \( C^k \) and \( C^\infty \) functions, the Blumberg theorem, bounded variation in the sense of Cesari, and various theorems on Fourier series and generalized bounded variation of a function.

Features:
- Contains new results and complete proofs of some known results for the first time.
- Demonstrates the wide applicability of certain basic notions and techniques in measure theory and set-theoretic topology.
- Gives unified treatments of large bodies of research found in the literature.

Contents: Part 1. The One Dimensional Case: Subsets of \( \mathbb{R} \); Baire class 1; Differentiability classes; The derivative function; Part 2. Mappings and Measures on \( \mathbb{R}^n \): Bi-Lipschitzian homeomorphisms; Approximation by homeomorphisms; Measures on \( \mathbb{R}^n \), Blumberg’s theorem; Part 3. Fourier Series: Improving the behavior of Fourier series; Preservation of convergence of Fourier series; Fourier series of integrable functions; Supplementary material; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 54
Model Theory and Linear Extreme Points in the Numerical Radius Unit Ball

Michael A. Dritschel
University of Virginia, Charlottesville, VA

Hugo J. Woerdeman
College of William & Mary, Williamsburg, VA

This memoir initiates a model theory-based study of the numerical radius norm. Guided by the abstract model theory of Jim Agler, the authors propose a decomposition for operators that is particularly useful in understanding their properties with respect to the numerical radius norm. Of the topics amenable to investigation with these tools, the following are presented:

• A complete description of the linear extreme points of the $n \times n$ matrix (numerical radius) unit ball
• Several equivalent characterizations of matriascular extremals in the unit ball; that is, those members which do not allow a nontrivial extension remaining in the unit ball
• Applications to numerical ranges of matrices, including a complete parameterization of all matrices whose numerical ranges are closed disks

In addition, an explicit construction for unitary 2-dilations of unit ball members is given, Ando’s characterization of the unit ball is further developed, and a study of operators satisfying $|A| - \text{Re}(e^{i\theta}A) \geq 0$ for all $\theta$ is initiated.

Contents: Introduction; The Canonical Decomposition; The Extremals $\delta^n$; Extensions to the Extremals; Linear Extreme points in $c$; Numerical Ranges; Unitary 2-Dilations; Application to the inequality $|A| - \text{Re}(e^{i\theta}A) \geq 0$; Appendix; References; Index.

Memoirs of the American Mathematical Society, Volume 129, Number 615


Some Connections between Isoperimetric and Sobolev-type Inequalities

Serguei G. Bobkov, Syktyvkar State University, Russia, and Christian Houdré, Georgia Institute of Technology, Atlanta

For Borel probability measures on metric spaces, the authors study the interplay between isoperimetric and Sobolev-type inequalities. In particular the question of finding optimal constants via isoperimetric quantities is explored. Also given are necessary and sufficient conditions for the equivalence between the extremality of some sets in the isoperimetric problem and the validity of some analytic inequalities. Much attention is devoted to probability distributions on the real line, the normalized Lebesgue measure on the Euclidean spheres, and the canonical Gaussian measure on the Euclidean space.

Contents: Introduction; Differential and integral forms of isoperimetric inequalities; Proof of Theorem 1.1; A relation between the distribution of a function and its derivative; A variational problem; The discrete version of Theorem 5.1; Proof of propositions 1.3 and 1.5; A special case of Theorem 1.2; The uniform distribution on the sphere; Existence of optimal Orlicz spaces; Proof of Theorem 1.9 (the case of the sphere); Proof of Theorem 1.9 (the Gaussian case); The isoperimetric problem on the real line; Isoperimetry and Sobolev-type inequalities on the real line; Extensions of Sobolev-type inequalities to product measures on $\mathbb{R}^n$; References.

Memoirs of the American Mathematical Society, Volume 129, Number 616

Differential Equations

Elliptic Boundary Value Problems in Domains with Point Singularities

V. A. Kozlov, Russian Academy of Sciences, Moscow, V. G. Maz'ya, Linköping University, Sweden, and J. Rossmann, Rostock University, Germany

This monograph systematically treats a theory of elliptic boundary value problems in domains without singularities and in domains with conical or cuspidal points. This exposition is self-contained and a priori requires only basic knowledge of functional analysis. Restricting to boundary value problems formed by differential operators and avoiding the use of pseudo-differential operators makes the book accessible for a wider readership.

The authors concentrate on fundamental results of the theory: estimates for solutions in different function spaces, the Fredholm property of the operator of the boundary value problem, regularity assertions and asymptotic formulas for the solutions near singular points. A special feature of the book is that the solutions of the boundary value problems are considered in Sobolev spaces of both positive and negative orders. Results of the general theory are illustrated by concrete examples. The book may be used for courses in partial differential equations.

Contents: Introduction; Part 1. Boundary value problems for ordinary differential equations on the half-axis; Elliptic boundary value problems in the half-space; Elliptic boundary value problems in smooth domains; Variants and extensions; Part 2. Elliptic boundary value problems in an infinite cylinder; Elliptic boundary value problems in domains with conical points; Elliptic boundary value problems in weighted Sobolev spaces with nonhomogeneous norms; Variants and extensions; Part 3; Elliptic boundary value problems in domains with interior cusps; Elliptic boundary value problems in domains with inside cusps; Bibliography; Index; List of symbols.

Mathematical Surveys and Monographs, Volume 52


Optimization Methods in Partial Differential Equations

Steven Cox, Rice University, Houston, TX, and Irena Lasiecka, University of Virginia, Charlottesville, Editors

This book presents a collection of papers written by specialists in the field and devoted to the analysis of various aspects of optimization problems with a common focus on partial differential equation (PDE) models. These papers were presented at the AMS-SIAM 1996 Joint Summer Research Conference held at Mount Holyoke College, South Hadley, MA, in June 1996.

The problems considered range from basic theoretical issues in the calculus of variations—such as infinite dimensional Hamilton Jacobi equations, saddle point principles, and issues of unique continuation—to ones focusing on application and computation, where theoretical tools are tuned to more specifically defined problems. The last category of these problems include inverse/recovery problems in physical systems, shape optimization and shape design of elastic structures, control and optimization of fluids, boundary controllability of PDE's including applications to flexible structures, etc.

The papers selected for this volume are at the forefront of research and point to modern trends and open problems. This book will be a valuable tool not only to specialists in the field interested in technical details, but also to scientists entering the field who are searching for promising directions for research.

Applications are invited for the above Professorship tenable from 1 October 1998 from persons working in the field of Pure Mathematics.

Present pensionable stipend for a Professor is £41,288 a year.

Further information may be obtained from the Secretary General of the Faculties, General Board Division, University Offices, The Old Schools, Cambridge CB2 1TT, to whom applications, marked 'confidential', should be sent with the names of two referees by 24 October 1997.

The University follows an equal opportunities policy.

Ravi B. Boppana, New York University, Courant Institute, NY, and James F. Lynch, Clarkson University, Potsdam, NY, Editors

This volume contains selected papers from the DIMACS Workshop on Logic and Random Structures held in November 1995. The workshop was a major event of the DIMACS Special Year on Logic and Algorithms. The central theme was the relationship between logic and probabilistic techniques in the study of finite structures. In the last several years, this subject has developed into a very active area of mathematical logic with important connections to computer science. The DIMACS workshop was the first of its kind devoted to logic and random structures. Recent work of leaders in the field is contained in the volume, as well as new theoretical developments and applications to computer science.


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Dmitri Fomin, St. Petersburg State University, Russia, Sergey Genkin, Microsoft Corporation, and Ilia Itenberg, Institut de Recherche Mathématique de Rennes, France
...a rich collection of good problems ... useful notes for teachers ... Appendix A ... will be especially interesting for those who are dealing with all forms of cooperative learning ... may be very useful wherever there are classes devoted to solving non-standard problems.
—American Mathematical Monthly Mathematical World, Volume 7; 1996; ISBN 0-8218-0430-6; 272 pages; Softcover; List $29; All AMS members $23; Order code MAWRDL/7CI79

Mathematics and Sports
L. E. Sadovskii, Institute of Railroad Transportation Engineering, Moscow, Russia, and A. L. Sadovskii, Texas A & I University, Kingsville
...a nice survey of applications of mathematics in sporting events.
—Mathematical Reviews
Treatment is concise and insightful.
—Zentralblatt für Mathematik
Mathematical World, Volume 3; 1993; reprinted 1997; ISBN 0-8218-9500-1; 152 pages; Softcover; List $19; All AMS members $16; Order code MAWRDL/3CI79

On Being a Department Head, a Personal View
John B. Conway, University of Tennessee, Knoxville
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Co-published with the London Mathematical Society. Members of the LMS may order directly from the AMS at the AMS member price. The LMS is registered with the Charity Commissioners
History of Mathematics, Volume 10; 1996; ISBN 0-8218-0529-0; 153 pages; Hardcover; List $39; All AMS members $31; Order code HMATH/10CI79

Techniques of Problem Solving
Steven G. Krantz, Washington University, St. Louis, MO
1997; ISBN 0-8218-0619-X; 465 pages; Softcover; List $29; All AMS members $23; Order code TPSC79

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Luis Fernández and Haedeh Gooransarab, Washington University, St. Louis, MO, with assistance from Steven G. Krantz
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Walter Rudin, University of Wisconsin, Madison
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History of Mathematics, Volume 12; 1997; reprinted 1997; ISBN 0-8218-0633-5; 465 pages; Softcover; List $29; All AMS members $23; Order code HMATH/12CI79

What’s Happening in the Mathematical Sciences, 1995–1996
Barry Cipra
...stylish format ... largely accessible to laymen ... This publication is one of the snappier examples of a growing genre from scientific societies seeking to increase public understanding of their work and its societal value.
—Science & Government Report
What’s Happening in the Mathematical Sciences, Volume 3; 1997; ISBN 0-8218-0355-7; 111 pages; Softcover; List $12; Order code HAPPENING/3CI79

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**Procedures of Symposia in Pure Mathematics**

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- **The Arcata Conference on Representations of Finite Groups**, edited by Paul Fong, 1987, 552 pp. - PSAPM/47.2WS79 $82 $20

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- **Several Complex Variables and Complex Geometry**, edited by Eric Bedford, John P. D'Angelo, Robert E. Greene, and Steven G. Krantz, 1991, 262 pp. - PSAPM/52.1WS79 $60 $15
- **Several Complex Variables and Complex Geometry**, edited by Eric Bedford, John P. D'Angelo, Robert E. Greene, and Steven G. Krantz, 1991, 368 pp. - PSAPM/52.3WS79 $75 $15
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CALIFORNIA
CALIFORNIA POLYTECHNIC STATE UNIVERSITY Mathematics Department

Tenure-track in mathematics, beginning fall ’98. Assistant professor ($37,140 to $46,812). Duties include teaching (normal load: 12 hours per quarter), scholarship, advising, and committee service. Doctorate in mathematics is required. Applicants are expected to present evidence of excellent teaching and an active research program. Computational Mathematics (Recruitment Code: 83001): Areas of interest include dynamical systems, numerical analysis, topology, applied mathematics, or more generally any area that uses computational mathematics in a significant way. Operator Theory (Recruitment Code: 83002): Areas of interest include applications of operator theory to control theory, mathematical physics, and traditional topics in operator theory. Combinatorial Mathematics (Recruitment Code: 83003): Areas of interest include enumerative and algebraic combinatorics, Polya theory, theory of partitions, formal series, q-series, permutations statistics, and symmetric polynomials. Send letter of application, résumé, brief statement of professional goals, three letters of reference (at least one of which discusses teaching ability), and transcripts (unofficial okay initially) to: Chair, Screening Committee, Mathematics Department, Cal Poly, San Luis Obispo, CA 93407. Please specify recruitment code on all correspondence. Closing date: 11/1/97. Cal Poly is strongly committed to achieving excellence through cultural diversity. The University actively encourages applications and nominations of women, persons of color, applicants with disabilities, and members of other underrepresented groups. AA/EEO.

CALIFORNIA POLYTECHNIC STATE UNIVERSITY Mathematics Department Mathematics Education

Tenure-track position beginning fall ‘98. Assistant professor ($37,140 to $46,812). Responsibilities include teaching methods courses for prospective K-12 teachers, supervising student teachers and senior projects, and teaching mathematics courses. Doctorate in mathematics education with the equivalent of a master’s degree in mathematics or doctorate in mathematics with significant experience in teacher education is required. Precollege teaching experience and a background in educational technology and assessment is desired.

Send letter of application, résumé, professional goals, three letters of reference, and transcripts (unofficial okay initially) to: Chair, Math Ed Screening Committee, Mathematics Department, Cal Poly, San Luis Obispo, CA 93407. Indicate Recruitment Code 83004 on all correspondence. Closing date: 11/17/97. Cal Poly is strongly committed to achieving excellence through cultural diversity. The University actively encourages applications and nominations of women, persons of color, applicants with disabilities, and members of other underrepresented groups. AA/EEO.

UNIVERSITY OF CALIFORNIA, BERKELEY Tenured or Tenure-Track Position Department of Mathematics Berkeley, CA 94720

Pending budget approval, we invite applications for one or more positions effective July 1, 1998, at either the tenure-track (assistant professor) or tenured (associate or full professor) level in the general areas of pure or applied mathematics. Tenure-track applicants are expected to have demonstrated outstanding research potential, normally including major contributions beyond the doctoral dissertation. Such applicants should send a résumé, reprint or preprint and/or dissertation abstract, and three letters of evaluation to:

Luis A. Caffarelli, Chair, Mathematics Department, University of California, Berkeley, CA 94720, (510) 642-6551.

Closing date: 11/17/97.

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Submission: Promotions Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940, or via fax, 401-331-5842, or send e-mail to classified@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.
the Vice Chair for Faculty Affairs at the above address. It is the responsibility of the tenure-track applicants to make sure that letters of evaluation are sent. 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 People, and then Faculty Positions at Berkeley).

Tenure applicants are expected to demonstrate leadership in research and should send a curriculum vitae, list of publications, a few selected reprints or preprints, and the names and addresses of three references to the Vice Chair for Faculty Affairs at the above address. The applicant should indicate whether (s)he is applying for an associate professor or full professor position. The department will assume responsibility to solicit letters of evaluation and will provide evaluators with a copy of the summary of policies on confidentiality of letters of evaluation.

All applicants are requested to use the AMS standardized application form and to indicate their subject area using the AMS subject classification numbers. The form is the Academic Employment in Mathematics, AMS Standard Cover Sheet. It is available courtesy of the American Mathematical Society.

We should receive material for both tenure-track and tenure applications no later than November 1, 1997. Applications postmarked after the deadline will not be considered. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA AT
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Charles A. Morrey Jr.
Assistant Professorships
Department of Mathematics
Berkeley, CA 94720

We invite applications for these special (non-tenure-track) positions effective July 1, 1998. 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 three 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 People, and then Faculty Positions at Berkeley). 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, AMS Standard Cover Sheet. It is available courtesy of the American Mathematical Society.

We should receive this material no later than December 1, 1997. The University of California is an Equal Opportunity/Affirmative Action Employer.

TEMPORARY POSTDOCTORAL POSITIONS
Department of Mathematics
University of California at Berkeley
Berkeley, CA 94720

Several temporary positions beginning in full 1998 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; combined teaching/research appointments may be made for up to three years. Mathematicians whose research interests are close to those of regular department members will be given some preference. Applicants should send a resume; reprints, preprints, and/or dissertation abstract; and three 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 People, and then Faculty Positions at Berkeley). 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, AMS Standard Cover Sheet. It is available courtesy of the American Mathematical Society.

We should receive this material no later than December 1, 1997. The University of California is an Equal Opportunity/Affirmative Action Employer.

University of California, Los Angeles
Department of Mathematics
Regular Positions in Pure and Applied Mathematics

The UCLA Department of Mathematics invites applications for three or more tenure-track positions in mathematics. Exceptional promise in research and teaching is required. Positions are generally budgeted at the assistant professor level, but sufficiently outstanding candidates will be considered at higher levels. Teaching load is an average of 4.5 quarter courses per year. Positions subject to availability of resources and administrative approval. To apply, send electronic mail to search@math.ucla.edu, or open http://www.math.ucla.edu/search on the World Wide Web, or write to Tony Chan, Chair, Department of Mathematics, University of California, Los Angeles, CA 90095-1555, Attn: Staff Search. UCLA is an Equal Opportunity/Affirmative Action Employer.

I I L L I N O I S

UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN
Department of Mathematics
J. L. Doob Research Assistant Professorship

The Department of Mathematics plans to recruit young mathematicians, with preference given to those not more than one year past the Ph.D., for a three year, non-renewable, appointment as J. L. Doob Research Assistant Professor. It is our intent to attract the very best young scholars to our department. In order to succeed in this endeavor, the search will be ongoing and offers will be made at any time an outstanding candidate is located. As is usual with postdoctoral and visiting positions, the department expects to assume the responsibility for making the offers without prior approval from the administration.

In order to attract the best applicants a national search will be conducted. Advertisements for these positions will be published in major mathematical journals, distributed to peer mathematics departments, and placed on our web page. A search committee will be established to review the applications. They will consult with other faculty in the department and will make recommendations to the Executive Committee. The Executive Committee will make final decisions on offers.

UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN
Department of Mathematics
Tenure-Track Position

Applications are invited for one or more full-time faculty positions to commence August 21, 1998, at the tenure-track (assistant professor) level. Those faculty will be expected to pursue an vigorous research program, and to teach graduate students as well as undergraduate students. The department will consider applicants in all fields of mathematics, but we intend to show preference in applied mathematics, differential equations, number theory, algebraic geometry, combinatorics, computational mathematics, and probability theory. Salary and teaching load are competitive.

Tenure-track applicants must 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 arrange to have three letters of reference sent directly to the address below. It is the responsibility of the tenure-track applicants to make...
Employer.

To insure full consideration, all materials, including letters of recommendation, should be received by December 7, 1997. We encourage use of the application cover sheet provided by the American Mathematical Society and indication of the subject area using the AMS subject classification numbers. Applications from women and minority candidates are especially encouraged. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Mathematics
Tenured Position

Applications are invited for one or more full-time tenured faculty positions to commence August 21, 1998. Those faculty will be expected to pursue an outstanding research program and to teach graduate students as well as undergraduate students. The department will consider applicants in all fields of mathematics, but we intend to show preference in applied mathematics, differential equations, number theory, algebraic geometry, combinatorics, computational mathematics, and probability theory. Salary and teaching load are competitive.

Tenure applicants are expected to have a Ph.D. and a documented record of leadership in research as well as of excellence in teaching. They 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.

Philippe Tondeur, 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

To insure full consideration, all materials should be received by October 3, 1997. We encourage use of the application cover sheet provided by the American Mathematical Society and indication of the subject area using the AMS subject classification numbers. Applications from women and minority candidates are especially encouraged. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

MARYLAND

UNIVERSITY OF MARYLAND
AT COLLEGE PARK
Department of Mathematics

Applications are invited for tenure and tenure-track positions in the Department of Mathematics from researchers with strong interests in at least one of the following three fields: applied analysis, numerical analysis, and scientific computation. Exceptional research and teaching required. Successful candidates will integrate their research with our educational program.

Candidates at all levels will be considered. Priority will be given to applications received by Nov. 1, 1997. The appointments will commence in the fall of 1998.

The University of Maryland is an Equal Opportunity and Affirmative Action Employer that strongly encourages applications from female and minority candidates.

Please send a curriculum vitae, 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
EASTERN SHORE
Assistant/Associate Professor
Department of Mathematics and Computer Science

Applications are currently being accepted for a full-time, tenure-track appointment beginning August 1997. Salary is commensurate with experience and qualifications. Responsibilities: Teach twelve hours undergraduate mathematics, conduct and direct research, advise students, and participate in service activities to the campus community.

Qualifications: Earned doctorate in an area of mathematics or related area. Prior teaching experience at the university level required. Must have record of scholarly and research accomplishments, effectiveness in undergraduate teaching, and evidence of quality service.

Applications will be accepted until position is filled. Qualified applicants should submit letter of application, résumé, and three letters of professional recommendation (sent by referees) to:
Department of Human Resources
University of Maryland Eastern Shore
Princess Anne, MD 21853

To insure full consideration, all materials should be received by November 15 and will continue until the position is filled. As an EEO/AA employer, Williams especially welcomes applications from women and minority candidates.

WILLIAMS COLLEGE
Department of Mathematics
Williamstown, Massachusetts 01267

Anticipated tenure-eligible position in statistics, beginning fall 1998, probably at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and statistics, including scholarship and consulting, and Ph.D. required.

Please have a vita and three letters of recommendation on teaching and research sent to Hiring Committee. Evaluation of applications will begin November 15 and will continue until the position is filled. As an EEO/AA employer, Williams especially welcomes applications from women and minority candidates.

WILLIAMS COLLEGE
Department of Mathematics
Williamstown, Massachusetts, 01267

Anticipated visiting position(s) in mathematics or statistics for the 1998-99 year, probably full-time, probably at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research and Ph.D. required.

Please have a vita and three letters of recommendation on teaching and research sent to Visitor Hiring Committee. Evaluation of applications will begin November 15 and will continue until the position is filled. As an EEO/AA employer, Williams especially welcomes applications from women and minority candidates.

NEW YORK

RENSSELAER POLYTECHNIC INSTITUTE
Department of Mathematical Sciences

Applications are invited for a tenure-track assistant professor position in applied mathematics to begin in August 1998. Applicants are expected to have demonstrated outstanding research potential and to have a strong interest and ability in teaching. Of particular interest are candidates with a commitment to interdisciplinary research who are knowledgeable in scientific computation.

Applicants should submit a letter of application, a curriculum vitae, a description of research interests, and three letters of recommendation to Search Committee Chair, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, Troy, NY 12180. Evaluation of applications will begin October 15, 1997, and will continue until a candidate is selected.
Rensselaer is an Equal Opportunity/Affirmative Action Employer and strongly encourages applications from women and underrepresented minorities.

STATE UNIVERSITY OF NEW YORK AT BUFFALO

The Department of Mathematics anticipates the appointment of tenure-track assistant professors beginning September 1, 1998. Salary will be competitive. We seek applicants in the fields of applied mathematics, geometric analysis, and geometric topology who have excellent research accomplishments/potential and a strong commitment to teaching.

Applicants should send supporting information, including a C.V. with a list of research interests, and four letters of recommendation to:

Search Committee Chairman
Department of Mathematics
SUNY/Buffalo
106 Diefendorf Hall
3435 Main Street
Buffalo, New York 14214-3093

No electronic applications will be accepted.

The deadline for applications is November 1, 1997. Late applications will be considered until positions are filled.

SUNY/Buffalo is an Equal Opportunity/Affirmative Action Employer. We are interested in identifying prospective minority and women candidates. No person in whatever relationship with the State University of New York at Buffalo shall be subject to discrimination on the basis of age, creed, color, handicap, national origin, race, religion, sex, marital, or veteran status.

NORTH CAROLINA

NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics

The Department of Mathematics invites applications for a tenure-track position at the assistant or associate professor level in representation theory and combinatorics, beginning in the fall of 1998. Candidates must have a doctoral degree in mathematics, a strong ongoing research program in representation theory and/or algebraic combinatorics, and a commitment to effective teaching at the undergraduate and graduate levels. Preference will be given to candidates with postdoctoral experience. Applicants should send a vita and at least three letters of recommendation to Algebra Search Committee, Department of Mathematics, North Carolina State University, Raleigh, NC 27695-8205. Review of completed applications will begin immediately. Applications will continue to be accepted until the position is filled. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, veteran status, or disability.

RHODE ISLAND

BROWN UNIVERSITY

J. D. Tamarkin Assistant Professorship

Three-year non tenure, non renewable appointment, beginning July 1, 1998. Teaching load: two courses per semester (6 hours per week). Ph.D. degree must be received before start of appointment, but we will not consider applicants who will have held an academic or postdoctoral position for more than two years after their Ph.D. by June 1998. 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. A curriculum vitae, a completed application form, and three letters of recommendation should be received by December 1, 1997. Requests for application forms and all other inquiries should be addressed to Tamarkin Search Committee, Department of Mathematics, Brown University, Providence, RI 02912. Brown University is an Equal Opportunity/Affirmative Action Employer and encourages applications from women and minorities.

WISCONSIN

UNIVERSITY OF WISCONSIN-MADISON

The Department of Mathematics invites applications for one or more tenure-track positions to begin August 24, 1998. The department has identified its areas of priority as partial differential equations, real and harmonic analysis, algebra, and probability. Truly outstanding candidates in other areas will also be considered. Candidates should exhibit evidence of outstanding research potential, normally including significant contributions beyond the doctoral dissertation. A strong commitment to excellence in instruction is also expected. Additional information is available on the departmental WWW site, http://www.math.wisc.edu.

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:

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 for the lecturer positions should also send a brief statement of educational activities and interests.

Applicants should also arrange to have sent to the above address three or four letters of recommendation. At least one of these letters, preferably two for the lecturer positions, must discuss the applicant's teaching experience and capabilities. Other evidence of good teaching will be helpful. The deadline for completed applications is January 15, 1998, although applications will continue to be considered until all available positions are filled.

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 applicants must be released upon request. Finalists cannot be guaranteed confidentiality.
tion regarding applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

CA

DALHOUSIE UNIVERSITY
Assistant Professor
Mathematics

The Department of Mathematics, Statistics and Computing Science at Dalhousie University invites applications for two probationary tenure-track positions in mathematics at the assistant professor level effective September 1, 1998. Candidates with a Ph.D in any area of mathematics are encouraged to apply. Successful candidates will be expected to develop excellence in research and teaching and to train graduate students. Postdoctoral experience would be an asset. Applicants must submit a curriculum vitae, copies of up to five recent publications, a concise statement of present and projected research and teaching interests, and the names and mailing/e-mail addresses of three referees. The deadline for applications is October 1, 1997, but applications will be considered until the positions are filled. Applications should be sent to: Dr. R. P. Gupta, Chair, Department of Mathematics, Statistics and Computing Science, Dalhousie University, Halifax, NS B3H 3J5; fax: 902-494-5130; tel: 902-494-2572. Further information about the department is available at www.ca.dal.ca and about the University at www.dal.ca.

Dalhousie University is an Employment Equity/Affirmative Action Employer. The University encourages applications from qualified women, Aboriginal peoples, visibly handicapped people, and persons with disabilities. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents.

GERMANY

MAX-PLANCK-INSTITUTE FOR
MATHEMATICS IN THE SCIENCES
Leipzig, Germany
Five-Year Visiting Professorship

The Max-Planck-Institute invites applications for a distinguished five-year visiting research professorship in the fields of Riemannian and symplectic geometry and mathematical aspects of quantum field theories.

Applicants should have demonstrated outstanding research potential and clear evidence of achievement. Applicants should be under the age of 35. The Institute offers excellent research facilities, including a large visitor program. Salary will be on the German C3 scale (comparable to an associate professorship in North America).

Applications should be sent to: Prof. E. Zeidler, Max-Planck-Institute for Mathematics in the Sciences, Inselstr. 22-26, D-04103 Leipzig, Germany.

The deadline for applications is Oct. 31, 1997. Employment will start on Oct. 1, 1998, or at a mutually agreeable date.

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Volume 3, 1997

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January 1997, 603 pp./ISBN: 0-12-041552-6
Includes one CD-ROM.

Differential Equations with Mathematica
SECOND EDITION
Martha Abell and James Braselton
This Second Edition of the groundbreaking Differential Equations with Mathematica integrates new applications from a variety of fields, especially biology, physics, and engineering. The new handbook is also completely compatible with Mathematica version 3.0 and is a perfect introduction for Mathematica beginners. The book/CD-ROM package contains built-in commands that lets the user solve problems directly using graphical solutions.

Paperback: $44.95
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Patrick T. Tam
A Physicist's Guide to Mathematica teaches students and professional physicists how to master Mathematica using examples and approaches that will appeal to them. The book illustrates the usefulness of Mathematica in learning, teaching, and carrying out research in physics. Part One gives a practical, physicists-oriented, and self-contained introduction to the program; Part Two covers the application of Mathematica to mechanics, electricity and magnetism, and quantum physics.

Paperback: $59.00 (tentative)
April 1997, 506 pp./ISBN: 0-12-683190-4
Includes one disk.

Mastering Mathematica
Programming Methods and Applications
SECOND EDITION
John W. Gray
This new edition of Mastering Mathematica focuses on using Mathematica as a programming language, as programming in Mathematica is the best way to use the software to its fullest capacity. The book covers functional programming, imperative programming, rewrite programming, and object-oriented programming, and also addresses the use of Mathematica as a symbolic manipulator and a general tool for knowledge representation.

Paperback: $44.95 (tentative)
August 1997, c. 640 pp./ISBN: 0-12-296105-6

The Mathematica Programmer II
Roman Maeder
This book is a second volume to follow The Mathematica Programmer (Academic Press, 1993) and is compatible with the latest release of Mathematica, version 3.0. The new volume includes coverage of various paradigms of programming, including logic programming, high-order functions, combinatorial algebras, and Turing machines. The volume also includes a CD-ROM compatible with both Macintosh and Windows which contains updated programs from the first and second volumes, as well as HTML documents with links to all relevant information.

Paperback: $44.95
1996, 296 pp./ISBN: 0-12-460992-0
Includes one CD-ROM.

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Roman Maeder
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Selected Articles

J. Cremona
Computing Periods of Cusp Forms and Modular Elliptic Curves
To appear

F. Gouvêa
Non-Ordinary Primes
To appear

J.H. Conway, R.H. Hardin, N.J.A. Sloane
Packing Lines, Planes, etc.: Packings in Grassmannian Spaces
Volume 5, Number 2

S. Tompaidis
Approximation of Invariant Surfaces by Periodic Orbits in High-Dimensional Maps
Volume 5, Number 3

K.A. Brakke
Numerical Solution of Soap Film Dual Problems
Volume 4, Number 4

E. Bombieri, D.C. Hunt, A.J. van der Poorten
Determinants in the Study of Thue's Method and Curves with Prescribed Singularities
Volume 4, Number 2
Northwestern University invites nominations for the Frederic Esser Nemmers Prize in Mathematics, to be awarded during the 1997-98 academic year. The award includes payment to the recipient of $100,000. 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) and Joseph B. Keller (1996).

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 1998 Nemmers Prize in Mathematics will deliver a public lecture and participate in other scholarly activities at Northwestern University for 10 weeks during the 1998-99 academic year.

Nominations for the Frederic Esser Nemmers Prize in Mathematics will be accepted until December 1, 1997. 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.

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(January–December 19)

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<td>Joint family member (full rate)</td>
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<td>Joint family member (reduced rate)</td>
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<td>Contributing member (minimum $186)</td>
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<td>Student member (please verify)</td>
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<td>Unemployed member (please verify)</td>
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<td>Reciprocity member (please verify)</td>
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<td>Category-S member</td>
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<td>Multi-year membership</td>
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Montreal, Quebec Canada
University of Montreal
September 26-28, 1997

Meeting #924
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: Volume 18, Issue 3

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses
Jacob E. Goodman, City College, City University of New York, Convex geometry on affine Grassmannians and geometric transversals.
Dieter Kotschick, Universität Basel and Max-Planck-Institute für Mathematik, Bonn, Einstein metrics and topology.
François Lalonde, University of Quebec at Montreal, Symplectic topology, an interface between geometry and physics.
Ieke Moerdijk, University of Utrecht, Netherlands, Invariants of groupoids related to foliations.

Special Sessions
Category Theory and Its Applications, Michael Barr, McGill University, Ieke Moerdijk, University of Utrecht, Netherlands, and Myles Tierney, Rutgers University.
Combinatorial Geometry, David Avis, McGill University, Jacob E. Goodman, City University of New York, City College, and Richard Pollack, Courant Institute-New York University.
Commutative Algebra, Irena V. Peeva, Massachusetts Institute of Technology, and Hema Srinivasan, University of Missouri.
Geometric Analysis and Spectral Theory, Yannis Petridis and John Andrew Toth, McGill University.
History of Mathematics, Israel Kleiner, York University, and James J. Tattersall, Providence College.
Invariant Theory, Abraham Broer, University of Montreal, Yannis Y. Papageorgiou, C.R.M., University of Montreal, and David L. Wehlau, Royal Military College and Queen's University.
Non-Euclidean and Spacetime Geometries, Abraham A. Ungar, North Dakota State University.
Number Theory and Arithmetic Geometry, Henri Rene Darmon and Adrian Iovita, McGill University and CICMA, and Chantal David, Concordia University and CICMA.
Potential Theory, Kohur Gowri Sankaran, McGill University, and David H. Singman, George Mason University.
Symplectic Geometry and Differential Topology, Jacques C. Hurtubise and Lisa Claire Jeffrey, McGill University, and François Lalonde, University of Quebec at Montreal.
Claremont, California

Claremont Colleges

October 4, 1997

Meeting #925

Joint meeting with the Mathematical Association of America.

Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: None

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses

Irene Fonseca, Carnegie Mellon University, New trends in partial differential equations, calculus of variations, and applications to problems in materials science.

Michael T. Lacey, Georgia Institute of Technology, The bilinear Hilbert transform: New methods of phase plane analysis.

Marek R. Rychlik, University of Arizona, The solution of the equichordal point problem and the dynamics of algebraic correspondences.

Special Sessions

Applications of Symbolic Computation to Differential Equations, James Herod, Georgia Tech, and Maria Clara Nucci, University of Perugia, Italy.

Complex and Algebraic Dynamics and Applications, Marek R. Rychlik, University of Arizona.

Computer Proofs in Set Theory and Logic, Johan G. F. Belinfante, Georgia Institute of Technology.

Concrete Aspects of Real Polynomials, Victoria Ann Powers, Emory University, and Bruce A. Reznick, University of Illinois, Champaign-Urbana.

Discrete Conformal Geometry, Philip Lee Bowers, Florida State University.

Discrete and Combinatorial Geometry, András Bezdek and Wlodzimierz Kuperberg, Auburn University.

Harmonic Analysis and Its Applications, Michael Lacey, Georgia Institute of Technology.

Modern Banach Space Theory, Stephen Dilworth and Maria K. Girardi, University of South Carolina.

Nonlinear Dynamics and Applications, Wenxian Shen, Auburn University, and Yingfei Yi, Georgia Institute of Technology.

Recent Developments in PDEs, Calculus of Variations, and Applications to Problems in Materials Science, Irene Fonseca, Carnegie Mellon University, Daniel Phillips, Purdue University, and Vladimir Sverak, University of Minnesota.

Set-Theoretic Techniques in Topology and Analysis, Gary F. Gruenhage and Piotr Koszmider, Auburn University.

Stochastic Inequalities and Their Applications, Theodore P. Hill and Christian Houdré, Georgia Institute of Technology.

The Dynamics and Topology of Low Dimensional Flows, Robert W. Ghrist, University of Texas at Austin, and Michael C. Sullivan, Southern Illinois University at Carbondale.

Atlanta, Georgia

Georgia Institute of Technology

October 17–19, 1997

Meeting #926

Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: Volume 18, Issue 3
Milwaukee, Wisconsin
University of Wisconsin-Milwaukee
October 24–25, 1997

Meeting #927
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: Volume 18, Issue 4

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses
Spencer J. Bloch, University of Chicago, Mixed motives.
Henri Moscovici, Ohio State University, Noncommutative geometry and characteristic classes.
Wei Ming Ni, University of Minnesota, Spike-layers in nonlinear diffusion systems.
Andrei Suslin, Northwestern University, GL and functor cohomology.

Special Sessions
Analysis with Wavelets, Gilbert G. Walter, University of Wisconsin-Milwaukee, and Ahmed I. Zayed, University of Central Florida.
Applications of Model Theory to Analysis and Topology, Paul J. Bankston, Marquette University, and H. Jerome Keisler, University of Wisconsin.
Computability Theory, Steffen Lempp, University of Wisconsin, Madison, and Robert I. Soare, University of Chicago.
Concentration Phenomena in Differential Equations, Lia Bronsard, McMaster University, and Wei-Ming Ni, University of Minnesota.
Differential Geometry, Hongyou Wu, Northern Illinois University.
Eigenvalue Problems for Differential Equations, Paul A. Binding, University of Calgary, and Hans W. Volkmer, University of Wisconsin-Milwaukee.
Enveloping Algebras and Quantum Groups, Ian M. Musson and Yi Ming Zou, University of Wisconsin-Milwaukee.
Geometric Topology and Geometric Group Theory, Frederic Davis Ancel and Craig R. Guilbault, University of Wisconsin-Milwaukee.
Harmonic Analysis and Its Applications, Lung-Kee Chen, Oregon State University, Dashan Fan, University of Wisconsin-Milwaukee, and Yi-Biao Pan, University of Pittsburgh.
K-Theory and Motives, Daniel Richard Grayson, University of Illinois, Urbana-Champaign.
Low Dimensional Dynamics, Karen M. Brucks, University of Wisconsin-Milwaukee, and Beverly E. J. Diamond, University of Charleston.
Mathematics in Industry, Michael Benedikt, Lucent Technologies.
Number Theory and Cryptography, Eric Bach and Rene Peralta, University of Wisconsin-Milwaukee.
Operator Theory and Function Spaces, Željko Ćučković, University of Toledo.
Rings and Modules, Karl Andrew Kosler and Shubhangi S. Stalder, University of Wisconsin Centers-Waukesha.
Semigroups and Their Applications, Karl E. Byleen and Peter R. Jones, Marquette University.
Symplectic Topology and Quantum Cohomology, Yong-Geun Oh, University of Wisconsin, and Yongbin Ruan, University of Utah.

Albuquerque, New Mexico
University of New Mexico
November 8–9, 1997

Meeting #928
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: September 1997
Program issue of Notices: November 1997
Issue of Abstracts: Volume 18, Issue 4

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses
Charles P. Boyer, University of New Mexico, Quaternionic geometry and Einstein manifolds.
Abel Klein, University of California, Irvine, Localization of classical waves.

Special Sessions
(Multi) Wavelets and Numerical PDEs, Peter R. Massopust, Sandia National Laboratories.
Meetings & Conferences

Commutative Algebra, Scott Thomas Chapman, Trinity University, and Alan Loper, Ohio State University, Newark.

Computational Logic, Stanly Steinberg, University of New Mexico.


Computational Mechanics, D. L. Sulsky, University of New Mexico.

Difference and Differential Equations, Saber N. Elaydi, Trinity University, and Robert J. Sacker, University of Southern California.

Diophantine Geometry, Alexandru Buium, University of New Mexico.

Geometry and Analysis of Foliations, Efton L. Park and Kenneth S. Richardson, Texas Christian University.

Harmonic Analysis, Jay B. Epperson and Christina Pereya, University of New Mexico.

Localization and Other Multiple Scattering Phenomena of Classical Waves, Alexander Figotin, University of North Carolina at Charlotte, and Abel Klein, University of California, Irvine.

Nonlinear Mathematics, James M. Hyman, Los Alamos National Laboratory.

Quaternions in Global Riemannian and Algebraic Geometry, Charles P. Boyer and Galicki Krzysztof, University of New Mexico.

Accommodations

Participants should make their own arrangements directly with the hotel of their choice. The rates quoted for the DoubleTree Hotel are available until October 7, and participants should state that they will be attending the AMS Sectional Meeting. All rooms will be on a space available basis after the cut-off date. The AMS is not responsible for rate changes or for the quality of the accommodations. Rates quoted do not include taxes. Some of the hotels listed may offer special weekend rates.

DoubleTree Hotel, 201 Marquette NW; 505-247-3344; $79/single, $89/double, and $99/triple, until October 7; adjacent to the Albuquerque Convention Center.

La Posada de Albuquerque, 125 2nd Street NW; 505-242 9090; $115/single or double; two blocks from the Convention Center.

Hilton Hotel, 1901 University Blvd. NE; 505-884-250; $79-109/single and $89-119/19-double; approximately 10 minutes by automobile from the Convention Center.

Ramada Inn-Mountain View, 2020 Menaul Blvd. NE; 505-884-2511; $95/single and double. The Holiday Inn is approximately 10 minutes by automobile from the Convention Center.

Food Service: There are several eating establishments located in the area of the Convention Center and also in the hotels in the area. A list of Albuquerque restaurants will also be available at the registration desk.

Local Information

For further information please consult the Web site maintained by the Department of Mathematics at the University of New Mexico: http://www.math.unm.edu/conference.html, or visit the Web site http://www.abqcvb.org/ or send e-mail to info@abqcvb.org. Information on New Mexico can be obtained at http://www.nets.com/newmex-tourism/. November weather is generally pleasant with daytime temperatures in the 50–60° F. range, and nighttime temperatures in the 30–45° F. range.

Other Activities

AMS Book Sale: Examine the newest titles from AMS! Most books will be available at a special 50% discount offered only at meetings. Complimentary coffee will be served, courtesy of AMS Membership Services.

Parking: The price of overnight parking for DoubleTree guests is $5 per day, with in and out privileges, and $5 per day for valet parking. Parking at the Hilton Hotel and Holiday Inn is free.

Registration and Meeting Information: Registration will take place in the DoubleTree Hotel from 7:30 a.m. to noon and 1:30 p.m. to 4:00 p.m. on Saturday, November 8; and 9:00 a.m. to noon on Sunday, November 9. Registration fees are payable on-site only: $30/AMS member, $45/nonmember, and $10/emeritus member, students, or unemployed mathematical scientists. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express credit cards. Lectures will take place in meeting rooms in the Albuquerque Convention Center, adjacent to the DoubleTree Hotel.

Travel

USAirways has been selected as the official airline for this meeting. The following specially negotiated rates are available only for the period November 5–11: 5% discount off first class and any published USAirways promotional round-trip fare, or 10% discount off unrestricted coach fares with seven-day advance reservations and ticketing required. These discounts are valid providing all rules and restrictions are met and are applicable for travel from the continental U.S., Bahamas, Canada, and San Juan, P.R. Discounts are not combinable with other discounts or promotions. Additional restrictions may apply on international travel. For reservations call (or have your travel agent call) 800-334-8644 between 8:00 a.m. and 9:00 p.m. Eastern Daylight Time. Refer to Gold File Number 41380118.

Oaxaca, Mexico

Oaxaca, Mexico

December 3–6, 1997

Meeting #929

Third Joint Meeting of the American Mathematical Society and the Sociedad Mathematica Mexicana.

Associate secretary: Lesley M. Sibner
INSTITUTO TECNOLOGICA DE OAXACA

Announcement issue of Notices: September 1997
Program issue of Notices: December 1997
Issue of Abstracts: None

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses
Javier Bracho, IMATE-UNAM, Title to be announced.
Jorge Ize, IIMAS-UNAM, Title to be announced.
Gian-Carlo Rota, Massachusetts Institute of Technology, Title to be announced.
Ronald Stern, University of California, Irvine, Title to be announced.
Alberto Verjovsky, CIC and IMATE-UNAM, Title to be announced.
Raymond O. Wells, Rice University, Title to be announced.

Special Sessions
Algebraic Geometry and Commutative Algebra, Leticia Brambila, UAM-Iztapalapa, and Rick Miranda, Colorado State University.
Applied Non-linear Analysis, Gustavo Cruz, IIMAS-UNAM, Susan J. Friedlander, University of Illinois at Chicago, Rafael de la Llave, University of Texas at Austin, and Pablo Padilla, University Nacional Autonoma de Mexico.
Complex and Functional Analysis, William Abikoff, University of Connecticut, Raul E. Curto, University of Iowa, Salvador Perez-Esteva, University Nacional Autonoma de Mexico, and Michael Porter, CINVESTAV-IPN.
Differential Geometry and Topology, Luis Hernandez, CIMAT, Max Neumann, IMATE-UNAM, Peter Scott, University of California, Berkeley, and University of Michigan, and Kevin Corlette, University of Chicago.
General Topology, Charles L. Hagopian, California State University Sacramento, and Isabel Puga, FC-UNAM.
Graphs and Combinatorial Geometry, Janos Pach, City College, City University of New York, and Eduardo Rivera, IMATE-UNAM and UAM-Iztapalapa.
Mathematical Physics, Eric Carlen, Georgia Institute of Technology, Micho Durdevich, IMATE-UNAM, Roberto Quezada, UAM-Iztapalapa, and Nicolai Reshetikhin, University of California, Berkeley.
Numerical Analysis, Bernardo Cockburn, University of Minnesota, and Jean P. Hennart, IIMAS-UNAM.
Representation Theory of Algebras and Groups, Martha Takane and Ernesto Vallejo, IMATE-UNAM, and Dan Zacharia, Syracuse University.
Rings and Category Theory, Sergio Roberto Lopez-Permouth, Ohio University, and Jose Rios and Leopoldo Roman, IMATE-UNAM.
Stochastic Systems, Guillermo Segundo Ferreyra, Louisiana State University, and Daniel Hernandez, CINVESTAV-IPN.

Contributed Paper Sessions
There will be sessions of ten-minute contributed papers.
The deadline for submission is August 1. Overhead projectors and blackboards will be available for presentations.
All abstracts should be sent to verde@xanum.vam.mx.

Accommodations
Participants should make their own arrangements directly with the hotel and state that they will be attending the AMS-SMM Joint International Meeting. The AMS is not responsible for rate changes or the quality of the accommodations. All rates are quoted in U.S. dollars. If you reserve by fax, include complete name, bank, credit card number and expiration date, arrival/departure date, and room preference (single, double, etc.).

Hotel Misión de los Angeles, Calzada Porfirio Diaz No. 102, telephone: (52-951) 5-1500, fax: (52-951) 5-1680, e-mail: hmission@infosel.net.mx, http://oaxaca.infosel.com.mx/webs/hmission.htm, $55 single/double.

Hotel Victoria, Lomas del Fortín No. 1, telephone: (52-951) 5-2633 and 800-448-8355 (from the U.S.), fax: (52-951) 5-2411; $58 standard single/double, $79 Villa room single/double, $90 Junior suite single/double.

Food Service: There are very few restaurants near the Tecnológico de Oaxaca. Most restaurants are located downtown and at the hotels listed above. It is a five-minute drive by taxi from the Tecnológico to downtown Oaxaca or the hotels.

Local Information: Up-to-date meeting information can be obtained by consulting the Web site maintained by the SMM at http://www.matem.unam.mx/smm/smm.html.
Local and tourist information is available at http://antequera.com/OaxacaTour/

In December the temperature in Oaxaca varies from a low of around 50-59 °F (10-15 °C) during the night to a high around 77-82 °F (25-28 °C). Rain and cloudy skies are very rare in early December.

**Registration and Lectures**

There is no advance registration. Registration Desk: Teatro Macedonio Alcalá (downtown); Wednesday, 3:00 p.m. to 6:15 p.m.; Tecnológico de Oaxaca; Thursday and Friday, 9:00 a.m. to 1:00 p.m. and 4:00 p.m. to 8:00 p.m.; and Saturday, 10:00 a.m. to 1:00 p.m. Registration fee: US$50 (U.S. currency or equivalent amount in Mexican pesos).

The meeting will be held at the Instituto Tecnológico de Oaxaca, located in the northwest section of the city of Oaxaca, about three miles from the downtown area. Special Sessions and sessions for Contributed Papers will take place in classroom buildings "R" and "V"; Invited Addresses will be in building "I".

**Social Events:** There will be a reception on Wednesday evening, December 3, at the Santo Domingo former monastery, a XVI century architectural masterpiece.

Cultural events will be held on the evenings of Thursday, December 4, and Friday, December 5.

A tour to the Montalbán archeological site has been scheduled for Saturday afternoon, December 6.

The conference ball (including dinner) will take place on Saturday at 9:00 p.m. Tickets will cost US$30 and will be available at the Registration Desk.

**Travel**

**By Air:** Mexicana and Aeromexico have five daily flights from Mexico City to Oaxaca. The departure times are: 8:10 a.m., 10:00 a.m., 11:35 a.m., 3:40 p.m., and 6:50 p.m. The flying time is 55 minutes, and the round-trip fare is around $180. Note that there are few nonstop flights from the cities in the northern U.S. to Mexico City. Most flights go through cities like Atlanta, Dallas-Fort Worth, Miami, Los Angeles, and Houston. This means that the total travel time from northern U.S. cities to Oaxaca, including two stops, may be nine hours or more.

The taxi ride from the airport to downtown Oaxaca or the Tecnológico takes from 20 to 25 minutes, and the fare is approximately US$10.

**By Bus from Mexico City:** First-class bus service to Oaxaca is available from the Terminal de Autobuses del Poniente (Eastern Bus Station), also known as TAPO. The trip takes around six hours and costs between US$20 and US$27, one way, depending on the kind of bus.

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**Baltimore, Maryland**

**Baltimore Convention Center**

**January 7-10, 1998**

**Meeting #930**

Joint Mathematics Meetings, including the 104th Annual Meeting of the AMS, 81st 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: Robert J. Daverman
Announcement issue of Notices: October 1997
Program issue of Notices: January 1998
Issue of Abstracts: Volume 19, Issue 1

**Deadlines**

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: October 2, 1997
For summaries of papers to MAA organizers: September 5, 1997

**Invited Addresses**

Jonathan Alperin, University of Chicago, Problems in the representation theory of finite groups (AMS-MAA Invited Address).

Haim Brezis, Paris, France, How to handle infinite energies. (AMS-MAA Invited Address).

Melvin Hochster, University of Michigan, Ann Arbor, Title to be announced.

Bradley Lucier, Purdue University, West Lafayette, Indiana, Title to be announced.

Prabhakar Raghavan, IBM Almaden Research Center, San Jose, CA, Title to be announced.

Tudor Stefan Ratiu, University of California, Santa Cruz, Title to be announced.

Edward Witten, Institute For Advanced Study, Title to be announced. (AMS Josiah Willard Gibbs Lecture).

Lai-Sang Young, University of California, Los Angeles, Title to be announced.

**Special Sessions**

Applied Dynamics, Geometric Analysis, and Mechanics (Code: AMS SS A1), Tudor Ratiu, University of California at Santa Cruz.

Commutative Algebra and Algebraic Geometry (Code: AMS SS B1), Melvin Hochster, University of Michigan, Ann Arbor, and Craig L. Huneke, Purdue University.

Computable Mathematics and Its Applications (Code: AMS SS C1), Valentina Harizanov, George Washington University.
Computational Commutative Algebra (Code: AMS SS D1), William W. Adams, University of Maryland, College Park, Philippe Loustaunau, George Mason University, and Lyn Miller, Western Kentucky University.

Difference Equations and Applications (Code: AMS SS E1), Edward A. Grove and Gerasimos Ladas, University of Rhode Island.

History of Mathematical Logic (Code: AMS SS F1), John W. Dawson Jr., Pennsylvania State University, York.

History of Mathematics (Code: AMS SS G1), Karen H. Parshall, University of Virginia, and James J. Tattersall, Providence College.

Homotopy Theory (Code: AMS SS H1), Jean-Pierre G. Meyer and W. Stephen Wilson, Johns Hopkins University, and Douglas C. Ravenel, University of Rochester.

Inverse Problems and Signal Analysis (Code: AMS SS J1), M. Zuhair Nashed, University of Delaware.

Kleinian Groups and Hyperbolic Manifolds (Code: AMS SS L1), James W. Anderson, University of Southampton.

Knot Theory and Quantum Topology (Code: AMS SS K1), Doug Bullock, Boise State University, Mark E. Kidwell, U.S. Naval Academy, and Jozef H. Przytycki and Yongwu Rong, George Washington University.


Mathematics and Education Reform (Code: AMS SS N1), William Henry Barker, Bowdoin College, Jerry L. Bona, University of Texas at Austin, Naomi Fisher, University of Illinois at Chicago, Harvey B. Keynes, University of Minnesota, Minneapolis, and Kenneth C. Millett, University of California at Santa Barbara.

Nonlinear Inverse Problems: Mathematical Theory, Selected Applications (Code: AMS SS P1), Heinz W. Engl, Johannes Kepler University, and Thomas I. Seidman, University of Maryland, Baltimore County.

Quantum Gravity and Low-Dimensional Topology (Code: AMS SS Q1), John C. Baez, University of California Riverside, and Stephen F. Sawin, Fairfield University.

Recent Developments on the Laplace Operator and Its Geometric Applications (Code: AMS SS R1), Ying Shen and Shuhui Zhu, Dartmouth College.

Recent Progress in the Theory of Operator Algebras and Their Applications (Code: AMS SS S1), Randall Lee Crist, Creighton University, and Roger Smith, Texas A&M University.

Representation Theory and Noncommutative Harmonic Analysis: A Special Session Honoring the Memory of Harish-Chandra (Code: AMS SS T1), Robert S. Doran, Texas Christian University.

Representations of Finite Groups (Code: AMS SS U1), Jonathan L. Alperin, University of Chicago, and Jon F. Carlson, University of Georgia.

Smooth Ergodic Theory and Related Areas (Code: AMS SS V1), John M. Franks, Northwestern University, and John Smillie, Cornell University.

Topology in Dynamical Systems (Code: AMS SS W1), Kathleen T. Alligood, George Mason University, and Judy Anita Kennedy, University of Delaware.

Value Distribution Theory and Its Related Topics (Code: AMS SS X1), Ilpo Laine, University of Joensuu, Finland, Charles F. Osgood, National Security Agency, and C. C. Yang, Hong Kong University of Science and Technology.

Early Registration Opportunity
For the convenience of participants who would like to register early for this meeting, the advance registration/housing form has been included at the back of this issue. Note that the full announcement of the meeting will appear in the October issue.

Louisville, Kentucky
University of Louisville
March 20–21, 1998

Meeting #931
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: Volume 19, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Anders Bjorner, Royal Institute of Technology, Stockholm, Sweden, Title to be announced.
Andrew Bruckner, University of California at Santa Barbara, Title to be announced.
Philippe DiFrancesco, University of North Carolina at Chapel Hill, Title to be announced.
Abigail Thompson, University of California at Davis, Title to be announced.

Special Sessions
Algebraic Combinatorics (Code: AMS SS N1), Anders Bjorner, Royal Institute of Technology, and Michelle L. Wachs, University of Miami.
Applied Probability and Actuarial Science (Code: AMS SS P1), Bogdan Gapinski, Ewa M. Kubicka, Krzysztof Ostraszewski, and Grzegorz Rempala, University of Louisville.
Banach Space Theory (Code: AMS SS F1), Patrick N. Dowling and Beata Randrianantoanina, Miami University, Ohio.
Boundary Value Problems for Differential Equations (Code: AMS SS J1), Paul W. Eloe, University of Dayton.
Combinatorics and Enumerative Geometry (Code: AMS SS A1), Kequan Ding, University of Illinois, Urbana-Champaign, and Chi Wang, University of Louisville.
Combinatorics and Graph Theory (Code: AMS SS B1), Andre E. Kedzdy, Grzegorz Kubicki, and Jenoe Lebel, University of Louisville.
Discrete Mathematics, Classification Theory and Consensus (Code: AMS SS C1), Robert C. Powers, University of Louisville.
Fractal Geometry and Related Topics (Code: AMS SS D1), Ka-Sing Lau, University of Pittsburgh, and Weibin Zeng, University of Louisville.
Functional Equations and Inequalities (Code: AMS SS E1), Thomas Riedel and Prasanna Sahoo, University of Louisville.
Geometry of Affine Space (Code: AMS SS M1), Gene Freuden­burg, University of Southern Indiana, and David Wright, Washington University.
Low-Dimensional Topology (Code: AMS SS R1), Martin Scharlemann, University of California at Santa Barbara, and Abigail A. Thompson, University of California at Davis.
Modern Function Theory (Code: AMS SS Q1), David A. Herron and David Minda, University of Cincinnati.
Real Analysis (Code: AMS SS G1), Udayan B. Darji and Lee Larson, University of Louisville.
Semigroups, Algorithms, and Universal Algebra (Code: AMS SS H1), Ralph N. McKenzie, Vanderbilt University, and Steven Seif, University of Louisville.
Spectral Geometry (Code: AMS SS K1), Ruth Gornet, Texas Tech University, and Peter Anton Perry, University of Kentucky.
Spectral Theory, Mathematical Physics and Disordered Media (Code: AMS SS L1), Peter David Hislop, University of Kentucky, and Gunter H. Stolz, University of Alabama at Birmingham.
The Use of the History of Mathematics and Science in the University and School Classroom (Code: AMS SS I1), Richard M. Davitt, University of Louisville.

Manhattan, Kansas
Kansas State University
March 27–28, 1998
Meeting #932
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced

Issue of Abstracts: Volume 19, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Gopal Prasad, University of Michigan-Ann Arbor, Title to be announced.
Mikhail Vishik, University of Texas at Austin, Title to be announced.
Clarence Eugene Wayne, Pennsylvania State University, Title to be announced.
Zihong Jeff Xia, Northwestern University, Title to be announced.

Special Sessions
Abstract Harmonic Analysis (Code: AMS SS H1), Sadahiro Saeki, Kansas State University.
Cohomology of Finite Groups (Code: AMS SS F1), John S. Maginnis, Kansas State University, and Stephen F. Siegel, University of Massachusetts.
Dynamical Systems (Code: AMS SS N1), Amie Wilkinson and Zihong Jeff Xia, Northwestern University.
Groups and Geometry (Code: AMS SS I1), Ernest E. Shult, Kansas State University.
Integral Systems and Their Applications (Code: AMS SS M1), Kirill L. Vaninsky, Kansas State University.
Linear Operators and Holomorphic Function Spaces (Code: AMS SS G1), V. V. Peller, Kansas State University.
Mathematics Education and the Internet (Code: AMS SS C1), Andrew G. Bennett, Kansas State University.
Nonlinear Problems (Code: AMS SS D1), Lev Kapitanski, Kansas State University.
Numerical Analysis and Computational Mathematics (Code: AMS SS L1), Huanan Yang and Qisu Zou, Kansas State University.
Quantum Groups and Applications (Code: AMS SS J1), Volodymyr V. Lyubashenko and Ya S. Solbelman, Kansas State University.
Quantum Topology (Code: AMS SS K1), Louis Crane and David N. Yetter, Kansas State University.
Representation Theory of Lie Algebras, Algebraic Groups and Quantum Groups (Code: AMS SS E1), Zongzhu Lin, Kansas State University, and Daniel Ken Nakano, Utah State University.
Philadelphia, Pennsylvania
Temple University
April 4-6, 1998

Meeting #933
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of 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
Tobias H. Colding, Courant Institute-New York University.
Martin Davis, University of California at Berkeley.
Ezra Getzler, Max-Planck-Institute and Northwestern University.
Yanyan Li, Rutgers University, New Brunswick.

Special Sessions
Harmonic Analysis and Its Applications to PDEs (Code: AMS SS G1), Cristian E. Gutierrez, Temple University, and Guozhen Lu, Wright State University.
Heat Kernel Analysis on Lie Groups (Code: AMS SS H1), Leonard Gross, Cornell University, and Omar Hijab, Temple University.
Mathematical Pedagogy (Code: AMS SS J1), Orin N. Chein, Temple University.
Modular Identities and Q-Series in Number Theory (Code: AMS SS A1), Boris Datkovsky and Marvin I. Knopp, Temple University.
Nonlinear Partial Differential Equations (Code: AMS SS K1), Yanyan Li, Rutgers University.
PDEs in Several Complex Variables (Code: AMS SS B1), Shiferaw Berhanu and Gerardo Mendoza, Temple University.
Radon Transforms and Tomography (Code: AMS SS C1), Eric L. Grinberg, Temple University, and Eric Todd Quinto, Tufts University.
Rings and Representations (Code: AMS SS E1), Maria E. Lorenz, Ursinus College, and Martin Lorenz, Temple University.


The History of American Mathematics (Code: AMS SS D1), Karen H. Parshall, University of Virginia, and David E. Zitarelli, Temple University.
Toplogy of Manifolds and Varieties (Code: AMS SS F1), Sylvain E. Cappell, New York University-Courant Institute, and Georgia Triantafillou, Temple University.

Davis, California
University of California
April 25-26, 1998

Meeting #934
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of 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

Chicago, Illinois
DePaul University-Chicago
September 12-13, 1998

Meeting #935
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: December 12, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Vitaly Bergelson, Ohio State University.
Sheldon Katz, Oklahoma State University.
Ralf J. Spatzier, University of Michigan.
Vladimir Voevodsky, Northwestern University.
Meetings & Conferences

Special Sessions

Stochastic Analysis (Code: AMS SS A1), Elton P. Hsu, Northwestern University, and Richard B. Sowers, University of Illinois-Urbana.

Winston-Salem, North Carolina

Wake Forest University

October 9–10, 1998

Meeting #936

Southeastern Section

Associate secretary: Robert J. Daverman

Announcement issue of Notices: To be announced

Program issue of Notices: To be announced

Issue of Abstracts: To be announced

Deadlines

For organizers: January 6, 1998

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Special Sessions


Tucson, Arizona

University of Arizona-Tucson

November 14–15, 1998

Meeting #938

Western Section

Associate secretary: William A. Harris Jr.

Announcement issue of Notices: To be announced

Program issue of Notices: To be announced

Issue of Abstracts: To be announced

Deadlines

For organizers: February 12, 1998

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

State College, Pennsylvania

Pennsylvania State University

October 24–25, 1998

Meeting #937

Eastern Section

Associate secretary: Lesley M. Sibner

Announcement issue of Notices: To be announced

Program issue of Notices: To be announced

Issue of Abstracts: To be announced

Deadlines

For organizers: January 22, 1998

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Invited Addresses

Nigel D. Higson, Pennsylvania State University.

Tasso J. Kaper, Boston University.

Kate Okikiolu, University of California at San Diego, and MIT.

San Antonio, Texas

San Antonio Convention Center

January 13–16, 1999

Joint Mathematics Meetings, including the 105th Annual Meeting of the AMS, 82nd Meeting of the Mathematical Association of America (MAA), and annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: October 1998

Program issue of Notices: October 1998

Issue of Abstracts: To be announced

Deadlines

For organizers: April 14, 1998

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
Urbana, Illinois
University of Illinois, Urbana-Champaign
March 18–21, 1999
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: June 18, 1998
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Las Vegas, Nevada
University of Nevada-Las Vegas
April 10–11, 1999
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: July 10, 1998
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Buffalo, New York
State University of New York at Buffalo
April 24–25, 1999
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: July 24, 1998
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Michele M. Audin, University Louis Pasteur, Strasbourg.
Jeff Smith, Purdue University.

Alexander A. Voronov, Massachusetts Institute of Technology.
Gregg J. Zuckerman, Yale University.

Providence, Rhode Island
Providence College
October 2–3, 1999
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: January 6, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Austin, Texas
University of Texas-Austin
October 8–10, 1999
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: January 6, 1998
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Washington, District of Columbia
Sheraton Washington Hotel and Omni Shoreham Hotel
January 19–22, 2000
Joint Mathematics Meetings, including the 106th Annual Meeting of the AMS, 83rd Meeting of the Mathematical Association of America (MAA), with minisymposia and other special events contributed by the Society for Industrial and Applied Mathematics (SIAM), and annual meetings of the
Meetings & Conferences

Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).

Associate secretary: William A. Harris Jr.

Announcement issue of Notices: To be announced

Program issue of Notices: To be announced

Issue of Abstracts: To be announced

Deadlines

For organizers: April 20, 1999

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

Notre Dame, Indiana

*University of Notre Dame*

April 7–9, 2000

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: To be announced

Program issue of Notices: To be announced

Issue of Abstracts: To be announced

Deadlines

For organizers: July 7, 1999

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

New Orleans, Louisiana

*New Orleans Marriott and ITT Sheraton New Orleans Hotel*

January 10–13, 2001

Joint Mathematics Meetings, including the 107th Annual Meeting of the AMS, 84th 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).

Associate secretary: Lesley M. Sibner

Announcement issue of Notices: To be announced

Program issue of Notices: To be announced

Issue of Abstracts: To be announced

Deadlines

For organizers: April 11, 2000

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Williamstown, Massachusetts

*Williams College*

October 13–14, 2001

Eastern Section

Associate secretary: Lesley M. Sibner

Announcement issue of Notices: To be announced

Program issue of Notices: To be announced

Issue of Abstracts: To be announced

Deadlines

For organizers: January 11, 2001

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced
Please complete this form and return it 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

Baltimore Advance Registration/Housing Form

Joint Meetings

Name _____________________________
Mailing Address _____________________________
Telephone ___________________ Fax __________________
Email Address _____________________________

Badge Information: Name to appear on badge _____________________________
Affiliation for badge _____________________________
Nonmathematician Guest Badge _____________________________ (please note charge below)

Events

Events with Tickets _______________________
Price Per Total ____________ ____________
AMS Banquet #___Regular #___Veg #___Kosher $32 ____________
MER Banquet #___Regular #___Veg #___Kosher $32 ____________
NAM Banquet #___Regular #___Veg #___Kosher $32 ____________
Total _____________________________

Student Activities

□ Methchats (no charge)
□ MAA Student Workshop (no charge)

Statistical/Other Information

Mathematical Reviews/field of interest # _____________________________
How did you hear about this meeting? Check one:
□ Notices □ Focus □ WWW □ Colleague(s) □ Special Mailing
□ Please ☐ this box if you have a disability that requires special services.

Deadlines

Room lottery November 7, 1997
Housing reservations, listing of resumes/job descriptions in the Winter Lists November 20, 1997
Housing reservation changes/cancellations through MMSB December 8, 1997
Advance registration, Employment Register, Short Course, banquet December 19, 1997
50% Refund on banquets December 19, 1997*
50% Refund on advance registration January 2, 1998*
*no refunds after this date

Payment

Category Total
Joint Meetings fee(s) _____________________________
AMS Short Course _____________________________
Employment Register _____________________________
Event tickets _____________________________
Hotel deposit (only if paying by check) _____________________________
Total amount paid _____________________________
(please note that a $5 processing fee will be charged for each returned check or invalid credit card)

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)
Hotel Reservations

Below is the non-descriptive list of hotels at which reservations can be made through the Mathematics Meetings Service Bureau (MMSS) this fall. A more detailed list including rates for these hotels and a list of lower-priced hotels/motels that can be called directly will be published in the October issues of Notices and Focus and at www.ams.org/amsmtg/2014_intro.html. Reservations at the following hotels must be made through the MMSS to receive the convention rates listed. All rates are subject to a 12.5% sales occupancy tax.

Guarantee requirements: First night deposit by check (see reverse of form) or a credit card guarantee.

☐ Yes, I want to reserve a room now based on the information given. I understand that my request may not be processed until late September 1997.
☐ Deposit enclosed □ Hold with my credit card number ________________________________ Exp. Date __________ Signature __________

Date and Time of Arrival ________________________________ Date and Time of Departure ________________________________

Name of Other Room Occupant ________________________________ Arrival Date ______________ Spouse □ Child ___ (give age) ________________

Order of choice

<table>
<thead>
<tr>
<th>Hotel</th>
<th>Single</th>
<th>Double 1 bed</th>
<th>Double 2 beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renaissance Harborplace (hqtrqrs)</td>
<td>$102</td>
<td>$122</td>
<td>$112</td>
</tr>
<tr>
<td>Students</td>
<td>$82</td>
<td>$82</td>
<td>$92</td>
</tr>
<tr>
<td>Hyatt Regency Baltimore</td>
<td>$102</td>
<td>$122</td>
<td>$112</td>
</tr>
<tr>
<td>Students</td>
<td>$96</td>
<td>$95</td>
<td>$95</td>
</tr>
<tr>
<td>Omni Inner Harbor Hotel</td>
<td>$92</td>
<td>$92</td>
<td>$92</td>
</tr>
<tr>
<td>Students</td>
<td>$86</td>
<td>$86</td>
<td>$86</td>
</tr>
<tr>
<td>Days Inn Inner Harbor</td>
<td>$90</td>
<td>$90</td>
<td>$80</td>
</tr>
<tr>
<td>Students</td>
<td>$70</td>
<td>$70</td>
<td>$70</td>
</tr>
<tr>
<td>Marriott Inner Harbor</td>
<td>$96</td>
<td>$106</td>
<td>$106</td>
</tr>
<tr>
<td>Students</td>
<td>$86</td>
<td>$86</td>
<td>$86</td>
</tr>
<tr>
<td>Sheraton Inner Harbor</td>
<td>$95</td>
<td>$95</td>
<td>$95</td>
</tr>
<tr>
<td>Students</td>
<td>$85</td>
<td>$85</td>
<td>$85</td>
</tr>
<tr>
<td>Clarion Hotel (Mt Vernon Square)</td>
<td>$92</td>
<td>$82</td>
<td>$82</td>
</tr>
<tr>
<td>Students</td>
<td>$72</td>
<td>$72</td>
<td>$72</td>
</tr>
<tr>
<td>Baltimore Hilton &amp; Towers</td>
<td>$86</td>
<td>$86</td>
<td>$86</td>
</tr>
<tr>
<td>Students</td>
<td>$77</td>
<td>$77</td>
<td>$77</td>
</tr>
<tr>
<td>Holiday Inn</td>
<td>$79</td>
<td>$79</td>
<td>$79</td>
</tr>
<tr>
<td>Tremont Hotel (all suites)</td>
<td>$95</td>
<td>$95</td>
<td>$95</td>
</tr>
<tr>
<td>Students</td>
<td>$85</td>
<td>$85</td>
<td>$85</td>
</tr>
</tbody>
</table>

Special Housing Requests:
☐ I have disabilities as defined by the ADA that require a sleeping room that is handicap accessible.
My needs are:
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: ________________________________
Other requests: ________________________________

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 reservations.
Meetings and Conferences of the AMS

Associate Secretaries of the AMS

Western Section: William A. Harris Jr., Department of Mathematics, University of Southern California, Los Angeles, CA 90089-1113; e-mail: wharris@math.usc.edu; telephone: 213-740-3794.

Central Section: Susan J. Friedlander, Department of Mathematics, University of Illinois at Chicago, 851 S. Morgan (MC 249), Chicago, IL 60607-7045; e-mail: susan@math.nwu.edu; telephone: 312-996-3041.

Eastern Section: Lesley M. Sibner, Department of Mathematics, Polytechnic University, Brooklyn, NY 11201-2990; e-mail: lsibner@magnus.poly.edu; telephone: 718-260-3505.

Associate Secretaries of the AMS

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. Up-to-date meeting and conference information is available on the World Wide Web via the Internet at URL http://www.ams.org/.

Meetings:

1997

September 26-28 Montreal, Canada p. 1063
October 4 Claremont, California p. 1064
**October 17-19 Atlanta, Georgia p. 1064
October 24-26 Milwaukee, Wisconsin p. 1065
November 8-9 Albuquerque, New Mexico p. 1065
December 4-7 Oaxaca, Mexico p. 1066

1998

January 7-10 Baltimore, Maryland p. 1068
Annual Meeting
March 20-21 Louisville, Kentucky p. 1069
March 27-28 Manhattan, Kansas p. 1070
April 4-6 Philadelphia, Pennsylvania p. 1071
April 25-26 Davis, California p. 1071
September 12-13 Chicago, Illinois p. 1071
October 9-10 Winston-Salem, No. Carolina p. 1072
October 24-25 State College, Pennsylvania p. 1072
November 14-15 Tucson, Arizona p. 1072

1999

January 13-16 San Antonio, Texas p. 1072
Annual Meeting
March 18-21 Urbana, Illinois p. 1073

April 10-11 Las Vegas, Nevada p. 1073
April 24-25 Buffalo, New York p. 1073
October 2-3 Providence, Rhode Island p. 1073
October 8-10 Austin, Texas p. 1073

2000

January 19-22 Washington, DC Annual Meeting
April 7-9 Notre Dame, Indiana
2001

January 10-13 New Orleans, LA Annual Meeting
October 13-14 Williamstown, MA p. 1074

Important Information Regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 183 in the January issue of the Notices for general information regarding participation in AMS meetings and conferences.

Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of TeX is necessary to submit an electronic form, although those who use plain TeX, AMS-TeX, LaTeX, or AMS-LaTeX may submit abstracts with TeX coding. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html or send mail to abs-submit@ams.org, typing help as the subject line, and descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed abstracts should be sent to abs-submit@ams.org, typing submission as the subject line. Questions about abstracts may be sent to abs-info@ams.org.

Paper abstract forms may be sent to Abstracts Coordinator, AMS, P.O. Box 6887, Providence, RI 02940. Note that all abstract deadlines are strictly enforced. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

Conferences: (See http://www.ams.org/meetings/ for the most up-to-date information on these conferences.)

1998:

January 5-6: AMS Short Course on Singular perturbation concepts for differential equations. See the October 1997 issue for details.
ICM98 TRAVEL GRANT APPLICATION
for U.S. mathematicians attending the
International Congress of Mathematicians, Berlin, Germany, 1998

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 Berlin 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.

All applicants fill in this section.

Last name ___________________________ First and/or middle names ___________________________

Full mailing address (usable from now until Spring, 1998):
line one: __________________________________________
line two: __________________________________________
city __________________________ state ________ zip __________

Telephone __________________________ e-mail __________________________

Are you an INVITED SPEAKER at the Congress? __ If yes, send one copy of invitation letter.

Present rank or position: __________________________________________

Institution or organization: __________________________________________

Highest earned degree: __________________________________________ Year: __________

Have you requested or been granted funds which might be used for travel to this Congress? If so, give details:

(Please notify the American Mathematical Society if this information changes)

Mathematics specialties (ICM98 sections):

☐ 1. Logic
☐ 2. Algebra
☐ 3. Number Theory and Arithmetic Algebraic Geometry
☐ 4. Algebraic Geometry
☐ 5. Differential Geometry and Global Analysis
☐ 6. Topology
☐ 7. Lie Groups and Lie Algebras
☐ 8. Analysis
☐ 9. Ordinary Differential Equations and Dynamical Systems
☐ 10. Partial Differential Equations (includes non-linear functional analysis)
☐ 11. Mathematical Physics
☐ 12. Probability and Statistics
☐ 13. Combinatorics
☐ 14. Mathematical Aspects of Computer Science
☐ 15. Numerical Analysis & Scientific Computing
☐ 16. Applications
☐ 17. Control Theory and Optimization
☐ 18. Teaching and Popularization of Mathematics
☐ 19. History of Mathematics

Invited Speakers may skip to page 3. All others fill in this section.

Other positions held (professional, scientific, teaching, administrative): [For each give Institution or Organization, Position, and Dates]

1. __________________________________________

2. __________________________________________

3. __________________________________________
List up to five significant publications, with title/journal/page/date references. These may include recent accepted papers (give journals).

1. 

2. 

3. 

4. 

5. 

Scholarships, fellowships, etc. Specify institution, dates held, and field of study:

List research support from all sources in the last five years, including any current support: specify sponsor, title or identification of award, and amount and duration (dates):

List research proposals which have been submitted and/or are pending at this time; specify sponsor:

Further comments in support of your application, or other relevant professional contributions not already listed:

This section should be filled out by junior mathematicians only.

Thesis title and advisor: 

Junior 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 junior mathematicians. Submission of these letters is strongly encouraged but not required. Letters should be sent to Professional Programs, AMS, P.O. Box 6248, Providence, RI 02904. LETTERS ONLY (not applications) may be sent via e-mail to icm98@ams.org. Name of applicant and "ICM98" should appear on the first line of the message. Deadline for receipt of letters is October 31, 1997.
All applicants should submit ONE copy only of this page.

You may optionally provide the following. Your application will not be adversely affected if you choose not to provide this information.

<table>
<thead>
<tr>
<th>Gender:</th>
<th>Ethnic/racial status:</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Female</td>
<td>☐ American Indian or Alaskan Native</td>
</tr>
<tr>
<td>☐ Male</td>
<td>☐ Asian</td>
</tr>
<tr>
<td>Citizenship:</td>
<td>☐ Black, not of Hispanic origin</td>
</tr>
<tr>
<td>☐ U.S. citizen or permanent resident</td>
<td>☐ Hispanic</td>
</tr>
<tr>
<td>☐ Other non-U.S. citizen</td>
<td>☐ Pacific Islander</td>
</tr>
<tr>
<td></td>
<td>☐ White, not of Hispanic origin</td>
</tr>
</tbody>
</table>

☐ I decline to provide this information.
This volume is an introduction to Knot Theory; the theory of knots and links of simple closed curves in three-dimensional space. It consists of a selection of topics which graduate students have found to be a successful introduction to the field. Three distinct techniques are employed: Geometric Topology Manuevers, Combinatorics, and Algebraic Topology. Each topic is developed until significant results are achieved and chapters end with exercises and brief accounts of state-of-the-art research. Knot Theory has expanded enormously over the last decade. While the author describes important discoveries, this constitutes a comprehensive introduction to the field, presenting new insights in this area. Mathematicians and physicists who wish to gain an understanding of the basic ideas of the fundamental group and its tools. Carefully chosen exercises and problems are dispersed throughout the text. Written by an internationally known expert in the subject matter attains a unity and coherence that is missing in the traditional approach. Students will be able to fully appreciate and understand the common source of the topics they are studying while also realizing that they are "variations on a theme" rather than essentially different topics, and therefore, will gain a better understanding of the subject. The book is divided into three sections. Part I presents fundamental material on sets, and on real and complex numbers. Part II starts with the definition of a limit and its basic properties, and continues with three basic results; the Intermediate Value Theorem, the Mean Value inequality, and the Cauchy Criterion, all of which are proved by bisection arguments. The last chapter in this section contains a detailed discussion of infinite series, including a treatment of unordered sums. Part III comprises the standard material in analysis, and because it follows from the basic ideas presented in the earlier section, much of the material progresses remarkably smoothly.

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