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Notices

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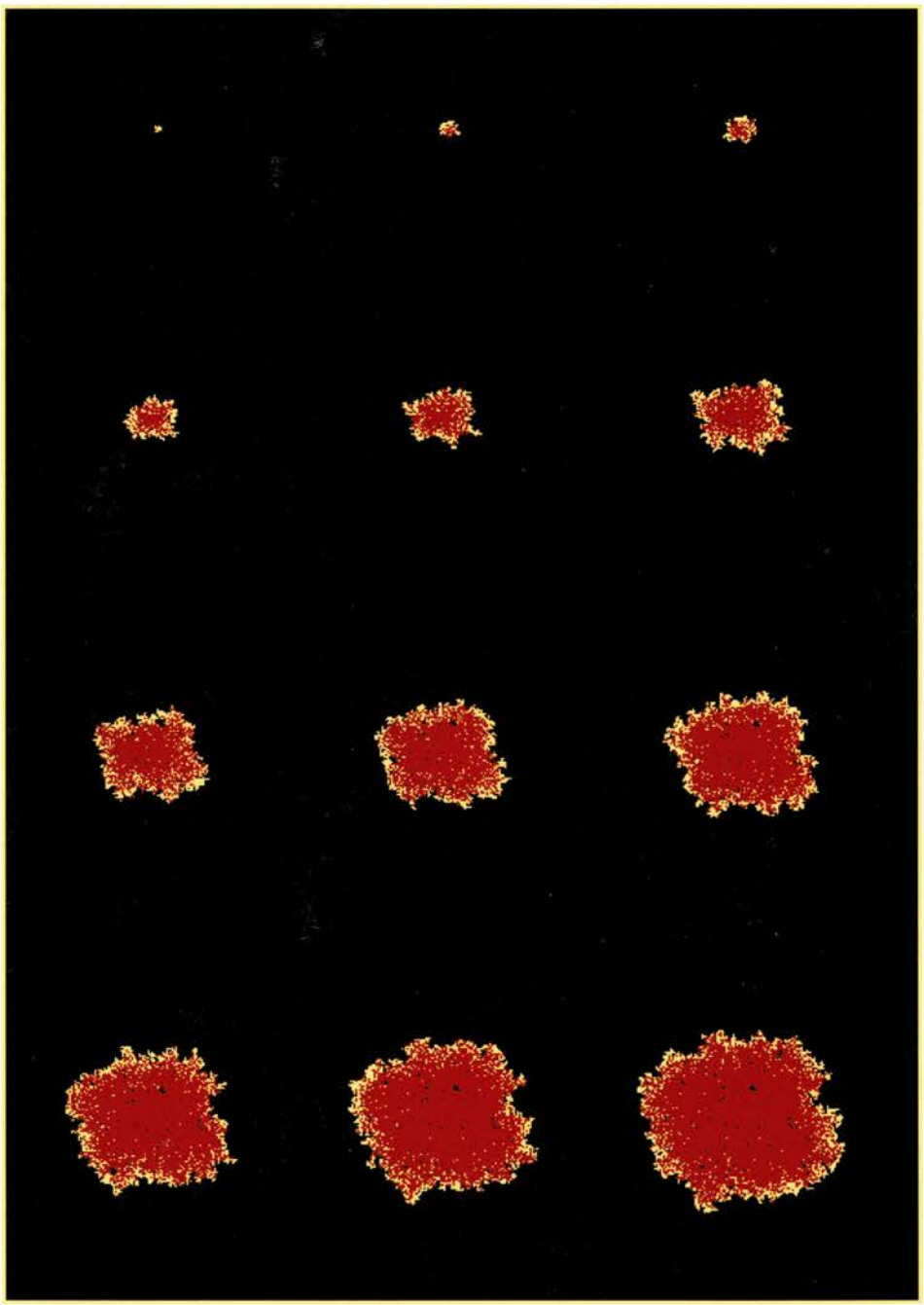

Stochastic Epidemic Model (see page 1314)

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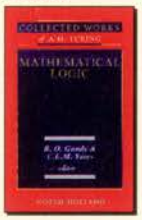

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By **J. van Mill,** Vrije Universiteit, Faculteit der Exacte Wetenschappen, Amsterdam, The Netherlands.
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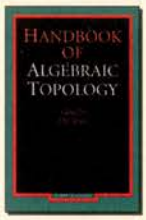

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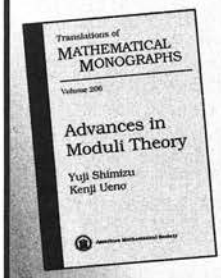


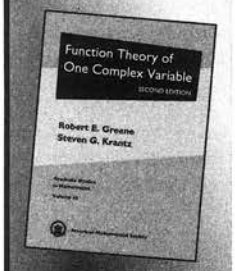
Supplementary Reading

Advances in Moduli Theory

Yuji Shimizu and **Kenji Ueno**, *Kyoto University, Japan*

This book begins by presenting the Kodaira-Spencer theory in its original naive form in Chapter 1 and introduces readers to moduli theory from the viewpoint of complex analytic geometry. Chapter 2 briefly outlines the theory of period mapping and Jacobian variety for compact Riemann surfaces, with the Torelli theorem as a goal. The theory of period mappings for compact Riemann surfaces can be generalized to the theory of period mappings in terms of Hodge structures for compact Kähler manifolds. In Chapter 3, the authors state the theory of Hodge structures, focusing briefly on period mappings. Chapter 4 explains conformal field theory as an application of moduli theory.

Translations of Mathematical Monographs (*Iwanami Series in Modern Mathematics*), Volume 206; 2002; 300 pages; Softcover; ISBN 0-8218-2156-3; List $49; All AMS members $39; Order code MMONO/206NT112



Recommended Text

Function Theory of One Complex Variable

Second Edition

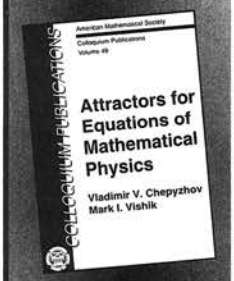
Robert E. Greene, *University of California, Los Angeles,* and **Steven G. Krantz**, *Washington University, St. Louis, MO*

From a review of the First Edition:

The book is carefully and precisely written in a lively and soft style. It is extremely clear ... and very detailed. Moreover, it is stimulating and very suitable for self-study ... Certainly, the book reflects the authors' experience in teaching. The other features include the fruitful connection with real analysis ... the authors have produced a modern, quality work that could serve as an excellent model for writing and teaching graduate texts ... it will occupy a distinguished place in the extensive literature on the subject ... I read this book with great pleasure and I warmly recommend it for all those who are interested in complex analysis of one variable.

—Mathematical Reviews

Graduate Studies in Mathematics, Volume 40; 2002; approximately 561 pages; Hardcover; ISBN 0-8218-2905-X; List $69; All AMS members $55; Order code GSM/40NT112



Independent Study

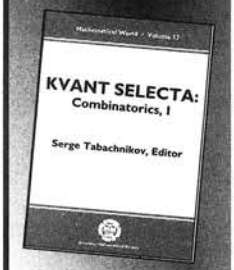
Attractors for Equations of Mathematical Physics

Vladimir V. Chepyzhov and **Mark I. Vishik**, *Russian Academy of Sciences, Moscow, Russia*

In this book, the authors study new problems related to the theory of infinite-dimensional dynamical systems that were intensively developed during the last 20 years. They construct the attractors and study their properties for various non-autonomous equations of mathematical physics: the 2D and 3D Navier-Stokes systems, reaction-diffusion systems, dissipative wave equations, the complex Ginzburg-Landau equation, and others. Since, as it is shown, the attractors usually have infinite dimension, the research is focused on the Kolmogorov ε-entropy of attractors. Upper estimates for the ε-entropy of uniform attractors of non-autonomous equations in terms of ε-entropy of time-dependent coefficients are proved.

The book gives systematic treatment to the theory of attractors of autonomous and non-autonomous evolution equations of mathematical physics. It can be used both by specialists and by those who want to get acquainted with this rapidly growing and important area of mathematics.

Colloquium Publications, Volume 49; 2002; 363 pages; Hardcover; ISBN 0-8218-2950-5; List $69; All AMS members $55; Order code COLL/49NT112



Supplementary Reading

Kvant Selecta: Combinatorics, I

Serge Tabachnikov, *University of Arkansas at Fayetteville* Editor

There is a tradition in Russia that holds that mathematics can be both challenging and fun. One fine outgrowth of that tradition is the magazine, *Kvant*, which has been enjoyed by many of the best students since its founding in 1970.

This book is the third collection of articles from *Kvant* to be published by the AMS. The volume is devoted mainly to combinatorics and discrete mathematics. Several of the topics are well known: nonrepeating sequences, detecting a counterfeit coin, and linear inequalities in economics, but they are discussed here with the entertaining and engaging style typical of the magazine. The articles are written so as to present genuine mathematics in a conceptual, entertaining, and accessible way. The books are designed to be used by students and teachers who love mathematics and want to study its various aspects, deepening and expanding upon the school curriculum.

Mathematical World, Volume 17; 2002; 131 pages; Softcover; ISBN 0-8218-2171-7; List $29; All AMS members $23; Order code MAWRLD/17NT112

Supplementary Reading

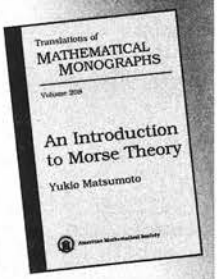
An Introduction to Morse Theory

Yukio Matsumoto, *University of Tokyo, Japan*

This book describes Morse theory for finite dimensions. Finite-dimensional Morse theory has an advantage in that it is easier to present fundamental ideas than in infinite-dimensional Morse theory, which is theoretically more involved. Therefore, finite-dimensional Morse theory is more suitable for beginners to study.

This textbook aims at introducing Morse theory to advanced undergraduates and graduate students. It is the English translation of a book originally published in Japanese.

Translations of Mathematical Monographs (*Iwanami Series in Modern Mathematics*), Volume 208; 2002; approximately 232 pages; Softcover; ISBN 0-8218-1022-7; List $39; All AMS members $31; Order code MMONO/208NT112



Supplementary Reading

Variational Problems in Geometry

Seiki Nishikawa, *Mathematical Institute, Tohoku University, Sendai, Japan*

This book is intended to be an introduction to some of the fundamental questions and results in geometric variational problems, studying variational problems on the length of curves and the energy of maps.

Each chapter may be read independently, with minimal preparation for covariant differentiation and curvature on manifolds. The first two chapters provide readers with basic knowledge of Riemannian manifolds. Prerequisites for reading this book include elementary facts in the theory of manifolds and functional analysis, which are included in the form of appendices. Exercises are given at the end of each chapter.

Translations of Mathematical Monographs (*Iwanami Series in Modern Mathematics*); 2001; approximately 0 pages; Softcover; ISBN 0-8218-1356-0; List $39; All AMS members $31; Order code MMONO-NISHIKAWANT112

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David Kinderlehrer, *Carnegie Mellon University, Pittsburgh, PA (ed.)*

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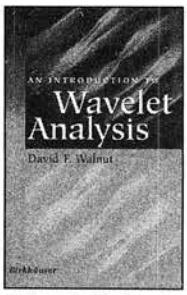
David Walnut, *George Mason University, Fairfax, VA*

An Introduction to Wavelet Analysis



An Introduction to Wavelet Analysis provides a comprehensive presentation of conceptual basis of wavelet analysis, including the construction and application of wavelet bases. Over 170 exercises guides the reader through the text. The book is an ideal text/reference for a broad audience of advanced students and researchers in applied mathematics, electrical engineering, computational science, and physical sciences. All readers will find this book an accessible presentation to wavelet theory without assuming prior knowledge of advanced concepts.

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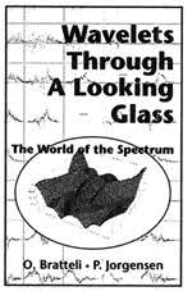
Ola Bratteli, *University of Oslo, Norway; and* **Palle Jorgensen** *University of Iowa, Iowa City*

Wavelets through a Looking Glass

The World of the Spectrum



This book combining wavelets and the world of the spectrum focuses on recent developments in wavelet theory, emphasizing fundamental and relatively timeless techniques that have a geometric and spectral-theoretic flavor. This self-contained book deals with important applications to signal processing, communications engineering, computer graphics algorithms, qubit algorithms and chaos theory, and is aimed at a broad readership of graduate students, practitioners, and researchers in applied mathematics and engineering. The book is also useful for other mathematicians with an interest in the interface between mathematics and communication theory.

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December 2001

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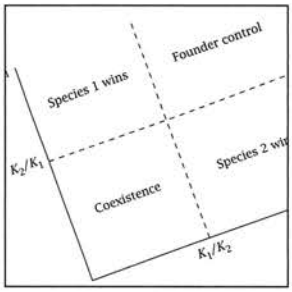

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Commentary

Notices
of the American Mathematical Society

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Departments

From the AMS Secretary

Welcome to Beijing for ICM-2002

The first International Congress of Mathematicians (ICM) in the new millennium will be held in Beijing, China, in August 2002. Chinese mathematicians are overjoyed as they look forward to this special moment and to receiving guests and friends from all over the world.

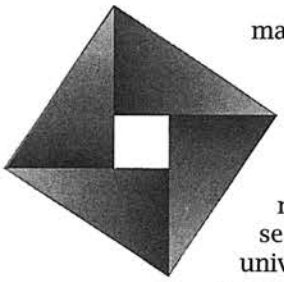
Chinese mathematics has a long history. Since the beginning of the twentieth century, Chinese mathematicians have been working hard to catch up to the most advanced levels of mathematics. The modernization of mathematics in China has accelerated at an unprecedented rate in the past two decades. Now we are greatly encouraged by being able to host the ICM-2002. Chinese mathematicians, including those who live outside China, are eager to contribute not only to preparing a successful congress but also to making it a new start for the development of Chinese mathematics and for closer international cooperation.

The preparation of the congress has won wide social and governmental support. In particular, the president of the People's Republic of China, Jiang Zemin, expressed his enthusiasm clearly when in October 2000 he met with a group of mathematicians from China and abroad. He said that "the Chinese government supports the ICM-2002 in Beijing and wishes to take this opportunity to strive to advance mathematical research and education in China to the world frontiers in the early twenty-first century and to lay a solid foundation for the further progress of science and technology in China." At the meeting President Jiang accepted an invitation from J. Palis, president of the International Mathematical Union, to give the opening address at the congress.

The ICM-2002 Local Organizing Committee has obtained from the Chinese government partial funding for the congress. Efforts to raise the remaining funds through donations from industries and private individuals are under way. Observing the resolution of the International Council of Scientific Unions on the free circulation of scientists, the China Association for Science and Technology has provided assurances that all bona fide mathematicians and their companions who have registered for ICM-2002 will be able to obtain visas for entry into China.

As China is the first developing country to host an ICM, the Local Organizing Committee has made plans to provide as much financial support as possible to allow both young and senior mathematicians from developing countries and from Eastern Europe to attend the congress. Application forms have been distributed, and a special subcommittee has been appointed to review the applications.

Mathematical traditions in Beijing can be traced back to ancient times. In the development of mathematics in modern China, Beijing has played an increasingly important role. In the early 1930s a group of outstanding Chinese mathematicians, including Hua Luo-keng and Chern Shiing-Shen, were trained here and stepped onto the international stage of mathematics from here.



Today Beijing is one of China's main centers for mathematical research and education. Three leading universities (Peking University, Tsing Hua University, and Beijing Normal University) and four research institutes of the Academy of Mathematics and Systems Sciences of the Chinese Academy of Sciences (the Institute of Mathematics, the Institute of Applied Mathematics, the Institute of Systems Science, and the Institute of Computational Mathematics), as well as the Nankai Institute of Mathematics at Nankai University in the nearby city of Tianjin, conduct mathematics instruction on a broad front and carry out many state-of-the-art research projects in various fields. In recent years special attention has been paid to attracting and training excellent young mathematicians, and international exchanges have greatly increased. Every year we receive numerous visitors from all over the world.

Now Chinese mathematicians are looking forward to welcoming guests for ICM-2002! The conference site at the Beijing International Convention Center and the Great Hall of the People in Tiananmen Square, where the opening ceremonies will be held, have been reserved. Hotels of every category will be available during the congress.

In addition to the section and plenary lectures, the congress will feature some cultural events; one possibility is a performance by the Peking Opera. Beijing is an ancient yet modern city with a rich and precious cultural heritage. There is much to see and explore in Beijing.

In conjunction with the Beijing Congress about forty satellite meetings will be held in different parts of Asia and one as far afield as Moscow. Taking part in one or two such satellite meetings can enhance the academic benefits of attending ICM-2002 and also provide the chance to enjoy China and its neighboring countries, which are both beautiful and historical.

Please visit the website `http://www.icm2002.org.cn/`, which contains up-to-date information about the congress.

—Zhi-Ming Ma
President, Chinese Mathematical Society
Chairman, Local Organizing Committee of ICM-2002

Letters to the Editor

The Computer and Mathematics

J. R. D. North asks ["Letters", June/July 2001] for a demonstration by a computer that the harmonic series diverges.

His example illustrates the following principle: Suppose that one has a computer algorithm alleged to provide an approximation to some mathematical quantity. Then the algorithm should be accompanied by a theorem giving a measure of the distance between the output of the algorithm and the mathematical quantity being approximated. For the harmonic series, one would soon find that the sum was infinite.

In 1973 Mike Waterman and I developed such a theorem for a calculation of Euler's constant [*Math. Comp.* **28** (1974), 599–604]. Our scheme failed because the computer made an undetected electronic error despite many built-in error-detection methods. The error was discovered a year later by the Australian mathematician Richard P. Brent, whose first try at computing Euler's constant to 21014 decimals had also failed, apparently because of a machine error [*Math. Comp.* **31** (1977), 771–777].

—*W. A. Beyer*
Los Alamos National Laboratory

(Received August 1, 2001)

The Continuum Hypothesis

While reading W. Hugh Woodin's articles "The Continuum Hypothesis" (Part I, June/July 2001; Part II, August 2001), I recalled the intuitive argument against the continuum hypothesis given by Chris Freiling [Axioms of symmetry: Throwing darts at the real number line, *J. Symbolic Logic* **51** (1986), 190–200]. Let $\mathbb{R}_{\aleph_0}$ be the set of all countable subsets of $\mathbb{R}$. Freiling considered the statement $A_{\aleph_0}$: for every function $f : \mathbb{R} \to \mathbb{R}_{\aleph_0}$ there are $x, y \in \mathbb{R}$ such that $x \notin f(y)$ and $y \notin f(x)$. He proved that $A_{\aleph_0}$ is equivalent to the negation of the continuum hypothesis and argued that $A_{\aleph_0}$ is intuitively true. His argument was that given f, the desired x and y can be found by random choices. Then, since $f(y)$ is countable, $x \notin f(y)$ with probability 1 and, by symmetry, $y \notin f(x)$ with probability 1.

I found Freiling's argument very convincing (after all, as Freiling put it, if by some very strange miracle, say, $x \in f(y)$, we can always make another random choice of x and y) until I considered a similar statement concerning the set $\mathbb{N}$ of natural numbers. Let $\mathbb{N}_{\text{finite}}$ be the set of all finite subsets of $\mathbb{N}$. Consider the statement A_{finite}: for every function $f : \mathbb{N} \to \mathbb{N}_{\text{finite}}$, there are $x, y \in \mathbb{N}$ such that $x \notin f(y)$ and $y \notin f(x)$. Since for any finite subset $F \subset \mathbb{N}$ and any randomly chosen $x \in \mathbb{N}$, $x \notin F$ with probability 1, we can use exactly the same reasoning Freiling used about $A_{\aleph_0}$ to argue that A_{finite} is intuitively true. However, A_{finite} is false: consider $f : \mathbb{N} \to \mathbb{N}_{\text{finite}}$ defined by $f(x) = \{1, 2, \ldots, x\}$.

After reading Woodin's articles, I believe that the continuum hypothesis may be resolved by methods of modern set theory, but I think it is unlikely that it will be settled, one way or the other, by a simple intuitive argument.

—*Janusz Konieczny*
Mary Washington College

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Online Tutorials

Mathematics students increasingly have access to online sources of tutorial assistance, whether from textbook publishers, educational institutions, or independent companies. Having recently been involved in a beta test of a new online tutorial site for calculus and precalculus (`http://www.hotmath.com/`), I am wondering about the impact of these resources on student learning. Hotmath suggests on its site that the benefits of their tutorial homework assistance outweigh the risks of abuse by students. I am very curious to know if this is true in practice.

As a full-time faculty member at American River College (Sacramento, CA) and a mathematics education graduate student at the University of California at Davis, I would welcome information from my teaching colleagues on any observations they might have made concerning how students use online tutorial sites; which ones they use; and what effect, for good or ill, the sites appear to have. Surely this is an area meriting further investigation.

I can be contacted at `abarcellos@ucdavis.edu`. Thank you.

—*Anthony Barcellos*
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(Received August 13, 2001)

Refereeing

To improve the quality of refereeing in mathematics journals at least partially [see "Letters to the Editor", Sept. 2001 issue], a reviewer recommending the acceptance of an article might be invited by the editor to forego his anonymity and have his name displayed prominently on the title page. Such visibility may lend more respect to the task of the reviewer and may serve as a reward for the reviewer's efforts.

—*Agnes P. Berger*
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(Received August 22, 2001)

Fellows of the AMS

In the August 2001 "Opinion" column Andy Magid proposes that the AMS create a "special class of distinguished members identified as 'Fellows of the American Mathematical Society'," and he points out that many sciences have set up institutions of this sort. Earlier in the article he writes that some department heads "believed that many university honors that could justifiably have gone to mathematics went instead to faculty in other disciplinary units simply because those disciplines have many more prizes than does mathematics." The fellows idea was then presented as a possible alternative to creating more prizes.

I would like to argue that this is not such a good idea, not because such institutions are ineffective. They are in fact extremely effective, but in

an undesirable way. I believe that such an institution would do little to affect the progress of mathematics, but I'm quite certain that it would have a very considerable effect on the careers of individual mathematicians, both those who were elected to fellowships and those who were not. It seems obvious, for instance, that whether a person was a fellow or not would have a substantial effect on his/her likelihood of obtaining funding for research. Further, whether we intend it or not, being a fellow would be a sort of certification and would play a major role in how the individual was advanced, just as the various university degrees qualify candidates for jobs at different levels.

Prizes are another matter because they are awarded generally for an important piece of work (we all remember that Einstein got the Nobel Prize for the photo-electric effect), and perhaps there should be more of them as significant new areas of mathematics emerge. But the emphasis should be on the mathematical achievement, and only secondarily on the person who achieved it.

To say it once more, I am convinced from my own experience that self-appointed, self-perpetuating, elitist groups like the one being proposed do more harm than good. Inevitably much energy is spent trying to get into the group or getting one's friends or colleagues in. Moreover, a person's professional advancement becomes much more dependent on "who you know" rather than what you've done. For all of these reasons I hope the AMS membership will avoid getting into this kind of a tangle.

—David Gale
University of California at Berkeley

(Received August 28, 2001)

Human Rights and the ICM

The upcoming International Congress of Mathematicians (ICM) in Beijing next summer has many mathematicians worried about the woeful human rights record of the Chinese government (see below and article by Allyn Jackson in the September 2001 issue of the *Notices*). They are concerned that by sticking to "mathematics as usual", willingly or not, they may be seen by their Chinese colleagues and others as effectively endorsing these oppressive practices by their host government. This is undoubtedly the way in which the government news media will present it to the Chinese public. Images on state television of three or four thousand distinguished international professionals applauding the officials welcoming the congress could be interpreted by their Chinese viewers as such an endorsement.

It seems to us that this puts an extra responsibility on the officials of the IMU (International Mathematical Union), the organizers of the meeting, to take account in a public way of the fate of imprisoned and harassed colleagues, academics, students, medical professionals, and other pro-democracy advocates.

There are many ways of doing this while still being appreciative of the accomplishments of this great ancient civilization, supportive of the legitimate aspirations of the Chinese people, and appreciative of the important progress made by China in recent years, including its strong support of mathematics. One such way is to schedule a session on Human Rights and Social Responsibilities of Scientists where such issues, which are not confined by any means to China, could be discussed in a global context. Such sessions have been held at many conferences, including at least one in China, without in any way diminishing the scientific program. There was also at the 1998 ICM in Berlin a program about the black period in Germany (1933–1945).

In addition to or independent of such a session, individual speakers could put up transparencies at the beginning or end of their lectures expressing (in a nonconfrontational way) their concerns about the human rights of, and solidarity with, oppressed scientists. This has been done by many speakers at scientific conferences since the 1970s when human rights of colleagues in the former USSR, Latin America (particularly José Luis Massera in Uruguay), and other places became an issue for many scientists.

Information about human rights of scientists in China and elsewhere is available at `http://math.rutgers.edu/~lebowitz/`. One can also find there an old booklet (currently being revised) describing actions which participants in scientific conferences in China may wish to take.

The undersigned is chair of the AMS Committee on Human Rights of Mathematicians, and this letter has also been endorsed by the following members of that committee: F. Bonahon, P.-S. Hsu, T.-Y. Lam, L. Nirenberg, Ya. G. Sinai, S. G. Staples, M. M. Tom, and D. A. Vogan. Our letter represents the personal opinions of these individuals; we are not speaking officially for the AMS.

—J. L. Lebowitz
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(Received September 5, 2001)

Mathematical Challenges in Spatial Ecology

Claudia Neuhauser

The word *ecology* comes from the Greek *oikos*, which means "house", and was coined by the German zoologist Ernst Haeckel in 1870. It is, according to the *Oxford English Dictionary*, the "branch of biology that deals with organisms' relations to one another and to the physical environment in which they live." Examples of such relations are predator-prey interactions and plants competing for resources. Such interactions may be influenced by demographic and environmental fluctuations and occur over a wide range of spatial and temporal scales.

Scientific curiosity by itself would be a sufficient impetus for studying ecology, but understanding species relations and interactions is not just an academic exercise: Humans rely on ecological services for purification of water and air, soil maintenance, pest control, waste management, nutrient recycling, and much more; these processes are controlled by complex interactions of species with each other and with the environment.

We are altering the environment at an unprecedented rate: foremost are land-use changes and invasions of nonnative species. These human-caused alterations of the environment disrupt the functioning of ecosystems, often with devastating consequences. For instance, land-use changes, such as the conversion of forests into agricultural land, are often accompanied by soil erosion that affects water flow and nutrient recycling. There are numerous examples where species invasions drastically alter ecosystems: for instance, the water hyacinth, a plant native to the Amazon and considered one of the world's worst invaders, now covers many lakes and rivers in the tropics. Land-use changes and species invasions are the two major causes of species extinctions: it is estimated that human activities have increased extinction rates by a factor of 100 to 1,000.

Both empirical work and theoretical work contribute to our understanding of how ecosystems function and to our ability to successfully manage and preserve them. Mathematicians can contribute to this understanding by collaborating with biologists on developing models, analyzing models, and relating theory to empirical work.

I will focus on one factor that has become increasingly prominent in theoretical and empirical ecological studies: namely, space (see Tilman and Kareiva, 1997). We live in a spatial world, and the spatial component of ecological interactions has been identified as an important factor in how ecological communities are shaped. Understanding the role of space is challenging both theoretically and empirically. Since it is impossible to cover all aspects of this area in a short article, I will concentrate on stochastic models in population ecology. After describing the most common types of spatial models, together with biological examples, I will conclude with some mathematical challenges in spatial ecology.

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The Role of Models in Ecology

Models in ecology serve a variety of purposes, which range from illustrating an idea to parameterizing a complex real-world situation. They are used to make general predictions, to guide management practices, and to provide a basis for the development of statistical tools and testable hypotheses.

Models that illustrate ideas are, for instance, Tilman's resource model (Tilman, 1982) and the Lotka-Volterra competition model. In Tilman's resource model, species compete for resources. In the case of competition for just one resource, the model predicts that the species with the lowest equilibrium resource requirement will outcompete all other species. Tilman and collaborators have tested the model in freshwater algae, for which silicate is the limiting resource, and in grasslands in Minnesota, where nitrogen is the major limiting resource. The Lotka-Volterra competition model, discussed in detail below, incorporates the observed reduction in the growth rates of two competing species as their densities increase. The model predicts that coexistence occurs if competition among individuals of the same species (*intraspecific* competition) is stronger than competition among individuals of different species (*interspecific* competition). In 1934, Gause tested this model in an experiment on competition between different species of paramecia (freshwater protozoans).

Making predictions in management situations requires more detailed and realistic models. Examples are models that investigate which areas need to be preserved to ensure persistence of an endangered species and models that predict how spatial planting patterns of a genetically modified crop affect the evolution of pathogen resistance. Realistic models are essential when experiments are not feasible or when either the temporal or the spatial scale over which predictions are sought is very large. For instance, predictions of the effect of an increase in carbon dioxide in the atmosphere on global climate and vegetation over the next one hundred years have to be aided by modeling: we can manipulate carbon dioxide levels only over short temporal and small spatial scales; models then extrapolate to the larger scale.

Models can help to design experiments, to test hypotheses, and to develop new hypotheses and ideas. New ideas may contradict long-held views and spur new research to resolve controversies; conflicting hypotheses may coexist until a synthesis is reached. Models are not the ultimate judge in resolving controversies, but they do play an important role in investigating consequences of alternative hypotheses. To illustrate this point, I will briefly discuss a long-standing controversy in ecology: namely, whether a more diverse community is more stable, a question that has consequences for the effects of species loss.

In the 1950s, Elton and MacArthur promoted the idea that a more diverse community is more stable. Their conclusion was based on a combination of verbal models and observations from natural and agricultural systems. Their idea was accepted until the 1970s, when Robert May investigated mathematical models of randomly assembled communities that showed a decrease in stability with diversity—just the opposite of the conclusion of Elton and MacArthur. Although May emphasized that there was no paradox, since his randomly assembled communities may not resemble natural systems, the stability-diversity hypothesis was no longer believed to be universally true. May's contribution demonstrated that mathematical reasons alone do not suffice and that biological reasons need to be sought to understand the relationship between diversity and stability. At that time there was a marked lack of empirical evidence for or against the hypothesis; moreover, the word "stability" was used in different ways, making comparisons between different statements difficult. Over the last ten years the stability-diversity debate has been revived, and several empirical and theoretical studies have been published that argue either side. New empirical results and new insights from models that address conflicting hypotheses might ultimately resolve the debate.

Modeling in Spatial Ecology—a Brief History

Mathematical models have played an important role throughout the history of ecology. Early examples are population growth models such as exponential growth, which Thomas Malthus used in 1798 to argue the consequences of unrestricted population growth, and logistic growth, which was developed by Pierre-François Verhulst in 1835 to model density-dependent population growth and used by Raymond Pearl and Lowell J. Reed in the 1920s to predict the future population size of the U.S. The 1920s also saw the development of mathematical models of multispecies interactions, notably the predator-prey and competition models of Alfred J. Lotka and Vito Volterra.

Before the 1970s ecological population modelers typically used ordinary differential equations, seeking equilibria and analyzing stability. The early models provided important insights, such as when species can stably coexist and when predator and prey densities oscillate over time.

A common feature of these early models is that the interactions were based on the *mass-action law*, an approach that has its conceptual foundation in modeling chemical reactions. When the reactants are well mixed and have to collide in order to react, the mass-action law says that the collision rate (hence the reaction rate) is proportional to the product of the concentrations of the reacting molecules.

In many ecological situations, however, the assumption of being well mixed does not hold, and a spatial model with local interactions is more appropriate and can result in predictions that differ from the well-mixed case. The two most frequently quoted and now classical studies that point to the central role of spatial subdivision are Andrewartha and Birch's 1954 observations of insect populations that became frequently extinct but persisted globally due to recolonization from local populations, and Huffaker's 1958 laboratory experiment with a predator-prey system of two mites, one that feeds on oranges (*Eotetranychus sexmaculatus*) and the other a predatory mite (*Typhlodromus occidentalis*) that attacks *E. sexmaculatus*. Huffaker set up an array of oranges and rubber balls with different levels of spatial complexity that controlled dispersal and demonstrated that a complex, spatially heterogeneous array promoted coexistence, whereas coexistence was impossible in simpler, spatially homogeneous arrays. Mathematical models later confirmed that spatial subdivision is important for the persistence of populations.

Some of the early models include space implicitly, such as the *Levins model* (Levins, 1969), discussed below, which uses the framework of ordinary differential equations to describe the dynamics of a population in a spatially subdivided habitat. Populations may go extinct in patches and may subsequently be recolonized from other occupied patches. Space is implicit in this framework in the sense that recolonization is equally likely from all occupied patches, regardless of their locations. Models that include space explicitly, such as reaction-diffusion equations, were employed by Skellam in the 1950s to describe the invasion of species; they are of the same type as Fisher's 1937 model for the spread of a novel allele. Though these models include space, they still do not allow for spatial correlations, since local populations are effectively infinite.

In the late 1960s and early 1970s, F. Spitzer in the United States and R. L. Dobrushin in the Soviet Union began to develop a framework for spatial stochastic models known as *interacting particle systems*. These are stochastic processes that evolve on the d-dimensional integer lattice. Each site on the lattice is in one of a finite or countable number of different states, and sites change their states according to rules that depend on the states of neighboring sites. Originally, interacting particle systems were motivated by attempts to describe phenomena in physics, but it soon became evident that this framework is useful in biology. Some of these models can be viewed as spatial generalizations of classical ecological models such as the logistic model and the Lotka-Volterra competition model.

During the 1970s the availability of computers greatly expanded the use of spatial models in ecology. Although spatial ecology today is still dominated by theoretical investigations, empirical studies that explore the role of space are becoming more common due to technological advances that allow the recording of exact spatial locations.

The Mathematical Framework of Spatial Models in Ecology

Demographic models are the fundamental building blocks of models in population and community ecology. The simplest demographic models are deterministic ones based on ordinary differential equations. I will use the logistic model as an example to introduce the different modeling frameworks. *Logistic growth* was introduced by Verhulst as a model for population growth with negative density dependence. Namely, if $N(t)$ denotes the population size at time t, then

$$\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right),$$

where r and K are positive parameters; r is the *intrinsic rate of growth*, which is the maximum per capita growth rate; and K is the *carrying capacity*, which is the nonzero equilibrium population size.

The easiest way to include space in the logistic model is the *metapopulation* framework in which an infinite number of sites are linked by migration. In the original formulation all sites are equally accessible, and we say that migration is *global* (the more general framework is discussed below); this model is *spatially implicit*, since no explicit spatial distances between sites are included.

The analogue of the logistic model in the metapopulation framework is the *Levins model*. Namely, if $u(t)$ denotes the fraction of occupied sites, then

$$\frac{du}{dt} = \lambda u(1-u) - u.$$

The colonization rate is equal to the parameter λ times the product of the fraction of occupied sites and the fraction of vacant sites. Time is scaled so that the rate at which sites become vacant equals 1, and a nontrivial equilibrium exists if λ is greater than 1. Deterministic models with global dispersal, called *mean-field models*, originated in physics. The idea is to replace complicated local interactions by an "effective field" produced by all other particles and to use the mass-action law to describe the dynamics.

Models at the next level of complexity explicitly include distances between sites. The simplest examples are reaction-diffusion equations, such as *Fisher's equation*, which was introduced to ecology by Skellam. It describes logistic growth in an explicitly spatial setting by

$$\frac{\partial u}{\partial t} = D\frac{\partial^2 u}{\partial x^2} + \lambda u(1-u) - u,$$

where $u = u(x,t)$ is the population density at location x at time t. The parameter D is called the *diffusion coefficient*, and the reaction term $\lambda u(1-u) - u$ has the same interpretation as in the Levins model.

Closely related to reaction-diffusion equations are integro-differential equations. The analogue of Fisher's equation in this framework is

$$\frac{\partial u(x,t)}{\partial t} = -u(x,t) + \lambda(1 - u(x,t)) \int k(x,y)u(y,t)\,dy.$$

The function $k(x,y)$ is a probability density that describes colonization of a vacant site at x from an occupied site at y; it usually depends only on the distance between x and y.

Finally, interacting particle systems allow the inclusion of local interactions. As mentioned above, an interacting particle system is a stochastic process with state space $E^{\mathbf{Z}^d}$, where E is some finite (or countably infinite) set. The state at time t is a configuration that assigns each site in $\mathbf{Z}^d$ a value in E. The dynamics of the model are described by *rate functions* that indicate how a site changes its state based on the current states of sites in a local neighborhood. The rate functions define exponentially distributed times, and we say that a change occurs at rate μ if the waiting time T for this event is exponentially distributed with mean $1/\mu$, that is, $P(T > t) = e^{-\mu t}$. The interacting-particle analogue of logistic growth in space is the *contact process* (see Liggett, 1985). In this model each site on the d-dimensional integer lattice is either vacant (state 0) or occupied (state 1). A site becomes occupied at a rate equal to λ times the fraction of occupied sites within a given neighborhood (for instance, all sites within distance R), and an occupied site becomes vacant at rate 1.

The above models are related in ways that are now well understood and that have been made mathematically rigorous both for the contact process and for many other models (Durrett and Neuhauser, 1994; for other examples see Durrett, 1995). For example, the reaction-diffusion equation follows from the contact process by scaling space and introducing fast stirring in the following way. The integer lattice is replaced by a lattice with sites distance ϵ apart, and neighboring sites exchange their contents at rate $\epsilon^{-2}/2$. One can show that in the limit as $\epsilon \to 0$, the probability that a site is occupied converges to a function satisfying the reaction-diffusion equation with $D = 1/2$.

An integro-differential equation can be obtained from the contact process through a similar rescaling procedure. Namely, replace the integer lattice by a lattice with sites distance ϵ apart and discretize the dispersal kernel so that as ϵ tends to 0, dispersing offspring have access to an ever-growing number of sites. For example, assume in a one-dimensional model that offspring are dispersed uniformly over the interval $[-1,1]$. When $\epsilon = 1$, the neighborhood consists of the two nearest sites, and when $\epsilon = 1/2$, the neighborhood consists of the nearest and the next nearest sites. As ϵ decreases further, more sites are included in the neighborhood, each site being equally accessible. Convergence to the above integro-differential equation can be shown under mild assumptions on the dispersal kernel.

The conceptual difference between the reaction-diffusion equation and the integro-differential equation is that in the former, individuals take many small steps in a random-walk-like fashion between reproductive events, like zooplankton in a water column, whereas in the latter individuals take only one big step right after they are born, like plant seeds. Both the partial differential equation and the integro-differential equation reduce to the Levins model when the initial distribution is constant in space.

In the following I will describe the framework of interacting particle systems in more detail. I will also mention two other frameworks that are popular in ecological modeling but less often used in mathematical studies.

Interacting Particle Systems

General Framework and Basic Techniques

Interacting particle systems are *continuous-time Markov processes* on $E^{\mathbf{Z}^d}$, where E is either a finite set or an infinite but countable set. (A Markov process is a stochastic process in which the future state depends only on the current state and the past becomes irrelevant.) The temporal evolution is given by rate functions that allow the process to evolve in continuous time. The contact process described above is just one of many examples studied over the last thirty years. See Liggett (1985) for the foundation of interacting particle systems, a description of analytical techniques, and some of the basic models and results, and Durrett (1988, 1995) for graphical methods and a summary of some more recent work.

Few analytical methods are available to analyze these models. The two most important techniques are *duality* and *coupling*, but whether these methods are available depends on the model. Duality can be loosely described as a technique that allows one to trace the history of a finite number of sites back to time 0, which then allows one to determine their state at the current time based on their history and the configuration at time 0. This is akin to identifying one's ancestors.

Coupling is a technique that allows comparison of two processes. For example, coupling can be used to show that if the contact process survives for some value of λ, then it will do so for all greater values. Namely, one can couple two contact processes with different birth rates in such a way

that whenever the process with the smaller birth rate has an occupied site, so has the process with the larger birth rate, provided both processes start with the same initial configuration.

Another powerful technique is *rescaling*. This method, developed by Bramson and Durrett (see Durrett, 1995), involves a comparison between the process of interest and *oriented site percolation*. Oriented site percolation with density p is a process on $\{(z,k) \in \mathbf{Z}^2 : z+k \text{ is even}\}$ in which every site, independently of all others, is open with probability p and closed with probability $(1-p)$. If p is sufficiently large, there is a positive probability that there is an infinite *open path* starting at $(0,0)$, and we say that the system *percolates*. (An open path from $(x,0)$ to (y,k) is a sequence of points $z_0 = (x,0), z_1, z_2, \ldots, z_k = (y,k)$ such that for $0 \le j \le k-1$, either $z_{j+1} = z_j + (-1,1)$ or $z_{j+1} = z_j + (1,1)$.) The basic idea of the rescaling argument is to show that for appropriate $p > 0$ the process under consideration, when viewed on suitable length and time scales, dominates an oriented site percolation model in which sites are open with probability p (Figure 1).

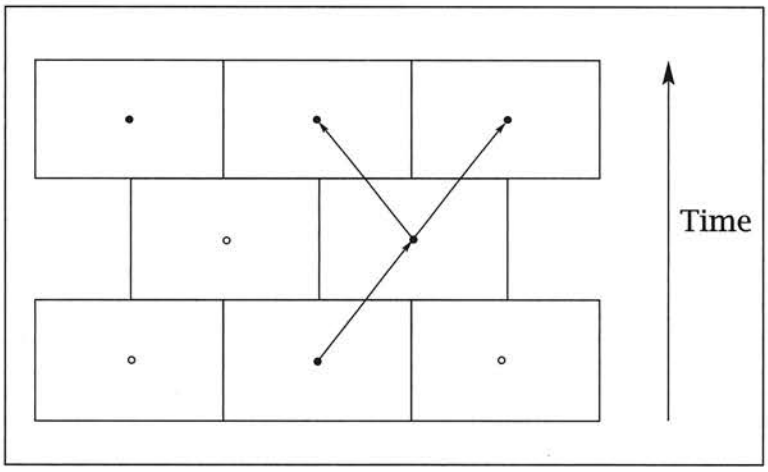

Figure 1. The rescaled lattice: Each box represents a space-time box. The dot in the center of each box represents a site in the associated oriented site percolation process; open sites are indicated by full circles, closed sites by open circles. Open paths are indicated by the arrows connecting open sites.

For instance, to show that the contact process survives (that is, there exists a nontrivial stationary distribution with a positive density of occupied sites), one needs to show that at any time the number of individuals in sufficiently large space-time boxes exceeds a certain threshold with probability close to 1. The space-time boxes are coupled to sites in an oriented site percolation process, so that whenever a site is open in the oriented site percolation process, the number of occupied sites in the contact process at any time in the corresponding space-time box exceeds a certain threshold. One can then show that the contact process retains the desired properties for all times provided the sites in the oriented site percolation process do percolate.

The number of models that have been studied is quite large. In the following, I will focus on a class of single-species and multispecies demographic models that describe competitive interactions within and between species. The emphasis in single-species models is on whether a nontrivial stationary distribution exists in which the species has a positive density and what patterns result from local interactions. In multispecies models there is an additional aspect, namely, whether species can coexist and what the mechanisms of coexistence are.

Survival of a Single Species in Space

The simplest single-species population model is the contact process introduced above, which describes growth when the birth rate is density dependent but the death rate is density independent. The density dependence in the birth dynamics enters because only vacant sites can be colonized. After more than twenty-five years of study, the contact process is quite well understood. There exists a critical birth parameter, greater than 1 (recall that 1 is the critical value for the nonspatial model), which depends on both the spatial dimension and the type of neighborhood, such that if the birth rate exceeds this threshold, the process survives, and otherwise the process dies out. The density of occupied sites is a nondecreasing function of the birth parameter. The nontrivial stationary distribution (if it exists) has positive correlations. Though the correlations are weak, they can be seen in the nearest-neighbor case, where occupied sites appear clumped.

If deaths also depend on the density, the corresponding model is known as the *annihilating branching process*. Individuals die at a rate equal to the fraction of occupied neighbors, and the birth process is the same as in the contact process. Individuals give birth at rate λ, and their offspring disperse within a given neighborhood, establishing themselves only on vacant sites. If the dispersal neighborhood is the same as the neighborhood that determines mortality, then a nontrivial stationary equilibrium exists for all $\lambda > 0$. It is the product measure with density $\lambda/(1+\lambda)$; that is, sites are independently occupied with probability $\lambda/(1+\lambda)$. Despite local dispersal, no spatial correlations build up at equilibrium (for references, see Neuhauser, 1999).

Multispecies Models

Multispecies models can be built from single-species models by incorporating interactions between species. I will focus on competitive interactions and discuss different mechanisms for coexistence.

Lotka-Volterra type competition. The classical, nonspatial, two-species *Lotka-Volterra competition model* is given by

$$\frac{dN_1}{dt} = r_1 N_1 \left(1 - \frac{N_1}{K_1} - \alpha_{12}\frac{N_2}{K_1}\right),$$
$$\frac{dN_2}{dt} = r_2 N_2 \left(1 - \frac{N_2}{K_2} - \alpha_{21}\frac{N_1}{K_2}\right),$$

where $N_i(t)$ is the abundance of species i at time t. The positive parameters r_i and K_i denote the intrinsic rates of growth and the carrying capacities, respectively, just as in the logistic model. The interaction between the two species is given by the nonnegative parameters α_{ij}, which describe the effect of species j on species i. The minus sign in front of the α_{ij}'s indicates that the interaction is *competitive*: the presence of either species reduces the density of the other. Besides Gause's experiment mentioned earlier, there have been many experiments that measure the strength of interspecific competition, such as the study by Rees et al. of a four-species community of annual plants that grow in a sand dune habitat in Norfolk, UK, and a study by Freckleton et al. of a community of rangeland annuals in Australia.

Analysis of the model (see Figure 2) reveals that if $\alpha_{12} < K_1/K_2$ and $\alpha_{21} < K_2/K_1$, then *coexistence* between the two species is possible; that is, there exists a locally stable equilibrium in which both species have positive densities. The mechanism for coexistence here is that each species impedes itself more than it is impeded by the other species. If $\alpha_{12} > K_1/K_2$ and $\alpha_{21} < K_2/K_1$, then species 2 *excludes* species 1: if species 2 has a positive density initially, then the system will converge to an equilibrium state in which species 1 is absent and species 2 is at its single-species equilibrium. (Similarly, if $\alpha_{12} < K_1/K_2$ and $\alpha_{21} > K_2/K_1$, species 1 excludes species 2.) If both $\alpha_{12} > K_1/K_2$ and $\alpha_{21} > K_2/K_1$, then eventually one species will exclude the other, but the winner depends on the initial densities of the two species; this phenomenon is called *founder control*.

Neuhauser and Pacala (1999) formulated this model as a spatial model on the d-dimensional integer lattice in which all sites are always occupied. Individuals die at a rate that depends on the densities of both species in the neighborhood (an individual of species 1 at $x \in \mathbf{Z}^d$ at time t dies at rate $u_1(x,t) + \alpha_{12}u_2(x,t)$, and an individual of species 2 dies at rate $u_2(x,t) + \alpha_{21}u_1(x,t)$, where $u_1(x,t)$ and $u_2(x,t)$ are the local relative frequencies at x at time t of species 1 and 2, respectively). If a site becomes vacant due to death, it gets filled immediately by an offspring from one of its neighbors, chosen at random. Using duality and rescaling, we showed that if the interspecific competition parameters are sufficiently close to 0, then coexistence occurs as in the nonspatial model. (Coexistence in the spatial model means that for any $\epsilon > 0$, there exists a sufficiently large box such that with probability at least $(1 - \epsilon)$ both types will be in the box for sufficiently large times.) When the interspecific competition parameters are both equal to 1, the dynamics simplify and we recover a well-studied model, called the *voter model*: at rate 1 the state at each site is replaced by the state of one of its neighbors, chosen at random. One thinks of the "voter" at each site as adopting a neighbor's opinion at rate 1. The voter model, which has been studied since the mid 1970s, shows spatial segregation in one and two spatial dimensions and coexistence in three and higher dimensions. Spatial segregation for the voter model means that the probability that any two sites are in different states tends to 0 as time tends to infinity.

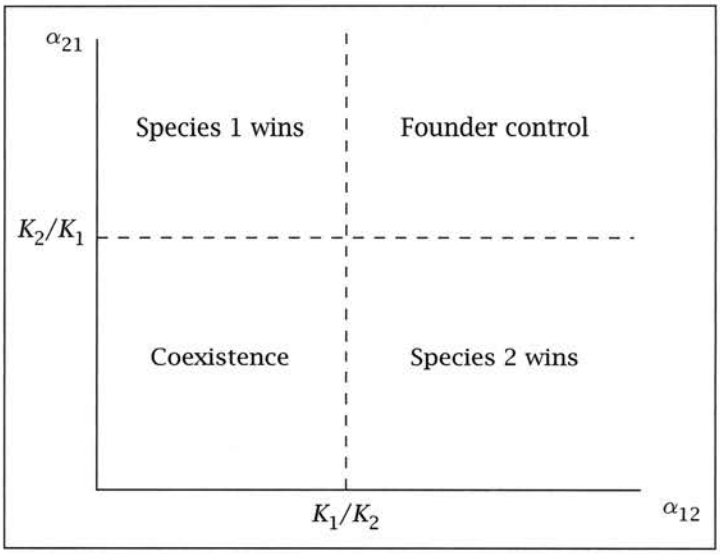

Figure 2. The phase diagram in the $\alpha_{12} - \alpha_{21}$ plane for the nonspatial Lotka-Volterra model with interspecific competition. The horizontal and vertical dashed lines represent the boundaries of regions where the behavior differs: coexistence, species 1 wins, species 2 wins, and founder control.

The one- and two-dimensional spatial Lotka-Volterra models differ from the nonspatial model in several ways (Figure 3). (In the following discussion, I exclude the one-dimensional nearest-neighbor case, since it behaves atypically.) The most striking difference is that coexistence is harder to get than in the nonspatial model; this came somewhat as a surprise, since it was believed that space would act as an additional niche and thus facilitate coexistence. The reduction of the parameter space where coexistence occurs is due to a combination of two factors: local interactions and the discreteness of individuals. If one chooses competition parameters close to where the nonspatial model changes behavior from coexistence to exclusion but still within the coexistence region, then the nonspatial mean-field model predicts coexistence with one species at a very low density and the other species close to its single-species

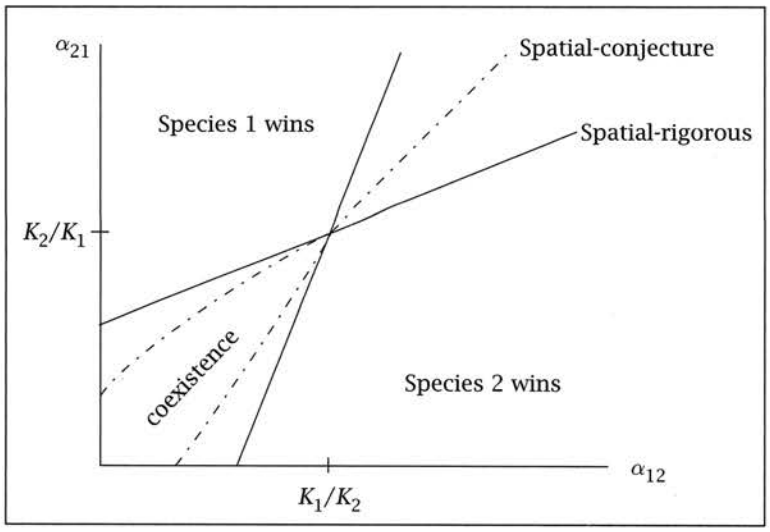

Figure 3. The phase diagram in the $\alpha_{12} - \alpha_{21}$ plane for the spatial Lotka-Volterra model with interspecific competition. Rigorous results for the spatially explicit model show that the coexistence and the founder control regions are smaller than in the nonspatial case (solid lines); we conjecture that the founder control region disappears in the spatial model (broken line).

equilibrium density. For the spatially explicit model with local interactions, it is impossible to maintain an arbitrarily small density of one species when the neighborhood size is kept fixed: a single individual of one type within a neighborhood of individuals of the other type has density equal to the reciprocal of the neighborhood size and thus cannot be made arbitrarily small. The smaller the neighborhood size, the more pronounced this effect is.

Furthermore, spatial segregation of species occurs as interspecific competition increases relative to intraspecific competition, resulting in cluster formation of like species. Using duality, we were able to give lower bounds on cluster sizes and conjectured that the clusters will not continue to grow forever if the α_{ij}'s are less than 1. This is different from the voter model ($\alpha_{ij} = 1$), where the clusters continue to grow. The spatial segregation of species for parameter values within the coexistence region of the nonspatial model again depends on neighborhood size. Namely, for equal competition parameters that are less than 1, we can choose a neighborhood size large enough so that coexistence is possible. But if the neighborhood size is fixed and the competition parameters approach 1 from below, then spatial segregation occurs.

Finally, using coupling, we found an expansion of the parameter region where one species excludes the other, but the winner depends on the competition parameters rather than on initial densities. In other words, the founder control region shrinks; we conjecture that the founder control region disappears altogether. The loss of the founder control region appears to be a common phenomenon in spatial models. The reason is that even though the mean-field model has two locally stable equilibria and the outcome of competition depends on initial densities, one of the two equilibria turns out to be stronger when using the partial differential equation or integro-differential equation approach. That is, as long as the stronger species occurs somewhere at a sufficiently high density over a sufficiently long interval, that species will expand its range via traveling waves and will eventually take over.

Competition-Colonization Trade-Off. The competition-colonization trade-off is another mechanism that is frequently invoked to explain coexistence, for instance in the Minnesota grasslands studied by Tilman's group. Some grass species allocate more biomass to their roots, which makes them better competitors for nitrogen, while others allocate more to seeds, which makes them better colonizers; and the different species coexist. The trade-off can be illustrated in a model in which species are hierarchically ordered. This model is known as the *grass-bushes-trees model* in mathematics (for references, see Durrett, 1995) and the *hierarchical model* in ecology (for references, see the article by Lehman and Tilman in Tilman and Kareiva, 1997). In the two-species mean-field version, the model is given by the following system of ordinary differential equations:

$$\frac{du_1}{dt} = \lambda_1 u_1(1 - u_1) - u_1,$$
$$\frac{du_2}{dt} = \lambda_2 u_2(1 - u_1 - u_2) - u_2 - \lambda_1 u_1 u_2,$$

where $u_i(t)$ is the density of species i at time t. Species 1 behaves like a contact process, and therefore for species 1 to survive, λ_1 needs to exceed the critical value (which is 1 for the mean-field model). Species 2 behaves like a contact process in the absence of species 1 but is replaced by offspring of species 1 if they land on sites that are occupied by species 2. Offspring of species 2 can land only on vacant sites, whereas offspring of species 1 can land on vacant sites or on sites occupied by species 2. Species 1 is thus considered the superior competitor. The principal conclusion from this model is that the inferior competitor (species 2) can coexist with the superior competitor (species 1) only if its birth rate exceeds the square of the birth rate of species 1, which makes species 2 the superior colonizer. Rescaling shows that the spatial version of this model has the same qualitative properties.

Spatial Heterogeneity. If factors such as temperature, pH, light, and soil moisture vary over small enough scales, then species can coexist by specializing on particular conditions. Biologically this is a very important factor for coexistence. From a mathematical point of view, however, this type of coexistence is less interesting, since one essentially

deals with noninteracting communities, each specialized to its own habitat type, and coexistence is trivial provided dispersal allows exchange of migrants.

Spatial heterogeneity generated by species dynamics is mathematically more interesting and also biologically important. For instance, light gaps in forests are created through tree fall. These gaps represent small-scale spatial heterogeneity in light availability and can allow species that differ in their light requirements to coexist. A light-tolerant species that reproduces on a fast time-scale and disperses over short distances can coexist with a shade-tolerant species by temporarily exploiting the gaps before the shade-tolerant species dominates the location again. This mechanism is called *successional niche* (Pacala and Rees, 1998).

We saw in the spatial Lotka-Volterra competition model that competitive interactions between species can generate spatial segregation, a form of spatial heterogeneity. This can facilitate coexistence of a large number of species by allowing different communities to exist side by side in patches without ever competing with species that live in another type of patch.

Spatial heterogeneity does not always facilitate coexistence. Indeed, habitat fragmentation, which results in a spatially heterogeneous landscape, is implicated as a major cause of species extinction. For instance, vast areas of Minnesota consisted of continuous prairie before European settlement. Now a large proportion of the original prairie has been converted either to urban areas or to farm land, resulting in a sparse patchwork of prairie fragments. Many of the fragments are so isolated that they have ceased to fulfill their ecological function. The effects of habitat fragmentation have been studied both theoretically and empirically. The hierarchical model has been explored quite extensively in the context of habitat fragmentation where a fixed proportion of habitat is assumed to be destroyed. The mean-field model exhibits somewhat surprising behavior: namely, the best competitor is affected most severely by habitat destruction and goes extinct first as the fraction of destroyed habitat increases (for references, see the article by Lehman and Tilman in Tilman and Kareiva, 1997). However, this effect depends crucially on the relative dispersal ranges of the competitors, and one can construct situations in a spatially explicit model that produce the opposite conclusion (Neuhauser, 1998).

The Point-Process Framework

Point processes are stochastic processes in which points are distributed in d-dimensional real space and the temporal dynamics are described by rate functions. Each point represents an individual, and the rate functions determine the demographic processes. Point processes differ from interacting particle systems primarily by placing individuals on continuous space, such as the real plane, rather than restricting them to a regular lattice. To obtain biologically sensible results, one needs to introduce a local carrying capacity that limits the number of individuals locally. Questions of interest are similar to the ones I discussed above within the framework of interacting particle systems.

The point-process framework is particularly suitable for modeling plant populations. Several forest models employ this framework (for references, see the article by Pacala and Levin in Tilman and Kareiva, 1997). Point processes model dynamics at the level of an individual. Each individual is represented by a point with a unique location and any other attributes one wishes to track (species type, genotype, and so forth). The advantage of models based on individuals is that they allow calibration using field data. For example, Pacala and coworkers calibrated the forest model SORTIE by collecting field data for fecundity, survivorship, mortality, dispersal, and so on for every tree species in the simulation model. The simulation model was used, for instance, to predict biomass and species diversity under different disturbance regimes.

Spatial point distributions describe the spatial patterns of point processes. As in the case of interacting particle systems, local dispersal of individuals can result in spatial correlations. Since it is generally impossible to obtain the probability distribution that describes the spatial pattern in equilibrium, much more modest goals are pursued, like finding the average number of individuals per unit area or the covariance structure of the spatial pattern. But even this is difficult. Pacala and collaborators have developed a nonrigorous approximation method called the *moment closure method.* (This method had been used before in physics.) The method works only for a certain class of rate functions, and even then it does not always give the correct answer. It amounts to deriving equations for the mean vector of species densities and the associated covariance matrix. These equations contain higher-order moments and are therefore not closed. The equations can be closed and then solved numerically either by neglecting higher-order central moments or by approximating them by lower-order moments (the latter works, for instance, in the case where global dispersal results in a Poisson distribution). This method allows one to study spatially homogeneous models that are at the onset of exhibiting spatial correlations, such as when offspring are dispersed over intermediate distances. (Dispersal over very short distances has the potential to result in large spatial correlations, whereas dispersal over long distances can be well approximated by deterministic partial differential equations or integro-differential equations, similarly to the de-

terministic approximations for interacting particle systems, which do not exhibit spatial correlations.)

Interacting particle systems and point processes are not very different qualitatively. For instance, the same mechanisms mentioned above that allow for coexistence in interacting particle systems are present in the corresponding point-process model. This suggests at least some degree of robustness with respect to the modeling framework. However, point processes are much harder to analyze than interacting particle systems, which explains why studies of point processes rely primarily on simulations or approximation methods.

The Metapopulation Framework

Many populations live in patchy habitats due to habitat fragmentation or to naturally occurring spatial heterogeneities. The metapopulation framework, introduced into ecology by Levins in 1969, is ideally suited to deal with such situations. Subsequently this modeling framework has been greatly expanded, in particular due to Ilkka Hanski's empirical and theoretical work on butterfly populations in Finland (for a summary, see Hanski, 1999).

Metapopulations are spatially implicit or explicit patch models. Each patch is either occupied or vacant; occupied patches become extinct at a rate that may depend on population size or patch area, and vacant patches become colonized by migrants from other patches. The dynamics within a patch can be deterministic or stochastic. Frequently, instead of modeling individuals, one tracks the probability of patch occupancy, and one uses area as a proxy for population size to determine extinction and colonization rates of patches.

The metapopulation framework has the flexibility to accommodate any spatial arrangement and thus provides a more realistic framework than interacting particle systems. This is particularly important if one attempts to parameterize a real population, as Hanski and coworkers have done in their butterfly studies in the Åland islands in Finland. The butterflies are the Glanville fritillary, a species that occurs in dry meadows that contain the larval host plants. There are a large number of (mostly small) suitable patches, scattered throughout the landscape. Local butterfly populations are small, with a high turnover rate. For many years Hanski and coworkers have collected data, such as population sizes, extinction rates, and recolonization rates. Their study is unique in both spatial and temporal extent. By combining empirical and theoretical work, they demonstrated that demographic stochasticity and inbreeding cause frequent local extinctions but that the metapopulation as a whole persists because of recolonization and asynchrony in local dynamics. Their study also points to the importance of sufficiently large and closely connected networks of patches to maintain the metapopulation: patches that are too isolated are never colonized.

Theoretical results on the persistence of such metapopulations are difficult to obtain due to the complex spatial arrangement of patches. Hanski and Ovaskainen (2000) have made some progress in the case of deterministic models. They defined a quantity, the metapopulation capacity, that depends solely on the spatial arrangement and the area of patches and that allows one to determine whether the population will persist. Theoretical results of persistence of stochastic metapopulations are lacking, though they are quite important, in particular when dealing with small populations where demographic stochasticity affects extinction of subpopulations.

Most metapopulation work deals with single populations. However, populations do not live in isolation. A habitat can contain tens to hundreds of species which interact in complex ways. Though it is not feasible to investigate models at this level of complexity by specifying all possible interactions between a large number of species, it would be worthwhile to study communities of a small number of species that live in a patchy environment. Different species have different life histories resulting in different dispersal strategies. How this affects persistence of the entire community is not well understood. Much work is needed to understand such metacommunities.

The Future of Spatial Ecology

I discussed spatial models that deal with a single species or with competition between species and for which various results have been proved mathematically rigorously. We have a good understanding of what types of spatial patterns emerge in single-species models and also what mechanisms produce coexistence or mutual exclusion of different species and which of these mechanisms require an explicitly spatial component. Even though little is known rigorously about how robust the results are with respect to specific dynamics, there is a general sense that the results are robust and that we have identified the basic mechanisms. Determining the relative importance of the different mechanisms in natural populations, however, remains a challenge.

In the following I wish to point to challenges in areas in ecology that I did not discuss above and to topics that would benefit from a mathematically rigorous investigation.

Other Areas

A large part of the theoretical ecology literature deals with predator-prey or host-pathogen interactions. Hassell, May, and collaborators (see the article by Hassell and Wilson in Tilman and Kareiva, 1997) have developed a sizable body of work on *coupled map lattices*, primarily in the context of host-parasitoid models. (Coupled map lattices are

spatially explicit, deterministic models with local dynamics.) In addition, some stochastic and spatially explicit versions of predator-prey and host-pathogen models have been analyzed mathematically rigorously (see Durrett, 1995). Most models involve just pairwise interactions. Less well understood are models that deal with multiple hosts, multiple predators/pathogens, and more complex interactions, such as a predator feeding on a prey species that in turn feeds on some other host.

Ecological models often neglect genetics. Starting with Wright's work, there is a large literature on genetics models that include space either implicitly or explicitly. The mating structure can create genetic variation due to reduced gene flow between locations, resulting in a patchy distribution of genotypes. In addition, different genotypes might be favored in different parts of the range. This variation can have important consequences, in particular when individuals are suddenly faced with new ecological and evolutionary conditions, such as rapid climate change or reduction in range due to habitat destruction.

Robustness

Results from theoretical models are based on specific dynamics within a specific framework. This is particularly true for spatially explicit stochastic models; proofs break down when the dynamics change ever so slightly. For instance, the birth rate in the contact process is proportional to the number of occupied sites in the neighborhood. Many results for the contact process use duality, which crucially relies on this exact linearity of the rates. But many results, like the existence of a critical value and positive correlations, should hold for more general rate functions. Likewise, the dynamics are crucial in the proof of spatial segregation of the two competing species in the Lotka-Volterra model in one and two spatial dimensions when interspecific competition becomes more important relative to intraspecific competition, but the same phenomenon should occur for other rate functions as well. Understanding this type of robustness is essential if we want to make general statements.

Robustness is needed also with respect to the modeling framework. For instance, deterministic spatial models often exhibit complex patterns that are not robust with respect to stochastic perturbations. Though these patterns are intriguing, and their study has given rise to a whole field that studies emerging phenomena, it is doubtful whether patterns that rely on specific deterministic dynamics and that are not robust to stochastic perturbations are relevant to natural systems where environmental and demographic stochasticity are important factors.

Tools

The development of analytical tools that are accessible to biologists is of high importance. Such tools are available for analyzing systems of differential or difference equations, but little is available for more complex models. One example of a tool that can be readily used for spatially explicit stochastic models is the moment closure method mentioned above. This approximation method has provided insight into the effects of local interactions in space, but has the drawback that it does not always yield correct answers. A better understanding of this method and the development of other methods are needed.

Computer simulations play an important role in spatial ecology. It is often easy to write the code for the spatial model, but the parameter space is frequently too large to do an exhaustive search to identify regions of qualitatively different behavior. In this case analytical approximations can prove very valuable. One way to proceed is to use the progression of models outlined above as a guide. Starting with a spatially explicit interacting particle system, one can first look at the corresponding reaction-diffusion or integro-differential equation that results from introducing either fast stirring or long-range dispersal. Since these models are more tractable, one can find regions in the parameter space where the behavior changes qualitatively. Often, the spatially explicit model has interesting behavior close to where the corresponding deterministic models have phase transitions; boundaries of those subspaces may be a good starting point for examining the interacting particle system (though by no means the only place where one should look for interesting behavior).

Empirical Studies

A frequent objective of empirical studies is to describe and explain spatial patterns and to determine the mechanisms that underlie the observed patterns. A mathematical model can help identify such mechanisms, but caution is in order since different mechanisms can result in similar patterns. Building models that distinguish between the different mechanisms is necessary to guide empirical studies to determine which mechanisms likely cause the observed patterns. This is a challenging task that requires both the creation and the analysis of new models. Only a thorough understanding of the theoretical properties of these models will inform empirical studies.

Currently, most spatial studies focus on just one species. In the future there will be an increased need for multispecies spatial models that can be parameterized by field data. It will thus be necessary to develop both robust models that can be parameterized and statistical methods that will allow the analysis of data from multispecies studies.

Finally, close collaboration between mathematicians and experimental biologists is needed for mathematical studies to have an impact on the understanding of how ecosystems function. This poses

a different kind of challenge: communication between the two groups. To effectively communicate, biologists and mathematicians need to speak a common language. This typically means that mathematicians need to make an effort to translate their results into plain English and to explain why they might be relevant to a biologist, and biologists need to make an effort to explain their terminology and to learn to identify situations in which mathematics can be useful.

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About the Cover

This month's cover is associated with the article in this issue by Claudia Neuhauser on spatial models. It is based on data calculated by Linda Buttel and Rick Durrett of Cornell University. Durrett, who has been a collaborator of Neuhauser, writes, "It shows the behaviour of a model of the spread of a disease like measles that you can only acquire once. Black sites are individuals susceptible to the disease, yellow sites are infected, and red sites are those who have had the disease and are now immune. This sequence of snapshots in time illustrates a result proved by Ted Cox and me in 1988—when the epidemic does not die out, it expands linearly and has an asymptotic shape, which is a convex set with the same point symmetries as the square lattice."

Other images like this one can be found in Durrett's article "Stochastic spatial models" in volume 41 of the *SIAM Review* (1999), pages 677–718.

One of the papers by Durrett and Neuhauser is "Epidemics with recovery in $D = 2$", *Ann. Appl. Probab.* **1** (1991), pages 189–206.

—*Bill Casselman* (covers@ams.org)

Jacques-Louis Lions (1928–2001)

Peter D. Lax, Enrico Magenes, and Roger Temam

Roger Temam

Jacques-Louis Lions was a scientist of remarkable prescience and immense energy. His vision extended to the development of entire areas of mathematical science. He understood that mathematics can make a great contribution to science, and he worked to see this goal realized.

He authored or coauthored 20 books and nearly 600 articles, and his mathematical legacy is extremely important. Founder of the French school of applied mathematics, he also had a considerable influence worldwide on many mathematicians and many mathematical institutions. Beyond all his personal achievements, his greatest satisfaction came from the success of his son, Pierre-Louis, who was awarded one of the Fields Medals at the International Congress of Mathematicians in Zurich in 1994.

Jacques-Louis Lions was born and grew up in the south of France in the charming town of Grasse, which produces many of the flowers used in the French perfume industry. His father was mayor of Grasse for nearly thirty years, a politician who is said to have been generously devoted to the good of his constituency. Lions's wife and lifelong companion, Andrée, was born and raised in the south of France too; they met in the Résistance during World War II. Lions was very attached to Grasse and the surrounding area; the family would return there during the academic recesses, and he would work there between professional trips.

After high school Jacques-Louis studied for one year at the University of Nice, which was then a small one-year college. His potential was detected by an oral examiner who advised him to prepare for the competitive École Normale Supérieure, which he entered the next year (1947) and attended until 1950. He then joined the Centre National de la Recherche Scientifique (CNRS) and started research under the direction of Laurent Schwartz. Shortly before, Schwartz had completed the theory of distributions, for which he was awarded the Fields Medal in 1950. Schwartz foresaw that the theory of partial differential equations (PDE) should be revisited and completely redeveloped in the context of distribution theory, and he engaged several of his doctoral students in that direction, including Bernard Malgrange, François Treves, and Jacques-Louis Lions. In his thesis Lions developed the basis of the variational theory of linear elliptic and evolution equations, one of the approaches to these problems commonly used nowadays. After completing his thesis (thèse d'état), he developed his own research program, working hard and without interruption to the end of his life, even when he assumed other important and time-consuming responsibilities.

Jacques-Louis Lions passed away on May 17, 2001, at the age of seventy-three, after fighting his illness very discreetly the last few months. He is

Roger Temam, both a student and a collaborator of Jacques-Louis Lions, thanks the friends, colleagues, and collaborators of Lions who suggested additions to this article; in particular, Alain Bensoussan provided information concerning INRIA and CNES. A version of this article appeared in SIAM News **34** *(2001), no. 6, 2-4.*

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survived by his wife, Andrée; his son, Pierre-Louis, and daughter-in-law, Lila; and his grandson, Dorian.

Scientific Work

The mathematical work of Jacques-Louis Lions is at the same time very diverse and well unified. His work is described appropriately by the title (which he chose) for his chair at the Collège de France: "Analyse Mathématique des Systèmes et de leur Contrôle". The systems he had in mind are those described by linear and nonlinear partial differential equations. Analysis meant here everything from the most abstract existence theorems to approximation and numerical issues and computer implementations; control would come later.

In the early 1950s Lions started to develop the building blocks of what would be his "Analyse des Systèmes". He first addressed, alone or in collaboration, many issues in linear PDE theory and in distribution theory, including a work with J. Deny still commonly used and quoted nowadays. In the late 1950s he started his first two major and lasting works.

On the one hand, Lions started attending the Séminaire of Jean Leray at the Collège de France, and under his influence became interested in nonlinear partial differential equations, in particular the incompressible Navier-Stokes equations. The mathematical analysis of the Navier-Stokes equations, which had been dormant since the pioneering work of Leray in the 1930s, came back to life in 1951 with the article of Eberhard Hopf establishing the long-time existence of weak solutions for bounded domains in dimension three. The contributions of Lions to the subject are twofold. He and Giovanni Prodi (elder brother of the current president of the European Union) independently proved the uniqueness of weak solutions in dimension two, and they published this result together in 1959. Also, as part of his better understanding of evolution equations, Lions was able to considerably shorten the proof of Hopf and make the result more accessible; he thus contributed, with O. A. Ladyzhenskaya, J. Serrin, and others, to the beginning of the modern theory of mathematical fluid dynamics.

The other major thrust Lions began at that time was his work with Enrico Magenes on nonhomogeneous boundary value problems, which led eventually to the publication of a three-volume book in 1968. As part of this work, they made a systematic study of Sobolev spaces (introduced by Sobolev in the late 1930s), developing a wealth of results on spaces with fractional exponents, the many different characterizations of Sobolev spaces, and the theory of linear elliptic and parabolic equations in such spaces. A parallel theory needed for these purposes is the theory of interpolation between Hilbert or between Banach spaces, that is, the construction of spaces intermediate—in the sense of topology and set inclusion—between two given spaces. Lions made substantial contributions to interpolation; he had initiated interpolation between Hilbert spaces during a one-year postdoctoral visit at the University of Kansas in 1953 with Nachman Aronszajn. All this work is very "linear", but its importance and subsequent use in nonlinear problems is considerable.

Then, in the early 1960s, a new adventure started. Lions met (in spirit) another of his intellectual mentors, John von Neumann, who had previously designed the first computers and used numerical methods for the solution of partial differential equations from fluid mechanics and meteorology. At a time when the French mathematical school was almost exclusively engaged in the development of the Bourbaki program, Lions dreamed, almost alone in France, that there was an important future for mathematics in another direction. While continuing to produce high-level theoretical work in partial differential equations, he threw himself into the subject of numerical methods.

Although he did not publish yet in the area, he started the French school of numerical analysis. In a loft belonging to the CNRS (Institut Blaise Pascal)—away from the official center of Paris mathematical life, the (old) Institut Henri Poincaré—he started to teach a graduate course in numerical analysis, and he engaged graduate students in this program—in particular, and in chronological order, Jean Céa, Pierre-Arnaud Raviart, and Jean-Pierre Aubin, followed by many others. The mimeographed notes of the course he taught at the Institut Blaise Pascal were used to start numerical analysis programs in many places worldwide at a time when few books devoted to the numerical analysis of partial differential equations were available. In his course Lions used from the beginning the variational theory of boundary value problems, which he developed himself in his thesis and subsequently. This point of view was further developed in the first theses that he directed in numerical analysis, thus producing an appropriate framework for the mathematical development of finite element methods and for many other important subsequent and contemporary developments in numerical analysis. In this way Lions played a significant, albeit indirect, role in research on the numerical analysis of PDEs.

Lions began his professional career as professor at the University of Nancy (1954–1962) before going to the University of Paris (1962–1973) and then to the famous Collège de France from 1973 until his retirement in 1998. He was also part-time professor at the École Polytechnique (1966–1986), the alma mater of many of his graduate students.

Besides being involved in numerical analysis, he produced, as mentioned above, high-level theoretical work. Following an idea of George Minty and Felix Browder, he was involved in the development of the theory of strongly nonlinear equations that are monotone in their highest arguments. In his one joint paper with Jean Leray, he published in 1965 one of the most general results in that direction, extending and considerably simplifying an earlier result of Mark Vishik. Together with Guido Stampacchia, he published in 1965 and 1967 two articles developing the theory of variational inequalities. Subsequently Lions continued to develop this theory individually, with Haim Brezis, and later with Georges Duvaut in a book devoted to applications of variational inequalities to many concrete and specific problems in continuum mechanics and physics (1972). His 1969 book on nonlinear PDEs, including results by himself, colleagues, and students, was very exhaustive at the time. This valuable book, written in French, deserves to be better known; unfortunately the rights to the English translation were acquired by a company that went bankrupt. Nonetheless, this book played a role similar to the Institut Blaise Pascal mimeographed notes, being used worldwide to start courses or research in nonlinear partial differential equations.

The late 1960s were again the beginning of a new orientation for Lions in his theoretical and applied work. He was then scientific director at the newly created Institut de Recherche en Informatique et Automatique (IRIA, later INRIA). Alain Bensoussan and Roland Glowinski became his students and then his collaborators at IRIA. His work there included the numerical analysis of variational inequalities, leading to a two-volume book coauthored by Glowinski and R. Tremolières and published in 1976.

The French word "automatique" means automatic control or, more generally, control. Control is not usually paired with computer science; its presence in the name of IRIA can be attributed, in part, to the influence of Pierre Faurre, a younger scientist and industrialist highly respected by Lions (and who prematurely passed away a few months before him). At IRIA Lions discovered "systems theory", which became a new interest for him and a new component of his activity. He worked then on control theory, the area that lent its name to the second part of the title of his chair at the Collège de France.

Instead of publishing articles, he published directly a research monograph on the optimal control of systems governed by partial differential equations. This unique book, published in 1968, became the reference book on the subject; like others of his books, it was translated into English, Russian, Japanese, and Chinese. He then considerably developed the subject, writing nine books partly or totally devoted to control theory, which were published between 1968 and 1992. Two of them, in 1978 and 1982, were written with Alain Bensoussan: one was devoted to the applications of quasi-variational inequalities to stochastic control, and the other one to impulse control and quasi-variational inequalities. In the 1980s Lions was interested in controllability, and he introduced the Hilbert Uniqueness Method, which he developed in a book published in 1988. This was also the topic of his John von Neumann lecture at the meeting of the Society for Industrial and Applied Mathematics held in Boston in 1986. The question of controllability is whether one can drive a given system to a given state. In his very own style Lions reduced this problem to a problem of analysis that can be studied systematically, and he derived a wealth of results. His research also stimulated much work in both the control and the analysis communities, and it led to advances in the theory of certain partial differential equations, more specifically hyperbolic equations.

Another direction of Lions's research in the late 1970s and during the 1980s was homogenization, whose purpose is the macroscopic description of materials with a complex microscopic structure; PDEs and asymptotic and stochastic analysis are the tools needed here. His first major work appeared in 1978 in a book with Bensoussan and G. Papanicolaou. His former student Luc Tartar continued to develop this subject in a different direction. Lions also followed very closely the related work on G- and Γ-convergence of the Italian school around Ennio De Giorgi.[1]

In the 1990s, while he was president of the Centre National d'Études Spatiales (CNES) and president of the Scientific Council of the National Meteorological Office in France, Lions developed an interest in the mathematical problems of the ocean, the atmosphere, and the environment. The environment was the only subject for which he agreed to get directly involved in politics; in particular, he participated in the Venice Environment Initiative Network (VEIN), an international project which, however, did not come to maturity. On the scientific side, in one of his books on control he introduced and studied the concept of Sentinels for the control and detection of pollution, a concept that produced very good results in a thesis devoted to concrete applications. With two collaborators he wrote a series of eleven articles and a monograph on the mathematical problems raised by the primitive equations governing the motion of the atmosphere, the ocean, and the coupled atmosphere and ocean, and by related asymptotic and numerical issues. Lately he had been working on domain decomposition methods, a subject on which he wrote as early as 1972. His recent work

[1] *Concerning De Giorgi, see the obituary by Lions and François Murat,* Notices **44** *(1997), 1095–1096.*

with Olivier Pironneau on this subject led to nine articles or announcements of results, and a book was in progress.

Another massive work of Lions is the nine-volume series that he published and edited with Robert Dautray in 1988, *Analyse Mathématique et Calcul Numérique pour les Sciences et les Techniques*, seen by some as a modern version of the book by Courant and Hilbert. This series was translated into English as a six-volume series. During this work and on many other occasions, Dautray noted Lions's deep insight into the physics of the problems; Lions sometimes raised physically relevant questions not contemplated by the physicists with whom he was interacting. Lions also started to publish and edit with Philippe G. Ciarlet the *Handbook for Numerical Analysis* series, which Ciarlet intends to bring to completion; together they also edited two series of books in applied mathematics.

This brief description of the scientific work of Jacques-Louis Lions does not give a proper idea of its very considerable impact nor of the tremendous activity behind it, which included the original courses and lectures he gave, plenary lectures at major international congresses, seminars in small departments (often in developing countries), frequent travels to distant destinations, and hundreds of pages of faxes that he exchanged weekly with his collaborators.

We have also alluded to his students: Lions attracted many young people around him, both from France and from foreign countries. The complete list of his graduate students should appear in the near future on the Mathematics Genealogy website.[2] He had at least fifty students for Ph.D. theses or thèses d'état or habilitations corresponding to the postdoctoral level. All his students were delighted and amazed at how quickly he would read their drafts and how available he would be to each of them individually. Another reason for his success as thesis and postdoctoral advisor is that he could determine very quickly what research would suit a new student, and he would tailor new problems adapted to the student's abilities. Many of his students themselves became well-established mathematicians, and by the end of Lions's life he had scientific descendants of the sixth generation. In France most of those working in the numerical analysis of PDEs are his scientific descendants, and so are a significant number of those working in applied PDEs. He was very careful not to influence his students too much, saying that he saw himself as a counselor, trying only to help his students develop the best of their possibilities.

Lions also had regular scientific contacts with many high-level scientists worldwide whom he visited regularly or who visited him in Paris. Visitors usually spoke at one of the seminars Lions was directing, thus providing up-to-date information to his students and collaborators. For thirty-six years he directed one or two weekly high-level seminars, one applied and one theoretical from 1962 to 1984. When he left INRIA, the two seminars merged at the Collège de France, and, until 1998, there would regularly be one or two (or possibly three) lectures on Friday afternoons. For several years at the beginning, Haim Brezis assisted him in the organization of the Collège de France seminar, and they published the proceedings of the seminar in twelve volumes of the *Pitman Research Notes* series. The long list of regular visitors included Felix Browder, Louis Caffarelli, Peter Lax, Andrew Majda, Louis Nirenberg, and Paul Rabinowitz from the U.S.; Ennio De Giorgi, Enrico Magenes, and Guido Stampacchia from Italy; Shmuel Agmon from Israel; John Ball from the United Kingdom; Li Ta-tsien from China; and Sergei Sobolev and Mark Vishik from the former USSR.

As Enrico Magenes recalls below, among the countless mathematical initiatives of Lions is that at the end of World War II he was the first French mathematician (along with Laurent Schwartz) to reestablish contact with the Italian mathematical community and to visit Italy. Thence followed the lasting and very active interaction and collaboration with Ennio De Giorgi, Enrico Magenes, Giovanni Prodi, and Guido Stampacchia. Lions started to guide a long series of Italian postdoctoral researchers who eventually became themselves well-established mathematicians, the first one in Nancy being Emilio Gagliardo. Lions also helped the development of applied mathematics in Spain and in India (Bangalore), always very generous of his time with young people for correspondence, advising, and visits.

Scientific Responsibilities and Other Activities

The scientific research of Jacques-Louis Lions was only part of his professional activity; the other part was his role as manager and consultant, his responsibilities in governmental organizations, and later his role in high-level industrial companies. He seems to be one of very few mathematicians in modern history to have had at the same time important research activities and important positions in governmental and industrial organizations.

In 1980 IRIA became INRIA (N for National) and Lions became its first president, a position he held until 1984. Lions was both the manager and the scientific head of this new institute, which he literally molded. As much as possible he got involved in all the scientific and organizational aspects. INRIA played and still plays an important role in the development of computer science in France.

Lions initiated the expansion of INRIA to Sophia-Antipolis, near Nice, and to Rennes. He designed

[2] http://mathgenealogy.mnsu.edu/.

the organization of the institute through projects (a very relevant and efficient approach to motivate teams) with precise objectives, budget assignments, and managerial responsibilities, as well as frequent reports and evaluations. He created Simulog, the first subsidiary of INRIA, which was followed by a long series of successes with spin-off companies. He always advocated that a project should have three pillars: scientific excellence, application relevance, and international cooperation. During his four years as president of INRIA, he gave the institute the basic principles on which a significant and long-standing success has been built.

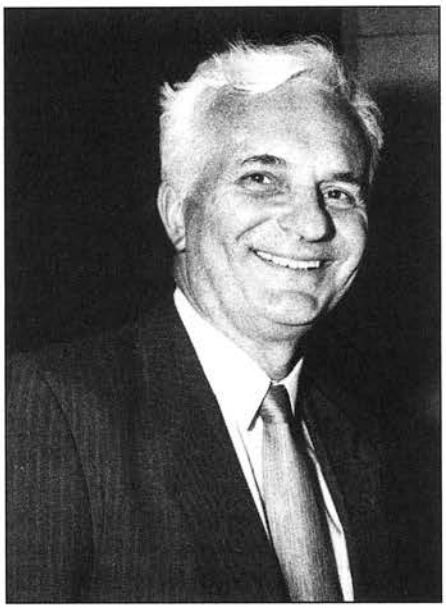
In 1984 Lions became president of the Centre National d'Études Spatiales (CNES), the French space agency. The physicist Hubert Curien, previous president of CNES and subsequently Minister of Research, foresaw the important role that mathematics would play in space research, and he asked Lions to accept this responsibility. In his new position Lions was confronted with new challenges. Beside the scientific ones (to supervise work on mathematics, physics, chemistry, and engineering), he went from directing INRIA, a new institute that he fully shaped, to presiding over a large, active, and well-established institution. Furthermore, he was the first mathematician to hold this position. He certainly did well, since he was reappointed for a second four-year term and since the current president, Alain Bensoussan, first appointed in 1996, is also a mathematician.

Lions was president of CNES in a period of economic growth which allowed the launching of big programs such as Ariane 4, Ariane 5, and the successor of the SPOT series. He was very effective in promoting CNES programs with the ministries in charge and, more generally, with politicians, industrialists, and decision makers. A man of conviction, he put his credibility at stake on these programs and created confidence.

His action was particularly effective in three areas. First, when the V15 Ariane launch failed in September 1985, he insisted that the scientists and engineers invest heavily in modelling and numerical treatment in order to sort out the causes of the failure. Later on, he insisted on having a CNES basic Research and Technology Program carried out in close cooperation with other institutes and research bodies. He successfully negotiated with NASA the France-U.S. space oceanography program Topex/Poséidon at a time when the flight of NASA payloads on Ariane launch vehicles was banned by the U.S. Congress.

Lions was very active in French-Soviet, and then French-Russian, negotiations to get flight opportunities for French astronauts. Numerous manned space missions such as Jean-Loup Chrétien's second flight and Michel Tognini's mission have to be credited to his actions.

In 1996, after Lions left the presidency of CNES, the new rocket Ariane 501 failed on its maiden flight. He was appointed chairman of the European Space Agency committee investigating the reasons for the failure. The conclusions of the investigations conducted under his direction appeared in *SIAM News* in October 1996. The failure was due to a calculation overflow that was not properly anticipated. This is now a textbook and classroom example of overflow in computing.



Photograph courtesy of INRIA Archives.

Jacques-Louis Lions

Although a new appointment was proposed to him, Lions retired from CNES in 1992, deciding once more to confront a new challenge: the industrial world. For many years he had been working on mathematical problems originating from industry, and as president of INRIA and CNES he had many contacts with industry. He then decided to enter the industrial establishment itself, and soon we were to see him as a member of the scientific council or of the board of directors of large industrial groups. He was president of the Scientific Committees of Pechiney, Gaz de France, Électricité de France, and France Telecom; high-level scientific consultant at Dassault-Aviation and Elf; and member of the board of directors of Dassault-Systems, Pechiney, Compagnie de Saint-Gobain, and Thomson Multimedia.

Lions was president of the French Academy of Sciences from 1997 to 1999. He was secretary (1978–1990) and then president (1991–1994) of the International Mathematical Union, and he initiated the World Mathematical Year 2000. He was also a member, the secretary, or the chairman of countless committees in research institutions. He never spared his efforts to help scientifically isolated individuals or young groups in Eastern Europe, in developing countries, and in other places.

Lions received many awards honoring his various activities. He was a member or foreign member of about twenty academies, including the French Academy of Sciences, the (U.S.) National Academy of Sciences, the American Academy of Arts and Sciences, the USSR and then the Russian Academy of Sciences, and the Third World Academy of Sciences. He received about twenty honorary degrees. He was awarded the von Neumann Prize in 1986, the Japan Prize and

the Harvey Prize in 1991, the Lagrange Prize in 1999, among others. In France he was Commandeur de la Légion d'Honneur and Grand Officier dans l'Ordre National du Mérite.

Jacques-Louis Lions was an exceptional person in many respects. He was a charismatic man, generous, very open and accessible, avoiding conflicts and contentious situations. One of the most striking aspects of his personality was his long-term vision; he was able to see and get involved in things that came to maturity five, ten, or twenty years later. He had many good ideas, and he had the mathematical talent, the physical strength, and the understanding of people needed to implement them.

Jean Céa wrote during the celebration of Lions's sixtieth birthday that he was at the same time a very simple and a complex person. He was indeed. Always kind, he could nevertheless make difficult decisions when needed and stick to them. He had a sense of humor and even knew how to put humor into serious matters or difficult situations. He would set high standards but remain kind to those who did not reach those standards. His long-term vision put him ahead of others and gave him time to elaborate subtle strategies, but he would withdraw and avoid conflicts when his propositions did not go through.

We said that Jacques-Louis Lions received many prizes, awards, and distinctions. Nevertheless, we believe that all in all he has given much more than he received. He will be very much missed by his friends and colleagues worldwide.

Peter D. Lax

Jacques-Louis Lions had many admirers and friends in the United States. We were only vaguely aware that he had been ill, so the news of his death came with the suddenness of a shock wave. We were—and are—stunned by the sense of loss.

Lions first came to our notice when he published his elegant generalization of the Titchmarsh convolution theorem to n dimensions. Subsequently he chose to work on the theory of linear partial differential equations; he was among the first to use systematically the theory of distributions. Under the influence of Jean Leray he turned to the theory of nonlinear partial differential equations, in particular the equations of fluid dynamics. He combined his interest in questions of existence with the equally intriguing questions of how to calculate these solutions numerically. This philosophy went against the then current intellectual fashion in France, formalized by Bourbaki, which gloried in looking for sources of mathematics in mathematics itself. That Lions was able to turn around almost singlehandedly this intellectual climate is one of his great achievements.

Lions had an open, friendly, generous personality, with a light touch and a subtle sense of humor. When an American whose desire to lecture in French vastly exceeded his ability to do so visited the University of Nancy, Lions tactfully told him that the graduate students and postdocs were very eager to improve their English and were very much looking forward to hearing lectures in that language. Much later, Lions was a member of a committee of the National Academy of Sciences whose task was to evaluate the standing of mathematics in America on an international scale. In the course of the discussion of applied mathematics, the British participant criticized the French school of applied mathematics for being overly devoted to finding the right function spaces rather than concentrating on the physical phenomenon. Lions disarmed the potentially painful confrontation by saying, in mock horror, "We knew we couldn't trust the English ever since they burnt Joan of Arc."

Lions the scientist left his mark on the scope of mathematics; Lions the person left his mark in our hearts. We mourn his loss.

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Enrico Magenes

The first meeting of J.-L. Lions with the Italian mathematicians took place, I believe, in May 1954 on the occasion of a conference in Brussels on partial differential equations. In this conference Mauro Picone proposed a problem in the theory of elasticity for which the existence of a solution was not yet known. Lions promptly gave the answer to Picone's problem and was happy to publish his paper in the *Annali di Matematica Pura ed Applicata* [vol. 41 (1956), 201–219].

But the decisive meeting occurred in Nice in the summer of 1957 at the Réunion des Mathématiciens d'Expression Latine, when Guido Stampacchia and I had the opportunity to meet Lions and to become friends with him because of common scientific interests and life experiences.[3]

Stampacchia and I wanted to know and make known in Italy the results of the school of Laurent Schwartz on distributions and on partial

Enrico Magenes is professor of mathematics at the University of Pavia. His article is an English translation, by the editor, of the French version, "Jacques-Louis Lions et les mathéticians italiens", that will appear in Matapli, *the journal of the Société de Mathématiques Appliquées et Industrielles.*

[3]*Editor's Note: The allusion here is to fighting against Nazism during World War II.*

differential equations. At our invitation Lions came to Genoa in April 1958 to give a series of lectures on mixed problems in the sense of Hadamard, which were published by Luigi Amerio in *Rendiconti del Seminario Matematico e Fisico di Milano* [vol. 28 (1959)].

After that year Lions's meetings with Italian mathematicians became very frequent. He gave lectures and courses at many university mathematics institutes (Genoa, Pavia, Milan, Rome, Naples,...), at the Scuola Normale Superiore di Pisa, at S.I.S.S.A. (Scuola Internazionale Superiore di Studi Avanzati, Trieste), at C.I.M.E. (Centro Internazionale Matematico Estivo), at I.A.C. (Istituto per le Applicazioni del Calcolo, Rome) of the Italian CNR (Consiglio Nazionale delle Ricerche), at the National Academy of Sciences in Rome, at the Istituto Lombardo of the Academy of Sciences and Letters of Milan, and finally at I.A.N. (the Institute of Numerical Analysis) of the CNR at Pavia. Concerning the I.A.N., one should recall that he conducted his activities and gave advice as a member of the scientific council, starting from the establishment of this institute in 1970 and continuing until 1992.

Even last year, when he was already ill, he gave a course on mathematical modeling at the University of Pavia. From start to finish his lectures were very clear and up to date, and he always proposed open problems.

He welcomed in France, to work with him or with his collaborators, many young Italian mathematicians, all of whom remember him with admiration and thanks. Mentioning here only researchers coming from Pavia, I recall C. Baiocchi, F. Brezzi, P. L. Colli, V. Comincioli, G. Geymonat, L. D. Marini, A. Quarteroni, A. Visintin,.... But the list of all the Italian researchers welcomed by Lions would be very long, including scientists of a very high level.

He worked personally with G. Stampacchia on variational inequalities and with G. Prodi on Navier-Stokes equations. With E. De Giorgi he was linked not only because of scientific interests, notably in the calculus of variations and in homogenizations in PDE, but also because of a great friendship, revealed especially when De Giorgi fell ill.

Finally, it is with deep emotion that I recall here our collaboration, which for me was an inestimable source of ideas, for which I will always be grateful to him. It began in 1958 and was carried on especially during the years 1958–1972, when we studied nonhomogeneous boundary-value problems for linear PDE, and later in the scientific council of the I.A.N. But even in the last months we thought about a regularity problem for solutions of a linear integro-differential equation that he posed.

I would like to recall one episode concerning our collaboration. After finishing our third paper on elliptic problems, we noticed a mistake. The error was of this kind: we had thought that the extension by zero outside a regular open set Ω in $\mathbb{R}^n$ was continuous from $H_0^{1/2}(\Omega)$ to $H^{1/2}(\mathbb{R}^n)$, which is false. Discovering a mistake in one of one's own papers is not a pleasant thing, but we recalled what Renato Caccioppoli used to say, with his Neapolitan humor: the only sure way to avoid making mistakes is to do nothing at all! In any case, the reaction of Lions and the speed at which he overcame the difficulty, proposing to me to introduce the space $H_{00}^{1/2}(\Omega)$ (that is, the interpolated space of order $1/2$ between $H_0^1(\Omega)$ and $L^2(\Omega)$), were astonishing to me.

Obviously we met each other many times during all those years (in Nancy, Paris, Grasse, Genoa, Pavia,...). This deepened our friendship, which extended to our families.

I wished to stress our collaboration to show that I had the opportunity to fully appreciate the intellectual and human qualities of Lions: his unaffected manners; his commitment and energy in work; his rapidity of intuition and decision; his openness to new ideas and new problems in a body of knowledge that increased more and more over time, even outside mathematics; his love of freedom; and his respect for the opinions of others. And I can also attest to his willingness to collaborate with all mathematicians and scientists, independently of their cultural tradition, as well as with the scientific institutions of all countries, be they countries with an old heritage or countries on the path of development.

We have lost not only a great mathematician but also a great man.

Leonard Carlitz (1907–1999)

David R. Hayes

Leonard Carlitz died on September 17, 1999, at the age of ninety-one years. Born in Philadelphia on December 26, 1907, he received his doctorate in mathematics from the University of Pennsylvania in 1930, working under the direction of H. H. Mitchell. Carlitz leaves a remarkable mathematical legacy, including work in number theory, finite field theory, combinatorics, special functions, and the arithmetic of polynomials over a finite field.

Carlitz spent a postdoctoral year (1930–31) with E. T. Bell at the California Institute of Technology as a National Research Council Scholar. During 1931–32, he studied with G. H. Hardy at Cambridge University, supported by an International Research Fellowship. This was the era when Hardy and Littlewood led one of the great centers of research in number theory, and Carlitz found the mathematical atmosphere there exhilarating. His work in additive number theory derives from that period.

On his return from Cambridge in 1932, Carlitz accepted a position at Duke University, where he remained until his retirement in 1977. He was a member of the editorial board of the *Duke Mathematical Journal* from 1938 to 1973, often serving as managing editor. In 1964 he was named James B. Duke Professor of Mathematics, the first member of the Duke mathematics department to hold one of these distinguished professorships.

Carlitz directed forty-five doctoral students at Duke. They are listed below with their dissertation titles. The fact that the great majority of these dissertations involve finite fields reflects Carlitz's abiding interest in the area for which he is perhaps best known. His approach to his students was low-key and supportive.

Carlitz published 770 research papers during his active years, and a final paper, culled from his classroom notes, appeared in the April 1995 issue of *Finite Fields and Their Applications*. In 1953 he published a record 44 papers. His most active decade was 1960–69, when he averaged 27 papers per year. During the early 1960s, when I was one of his graduate students, Carlitz had a National Science Foundation grant that paid for a half-time secretary. On more than one day I observed him reading a journal paper raising a question that he found of interest, that evening writing up a paper of his own answering the question, and having it typed and sent off to a journal the following day.

The importance of some of Carlitz's most profound papers was not appreciated until many years after they appeared in print. This unfortunate circumstance is sometimes attributed to the large number of his research papers. However, his choice of nondescriptive titles for many of his papers is a more likely explanation. In 1938 he introduced [2] the first Drinfeld module, now called the Carlitz module, anticipating a portion of Drinfeld's 1974 paper. Carlitz's paper showed how one may explicitly construct the abelian extensions of the function field $\mathbb{F}_q(T)$, a new and elegant solution of Hilbert's Twelfth Problem over $\mathbb{F}_q(T)$. Nevertheless, Carlitz entitled this paper "A class of polynomials".

David Goss's book [7] contains a detailed exposition of the Carlitz module and, more generally,

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of Carlitz's deeply original papers in the arithmetic of polynomials over $\mathbb{F}_q$. Carlitz wrote many papers on permutation polynomials, which provide one approach to the design of random number generators. His interest in this area originated in a paper of Dickson [5], whom Carlitz regarded as a mentor. Carlitz conjectured [8] that there are only a finite number of permutation polynomials of any given even degree over the *totality* of finite fields of odd order. This deep conjecture was proved [6] in 1993 using the classification theorem for finite simple groups. See [1] for a more detailed account of Carlitz's contributions to finite field theory. Carlitz's work with Olson [4] provides a sharp bound [3], [9] for the minus part of the class number of $\mathbb{Q}(\mu(p))$, p prime.

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What Is Mathematics? An Elementary Approach to Ideas and Methods

Reviewed by Brian E. Blank

What Is Mathematics? An Elementary Approach to Ideas and Methods
Richard Courant and *Herbert Robbins*
Second edition, revised by Ian Stewart
Oxford University Press, 1996
ISBN 0-19-510519-2
$19.95, 566 pages

Thirty-two years ago while browsing in my high school library, I happened upon an intriguingly titled expository book. I knew astonishingly little of the practice of mathematics at the time. I was aware that geometry derived from Thales, Pythagoras, and Euclid. Whether or not any geometric theorems were discovered after Euclid I could not say. That algebra and trigonometry were the results of conscious development would no more have occurred to me than the idea that the English language was the creation of dedicated professional linguists. I knew the names and work of many scientists—Copernicus, Kepler, and Galileo in astronomy; Darwin, Mendel, and Pasteur in biology; Boyle, Lavoisier, and Curie in chemistry; Archimedes, Newton, and Einstein in physics; Jenner, Harvey, and Koch in medicine; and many others, *none of whom were mathematicians.* Although my recreational reading of Hall and Knight had exposed me to an odd assortment of surnames, such as Venn and Horner, I knew of no first-rate scientist in the field of mathematics. Indeed, I did not really know that there was such a field.

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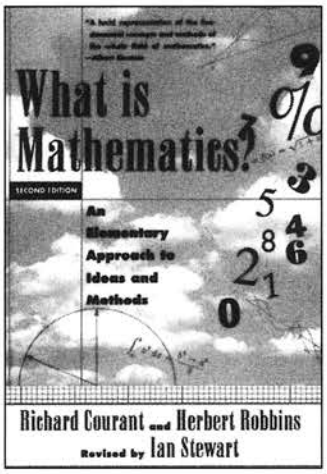

The book I pulled off the shelf that day did more than open my eyes; it changed my life. I graduated from high school later that year, armed with a twenty-dollar book certificate. It might have been prudent to save my award for the college textbooks that I would soon require. However, with no further access to my school library, I had a more pressing need. For less than nine dollars *What Is Mathematics?* by Richard Courant and Herbert Robbins became the first volume in my collection of mathematics books.

Only a sketchy summary of this well-known text need be given here. The first chapter is largely devoted to number theory. A chapter on real and complex numbers follows. The discussion includes Dedekind cuts, Cantor's theory of cardinal numbers, and Liouville's construction of transcendental numbers. The third chapter is concerned with field extensions and geometric constructions. It includes a thorough investigation of the impossible straightedge-and-compass constructions of classical Greek geometry (stopping short of a proof of Lindemann's Theorem). Chapters on projective geometry and topology come next. In preparation for the remainder of the book, Courant and Robbins continue

with a chapter that introduces the reader to the rigorous definition of limit, reinforced by genuine proofs of the Intermediate and Extreme Value Theorems. Optimization and calculus constitute the final two chapters in a rather unusual ordering: the calculus of variations is introduced before the calculus, the definite integral before the derivative.

As is often the case with skilled exposition of deep subject matter, *What Is Mathematics?* can be read at different levels. The professional mathematician who has not yet encountered the book is likely to find new things in the chapters on projective geometry and optimization. Also rewarding are the numerous small details that illuminate material that is more old hat. For example, an excellent "proof" that all positive integers are equal warns the reader against improper use of mathematical induction. Later on, a quite different "proof" of the same absurdity illustrates the need for establishing the existence of an extremum before it is determined.

Of course, *What Is Mathematics?* was not written for the professional mathematician. Many of the topics that are covered in the first six chapters bring to mind the "transition" books that have sprouted up in the last decade. They are often intended for sophomore or junior mathematics majors and have titles such as *Introduction to Mathematical Reasoning.* In fact, Courant and Robbins foresaw that their book could serve as the text for "college courses of an unconventional type on the fundamental concepts of mathematics." In conceiving *What Is Mathematics?*, Courant hoped for a wide readership that would comprise a broad spectrum of educated laypersons. Accordingly, *What Is Mathematics?* "presupposes only knowledge that a good high school course could impart." In those days—the first edition appeared in 1941, followed by three revisions at two-year intervals—calculus was rarely if ever part of the high school curriculum.

In the sixty years during which *Courant and Robbins*, as the book is often called, has been in print, several distinguished scholars have had the opportunity to sing its praises. Reviewing the first edition, E. T. Bell described the work as "inspirational collateral reading." Hermann Weyl thought it "a work of high perfection." For Marston Morse it was simply "a work of art." Even Albert Einstein chimed in with high praise. Any subsequent reviewer with the slightest humility would be excused for feeling that his further say-so would only be superfluous. To counter the perception of immodesty, I should point out that I brought something to my first reading of *Courant and Robbins* that none of these learned scientists could boast: profound ignorance. Whereas Einstein found the text "easily understandable," I often struggled.

Though the prerequisites for *What Is Mathematics?* are minimal, the "certain degree of intellectual maturity" that is mentioned vaguely in the preface is likely to be a steep hurdle for the hypothetical layperson Courant hoped to capture as his reader. Twenty-nine pages into the book the Prime Number Theorem is stated. It is not proved, of course, but the statement alone is a tough swallow for the reader who has not yet seen the natural logarithm. (At this point Courant and Robbins introduce the logarithm as area under a curve, a concept that is not made precise until the last chapter.) The reader who persists soon comes to the Law of Quadratic Reciprocity, a theorem that is exceptionally beautiful to those who have an ample supply of that maturity thing, but is thoroughly bewildering to those who do not.

Did Courant and Robbins miscalculate? Not at all! As the preface says, a genuine comprehension of mathematics cannot be acquired through "painless entertainment." There are plenty of popular books that run away from every mathematical difficulty; the reader who seeks such a treatment has always been well served. *Courant and Robbins* has earned what ought to be a permanent place in the mathematical literature by conveying not only a treasure-trove of mathematical facts but also the ideas and methods behind them. To my mind the balance of intuition and rigor is just right for a popular book that intends to lay open the real substance of mathematics. In the matter of proofs I cannot think of a single misjudgment. Every proof that is included, no matter how difficult for the beginner, is there because it contains an idea that anyone who perseveres can master. There is no better way to begin the acquisition of intellectual maturity.

If the world was the way we wished, then *What Is Mathematics?* would have sold like nickel beer. Courant had ambitious expectations for a work he said "expresses my own personal views and aims more than any other of my publications." Although he considered the title "a little bit dishonest," he heeded Thomas Mann, who had experienced the effect a tantalizing title can have on marketability. The title notwithstanding, sales of *What Is Mathematics?* did not reach Courant's hopes. If Constance Reid's ballpark estimate of over 100,000 copies up until 1976 is at all accurate, then annual purchases by individuals could never have amounted to more than a trickle. (Oxford University Press did not respond to my request for a more recent figure.)

A disappointment to its senior author, *What Is Mathematics?* turned into a bitter blow for Herbert Robbins. In 1938 at the age of twenty-three, Robbins completed his dissertation in topology under the direction of Hassler Whitney. He came to New York University as an instructor one year later. Although he "had not the faintest acquaintance with or interest in either probability or statistics," he was assigned such a course when William Feller

did not arrive there as planned. It marked the start of Robbins's long, distinguished career in mathematical statistics. After serving in the Navy during World War II, he taught at the University of North Carolina and then, from 1953 until his retirement in 1985, at Columbia University. After his first retirement Robbins taught at Rutgers University, Newark, until he retired again in 1997. Shortly before that second retirement Robbins's name was featured in news reports in conjunction with a remarkable software development. As a Harvard undergraduate in 1933 Robbins had conjectured that certain algebras, which came to be called Robbins algebras, are Boolean. Headlines were made in 1996 when the Robbins problem, which had thwarted all human effort, was proved automatically by a theorem-proving program developed at Argonne National Laboratory. Herbert Robbins died earlier this year at the age of eighty-six. (For further biographical details and a discussion of the contributions Robbins made to mathematical statistics, the interested reader may consult [8]. Transcriptions of two interviews, [1], [6], make for fascinating reading.)

Robbins was an excellent writer. His prose was sometimes provocative, often witty, always stylish. Serendipity brought him to New York University at the moment Courant was in need of help improving and amplifying the mimeographed notes that would become *What Is Mathematics?*. By Robbins's estimate the manuscript was only one quarter to one third written when he became involved. In an interview with Constance Reid he characterized his collaboration with Courant as "pretty close."

Mathematical collaboration is such a wonderful process that conventions have evolved to protect its sanctity. The basic principles are to not ask who did what and to assign each coauthor three quarters of the total credit due. In the case of *What Is Mathematics?* the temptation to violate the rules proved too great. The disparity in status between the two coauthors at the time of publication, the book's dedication (to the children of Courant), the preface (written and signed by Courant alone), the copyright (in Courant's name only) all prompted indiscreet questions. With justification Robbins became sick of the inquiries (for which he had a sharply humorous retort [10]). The relationship he had with Courant ended sordidly, with recriminations passing between the coauthors.

It is ironic really. One of the ten lessons Gian-Carlo Rota wished he had been taught is that mathematicians are more likely to be remembered for their expository work than for their original research [11]. Courant and Robbins may become the most convincing examples of this lesson. Their names have been inextricably linked for sixty years, and the bond will only grow stronger. I am reminded of Sir William Gilbert and Sir Arthur Sullivan. Gilbert penned many well-received plays, which are now known only to specialists of the Victorian theater. Sullivan composed many popular vocal and orchestral works: they are rarely heard nowadays. Yet working as a team, Gilbert and Sullivan were nonpareil. Their partnership was broken by a quarrel, but the work it produced is eternal. So too may the individual achievements of Courant and Robbins fade with the passing of time. So too does their joint effort seem destined to sparkle forever.

Even a classic can benefit from a sprucing up now and then, especially if it seeks to portray the existing state of an active field. *Courant and Robbins* was long overdue for an update when Oxford University Press brought out a second edition in 1996. This version is said to be by Courant and Robbins and *revised* by Ian Stewart. The latter part of that description is deceptive. Crack open the new edition: if you are familiar with the original, then you will be treated to a wave of nostalgia. All the old figures are there. Even the original typesetting has been preserved—quite a welcome change from the homogenized TEX of the present. Closer inspection, however, reveals something less welcome: the new edition is by and large a photographic reproduction. I could not find even one change in it. Stewart rationalizes this in his preface: "not a single word or symbol had to be deleted from this new edition." Really? After half a century could we not have had a correction to the name of Mr. Arch medes (p. 400)? Does anyone still use the term "dyadic system" in preference to "binary system" (pp. 8–9)? I suppose that there is nothing wrong with retaining the notation C_i^n for the binomial coefficients, but it does seem dated now that mathematical notation has standardized on something else.

How, then, does the second edition differ from its predecessor? Stewart has added a thirty-seven-page new last chapter titled "Recent Developments". Without doubt, the mathematician will value Stewart's contribution. As a reviewer I cannot be so positive. My most serious complaints stem from the decision to leave the original text unaltered, reserving the necessary amendments for the new chapter. The modern reader still finds the statuses of Fermat's Last Theorem, the Four Color Problem, and the Continuum Hypothesis reported as they existed in 1947. There are no footnotes nor any forward references to Stewart's new chapter that alert the reader to the falsity of the statements he has read. This is particularly regrettable in a work that is not aimed at experts.

Given Stewart's lengthy record of successful popular exposition, I am surprised to find myself at odds with several aspects of his approach. I do not believe he focuses sharply enough on the hypothetical educated layperson that Courant and Robbins had in mind as their targeted reader. Summarizing over two thousand years of mathematical

developments, Courant and Robbins deftly picked out the highlights and kept the discussion within the attention spans of their intended readers. By contrast, Stewart has been much less selective in telling us about the progress that has been made in less than sixty years. I fear the beginner will find the detail overwhelming in several places. That danger is especially great in the new discussions that receive inadequate foundation. For example, Courant and Robbins limit their treatment of the zeta function $\zeta(s)$ to (real) $s \geq 1$ (pp. 480–481). A few pages earlier they *hint* at analytic continuation when they *formally* substitute $z = ix$ into the power series for $\exp(z)$, (real z). I do not think the average reader will, on this basis, see so far as to extend the domain of the zeta function to complex s. Courant and Robbins must have come to the same conclusion, for they forbear mentioning the Riemann Hypothesis. Yet, without further preparation, Stewart rattles off its statement and, not stopping there, tells us what we will know should the (unstated) Generalized Riemann Hypothesis ever be proved true. Surely this is too much!

Although Stewart asserts in his preface that he has "made no attempt to introduce new topics that have recently come to prominence," he admits to bending his rules on occasion. Thus, the treatment of *dimension* by Courant and Robbins, fitting for its place in the chapter on topology, is used by Stewart as a pretext for a digression on Hausdorff dimension. Why? The original authors certainly knew about the concept and chose not to include it. This is a matter of the camel's nose slipping under the tent: once Hausdorff dimension enters, fractals inevitably follow. Granted, fractals can be amusing and even the source of serious mathematics. However, when given a gratuitous, superficial treatment, are they Courant-Robbins worthy?

There are some other places where old friends of *What Is Mathematics?* may wish that Stewart had used his author's license less freely. In the matter of Whitney's problem of an inverted pendulum on a train, a neat little riddle that attracted the attention of Littlewood [9, pp. 32–35], Stewart relates a challenge to the basic continuity assumption that underlies the solution given by Courant and Robbins. Ironically, that challenge itself relies on the assumption that the train can move in a way that is physically impossible, as Gillman has pointed out in his review [5]. (As long as I am mentioning the work of other reviewers, I would be remiss if I did not steer you to [3].)

It would be pointless and misleading to continue with further quibbles. It is hardly shocking to see that even an accomplished author can fall short of the standard Courant and Robbins set. On balance there can be no question that Stewart's contribution enhances *What Is Mathematics?*. Given that the original text is included verbatim in the new edition, Stewart's chapter may be regarded as a welcome bonus. At the time of this writing, you can still buy *What Is Mathematics?* for less than twenty dollars (although it is no longer clothbound, and you don't get as much change back); that makes it a real bargain.

Turning the yellowed pages of my first edition, seeing annotations in my own hand that I no longer remember making, considering the longevity of this classic, I am prompted to reflect on many things. The high school in which I discovered *What Is Mathematics?* was boarded up many years ago. The bookstore where I bought it has long since given way to the caffè latte trade. Now its two authors are dead. *Tempus fugit.* We mathematicians like to think that our subject has a permanent character that is rarely found elsewhere. As Hardy put it, "Greek mathematics is permanent, more permanent even than Greek literature. Archimedes will be remembered when Aeschylus is forgotten, because languages die and mathematical ideas do not." Hardy penned that thought as Courant and Robbins prepared for publication. For a long time it seemed like a safe bet.

Certainly Euclid's *Elements* has demonstrated that an inspired mathematical text can serve a very long time. In recent years, however, even Euclid has increasingly been charged with irrelevance. "In an age when computing power is abundant these maths are obsolete. At a minimum, it is time to transfer responsibility for teaching geometry to the history department. The problems for which geometry entered the schools have been either solved or taken over by other methods." So wrote the senior manager of a supercomputer company in a highly lauded glimpse of our digital future [2]. His is not an isolated voice. Though theorems once proved stay proved forever, appreciation of them can wane. What effect will shifts of interest have on *Courant and Robbins*? How will *What Is Mathematics?* hold up now that the good high school course that Courant spoke of is in danger of vanishing? How many students will be prepared to fight their way through *Courant and Robbins* in a time when education is so often confused with painless entertainment? I think that these questions are already being answered. For many reasons I find that Körner's *The Pleasures of Counting* [7] makes a more accessible recommendation for the sort of student I would have directed to *Courant and Robbins* twenty years ago. That in itself is not a bad thing: though it bears little resemblance to *Courant and Robbins*, Körner's book can fairly be described as "inspirational collateral reading." It allows the beginner to peek into the mathematician's art, and it *is* excellent. Do not take my word for it—see the *Notices* review [4]. That review urged the placement of *The Pleasures of Counting* in high school libraries where it can influence the talented student who might consider

a career in mathematics. I would urge no less for *Courant and Robbins. What Is Mathematics?* should be in every high school library. You never know what life it might change when some curious student pulls it down from the shelf.

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Theater Review

Fermat's Last Tango

Reviewed by Robert Osserman

The Clay Mathematics Institute (CMI) is offering at cost a VHS tape as well as a (higher-quality) DVD disk of *Fermat's Last Tango*. The tape and DVD also include an 8-minute interview with Andrew Wiles. The CMI has also prepared a 16-page illustrated pamphlet to accompany the tape and DVD. The pamphlet presents the history of the Fermat problem, descriptions of the mathematical figures (historical and modern) who appear in the musical, a note from the author (Joanne Sydney Lessner), and information about the actors and the muscial numbers. For further information visit the website `http://www.claymath.org/events/fermatslasttango.htm`.

A CD recording featuring the original cast is also available ($18.00); details may be found at `http://www.fermatslasttango.com`.

Fermat's Last Tango
A musical by Joshua Rosenblum and Joanne Sydney Lessner
with Chris Thompson and Edwardyne Cowan as Daniel Keane (Wiles) and his wife, and Jonathan Raab as Fermat
Live-performance video by David Stern

In a season where one improbable event followed another, as mathematics took center stage in theaters and on the screen, perhaps none was quite as improbable as a musical comedy based on the story of Andrew Wiles wrestling with the proof of Fermat's Last Theorem. And the competition was formidable: a biography of mathematician John Nash, *A Beautiful Mind*, transformed into a major motion picture with *Gladiator* star Russell Crowe in the lead role; and a Broadway play, three of whose four characters are mathematicians, awarded first a Pulitzer Prize and then the Tony Award for best new play. That play, by David Auburn, is entitled *Proof*,[1] forcing the authors of the musical, which originally had the same name, to come up with a new title, whence *Fermat's Last Tango*.

Fermat's Last Tango had a six-week run at the York Theatre in New York City to mixed reviews. It is clearly not everyone's cup of tea. On the other hand, there is nothing else remotely like it, and luckily Arthur Jaffe, president of the Clay Mathematics Institute, was able to arrange for a high-level professional video recording with the original cast. That recording had its premiere showing on July 16, 2001, in Berkeley at the Berkeley Repertory Theatre's brand new proscenium venue, the Roda Theatre. The occasion was a special event in connection with the Clay-sponsored miniprogram on the global theory of minimal surfaces taking place at the Mathematical Sciences Research Institute (MSRI) at the time. *Fermat's Last Tango* proper was preceded by an 8-minute video of an interview with Andrew Wiles and followed by a question-and-answer session moderated by David Hoffman of MSRI, with Kenneth Ribet of the University of California, Berkeley; Karl Rubin of Stanford University; and Arthur Jaffe. With the combination of participants in the MSRI program and members of the Berkeley mathematics department, the audience of four hundred or more was heavily skewed toward mathematicians but must have still included a majority who were not.

Although officially billing itself as a musical—or, more specifically, a "musical fantasy"—*Fermat's Last Tango* is more of a blend of a musical

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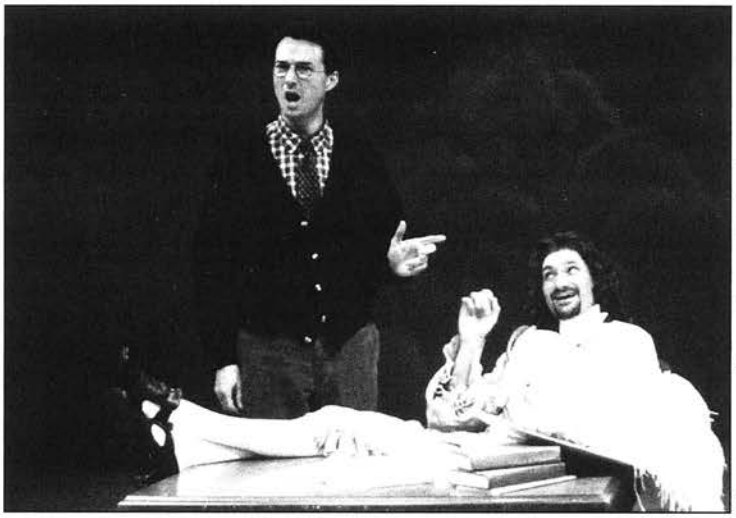
[1] *Two reviews of* Proof *appeared in the* Notices, *one by Mark Saul in the June/July 2001 issue (pages 596–597) and one by Dave Bayer in the October 2000 issue (pages 1082–1084).*

and a one-act opera. It is about ninety minutes in length, with many recitatives, and the set pieces alternate between arias and musical numbers.

The story is one well known to all mathematicians and a good part of the general public: Gerhard Frey suggests a link between Fermat's Last Theorem and elliptic curves. Ken Ribet turns Frey's insight into a precise theorem, showing that Fermat's Last Theorem would be a corollary of a well-known conjecture, the Taniyama-Shimura conjecture. Upon learning of Ribet's result, Andrew Wiles retires to his attic study, working in secret to find a proof, and seven years later announces that he has succeeded.

Fermat's Last Tango takes up the story from there (filling in the background along the way). The names of Wiles and his wife are changed—he is now "Daniel Keane"—while all other names are retained from real life. After Daniel informs his overjoyed wife that he has finally finished with Fermat and can return to a normal life, he is besieged by reporters, then asks his wife for just a few more minutes alone with his papers and the fruits of his seven years' labors. At that point he is startled by the appearance of none other than Fermat himself, who is portrayed as a somewhat diabolical version of the original. They engage in a good bit of banter until, during a visit to the "Aftermath", Fermat suddenly confronts Keane, in one of the catchiest numbers of the show, with "Your proof contains a big fat hole." From then on, as Daniel sinks back into the isolation of his study, trying to plug the hole and save his proof, Fermat plays the part of an anti-muse to Daniel, continually teasing and taunting him. He is assisted by a quartet of supporting characters—Pythagoras, Euclid, Newton, and Gauss—from the Aftermath. Daniel's wife, in contrast, is portrayed as remarkably sympathetic, loyal, tuned in to every change in Daniel's mood, and constantly assuring him that she will always be there for him. Unfortunately, Fermat points out that he too will always be there, and the three of them perform a tango-à-trois, the title tango of the piece. I would not be giving away anything to reveal that a happy ending is in store.

As I said earlier, there is nothing else I know that is remotely like this, so that comparisons are pretty well impossible. On one level it is a farce, and as with any farce, reactions are likely to range from finding it just plain silly to thinking it hilarious. Personally, some parts struck me as silly and others really worked. There were also sections that seemed to go on a bit too long. But that may have been part of the design, because by the time the story builds to its dénouement, the slapstick tone yields temporarily to a more serious one, and I found, to my surprise, that I was really moved. Part of the credit for that is due to the three leads, all of whom are excellent, both as singers and as actors. And part is clearly due to the music and



Photos courtesy of Joanne Lessner (JoeyCorp).

Chris Thompson (left) as Daniel Keane and Jonathan Raab as Fermat in the play "Fermat's Last Tango".

"Your proof contains a big fat hole..."

lyrics, which become progressively stronger. But what makes *Tango* truly unique is not only the choice of subject matter for a musical but the fact that no attempt is made to mince words. Equations are written, spoken, and sung; theorems are stated in full; the history is occasionally simplified, but is basically correct; and we hear "Taniyama-Shimura conjecture" so often that it begins to roll off the tongues of the performers as if nothing could be more natural.

What is a "general audience" to make of all this? For that matter, what is a mathematical audience to make of it? My impression at this first screening was that reactions ranged from mildly amused to enthusiastic. Nonmathematicians seemed generally to feel that they learned something as well as having been entertained. The fact is, the story of Wiles's wrestling with and finally subduing Fermat's Last Theorem is a gripping one, well worth retelling in whatever form. These days, with great interest by the mathematical community in outreach to the general public, the

screening of *Fermat's Last Tango*, followed by a question-and-answer period such as the one at this premiere, could be a marvelous vehicle for reaching a new audience. At the least they could not help but learn that mathematics is very much a live subject, with mathematicians endlessly engaged in the act of discovery.

In a production billed as a musical fantasy, it seems pointless to quibble about historical accuracy, but since the portrayal of actual events is for the most part quite faithful, it may be worth pointing out one departure that I found rather unfortunate. It is the depiction of Andrew Wiles/Daniel Keane as having withdrawn completely for seven years, holed up in his attic study night and day, neglecting wife and children, as he doggedly pursued the will-of-the-wisp Fermat. The testimony of Wiles's friends is quite the contrary. It is true that his working hours were devoted to the single-minded goal of proving Fermat's Last Theorem. But it is too bad that in order to increase the dramatic effect, the authors chose to reinforce stereotypes about the supposed incompatibility of long hours of intense mathematical concentration with an active family and social life, to say nothing of other interests and pursuits. A postshowing discussion could provide the occasion for raising this point, along with at least two others where the authors made a deliberate decision to simplify the history: the role of Richard Taylor is omitted, and Wiles is said to have solved the complete Taniyama-Shimura conjecture.

With or without a discussion, much of *Fermat's Last Tango* is just plain fun. A general audience should enjoy many of the spoofs, the jokes, and the songs. Mathematicians may well find themselves haunted by the refrain "Your proof contains a big fat hole" while their nonmathematical partners go out ruefully humming "Math widow". As for the graduate students and postdocs in the audience, they have one of the liveliest tunes for themselves, "Mathematics is a young man's game", which incidentally opens up two further obvious topics for a lively subsequent discussion.

It All Fits Together

Notes on a Visit to Japan

Mark Saul

Japanese society can be a puzzle for the foreign visitor. But eventually the pieces all fit together.

In the summer of 2000, supported by the National Science Foundation, I spent two weeks talking and working with Japanese teachers and researchers in mathematics education. I attended the International Congress on Mathematical Education as well as a seminar for American and Japanese classroom teachers.

On the first morning of my visit, I went to catch a bus. Commuters pouring out of the nearby train station lined up for their rides. Using the universal gestures, I found my way to a small change booth. Fares were paid outside the bus to make loading faster.

After paying my fare, I discovered two lines. Which was mine? I tried to ask a fellow commuter. I pointed to the other line, then to my destination, and he nodded. I pointed to the line we were on, then to my destination, and he nodded. Did he understand my question? Or would I be whisked away to some obscure Tokyo suburb?

The puzzle was solved when the bus pulled up. It had two doors. To expedite loading, passengers formed two lines for the same bus. It all fits together.

I had analogous experiences with more serious professional matters as well. What we hear in America about the Japanese educational system sometimes seems strange, because we are seeing only one piece of the puzzle. Finding the other pieces can be difficult, because we must learn to ask just the right question.

For example, we often hear that Japanese teachers don't give homework. "That's right," said Hiroko Uchino, a colleague at the teachers' seminar. "Most of our students spend several hours a week at juku [the privately run after-school programs that supplement public education]. They get homework there, so we don't have to give homework in our classes. The juku homework is directly related to what the students are learning in the schools. If we did give homework, the students would do the juku homework first and ours only if they have time. So we leave homework to juku." It all fits together.

Uchino then filled in another part of the picture: "In the district where I teach now, there are not many juku. So in fact I do give homework."

"But can all students afford juku?" I asked Hiroshi Fujita, a mathematician involved in education. Fujita was instrumental in forming a team to represent Japan in the International Mathematical Olympiad and is active in the construction of national curricula.

He replied, "Happily, most can. And in families where money is short, Japanese parents will usually decide to spend it on education rather than on other items."

Hiroko Uchino explained a bit more: "For many students, juku is a social thing. They'll ask their parent, 'Mom, Kenzo goes to this cool juku on Makuhari Street. Can I go there with him?' Even if

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they wanted to, it would be hard for parents to say no."

Fujita contributed yet another piece. "We are in the process of cutting our curriculum now, by about 30 percent. The Ministry of Education has decided that students will not have school on Saturdays. Part of the decision process will involve examining whether topics will be covered by juku, even if we drop them from the official curriculum."

Fujita was referring to a recent decision by the Ministry of Education to phase out classes on Saturday for Japanese students. As the Ministry expresses it, the Japanese want to return to the children a "zest for life". The Japanese are very conscious that childhood is difficult in their society and that many children do well in mathematics but do not like the subject. I have heard this point dismissed by some American observers as being less important than academic achievement. The Japanese themselves seem to have a different view.

What will be cut? The process will be a very important one for Americans to watch. Will the Japanese cut out the part of their curriculum that encourages thinking and experimentation? Will they cut out computational skills? Or will they strike a balance? The results will tell us much about what the Japanese value in their own system.

Right now juku is an essential part of the balance in many schools. How is work at juku aligned with schoolwork? Masayuki Ishitani, a high school teacher, explained this piece. We had been talking about textbooks: about how much thinner the Japanese texts are than the American and how textbooks are supplied free to students in Japanese elementary and middle schools. "The publishers don't make money on the textbooks they publish. They get their revenue by publishing supplementary review books, three or four times thicker than the text. These contain problems on the topics covered by the text and sometimes additional explanation. Everyone buys these books. The publishers make their money, and the juku gets its instructional material."

Viewed from afar, the Japanese system of mathematics education sometimes seems simple. The teachers know the mathematics and train the students in the subject. Then the students take tests and succeed. There is no nonsense about "understanding", about students constructing their own knowledge, about critical thinking or the beauty and mystery of mathematics. If we simply attended directly to instruction and not to the students' "understanding", we would be able to duplicate the Japanese achievement.

This view is simple but wrong. The Japanese teachers I talked to set great value in student understanding. They eschewed direct instruction, preferring rather to have students learn through experience. The lessons I saw, mostly in elementary and middle school classes, used cooperative learning, group discussion, and hands-on experiences. Teacher intervention was minimal and subtle. In short, the lessons I saw were not very different from those described in the *Principles and Standards for School Mathematics* of the National Council of Teachers of Mathematics.

So what is the difference? How are the Japanese so remarkably successful where the Americans have significant problems? A historical view provides a piece of the answer.

When I commented about this to Akihiko Takahashi, he replied, "This has not always been the case. Direct instruction was quite common until the postwar years. Our view of education has changed completely in the last generation or two."

Curiouser and curioser. How could this formal, traditional society turn itself around so quickly? Especially in the field of education, which is notoriously conservative? It would seem that American society, which sets such a high value on growth, on initiative, on progress, would have much greater capacity to adopt new ideas than a society with millennia of highly formal traditions in education.

It was Gail Burrill, a noted American educator and director of the Mathematical Sciences Education Board, who gave me a clue. "Conservative? That's not how I think of Japan at all. I think of Deming's view." She was referring to the work of W. Edwards Deming, the American engineer and businessman who helped to revitalize Japanese industry after World War II. "The Japanese are highly skilled at looking around, at adapting what they see to their own needs. And not just adapting. They have a long tradition of seeking improvement in what they find. That is one key to their economic success, and it may also be a key to their success in education." Another piece of the puzzle began to fit into place.

Yet another piece bothered me, but it took an experience outside of education to help me organize my ideas. At lunch counters Japanese food often comes in "sets". For example, you can get a roll, soup, and coffee all for one price, or you can get a sandwich, coffee, and dessert all for one price.

But what if you want a sandwich, soup, and dessert?

Once you've made your wishes known to the sales clerk, she will pause, then talk to her colleague. Both will consult with their supervisor, and he may consult with his supervisor, in a process that will take 15 or 20 minutes. You have unwittingly created a personal crisis: the desire of the staff to please a guest or help a patron conflicts with their need for order and their urge to make the system work. You may or may not get the meal you want. But it is not likely that you will request something outside a "set" next time.

How does this play out in schools? What of the student who wants a sandwich and dessert, who doesn't fit well into the "set" system? American teachers and schools spend much time and effort addressing this question. The Japanese, however, had trouble even understanding what it meant. They described to me their work with physically or mentally challenged students. They talked a bit about remediation. But I had difficulty describing to them the all-too-common American student who has troubles at home that overflow into the classroom, whose lack of social skills prevents fruitful classroom interactions, whose self-image does not include success in school, or whose feelings about adults thwart a healthy student-teacher relationship. These classroom challenges were not at all familiar to my hosts.

The problem of students bringing emotional baggage to class is certainly not as prevalent in Japan as it is in the United States. The Japanese child learns to fit into its society just as the hungry tourist learns about sets of food. Sometimes the rules of Japanese culture seem oppressive to the outsider, destructive of the individual's need for self-definition and self-expression. But Japanese children may not experience this conformity as something imposed on them. Rather, they may feel it is a way of pleasing people around them, people whom they love and respect. Why rebel against one's own instincts to love and to please?

I needed to know more about this question than a brief visit could provide. So I turned to Dan Teague. He has been working for almost a decade with the Japanese, mostly in the area of classroom technology, and has seen many Japanese classrooms.

"The teachers term them the 'red-haired kids'. They sit in the back of the room and don't do much work. They seem to feel disenfranchised by the system, and they rebel. But their form of rebellion isn't the same as our students'. It's more like dyeing your hair red, things that we would consider to be pretty standard adolescent stuff. That's not the kind of thing kids are supposed to be doing in Japan. They don't take their studies seriously. They leave school and become laborers—just like in the U.S."

Jackie Hurd teaches elementary school in California and spent a year in Japan. She told me a bit more about this aspect of Japanese schools. "Japanese teachers sometimes do have to deal with disruptive students. For example, bullying in the middle and high schools is a serious issue. But when they are having problems with a student, they don't refer them to the principal or counselor. It is not unusual for a Japanese teacher to visit a home to talk to parents or to consult with a group of teachers. The student will quickly get the message that several adults are involved.

"Another factor that influences the amount of disruptive behavior is the amount of time Japanese schools devote to community-building activities. Japanese schools devote as many as thirty days each school year to grade-level or schoolwide events, such as sports days, that are intended to build a sense of inclusion. Kids who are borderline may be pulled in by these events. It becomes very conspicuous to be on the outside, so only a tiny number of them separate themselves with antisocial behavior."

Dan Teague described how the examination system contributes to the picture. "A lot of the Japanese system is exam driven. High school is important because it prepares you for the college entrance exams. So it's important to go to a good high school. And middle schools prepare you for the high school entrance exams. These exams are milestones on the path to college. So if you've gotten into a good high school but then decide that the college exams are not for you, you're sort of stuck. You dye your hair red and drop out.

"The schools recognize this but don't do much. These kids are not disruptive. They sit in class without working, but also without disturbing others. Our problem is that when kids buy out of the system, they take others down with them. But in Japan you buy out on your own."

Teague continued, "College is interesting. The engineering schools, the medical schools, are serious places. But many of the other programs are less demanding. The philosophy is that graduates will be hired by big corporations, who will train them in their own subculture. Not everything has to be done in preservice education. Part of this is true for teachers as well. While their preservice training is serious, it is mostly about content. Pedagogical skills are carefully honed once the teacher has started work in the field."

Teague's words rang in my ears as I learned more about my colleagues' lives. Perhaps the most interesting part of the Japanese puzzle, and the one that may turn out to be critical to our understanding, is the practice of "lesson study". This collective examination of classroom practice has been well described in *The Teaching Gap*, by James W. Stigler and James Hiebert (Free Press, 1999). Briefly, Japanese teachers meet several times a year to observe a colleague's teaching. They then meet to discuss the lesson, how it went, and how it might be improved. Often, the lesson is taught again, with another round of inquiry. This practice is central to the work of the Japanese teacher: good lesson ideas are polished and published, and professional teacher organizations sponsor conferences built around lesson study.

When I first heard of this, I could not imagine how a teacher could submit to such a practice. Teaching is very personal, isn't it? The lesson plans I write—when I write them—are documents

intended for my supervisors, whose purpose is to hold me accountable for my work. How could a teacher possibly submit to a system where his practice and his accountability are held up to public scrutiny? It seemed to me at first something like the self-criticism sessions of Mao's Red Guard.

Rocky Von Eye, another American teacher, once told me about her visit to Japan. She was invited to a family dinner in a restaurant at which a fish, still alive, was brought to the table and cut up for sushi while its heart beat and its spine wriggled. Rocky worked hard to find a way to express her horror.

Finally, she asked her hosts delicately, "How does the fish feel?"

"Oh," they replied, "the fish is very happy. Look how many people it is feeding." Was this how Japanese teachers feel, giving so much of themselves to their colleagues?

This part of the puzzle filled in slowly. It became clear, through conversation and observation, that my fears were those of an outsider. Japanese teachers are trained with the expectation that they will engage in lesson study. They see other teachers working on it. They think of it partly as an opportunity to share what they know and can do or to talk about what they feel they need. The conversations I heard were in no way adversarial. Criticism was softened with praise and delivered with empathy. And this was all done in a natural fashion, without calling into question ego or professional pride. In Japan the culture of teaching has developed in a different direction from its path in America.

One reason that teaching is so private and such a source of pride in our country is that there are few other sources of pride for teachers. We don't have many rewards for good teaching. You close your door, you love your students, you enjoy your success. And you try to minimize intervention, for intervention is usually threatening. Your supervisor may need to feel knowledgeable as well and want to give suggestions for improvement, not rewards for success. Likewise, a researcher may want to look for ways to improve your instruction, not to learn from it. Even your colleagues may be looking competitively, to see what they are doing better, rather than cooperatively, to see what knowledge can be shared. We often think of teachers, not as sources of knowledge about instruction, but as agents putting to use the knowledge collected by others. Japanese teachers see themselves differently: as researchers and agents for change, roles which are largely denied American teachers. Lesson study is one way in which Japanese teachers enact these roles.

A Japanese lesson plan is quite a different document from an American lesson plan. The latter serves the novice teacher as an organizing device. But after a few years of teaching, other tools structure the day more efficiently. Planning for instruction takes place more and more in one's mind, with notes or diaries substituting for the formal lesson plan.

Except when it comes to one's supervisors. In America the experienced teacher sometimes sees the writing of a lesson plan as paperwork, a form of punishment by the bureaucracy for knowing too much. One's organizational prowess must be proved by committing it to paper.

I asked about this at a public seminar. The question was embarrassing to some of the American participants. Who is this tough teacher who doesn't think he needs to plan? Why is he objecting to a practice that we want to use to improve instruction in America? But I persisted: What's in it for the experienced teacher?

The Japanese had two answers to this question. One answer came quickly: No matter how good one is at one's job, there is room to improve. "Certainly," I thought, "but is writing down what you know an efficient tool for improvement?" This facile answer did not seem satisfying and probably was provoked by a misunderstanding of the cultural background to my question.

As often happened in Japan, I had to watch the process unfold to get a deeper answer. We were invited to a conference on lesson study. A group of teachers decided years ago to organize this conference annually during summer vacation. The event has become quite popular, with teachers traveling long distances to attend.

Kozo Tsubota, a master elementary school teacher, gave a lesson on stage to a group of students assembled for the purpose. The lesson was a work of art. The class had been working with pentominoes (figures made out of five unit squares). Tsubota asked them whether they could cover certain shapes (also built out of unit squares) with pentominoes. The lesson built towards an understanding that a necessary condition for the existence of such a covering was that the number of squares forming the shape was a multiple of 5. But of course this brief paragraph does not capture the magic of the lesson.

We had been warned before the conference that the discussion of the lessons here would include much more criticism than usual. I was interested in what criticisms Tsubota would receive. Would his colleagues find some deep flaw in the lesson? Or would they pick at nits to fulfill their role as friendly critic?

Neither turned out to be the case. There was some interesting discussion about the mechanics of the lesson. There was some more discussion about whether the students really understood that the condition of divisibility by 5 was not sufficient, only necessary. But mostly there was discussion about how this lesson fit into the curriculum, where it might lead, and how the

wonderful discussions and explorations generated could be harnessed in other contexts.

What I was seeing was not the submission to collective authority of a once-proud teacher. Rather, it was a process honoring his work and his knowledge and putting it at the service of other teachers, including novices struggling to find their feet, more experienced teachers looking for ideas to adapt, and master teachers seeking to broaden their expertise. We have few such processes in the United States, and I found myself wanting to make this one work for us. The very grounds on which I had initially rejected lesson study turned out to be the attractions it held for me.

One more piece fit together the next evening. In outlining the process of lesson study, the Japanese always included, as a final step, a "party". Many of us found this amusing. Of course it's important to build informal relationships with coworkers. Teachers relax over lunch, complain at the copying machine, and even go out for a drink after work. But why list this as part of the process? We found out that evening.

Japanese meetings are businesslike. There is less of the jocularity that softens work relationships in American meetings. Discussion is confined to the meaningful and doesn't seem to acknowledge personal relationships. Can the Japanese play out their professional roles without these personal relationships?

Of course not, and we discovered this piece of the puzzle at an evening *enkai*, the Japanese term for an office party. We sat, in the Japanese manner, on tatami mats. The beer and sake flowed, tasty Japanese dishes were passed around, and the discussion was anything but formal. Our colleagues, who appeared so businesslike and efficient earlier in the day, proved to be warm and sensitive individuals, communicating with earthy humor and ebullient spirits their hopes for further work, their enjoyment of our encounter, and their search for a more direct, even emotional, understanding of each other to form the basis for our relationships.

Eizo Nagasaki, a researcher at the National Institute for Educational Research, found words to describe this experience. "We have been joking about the party as the last step in lesson study, but in fact it is more than a joke. Lesson study involves criticism, which can be difficult to hear. The teacher whose lesson is being studied has contributed significant effort and deserves a chance to relax and enjoy himself. So do the other participants. The party is a way of saying to the teacher, 'We value you. We appreciate your efforts. Even our criticism is directed to your work and not to you as a person. No matter what has come out of the lesson study, we accept and celebrate who you are.'" This attitude is something we could well learn from in American education. We celebrate our students' achievement much more than our teachers'.

A traveler to the Far East finds that part of the price of the trip is exacted in time: the journey home is very long. Yet there is a silver lining to this cloud. The long trip provides time for introspection, for putting together what one has learned.

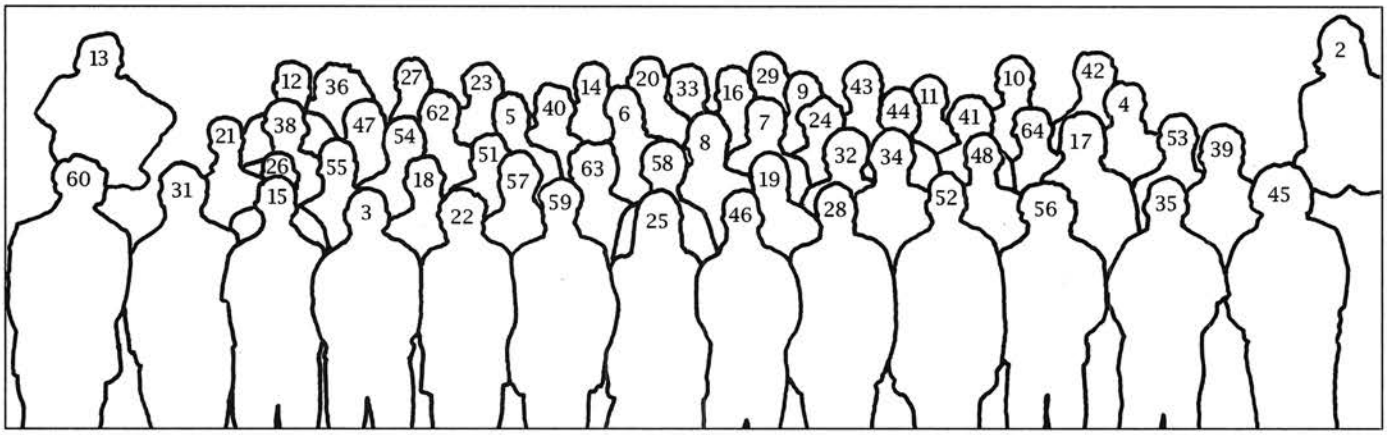
As I flew over the stormy North Pacific, I reflected that perhaps the deepest lesson we can learn from Japan is about the very nature of our educational system. Their system is a tight mechanism whose pieces articulate with one another. And ours? We have 15,000 school districts, 50 states, numerous government and private organizations, all sharing responsibility for delivering and improving instruction. We are just waking up to the fact that this all forms a system, one that has grown up more or less without our conscious attention. It is not surprising that the system lies in pieces. Our next task is to fit the pieces together.

Twenty-five Years Ago: The Durham Symposium on Partial Differential Equations

Peter J. Bushell and David E. Edmunds

A London Mathematical Society (LMS) Symposium on Partial Differential Equations was held at the University of Durham, UK, from July 12 to July 23, 1976. The organisers were D. E. Edmunds and L. E. Fraenkel, both then at the University of Sussex, and the symposium was supported not only by the LMS but also by a grant from the British Science Research Council (SRC), which has now mutated into the EPSRC (Engineering and Physical Sciences Research Council). Indeed, the meeting may fairly be regarded as the culmination of eight years of support of PDEs by the SRC, which was keen to give fresh impetus to work in this important area. The programme consisted of formal lectures and "splinter-group" discussions organised on an ad hoc basis. Open problems were recorded in a book, now kept in the School of Mathematical Sciences, University of Sussex.

The intention was to have a broad, high-level research meeting, with participation by invitation only. That this ambition was realised in a most remarkable way is perhaps more apparent now than it was at the time, for while the participants included an extraordinarily large proportion of mathematicians who were then of the first rank by world standards, there were also many younger people present who subsequently went on to gain similar eminence. The appeal and historical significance of this photograph stems from the way in which this snapshot of the past gives a glimpse of the future.



Key to Photograph

2. **C. J. Amick** (Cambridge), 3. **M. F. Atiyah** (Oxford), 4. **J. F. G. Auchmuty** (Indiana), 5. **J. M. Ball** (Heriot-Watt), 6. **T. B. Benjamin** (Essex), 7. **H. Brézis** (Paris VI), 8. **F. E. Browder** (Chicago), 9. **K. Brown** (Heriot-Watt), 10. **P. J. Bushell** (Sussex), 11. **J. Carr** (Heriot-Watt), 12. **C. M. Dafermos** (Brown), 13. **J. J. Duistermaat** (Utrecht), 14. **N. du Plessis** (Newcastle upon Tyne), 15. **M. S. P. Eastham** (Chelsea College, London), 16. **D. E. Edmunds** (Sussex), 17. **J. Eells** (Warwick), 18. **W. D. Evans** (Cardiff), 19. **R. Finn** (Stanford), 20. **W. Forster** (Southampton), 21. **L. E. Fraenkel** (Sussex), 22. **F. G. Friedlander** (Cambridge), 23. **L. Gårding** (Lund), 24. **E. Giusti** (Firenza), 25. **F. Goldman** (Glasgow), 26. **V. W. Guillemin** (M.I.T.), 27. **J. Hale** (Brown), 28. **P. Hess** (Zurich), 29. **L. Hörmander** (Lund), 31. **R. J. Knops** (Heriot-Watt), 32. **J. Leray** (Collège de France), 33. **A. Lichnewsky** (Paris-Sud), 34. **R. H. Martin** (North Carolina), 35. **J. B. McLeod** (Oxford), 36. **R. Melrose** (Cambridge), 38. **V. B. Moscatelli** (Sussex), 39. **V. J. Mustonen** (Oulu, Finland), 40. **L. Nirenberg** (New York), 41. **J. Norbury** (University College, London), 42. **J. Ockendon** (Oxford), 43. **L. A. Peletier** (Delft), 44. **A. Plant** (Essex), 45. **A. J. B. Potter** (Aberdeen), 46. **P. H. Rabinowitz** (Wisconsin), 47. **J. C. Saut** (Paris-Sud), 48. **J. B. Serrin** (Minnesota), 51. **G. Stampacchia** (Scuola Normale), 52. **R. F. Streater** (Bedford College, London), 53. **C. A. Stuart** (Aberdeen), 54. **L. Tartar** (Paris-Sud), 55. **M. Thompson** (Ahmadu Bello, Nigeria), 56. **J. Toland** (Essex), 57. **N. S. Trudinger** (Canberra), 58. **J. R. L. Webb** (Glasgow), 59. **H. Weinberger** (Minnesota), 60. **T. J. Willmore** (Durham), 62. **Mrs. J. Hale**, 63. **Mrs. G. Stampacchia**, 64. Unknown–not registered. Participants not appearing in photograph: **H. Amann** (Ruhr, Universität Bochum), **A. Jeffrey** (Newcastle upon Tyne), **M. Miranda** (Trento), **I. Singer** (M.I.T.), **R. A. Smith** (Durham).

AMERICAN MATHEMATICAL SOCIETY

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Mathematics People

SIAM Prizes Awarded

The Society for Industrial and Applied Mathematics (SIAM) awarded several prizes at its annual meeting in San Diego in July 2001.

EDUARDO D. SONTAG of Rutgers University received the W. T. and Idalia Reid Prize. This prize is given for research in or other contributions to the areas of differential equations and control theory. It carries a cash award of $10,000.

WILLIAM W. SYMES of Rice University was awarded the Ralph Kleinman Prize, which carries a cash award of $5,000. The Kleinman Prize is awarded to one individual for outstanding research or other contributions that bridge the gap between mathematics and applications.

THOMAS Y. HOU of the California Institute of Technology was awarded the James H. Wilkinson Prize in Numerical Analysis and Scientific Computing. This prize is awarded for research in or other contributions to numerical analysis and scientific computing during the six years preceding the award. It carries a cash award of $1,000.

CHRISTIAN LUBICH of Universität Tübingen received the Germund Dahlquist Prize, which is awarded to a young scientist (normally under age 45) for original contributions to fields associated with Germund Dahlquist, especially the numerical solution of differential equations and numerical methods for scientific computing. A cash award of $1,000 accompanies the prize.

In addition, two lecture prizes were awarded: DAVID L. DONOHO of Stanford University was honored with the John von Neumann Lectureship, which carries a cash award of $2,500. STEVEN H. STROGATZ of Cornell University received the I. E. Block Community Lectureship and an honorarium of $500.

—From a SIAM announcement

MAA Writing Awards Presented

The Mathematical Association of America (MAA) presented several awards for excellence in expository writing at its Summer Mathfest in Madison, Wisconsin, in August 2001.

The Carl B. Allendoerfer Awards are given for articles published in *Mathematics Magazine* and carry a cash award of $500. The award for 2001 was given to JAMES N. BRAWNER, Armstrong Atlantic State University, for his article "Dinner, Dancing, and Tennis, Anyone?", *Mathematics Magazine*, Vol. 73, 2000, and to RAPHAEL FALK JONES, Brown University, and JANICE L. PEARCE of Berea College for their joint article "A Postmodern View of Fractions and the Reciprocals of Fermat Primes", *Mathematics Magazine*, Vol. 73, 2000.

The Trevor Evans Award is given to authors of exceptional articles that are accessible to undergraduates and that were published in *Math Horizons*. This prize carries a cash award of $250. Two awards were given for 2001. IRA ROSENHOLTZ, Eastern Illinois University, won for his article "One Point Determines a Line—A Geometric Axiom of Choice", *Math Horizons*, November 2000. JAMES TANTON, St. Mary's College of Maryland, was honored for his article "A Dozen Areal Maneuvers", *Math Horizons*, September 2000.

The Lester R. Ford Award honors articles published in *The American Mathematical Monthly* and carries a cash prize of $500. The awardees for 2001 are KEITH KENDIG, Cleveland State University, for "Is a 2000-Year-Old Formula Still Keeping Some Secrets?", *American Mathematical Monthly*, May 2000, and E. R. SCHEINERMAN, Johns Hopkins University, for "When Close Is Close Enough", *American Mathematical Monthly*, June 2000.

The George Pólya Award is given for articles published in *The College Mathematics Journal* and has a cash prize of $500. Two awards were made for 2001. EZRA A. BROWN, Virginia Polytechnic Institute and State University, won an award for "Three Fermat Trails to Elliptic Curves", *College Mathematics Journal*, Vol. 31, 2000. CHIP ROSS, Bates College, and JODY M. SORENSEN, Grand Valley State University, were honored for their joint article "Will the Real Bifurcation Diagram Please Stand Up!", *College Mathematics Journal*, Vol. 31, 2000.

—MAA announcement

Prizes of the CRM, Montreal

Several prizes have been awarded to mathematicians by the Centre de Recherches Mathématiques (CRM), Montreal, Canada. They are listed below.

ANDRÉ-MARIE TREMBLAY of the University of Sherbrooke was awarded the 2001 CAP-CRM Prize in Theoretical and Mathematical Physics jointly by the CRM and the Canadian Association of Physicists (CAP). The CAP-CRM Prize, instituted in 1995, is intended to recognize exceptional achievements in research in the fields of theoretical and mathematical physics. The prize is given for research done primarily in Canada or in affiliation with a Canadian university or industry. It carries a cash award of CA$2,000 and a commemorative medal. Awardees are invited to lecture at the annual congress of the CAP.

ISRAEL M. SIGAL of the University of Toronto was awarded the 2000 CRM/Fields Institute Prize by The Fields Institute for Research in Mathematical Sciences (Toronto) and the CRM. WILLIAM T. TUTTE of the University of Waterloo has been awarded the prize for 2001. The prize recognizes exceptional achievement in the mathematical sciences. Recipients are chosen on the basis of outstanding contributions to the advancement of research, with research having been done primarily in Canada or in affiliation with a Canadian university. A prize of CA$5,000 is awarded, and the recipients present lectures at the CRM and at The Fields Institute.

ECKHARD MEINRENKEN of the University of Toronto has been awarded the 2000 André Aisenstadt Mathematics Prize. The prize, instituted in 1991, consists of an award of CA$3,000 and is intended to recognize talented young Canadian researchers in pure and applied mathematics who have held the Ph.D. for no more than seven years.

—From a CRM announcement

Emmanuel Candes Awarded Popov Prize

EMMANUEL CANDES of the California Institute of Technology was awarded the third Vasil Popov Prize at the Texas Approximation Theory Conference held in St. Louis, Missouri. The Popov Prize is awarded every third year to a young mathematician (within six years of receipt of the Ph.D.) who has made outstanding research contributions to approximation theory and related areas. This year the prize consisted of a cash award of $1,000.

Candes received his Ph.D. in statistics from Stanford University in 1998. He was awarded the Popov Prize for his development of ridgelets and other wavelet descendents, such as curvelets. These novel building blocks provide more efficient representations of functions that have singularities along curves. They are motivated by potential applications to image and data processing. In addition to developing ridgelet frames, Candes solved deep problems in nonlinear approximation by linear combinations of ridgelets. Previous Popov Prize winners are Albert Cohen (1995) and Arno Kuiljaars (1998).

—Ronald DeVore, University of South Carolina

O'Rourke Named NSF Distinguished Teaching Scholar

JOSEPH O'ROURKE of Smith College was chosen as one of the winners of the first Director's Awards for Distinguished Teaching Scholars, established by the National Science Foundation (NSF). Intended to encourage scientists and engineers to become involved in education, this award is the NSF's highest honor for excellence in both teaching and research. O'Rourke is one of seven scholars who will each receive an award of $300,000 over four years. They will be honored at a ceremony at the National Academy of Sciences in Washington, DC.

—From an NSF announcement

Radcliffe Institute for Advanced Study Fellowships Awarded

The Radcliffe Institute for Advanced Study at Harvard University awards more than 50 funded postdoctoral fellowships each year to scholars, professionals, writers, and artists from throughout the world. Three mathematicians are among the fellows chosen for the 2001–2002 academic year.

MEGAN M. KERR of Wellesley College will conduct research on the geometry of symmetric spaces, solvable groups, and harmonic manifolds. She proposes to describe the family of Einstein solvmanifolds "near" a certain hyperbolic space which lies within a twelve-dimensional family. TATIANA TORO of the University of Washington will study the two-sided free boundary regularity problem with rough boundary data. She intends to establish that weak notions of regularity are for many purposes sufficient to answer basic questions in analysis and geometry. NANNY WERMUTH

of the Johannes Gutenberg University, Mainz, will study joint responses in graphical Markov models. She intends to design simple algorithms to derive important implications of a given process, no matter which type of variables and which type of distributions of variables are involved.

—From a Radcliffe Institute announcement

National Defense Science and Engineering Graduate Fellowships Awarded

Seventeen young mathematicians have been awarded National Defense Science and Engineering Graduate (NDSEG) Fellowships by the Department of Defense (DoD). As a means of increasing the number of U.S. citizens trained in disciplines of military importance in science and engineering, DoD awards fellowships to individuals who have demonstrated ability and special aptitude for advanced training in science and engineering. The fellowships are sponsored by the United States Army, Navy, and Air Force.

Following are the names of the fellows in mathematics, followed by the student's institution and the office that awarded the fellowship. JY-YING CHEN, Stanford University, Office of Naval Research (ONR); LI-CHUNG CHEN, Harvard University, ONR; NICHOLAS ERIKSSON, Massachusetts Institute of Technology, Army Research Office (ARO); JOSEPH FLENNER, University of Michigan, ARO; JAIME HALETKY, Rensselaer Polytechnic Institute, Air Force Office of Scientific Research (AFOSR); WILLIAM HEUETT, University of Washington, AFOSR; GEORGE KIRKUP, Harvard University, AFOSR; FUMEI LAM, Massachusetts Institute of Technology, ONR; MARCO LATINI, Harvey Mudd College, AFOSR; JERREL MAST, Harvard University, ARO; CAROL MEYERS, Pomona College, ARO; CARL MILLER, Duke University, ONR; MICHAEL SCHEIN, California Institute of Technology, ONR; RAPHAEL SCHORR, Massachusetts Institute of Technology, AFOSR; WILLIAM SHERWOOD, Princeton University, AFOSR; JOHN THACKER, Duke University, ARO; and MARK TYGERT, Princeton University, ARO.

—From an NDSEG announcement

Invited Speakers for ICM2002

The International Congress of Mathematicans 2002 (ICM2002) will be held in Beijing, China, August 20–28, 2002. Below are the names of individuals invited to present lectures at the congress. For further information, consult the ICM2002 website, `http://www.icm2002.org.cn`. The full program of ICM2002 will be published in a future issue of the *Notices*.

Plenary Speakers

NOGA ALON, Tel Aviv University, Israel; DOUGLAS NORMAN ARNOLD, Institute for Mathematics and its Applications, University of Minnesota, USA; ALBERTO BRESSAN, S.I.S.S.A., Italy; LUIS ANGEL CAFFARELLI, University of Texas at Austin, USA; SUN-YUNG ALICE CHANG, Princeton University, USA; DAVID LEIGH DONOHO, Stanford University, USA; LUDWIG DMITRIEVICH FADDEEV, Steklov Mathematical Institute, Russia; SHAFI GOLDWASSER, Massachusetts Institute of Technology, USA; UFFE HAAGERUP, University of Southern Denmark; MICHAEL JEROME HOPKINS, Massachusetts Institute of Technology, USA; VICTOR KAC, Massachusetts Institute of Technology, USA; HARRY KESTEN, Cornell University, USA; FRANCES CLARE KIRWAN, University of Oxford, United Kingdom; LAURENT LAFFORGUE, Institut des Hautes Études Scientifiques, France; DAVID B. MUMFORD, Brown University, USA; HIRAKU NAKAJIMA, Kyoto University, Japan; YUM-TONG SIU, Harvard University, USA; RICHARD LAWRENCE TAYLOR, Harvard University, USA; GANG TIAN, Massachusetts Institute of Technology, USA; EDWARD WITTEN, Institute for Advanced Study, USA.

45-Minute Invited Speakers

Section 1: Logic. ELISABETH BOUSCAREN, Université de Paris 7-CNRS, France; JAN DENEF, Catholic University of Leuven, Belgium; MOTI GITIK, Tel Aviv University, Israel; DANIEL LASCAR, Université de Paris 7, France; HUGH WOODIN, University of California at Berkeley, USA.

Section 2: Algebra. ALEXEI IGOREVICH BONDAL, Steklov Institute of Mathematics, Russia; OFER GABBER, Institut des Hautes Études Scientifiques, France; MARC NOEL LEVINE, Northeastern University, USA; DMITRI OLEGOVICH ORLOV, Steklov Institute of Mathematics, Russia; CHERYL ELISABETH PRAEGER, University of Western Australia; MARKUS ROST, The Ohio State University, USA; ZLIL SELA, Hebrew University, Israel; J. TOBY STAFFORD, University of Michigan, USA; DMITRY E. TAMARKIN, Harvard University, USA.

Section 3: Number Theory. JAMES W. COGDELL, Oklahoma State University, USA; HENRI JOSE COHEN, Université de Bordeaux I, France; ROBERT FREDERICK COLEMAN, University of California at Berkeley, USA; JEAN-MARC FONTAINE, Université de Paris-Sud, France; ANNETTE HUBER, Universität Leipzig, Germany; KAZUYA KATO, University of Tokyo, Japan; STEPHEN S. KUDLA, University of Maryland, USA; ILYA I. PIATETSKI-SHAPIRO, Yale University, USA; EMMANUEL B. ULLMO, Princeton University, USA, and Université Paris-Sud, France; TREVOR DION WOOLEY, University of Michigan, USA.

Section 4: Differential Geometry. BENJAMIN HARDWICK ANDREWS, Australian National University; ROBERT BARTNIK, University of Canberra, Australia; PAUL IAN BIRAN, Tel-Aviv University, Israel; HUBERT LEWIS BRAY, Massachusetts Institute of Technology, USA; XIUXIONG CHEN, Princeton University, USA; WEIYUE DING, Chinese Academy of Sciences and Peking University, China; PETER WAI-KWONG LI, University of California at Irvine, USA; YIMING LONG, Nankai University, China; ANTON PETRUNIN, Pennsylvania State University, USA; XIAOCHUN RONG, Rutgers University at New Brunswick, USA; RICHARD EVAN SCHWARTZ, University of Maryland, USA; PAUL SEIDEL, École Polytechnique, France, and Institute for Advanced Study, USA; BRIAN CABELL WHITE, Stanford University, USA; WEIPING ZHANG, Nankai Institute of Mathematics, Nankai University, China.

Section 5: Topology. MLADEN BESTVINA, University of Utah, USA; YURI VITALIEVICH CHEKANOV, Moscow Center for Continuous Mathematics Education, Russia; MIKIO FURUTA, University of Tokyo, Japan; EMMANUEL GIROUX, École Normale Supérieure de Lyon, France; LARS HESSELHOLT, Massachusetts Institute of Technology, USA; ELENY-NICOLETA IONEL, University of Wisconsin at Madison, USA; PETER TEICHNER, University of California at San Diego, USA; ULRIKE LUISE TILLMANN, Oxford University, United Kingdom; SHICHENG WANG, Peking University, China.

Section 6: Algebraic and Complex Geometry. HÉLÈNE ESNAULT, Universität Essen, Germany; LOTHAR GOETTSCHE, Abdus Salam International Centre for Theoretical Physics, Italy; SHIGERU MUKAI, Research Institute for Mathematical Sciences, Kyoto University, Japan; RAHUL VIJAY PANDHARIPANDE, California Institute of Technology, USA; RICHARD PINK, Eidgenössische Technische Hochschule, Zürich, Switzerland; MILES REID, University of Warwick, United Kingdom; VADIM SCHECHTMAN, Université Paul Sabatier, France; BURT TOTARO, University of Cambridge, United Kingdom.

Section 7: Lie Groups and Representation Theory. PATRICK DELORME, Institut de Mathématiques de Luminy, France; PAVEL I. ETINGOF, Massachusetts Institute of Technology, USA; DENNIS GAITSGORY, Harvard University, USA; MICHAEL H. HARRIS, Université de Paris 7, France; ALEXANDER KLYACHKO, Bilkent University, Turkey; TOSHIYUKI KOBAYASHI, Research Institute for Mathematical Sciences, Kyoto University, Japan; VIKRAM BHAGVANDAS MEHTA, Tata Institute of Fundamental Research, India; ECKHARD MEINRENKEN, University of Toronto, Canada; MAXIM LEONIDOVICH NAZAROV, University of York, United Kingdom; FREYDOON SHAHIDI, Purdue University, USA; MARIE-FRANCE VIGNERAS, Université de Paris 7, France.

Section 8: Real and Complex Analysis. ALEXANDRE EREMENKO, Purdue University, USA; JUHA MATTI HEINONEN, University of Michigan, USA; CARLOS E. KENIG, University of Chicago, USA; NICOLAS LERNER, Université de Rennes 1, France; MICHAEL LIAM MCQUILLAN, Institut des Hautes Études Scientifiques, France; TERENCE CHI-SHEN TAO, University of California at Los Angeles, USA; CHRISTOPH THIELE, University of California at Los Angeles, USA; STEVEN ZELDITCH, Johns Hopkins University, USA; XIANGYU ZHOU, Chinese Academy of Sciences, China.

Section 9: Operator Algebras and Functional Analysis. SEMYON ALESKER, Tel Aviv University, Israel; PHILIPPE BIANE, École Normale Supérieure, France; DIETMAR HERBERT BISCH, University of California at Santa Barbara, USA; LIMING GE, Chinese Academy of Sciences, China; VINCENT G. LAFFORGUE, Université de Paris Pierre et Marie Curie, France; RAFAL LATALA, Warsaw University, Poland.

Section 10: Probability and Statistics. GÉRARD ALBERT BEN AROUS, École Polytechnique Fédérale de Lausanne, Switzerland; JEAN BERTOIN, Université de Paris 6, France; PETER J. BICKEL, University of California at Berkeley, USA; ERWIN BOLTHAUSEN, Universität Zürich, Switzerland; LAWRENCE D. BROWN, University of Pennsylvania, USA; MUFA CHEN, Beijing Normal University, China; KURT JOHANSSON, Royal Institute of Technology, Sweden; GREGORY FRANCIS LAWLER, Duke University, USA; YUVAL PERES, University of California at Berkeley, USA; AGOSTON PISZTORA, Carnegie Mellon University, USA; TERENCE PAUL SPEED, University of California at Berkeley, USA; ANDREI YURIEVICH ZAITSEV, St. Petersburg Branch of the Steklov Mathematical Institute, Russia; OFER ZEITOUNI, Technion, Israel.

Section 11: Partial Differential Equations. LUIGI AMBROSIO, Scuola Normale Superiore, Italy; HAJER BAHOURI, Faculté des Sciences de Tunis, Campus Universitaire, Tunisia; JIAXING HONG, Fudan University, China; TERO KILPELÄINEN, University of Jyväskylä, Finland; YANYAN LI, Rutgers University, USA; TAI-PING LIU, Academia Sinica, Taiwan, and Stanford University, USA; VLADIMIR MAZ'YA Linköping University, Sweden; TRISTAN JOEL RIVIÈRE, École Normale Supérieure and École Polytechnique, France; DANIEL IOAN TATARU, Northwestern University, USA; XU-JIA WANG, Australian National University; SIJUE WU, University of Maryland, USA; MACIEJ ZWORSKI, University of California at Berkeley, USA.

Section 12: Ordinary Differential Equations and Dynamical Systems. ALAIN CHENCINER, IMCCE and Université de Paris VII, France; MICHAEL BENEDICKS, Royal Institute of Technology, Sweden; CHRISTIAN BONATTI, Université de Bourgogne, France; EDUARD FEIREISL, Czech Academy of Sciences, Czech Republic; BERNOLD FIEDLER, Freie Universität Berlin, Germany; GIOVANNI FORNI, Princeton University, USA; ENRIQUE RAMIRO PUJALS, Universidade Federal de Rio de Janeiro, Brazil; DANIEL J. RUDOLPH, University of Maryland, USA; LEONID PAVLOVICH SHILNIKOV, Institute of Applied Mathematics and Cybernetics, Russia; JOHN SMILLIE, Cornell University, USA; DMITRY TRESCHEV, Moscow State University, Russia.

Section 13: Mathematical Physics. JEAN BRICMONT, University of Louvain, Belgium; MICHAEL RONALD DOUGLAS, Rutgers University, USA; JEAN-PIERRE ECKMANN, University of Geneva, Switzerland; DANIEL S. FREED, University of Texas at Austin, USA; KENTARO HORI, Harvard University, USA; SVETLANA JITOMIRSKAYA, University of California at Irvine, USA; KEFENG LIU, University of California at Los Angeles, USA; BRUNO NACHTERGAELE, University of California at Davis, USA; NIKITA ALEKSANDROVICH NEKRASOV, Institut de Hautes Études Scientifiques, France; MASATOSHI NOUMI, Kobe University, Japan; CRAIG ARNOLD TRACY, University of California at Davis, USA; MACIEJ P. WOJTKOWSKI, University of Arizona, USA.

Section 14: Combinatorics. IMRE BARANY, Hungarian Academy of Sciences and University College London, United Kingdom; AART BLOKHUIS, Technical University Eindhoven, The Netherlands; GÉRARD CORNUÉJOLS, Carnegie Mellon University, USA; PHILIPPE FLAJOLET, INRIA Rocquencourt, France; NATHAN LINIAL, Hebrew University, Israel; BRUCE ALAN REED, Université de Paris Pierre et Marie Curie, France, and McGill University, Canada; PETER WINKLER, Bell Laboratories, USA; GÜNTER M. ZIEGLER, Technische Universität Berlin, Germany.

Section 15: Mathematical Aspects of Computer Science. SANJEEV ARORA, Princeton University, USA; URIEL FEIGE, The Weizmann Institute, Israel; RUSSELL GRAHAM IMPAGLIAZZO, University of California of at San Diego, USA; RAVI KANNAN, Yale University, USA; ALEXEI Y. KITAEV, Microsoft Research, USA; RAN RAZ, The Weizmann Institute, Israel; DANIEL ALAN SPIELMAN, Massachusetts Institute of Technology, USA.

Section 16: Numerical Analysis and Scientific Computing. ALBERT A. COHEN, Université de Paris Pierre et Marie Curie, France; JAMES WELDON DEMMEL, University of California at Berkeley, USA; MITCHELL BARRY LUSKIN, University

of Minnesota, USA; ROLF C. RANNACHER, Universität Heidelberg, Germany; CHRISTOPH SCHWAB, Eidgenössische Technische Hochschule, Switzerland; JAMES A. SETHIAN, University of California at Berkeley, USA; EITAN TADMOR, University of California at Los Angeles, USA.

Section 17: Application of Mathematics in the Sciences. YANN BRENIER, Université de Nice, France; MICHAEL P. BRENNER, Harvard University, USA; WEINAN E, Princeton University, USA, and Peking University, China; NICOLE EL KAROUI, École Polytechnique, France; LEI GUO, Chinese Academy of Sciences, China; THOMAS C. HALES, University of Michigan, USA; NANCY JANE KOPELL, Boston University, USA; ALEXANDER MIELKE, Universität Stuttgart, Germany; FELIX OTTO, Universität Bonn, Germany; ALFIO MARIA QUARTERONI, École Polytechnique Fédérale de Lausanne, Switzerland, and Politechico di Milano, Italy; ZHOUPING XIN, The Chinese University of Hong Kong; JIA-AN YAN, Chinese Academy of Sciences, China.

Section 18: Mathematics Education and Popularization of Mathematics. (***Note:*** Section 18 has three 45-minute speakers, plus an additional eight speakers who will participate in two panel discussions running 90 minutes each.) 45-minute speakers: JEAN-LUC DORIER, Laboratoire Leibniz, France; VAGN LUNDSGAARD HANSEN, Technical University of Denmark; SHUTIE XIAO, Tsinghua University, China. Panel, Group 1: JAN DE LANGE, University of Utrecht, The Netherlands; GABRIELE KAISER (moderator), Universität Hamburg, Germany; FREDERICK KOON-SHING LEUNG, University of Hong Kong; IVAN YASCHENKO, Moscow Center for Continuous Math Education, Russia. Panel, Group 2: DEBORAH LOEWENBERG BALL, University of Michigan, USA; CELIA MARY HOYLES, University of London, United Kingdom; HANS NIELS JAHNKE (moderator), Universität Essen, Germany; NITSA MOVSHOVITZ-HADAR, Technion-Israel Institute of Technology.

Section 19: History of Mathematics. UMBERTO BOTTAZZINI, Università di Palermo, Italy; MORITZ EPPLE, Universität Bonn, Germany; ANJING QU, Northwest University, China.

—From an ICM announcement

Mathematics Opportunities

National Research Council Research Associateship Programs

The Policy and Global Affairs Division of the National Research Council (NRC) is sponsoring the 2002 Postdoctoral and Senior Research Associateship Programs. The programs are meant to provide opportunities for Ph.D., Sc.D., or M.D. scientists and engineers of unusual promise and ability to perform research at one of more than 120 research laboratories throughout the United States and overseas.

Full-time associateships will be awarded for research in the fields of mathematics, chemistry, earth and atmospheric sciences, engineering, applied sciences and computer science, life and medical sciences, space and planetary sciences, and physics. Most of the laboratories are open to both U.S. and non-U.S. nationals and to both recent doctoral recipients and senior investigators.

Awards are made for one or two years, renewable for a maximum of three years. Annual stipends for recent Ph.D. recipients range from $30,000 to $50,000, depending on the sponsoring laboratory; the awards for senior recipients will be higher. Support is also provided for allowable relocation expenses and for limited professional travel during the period of the award.

Awards will be made three times during the year, and applications will be accepted on a continuous basis. The deadlines for application materials to be postmarked are **January 15, April 15**, and **August 15, 2002**. The award recipients will be announced in March–April, July, and November.

For further information and application materials, see the NRC website at `http://www4.nationalacademies.org/pga/rap.nsf/`, or contact the National Research Council, Associateship Programs (TJ 2114), 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-2760; fax 202-334-2759; e-mail: `rap@nas.edu`.

—From an NRC announcement

National Defense Science and Engineering Graduate Fellowships

As a means of increasing the number of U.S. citizens trained in disciplines of military importance in science and engineering, the Department of Defense (DoD) plans to award approximately 200 new three-year graduate fellowships in April 2002, based on available funding. The DoD will offer these fellowships to individuals who have demonstrated ability and special aptitude for advanced training in science and engineering. National Defense Science and Engineering Graduate (NDSEG) Fellowships will be awarded for study and research leading to doctoral degrees in mathematical, physical, biological, ocean, and engineering sciences.

The NDSEG Fellowship Program is open only to applicants who are citizens or nationals of the United States. NDSEG Fellowships are intended for students at or near the beginning of their graduate studies in science or engineering. Applicants must receive or be on track to receive their bachelor's degrees by fall of 2002. Applications are

encouraged from women, persons with disabilities, and minorities, including members of ethnic minority groups such as African American, American Indian and Alaska Native, Asian, Native Hawaiian and other Pacific Islander, Hispanic, or Latino.

The deadline for submitting a complete application is **January 16, 2002.** Application materials are available from, and completed applications should be returned to, the American Society for Engineering Education (ASEE) at: NDSEG Fellowship Program, c/o American Society for Engineering Education, 1818 N Street, N.W. #600, Washington, DC 20036; telephone 202-331-3516; fax 202-265-8504; e-mail: ndseg@asee.org. For further information, see the website http://www.asee.org/ndseg/html/preface.htm.

—From an NDSEG announcement

NRC-Ford Foundation Fellowships for Minorities

The National Research Council (NRC) administers the Ford Foundation Fellowships for Minorities program. The program offers Predoctoral Fellowships, Dissertation Fellowships, and Postdoctoral Fellowships. To be eligible, applicants must belong to one of the following groups: Black/African American, Alaskan Native, Mexican American/Chicano/Chicana, Native American, Native Pacific Islander (including Filipino), or Puerto Rican.

The Predoctoral Fellowship offers support for three years in research-based programs in social and behavioral sciences, humanities, physical sciences, biological sciences, engineering, and mathematics, or for interdisciplinary programs comprised of two or more eligible disciplines leading to the Ph.D. or Sc.D. The annual stipend is $16,000, and there is a cost of education allowance of $7,500. The deadline to apply is **November 19, 2001.**

The Dissertation Fellowship is intended for the final year of dissertation writing. This year the Dissertation Fellowship will support individuals completing Ph.D.'s in education; please note that individuals pursuing Ed.D. degrees are not eligible for this award. The stipend is $24,000 for one year. The deadline to apply is **December 3, 2001.**

The Postdoctoral Fellowship offers one year of postdoctoral support for individuals who have received their Ph.D.'s in the last seven years. The stipend is $35,000 for one year, and there is a research and travel allowance of $7,500. The deadline to apply is **January 7, 2002.**

Applicants are encouraged to apply online at http://national-academies.org/fellowships/. The postal address is Ford Foundation Fellowships/TJ2041, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418. The telephone number is 202-334-2872. The e-mail address is infofell@nas.edu.

—From an NRC announcement

AMS-AAAS Mass Media Fellowships

The American Association for the Advancement of Science sponsors the Mass Media Science and Engineering Fellows Program, through which graduate students work during the summer in major media outlets. The AMS provides support each year for one or two graduate students in the mathematical sciences to participate in the program. In past years the AMS-sponsored fellows have held positions at *Business Week*, National Geographic Television, and *Time* magazine.

Fellows receive a weekly stipend plus travel expenses to work for ten weeks during the summer as reporters, researchers, and production assistants in media organizations. They observe and participate in the process by which events and ideas become news, improve their ability to communicate about complex technical subjects in a manner understandable to the public, and increase their understanding of editorial decision making and the manner in which information is effectively disseminated. Each fellow attends an orientation and evaluation session in Washington, DC, and begins the internship in mid-June. Fellows submit interim and final reports to AAAS. A wrap-up session is held at the end of the summer.

Mathematical sciences faculty are urged to make their graduate students aware of this program. The deadline to apply for fellowships for the summer of 2002 is **January 15, 2002**. The fellowship application is available online at http://ehr.aaas.org/ehr/ (click the "Projects" link). For more information contact Katrina Malloy, Program Coordinator, AAAS Mass Media Science and Engineering Fellows Program, 1200 New York Avenue, NW, Washington, DC 20005; telephone 202-326-6760; fax 202-371-9849; or the AMS Washington Office, 1527 Eighteenth Street, NW, Washington, DC 20036; telephone 202-588-1100; fax 202-588-1853; e-mail: amsdc@ams.org.

—Elaine Kehoe

AMS Scholarships for "Math in Moscow"

The Independent University of Moscow has created a program called "Math in Moscow", which offers foreign students (undergraduate or graduate students specializing in mathematics and/or computer science) the chance to spend a semester in Moscow studying mathematics.

Math in Moscow provides students with a fifteen-week program similar to the Research Experiences for Undergraduates programs that are held each summer across the U.S. Math in Moscow draws on the Russian tradition of teaching mathematics, which emphasizes creative approaches to problem solving rather than memorizing theorems. The focus is on developing in-depth understanding of carefully selected material rather than broad surveys of large quantities of material. Discovering mathematics under

the guidance of an experienced teacher is the central principle of Math in Moscow. Most of the program's teachers are internationally recognized research mathematicians, and all of them have considerable teaching experience in English, typically in the U.S. or Canada. (All instruction is in English.)

Each semester five $5,000 scholarships will be granted to U.S. students to attend the Math in Moscow program. Funding is provided by the National Science Foundation, and the scholarships are administered by the AMS. To be eligible for the scholarships, students must submit applications *both* to the Math in Moscow program and to the AMS. An applicant should be an undergraduate mathematics or computer science major enrolled at a U.S. institution.

May 15 is the deadline for applications to enroll in Math in Moscow for the following fall semester; **October 15** is the deadline for the spring semester. The same deadlines apply for the AMS scholarships.

Information and application forms for Math in Moscow are available on the Web at `http://www.mccme.ru/mathinmoscow/`, or by writing to: Math in Moscow, P.O. Box 524, Wynnewood, PA 19096; fax +7095-291-65-01; e-mail: `mim@mccme.ru`. Information and application forms for the AMS scholarship are available on the Web at `http://www.ams.org/careers-edu/mimoscow.html`, or by writing to: Math in Moscow Program, Professional Services Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904; e-mail: `prof-serv@ams.org`.

—Allyn Jackson

Call for Nominations for Lobachevskii Medal

The Lobachevskii Medal is awarded every five years by Kazan University for distinguished achievements in geometry. The next award will be given in December 2002.

Universities and other scientific institutions may nominate mathematicians for outstanding scholarly works such as monographs, textbooks, or series of scientific papers. Further information and instructions for nomination may be found at the website `http://www.ksu.ru/lobmed/`. The deadline for nominations is **May 1, 2002.**

—From a Kazan University announcement

EDGE Summer Program

Funded by the National Science Foundation and the Andrew W. Mellon Foundation, the Enhancing Diversity in Graduate Education (EDGE) Program, a postbaccalaureate summer enrichment program, is designed to strengthen the ability of women and minority students to successfully complete graduate programs in the mathematical sciences.

The summer program consists of two core courses in analysis and algebra/linear algebra. There will also be minicourses in vital areas of mathematical research in pure and applied mathematics, short-term visitors from academia and industry, guest lectures, graduate student mentors, and problem sessions. In addition, a follow-up mentoring program and support network will be established with the participants' respective graduate programs.

Applicants to the program should be women who are (i) graduating seniors who have applied to graduate programs in the mathematical sciences, (ii) recent recipients of undergraduate degrees who are now entering graduate programs, or (iii) first-year graduate students. All applicants should have completed standard junior-senior-level undergraduate courses in analysis and abstract algebra and have a desire to earn the doctorate degree. Women from minority groups who fit one of the above three categories are especially encouraged to apply. Final acceptance to the program is contingent upon acceptance to a graduate program in the mathematical sciences.

In 2002 the program will be held at Bryn Mawr College in Bryn Mawr, PA. The dates for the summer program are June 3–28, 2002. It will be codirected by Sylvia Bozeman (Spelman College) and Rhonda Hughes (Bryn Mawr College). A stipend of $2,000 plus room and board will be awarded to participants. Names of applicants chosen to participate in the program will be announced by April 15, 2002.

Applications should consist of the following: (1) a completed application form; (2) a statement describing the expected value of this program to the applicant's academic goals; (3) two letters of recommendation from mathematical sciences faculty familiar with the applicant's work; (4) a transcript and current résumé; (5) a list of graduate programs to which the applicant has applied, together with a ranked list of her two or three top choices.

The application deadline is **March 1, 2002**. Applications should be sent to: EDGE Program, Department of Mathematics, Bryn Mawr College, Bryn Mawr, PA 19010.

For more information or to obtain applications, visit the program's Web site at `http://www.brynmawr.edu/Acads/Math/edge/edge.html`.

—Rhonda Hughes

News from The Fields Institute

The Fields Institute for Research in Mathematical Sciences has announced its program for 2001–2002, the Thematic Year on Numerical and Computational Challenges in Science and Engineering. The program will center on the development, analysis, and testing of new numerical methods in linear algebra, optimization, differential equations, and dynamical systems. The program features a series of workshops that focus on several key application areas, including climate modeling, computational biology, computational finance, and computer animation. The program will also explore the interaction between symbolic and numeric computation.

Activities during 2002 include graduate courses on Numerical Solution of PDEs, given by Robert Almgren, and

Numerical Solution of Optimization Problems, given by Henry Wolkowicz. In addition, the following events are scheduled.

February 4–22, 2002. Lecture Series on Numerical and Computational Challenges in Environmental Modeling. Lecturer: Zahari Zlatev.

February 25–March 1, 2002. Week on Computational Challenges in Mathematical Finance. The week begins with a two-day course on PDE methods for path-dependent options, followed by a three-day workshop on computational methods and applications in finance. Organizers: Tom Coleman, Peter Forsyth, Ken Vetzal.

March 4–15, 2002. Coxeter Lecture Series: Solving Wave Propagation Problems in Heterogeneous Media. Lecturer: Randy LeVeque.

May 2002. Optimization Visitors to The Fields Institute. There will be a group of visitors in optimization at The Fields Institute before, during, and after the Seventh SIAM Conference on Optimization. Organizer: Henry Wolkowicz.

May 13–16, 2002. Workshop on Numerical Challenges in Computer Animation. Organizer: Demetri Terzopolous.

May 27–June 1, 2002. Informal Working Group on Validated Optimization. Organizers: George Corliss, Ken Jackson, Baker Kearfott, Vladik Kreinovich, Weldon Lodwick.

July 13–19, 2002. Symbolic Computational Algebra 2002. Fields Institute special meeting on Symbolic and Numeric Computation in Geometry, Algebra and Analysis. Organizers: Robert Corless, Edward Green, Serkan Hosten, Reinhard Laubenbacher, Victoria Powers, Greg Reid.

July 29–August 2, 2002 (tentative). Short Course on Numerical Solution of Advection-Diffusion-Reaction Equations. Instructor: Jan Verwer.

August 6–9, 2002 (tentative). IMACS International Conference on Adaptive Methods for PDEs.

August 12–15, 2002 (tentative). The 2002 Workshop on the Solution of Partial Differential Equations on the Sphere.

Further information on the activities of the thematic year can be found at `http://www.fields.utoronto.ca/programs/scientific/01-02/numerical/`.

—From a Fields Institute announcement

News from MSRI

The Mathematical Sciences Research Institute (MSRI) in Berkeley, California, is pleased to announce a new program entitled *Summer Research at MSRI,* to begin in the summer of 2002. This year MSRI will host individuals or small groups (up to 12) to come and work at MSRI for a minimum of two weeks between June 3, 2002, and July 31, 2002. Besides office space, computer facilities, and access to the library, MSRI will make available this summer a small amount of travel funds. Preference for these funds will be given to those who are not otherwise supported. To be considered for the Summer Research program, please send a one-page description of the research project, a list of participants, and dates that you wish to spend at MSRI. If MSRI funding is desired, please indicate what level of travel support is necessary and describe your present and pending support. Please send this information to the MSRI Deputy Director, Michael F. Singer, either electronically to `singer@msri.org`, or by mail to: Michael F. Singer, Mathematical Sciences Research Institute, 1000 Centennial Drive, Berkeley, CA 94720-5080.

For more information about MSRI events and lectures on streaming video, see `http://www.msri.org/`. To stay abreast of events at MSRI, subscribe to the bimonthly electronic newsletter *OUTLOOK.* Go to `http://www.msri.org/local/computing/majordomo/` and add your name to the *OUTLOOK* mailing list.

—MSRI announcement

Josiah Willard Gibbs Instructorships/Assistant Fellowships

Editor's Note: *The following information arrived too late to be included in the "Stipends for Study and Travel" section of the October 2001* Notices. *For instructions on submitting information for "Stipends for Study and Travel," which appears annually in the October issue, please write to the* Notices *managing editor,* `notices@ams.org`.

The Department of Mathematics, Yale University, offers the Gibbs instructorships and assistant professorships to men and women with the doctorate who show definite promise in research in pure mathematics. Appointments are for two or three years. The teaching load (three one-semester courses) is kept light to allow ample time for research. Part of the teaching duties over the term of the appointment may consist of a one-semester course at the graduate level in the general area of the instructor's research. American citizens and U.S. residents will automatically be considered for special Gibbs Instructorships that are supported by a National Science Foundation (NSF) VIGRE grant. These appointments are for three years and also carry a reduced teaching load. The 2002-2003 salary will be at least $49,800.

The application deadline is **January 1, 2002**. Applications are available at the website `http://www.math.yale.edu`. Inquiries may be sent to Gibbs Committee, Department of Mathematics, Yale University, Box 208283, New Haven CT 06520-8283; or by e-mail to `gibbs.committee@math.yale.edu`.

Yale University is an Affirmative Action/Equal Opportunity Employer. Applications from women and members of minority groups are welcome.

—Department of Mathematics, Yale University

Inside the AMS

Society to Sponsor Project NExT Fellows

Project NExT (New Experiences in Teaching) is a professional development program started in 1994 by the Mathematical Association of America (MAA). Each year sixty to seventy new Ph.D.'s receive Project NExT Fellowships, which allow them to attend special events at the MAA Mathfest and at the Joint Mathematics Meetings. Between meetings the fellows use listservers to stay in contact with each other, with former Project NExT Fellows, and with senior mathematician mentors.

The purpose of the program is to prepare the fellows for life as productive mathematics faculty members in colleges or universities. Much of the emphasis is on undergraduate education, from practical aspects like assigning grades to larger issues like calculus reform. The fellows also have plenty of opportunity to discuss the many professional matters facing young faculty, such as balancing research and teaching and applying for grants. About 500 new Ph.D.'s have completed Project NExT Fellowships.

Since its inception Project NExT has been supported by a grant from the Exxon (now ExxonMobil) Education Foundation, which covered most costs apart from the fellows' travel to the meetings; travel costs are paid for by the fellows' institutions. Because ExxonMobil will gradually withdraw its direct support, the MAA sought a new way to keep Project NExT alive. The MAA proposed that a number of mathematics organizations pool their resources by each supporting a portion of the fellows. Several organizations, including the AMS, have agreed to this plan.

Starting in 2002, the AMS will support six "AMS NExT Fellows" who are from Ph.D.-granting institutions and who show some special promise in mathematics research. The AMS will also hold activities for the AMS NExT Fellows at the Joint Mathematics Meetings. During its first year, funding for AMS participation in the Project NExT program will come from the Society's Unrestricted Endowment.

For further information about Project NExT, visit the website `http://archives.math.utk.edu/projnext/`. Information about applying for Project NExT Fellowships will appear in the *Notices* in early 2002.

—*Allyn Jackson*

Deaths of AMS Members

BURTON H. COLVIN, of Gaithersburg, MD, died on August 24, 2001. Born in July 1916, he was a member of the Society for 61 years.

DANIEL KOCAN, of Frederick, MD, died on September 4, 2001. Born on August 16, 1924, he was a member of the Society for 49 years.

CHARLES SALTZER, professor emeritus, Ohio State University, died on September 9, 2001. Born on February 3, 1918, he was a member of the Society for 55 years.

Reference and Book List

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

Contacting the *Notices*

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

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

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

Upcoming Deadlines

November 16, 2001: Applications for MSRI Postdoctoral Fellowships and General Memberships. See http://www.msri.org/.

November 19, 2001: Applications for NRC-Ford Foundation Fellowships for Minorities Predoctoral Fellowship. See "Mathematics Opportunities" in this issue or http://national-academies.org/fellowships/.

December 1, 2001: Applications for NSF, NIH/FIC, USDA/ARS summer research program in 2002 for U.S. graduate students in Japan, Korea, and Taiwan. See http://www.twics.com/~nsftokyo/ (select "Summer Programs"), or contact Larry H. Weber, NSF/EAP; telephone 703-292-8704; e-mail: lweber@nsf.gov.

December 1, 2001: Applications for AMS Centennial Fellowships. See http://www.ams.org/employment/

Where to Find It

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

AMS Bylaws—*November 2001, p. 1205*

AMS E-mail Addresses—*November 2001, p. 1195*

AMS Ethical Guidelines—*June 1995, p. 694*

AMS Officers 2000 and 2001 (Council, Executive Committee, Publications Committees, Board of Trustees)—*May 2001, p. 520*

AMS Officers and Committee Members—*October 2001, p. 1032*

Conference Board of the Mathematical Sciences—*September 2001, p. 843*

Information for *Notices* Authors—*June/July 2001, p. 611*

Mathematics Research Institutes Contact Information—*August 2001, p. 731*

National Science Board—*February 2001, p. 216*

New Journals for 2000—*June/July 2001, p. 612*

NRC Board on Mathematical Sciences and Staff—*April 2001, p. 427*

NRC Mathematical Sciences Education Board and Staff—*May 2001, p. 517*

NSF Mathematical and Physical Sciences Advisory Committee—*March 2001, p. 328*

Program Officers for Federal Funding Agencies—*October 2001, p. 1009 (DoD, DoE); November 2001, p. 1198 (NSF)*

centflyer.html, or contact Executive Director, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294; e-mail: ams@ams.org; telephone 401-455-4106.

December 3, 2001: Applications for NRC-Ford Foundation Fellowships for Minorities Dissertation Fellowship. See "Mathematics Opportunities" in this issue or http://national-academies.org/fellowships/.

December 15, 2001: Applications for AMS Epsilon Fund. See http://www.ams.org/careers-edu/epsilon.html, or contact: Professional Services Department, AMS, 201 Charles Street, Providence, RI 02904; telephone 800-321-4267, ext. 4105; e-mail: prof-serv@ams.org.

December 31, 2001: Nominations for NSF Alan T. Waterman Award. Telephone 703-292-8096 or e-mail: Susan Fannoney, sfannone@nsf.gov.

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

January 1, 2002: Applications for Chinese Mathematical Society grants for ICM 2002. See http://www.icm2002.org.cn/F/F_Eeurope.htm.

January 7, 2002: Applications for NRC-Ford Foundation Fellowships for Minorities Postdoctoral Fellowship. See "Mathematics Opportunities" in this issue or http://national-academies.org/fellowships/.

January 10, 2002: Applications for AAUW Educational Foundation Fellowships and Grants. See http://www.aauw.org/3000/fdnfelgra/selectprofbd.html.

January 15, 2002: Applications for AMS-AAAS Mass Media Fellowships. See "Mathematics Opportunities" in this issue or http://ehr.aaas.org/ehr/.

January 15, April 15, August 15, 2002: Applications for National Research Council Research Associateship Programs. See "Mathematics Opportunities" in this issue or http://www4.nationalacademies.org/pga/rap.nsf/.

January 16, 2002: Applications for National Defense Science and Engineering Graduate Fellowships. See "Mathematics Opportunities" in this issue or http://www.asee.org/ndseg/html/preface.htm.

January 21, 2002: Applications for AWM Workshop for Women Graduate Students and Postdocs. See http://www.awm-math.org/.

January 31, 2002: Applications for postdoctoral fellowships at the Institut Mittag-Leffler. See http://www.ml.kva.se/.

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

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

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

March 1, 2002: Applications for EDGE Summer Program. See "Mathematics Opportunities" in this issue or http://www.brynmawr.edu/Acads/Math/edge/edge.html.

March 1, 2002: Nominations for Third World Academy of Sciences (TWAS) Awards in Basic Sciences. See http://www.ictp.trieste.it/~twas/Awards_Info.html.

May 1, 2002: Nominations for Lobachevskii Medal. See "Mathematics Opportunities" in this issue or http://www.ksu.ru/lobmed/.

May 15, 2002: Applications for fall semester of Math in Moscow and for AMS scholarships. See "Mathematics Opportunities" in this issue.

October 15, 2002: Applications for spring semester of Math in Moscow and for AMS scholarships. See "Mathematics Opportunities" in this issue.

Book List

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

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

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

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

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

Calculated Bets: Computers, Gambling, and Mathematical Modeling to Win, by Steven S. Skiena. Cambridge University Press, September 2001. ISBN 0-521-00962-6.

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

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

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

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

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

* *Conquering Statistics: Numbers without the Crunch*, by Jefferson Hane Weaver. Perseus, paperback edition, August 2001. ISBN 0-732-820495-1.

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

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

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

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

The Difference Engine: Charles Babbage and the Quest to Build the First Computer, by Doron Swade. Viking, September 2001. ISBN 0-670-91020-1.

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

* *The Dream Machine: J. C. R. Licklider and the Revolution That Made Computing Personal*, by M. Mitchell Waldrop. Viking, 2001. ISBN 0-670-89976-3.

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

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

Exploring Randomness, by Gregory J. Chaitin. Springer, December 2000. ISBN 1-852-33-417-7. (Reviewed October 2001.)

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

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

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

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

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

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

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

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

In Code: A Mathematical Journey, by Sarah Flannery and David Flannery. Workman Publishing, May 2001. ISBN 0-761-12384-9.

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

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

* *Mathematics and the Roots of Postmodern Thought*, by Vladimir Tasic. Oxford University Press, 2001. ISBN 0-195-13967-4.

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

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

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

* *A New Kind of Science*, by Stephen Wolfram. Wolfram Media, Inc., October 2001. ISBN 1-579-55008-8.

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

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

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

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

The Parrot's Theorem, by Denis Guedj. St. Martin's Press, September 2001. ISBN 0-312-28055-6. (Reviewed March 2001.)

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

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

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

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

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

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

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

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

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

The Universal History of Computing: From the Abacus to the Quantum Computer, by Georges Ifrah; translated from the French and with notes by

Institute for Mathematical Sciences National University of Singapore

POST-GENOME KNOWLEDGE DISCOVERY

The Institute for Mathematical Sciences, newly formed in July 2000, will hold its second program from January to June 2002.

The program, which is on Post-Genome Knowledge Discovery, will focus on the computational and statistical analysis of sequence and genetic data and the mathematical modeling of complex biological interactions. It is intended to bring together biologists, bioinformaticians, computer scientists, mathematicians and statisticians for interaction and exchange of knowledge and ideas.

The program topics are:

1. Sequence and gene expression analysis (Jan.—Feb. 2002)
2. Population and statistical genetics (Mar.—Apr. 2002)
3. Protein interaction and clinical data analysis (May—Jun. 2002)

The Institute invites applications for Membership for participation in the above program. Limited funds are available to cover travel and living expenses to young scientists. Application should be received at least (3) months before the commencement of membership.

More information and application forms are available from:

`http://www.ims.nus.edu.sg`

or by writing to:

Secretary, Institute for Mathematical Sciences
National University of Singapore
3 Prince George's Park
Singapore 118402, Republic of Singapore

E. F. Harding, assisted by Sophie Wood, Ian Monk, Elizabeth Clegg, and Guido Waldman. John Wiley & Sons, November 2000. ISBN 0-471-39671-0.

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

The Unknowable, by Gregory J. Chaitin. Springer, August 1999. ISBN 9-814-02172-5. (Reviewed October 2001.)

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

Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being, by George Lakoff and Rafael Núñez. Basic Books, October 2000. ISBN 0-465-03770-4. (Reviewed November 2001.)

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

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

**Added to "Book List" since the list's last appearance.*

Backlog of Mathematics Research Journals

Journal (Print)	Number issues per Year	Approximate Number Pages per Year	2000 Median Time (in Months) from: Submission to Final Acceptance	2000 Median Time (in Months) from: Acceptance to Final Publication	Editor's Current Estimate of Waiting Time between Submission and Publication (in Months)
Acta Math.	4	600	7	8	16
Algebras Groups Geom.	NR	NR	NR	NR	NR
Ann. of Math.	6	1400	10	9	12–15
Ann. Probab.	NR	NR	NR	NR	NR
Ann. Sci. École Norm. Sup.	NR	NR	NR	NR	NR
Ann. Statist.	6	1900	18	8	24
Anziam J.[1]	NR	NR	NR	NR	NR
Appl. Math. Lett.	6	1000	5	4	9
Bull. Austral. Math. Soc.	6	1056	9	6	9
Bull. Soc. Math. France	NR	NR	NR	NR	NR
Circuits Systems Signal Proc.	6	720	15	5	16
Comm. Algebra	NR	NR	NR	NR	NR
Comm. Partial Diff. Equations	6	2400	12	12	15
Comput. Math. Appl.	24	3600	5	5	9
IMA J. Math. Control Inform.	NR	NR	NR	NR	NR
Indag. Math.	4	620	6	5	8
Inst. Hautes Études Sci. Publ. Math.	2	400	6	6	3
Internat. J. Math. Math. Sci.	NR	NR	NR	NR	NR
Israel J. Math.	6	2280	8	13	17
J. Algebraic Geom.	4	800	6	11	15–17
J. Amer. Statist. Assoc.	4	1450	17	7	20
J. Appl. Math. Stochastic Anal.	4	457	16	9	18
J. Austral. Math. Soc.	6	852	9.7	8	20
J. Differential Geom.	9	2000	10–12	8	10
J. Engrg. Math.	NR	NR	NR	NR	NR
J. Geom. Anal.	4	760	28	20	18
J. Integral Equations Appl.	4	700	7	8	14
J. Operator Theory	NR	NR	NR	NR	NR
J. Symbolic Logic	4	2000	8	20	18
Math. Comput. Modelling	24	3600	5	4	8
Math. Control Signals Sys.	4	2000	14	11	24
Mem. Amer. Math. Soc.	6	3200	13	12.2	25.2
Michigan Math. J.	3	620	5	8	12
Numer. Funct. Anal. Optim.	8	1000	6	5	12
Quart. Appl. Math.	4	800	12	10.2	22.2
Quart. J. Mech. Appl. Math.	NR	NR	NR	NR	NR
Results Math.	4	800	8	3	6
Rocky Mountain J. Math.	4	1600	5	18	21

2000 Median Time. This information is as reported by the editor of the journal.

Journal (Print and Electronic)	Number issues per Year	Approximate Number Pages per Year	2000 Median Time (in Months) from: Submission to Final Acceptance	Acceptance to Electronic Posting	Acceptance to Print	Editor's Estimate of Waiting Time for Paper Submitted to be Published (in Months)
Acta Inform.	12	960	NR	4	4	14
Aequationes Math.	6	640	9	10	10	16
Algorithmica	NR	NR	NR	NR	NR	NR
Amer. J. Math.	6	1200	NA	6.23	7.23	12-14
Ann. Appl. Probab.	4	1400	18	NR	12	18
Ann. Sci. Ecole Norm. Sup.	6	924	8	10	8	10
Appl. Math. Optim.	NR	NR	NR	NR	NR	NR
Arch. Hist. Exact. Scis.	6	600	6	4	4	5
Arch. Math. Logic	8	624	NA	8	10	NR
Arch. Rational Mech. Anal.	20	1800	NA	7	7	3
Bull. London Math. Soc.	6	768	8	12	12	20
Calc. Var. Partial Diff. Equations	8	850	6.5	5.2	8.5	NA
Canad. J. Math.	6	1344	11	NA	8	21
Canad. Math. Bull.	4	512	14	NA	12	24
Combinatorica	4	600	12	15	9	22
Comm. Math. Phys.	27	6534	5.5	7	7	12.5
Computing	8	768	7.7	6	6.9	12
Constr. Approx.	4	624	10	2	11	18
Discrete Comput. Geom.	8	1280	9	9	9	13
Duke Math. J.	15	3000	15	8	9	14
Graphs Combin.	4	800	14	10	10	18
Houston J. Math.	4	900	9	12	14	15
Illinois J. Math.	4	1300	5	NR	8	18
IMA J. Appl. Math.	6	648	5	NR	5	12-14
IMA J. Math. Appl. Med. Biol.	4	400	15	4	4	10
IMA J. Numer. Anal.	4	650	24	12	12	12
Indiana Univ. Math. J.	4	1500-1600	NR	NR	NR	9
Internat. J. Math. and Math. Sci.	48	3500	4	4	6	8
Internat. Math. Res. Not.	36†	2000	2	3	1	3
Invent. Math.	12	2740	8.5	4	6.5	NA
J. Algorithms	8	1580	21	4	4	5
J. Amer. Math. Soc	4	1000	8.8	1.4	4.1	12.9
J. Assoc. Comput. Mach.	6	1100	16	NA	6	19
J. Classification	2	320	15	18	5	18
J. Complexity	4	900	9	4.5	9	15
J. Comput. System Sci.	6	1400	12	NR	3	18
J. Cryptology	NR	NR	NR	NR	NR	NR
J. Eur. Math. Soc.	4	384	6	2	4.5	10
J. London Math. Soc.	6	1536	9	9	9	18
J. Math. Biol.	12	1150	17.8	5.1	7.1	21.5
J. Math. Phys	12	7500	4	2.5	7	7
J. Theoret. Probab.	4	1000	18	6	8	18
Linear Algebra Appl.	18	4250	10	6	6	12
Manuscripta Math.	12	1632	8	3.5	3.5	11.5
Math. Ann.	12	2500	10	4	8	NA
Math. Biosci.	12	1400	NR	NR	NR	NR
Math. Comp.	4	1750	12.9	6.3	16.4	29.3
Math. Oper. Res.	4	750-800	22.6	3	7.4	18-24
Math. Programming Ser. A	6	1296	7.5	6.5	6	NA
Math. Social Sci.	6	800	9-12	9-12	9-12	18
Math. Z.	12	2500	12	5	8.5	NA
Methods Appl. Anal.	4	240	5	3	2	7
Monatsh. Math.	12	1050	11	6	6	10
Nonlinear Anal.	30	3200	NR	NR	NR	
Numer. Math.	12	2400	NR	**	13	13
Oper. Res.	6	1100	24	12	12	18
Pacific J. Math.	10	2560	8	11	14	13
Probab. Theor. Relat. Fields	12	1806	12.7	7.6	9.6	16
Proc. Amer. Math. Soc.	12	3520	5.8	12.9	19.2	25
Proc. London Math. Soc.	6	1536	8	12	12	18
Quart. J. Math. Oxford Ser. A (2)	4	520	8	9	9	15

Journal (Print and Electronic)	Number issues per Year	Approximate Number Pages per Year	2000 Median Time (in Months) from: Submission to Final Acceptance	Acceptance to Electronic Posting	Acceptance to Print	Editor's Estimate of Waiting Time for Paper Submitted to be Published (in Months)
Reliab. Comput.	6	500	8	10	11	11
Semigroup Forum	6	960	28	5.5	19	24
SIAM J. Appl. Math.	6	2200	10.5	10	10	21
SIAM J. Comput.	6	2100	19	13	13	27
SIAM J. Control Optim.	6	1980	13.5	8	8	28
SIAM J. Discrete Math.	4	680	21	4	4	17
SIAM J. Math. Anal.	6	1400	11	8.5	8.5	24
SIAM J. Matrix Anal. Appl.	4	1300	12	9.5	9.5	27
SIAM J. Numer. Anal.	6	2100	13	9	9	26
SIAM J. Optim.	4	1150	17	9	9	27
SIAM J. Sci. Comput.	6	2280	12	12	18	23.5
SIAM Rev.	4	800	8	6	7	12
Smarandache Notions J.	1	350	1	1	3	3
Theory Comput. Syst.	6	600	15	5	5	16
Topology	6	1300	11	7	10	15
Topology Appl.	27	3000	6	NR	19	18
Trans. Amer. Math Soc.	12	5750	12.4	17.4	21.4	28

Journal (Electronic)	Number of Articles Posted in 2000	2000 Median Time (in days) from: Submission to Final Acceptance	Acceptance to Posting	Format(s)
Acta Math. Acad. Paedagog. Nyházi. (www.emis.de/journals/AMAPN)	10	89	60	pdf, ps
Algebra Montpellier Announcements (www.emis.ams.org/journals/AMA/index.html)	3	30	15	pdf, ps, dvi
Appl. Sci. (www.mathem.pub.ro/app)	10	14	14	ps, dvi
Chicago J. Theoret. Comp. Sci. (www.cs.uchicago.edu/publications/cjtcs/)	11	180	62	html, pdf, ps, dvi, tex
Complex Internat. (www.csu.edu.au/ci)	46	30	NR	html, pdf, ps, tex, other
Conform. Geom. Dyn. (www.ams.org/ecgd)	7	217	50	pdf, ps, dvi, tex
Diff. Eq. Contr. Process (www.neva.ru/journal)	13	15	10	html, tex
Differ. Geom. Dyn. Syst. (www.mathem.pub.ro/dgds)	10	14	14	ps, dvi
Discrete Math. Theor. Comput. Sci. (dmtcs.loria.fr)	17	100	8	pdf, ps
Doc. Math. (www.mathematik.uni-bielefeld.de/documenta/) (www.math.uiuc.edu/documenta/)	21	194	8	html, pdf, ps, dvi
Electron. Comm. Probab. (www.math.washington.edu/~ejpecp)	17	94	36	html, pdf, ps, dvi, tex, other
Electron. J. Combin. (www.combinatorics.org)	46	90	5	pdf, ps, dvi, tex, other
Electron. J. Differential Equations (ejde.math.swt.edu) (ejde.math.unt.edu)	76	97	5	pdf, ps, dvi, tex
Electron. J. Linear Algebra (www.math.technion.ac.il/iic/ela/)	19	192	28	pdf, ps, tex, other
Electron. J. Probab. (www.math.washington.edu/~ejpecp)	17	98	43	html, pdf, ps, dvi, tex, other
Electron. J. Qual. Theory Differ. Equ. (www.math.u-szeged.hu/ejqtde/)	10	45	3	pdf, ps, dvi

Journal (Electronic)	Number of Articles Posted in 2000	2000 Median Time (in days) from: Submission to Final Acceptance	2000 Median Time (in days) from: Acceptance to Posting	Format(s)
Electron. Res. Announc. Amer. Math. Soc. (www.ams.org/era)	13	87	9	pdf, ps, dvi, tex
Electron. Trans. Numer. Anal. (etna.mcs.kent.edu)	15	252	16	html, pdf
ESAIM Control Optim. Calc. Var. (www.emath.fr/cocv/), (www.edpsciences.org/cocv/)	24	297	63	pdf, ps
Geom. Topol. (www.maths.warwick.ac.uk/gt/)	19	214	7	pdf, ps
Homology Homotopy Appl. (www.rmi.acnet.ge/hha/)	11	180	14	ps, dvi
Integers. Electron. J. Combin. Numb. Th. (www.integers-ejent.org)	12	122	2	pdf, dvi, tex
J. Artificial Intelligence Res. (www.jair.org/)	28	87	129	html, pdf, ps
J. Funct. Logic Programming (www.danae.uni-muenster.de/lehre/kuchen/JFLP/)	6	180	1	pdf, ps
J. Graph Algorithms Appl. (www.cs.brown.edu/publications/jgaa/)	8	381	23	pdf, ps
J. High Energy Phys. (jhep.sissa.it)	870	45	25	pdf, ps, dvi, tex
J. Inequal. Pure Appl. Math. (jipam.vu.edu.au)	22	75	100	html, pdf, ps, dvi, tex, other
J. Integer Seq. (www.research.att.com/~njas/sequences/JIS/)	17	120	50	html, pdf, ps, dvi, tex
LMS J. Comput. Math. (www.lms.ac.uk/jcm/)	16	201	31	html, pdf, other
Lobachevskii J. Math. (ljm.ksu.ru)	9	90	30	ps
Math. Phys. Electron. J. (www.maia.ub.es/mpej)	6	150	3	ps
New York J. Math. (nyjm.albany.edu:8000/nyjm.html)	13	108	21	pdf, ps, dvi, other
Represent. Theory (www.ams.org/ert)	18	184	31	pdf, ps, dvi, tex
Sem. Lothar. Combin. (www.mat.univie.ac.at/~slc)	18	81.28	15.67	pdf, ps, dvi, tex
Sorites (www.ifs.csic.es/sorites/) (www.filosoficas.unam.mx/~sorites)	12	91	152	html, pdf, ps, other
Southwest J. Pure Appl. Math. (rattler.cameron.edu/swjpam/swjpam.html)	20	245	165	dvi, tex
Stud. Nonlinear Dyn. Econom. (mitpress.mit.edu/e-journals/SNDE/)	12	289	377	html, pdf, ps, other
Theory Appl. Categ. (www.tac.mta.ca/tac/)	15	193	10	pdf, ps, dvi

The following electronic-only journals are covered by *Mathematical Reviews*. No response was received to requests for information: *ACM J. Experimental Algorithms* (www.jea.acm.org/), and *ESAIM Probab. Statist.* (www.emath.fr.Maths/Ps/ps.html).

NR means no response received.
NA means not available or not applicable.
[1] Formerly J. Austral. Math. Soc. Ser. B.
* Date of receipt of manuscript not given in this journal.
** One week before publication.
*** From date accepted.
† SIAM provided information for both print and electronic products. Information about the print product is reported in this survey.

Statistics on Women Mathematicians Compiled by the AMS

At its August 1985 meeting the Council of the AMS approved a motion to regularly assemble and report in the *Notices* information on the relative numbers of men versus women in at least the following categories: membership in the AMS, invited hour addresses at AMS meetings, speakers at Special Sessions at AMS meetings, percentage of women speakers in AMS Special Sessions by gender of organizers, and members of editorial boards of AMS journals.

It was subsequently decided that this information would be gathered by determining the sex of the individuals in the above categories based on name identification and that additional information on the number of Ph.D.'s granted to women would also be collected using the AMS-IMS-MAA Annual Survey. Since name identification was used, the information for some categories necessitated the use of three classifications:

Male: names that were obviously male

Female: names that were obviously female

Unknown: names that could not be identified as clearly male or female (e.g., only initials given, non-gender-specific names, etc.)

The following is the sixteenth reporting of this information. Updated reports will appear annually in the *Notices*.

Invited Hour Address Speakers at AMS Meetings (1991–2000)

Male:	441	84%
Female:	77	15%
Unknown:	10	1%
Total checked:	528	

Speakers at Special Sessions at AMS Meetings (1996–2000)

Male:	9,257	79%
Female:	1,513	13%
Unknown:	890	8%
Total checked:	11,660	

Percentage of Women Speakers in AMS Special Sessions by Gender of Organizers (2000)

Special Sessions with at Least One Woman Organizer

Total number of speakers:	749	
Male:	558	75%
Female:	143	19%
Unknown:	48	6%

Special Sessions with No Women Organizers

Total number of speakers:	1,465	
Male:	1,163	79%
Female:	156	11%
Unknown:	146	10%

Members of the AMS Residing in the U.S.

Male:	12,158	72%
Female:	2,868	17%
Unknown:	1,916	11%
Total checked:	16,942	

Trustees and Council Members

	2000		1999		1998		1997	
Total:	50		51		48		49	
Male:	37	74%	39	76%	37	77%	38	78%
Female:	13	26%	12	24%	11	23%	11	22%

Members of Editorial Boards of AMS Journals

	2000		1999		1998		1997		1996		1995		1994		1993		1992		1991	
Total:	219		230		213		213		198		194		176		177		178		169	
Male:	186	85%	198	86%	182	85%	189	89%	177	89%	175	90%	161	91%	159	90%	163	92%	156	92%
Female:	33	15%	32	14%	31	15%	24	11%	21	11%	19	10%	15	9%	18	10%	15	8%	13	8%

Ph.D.'s Granted to U.S. Citizens

	2000		1999		1998		1997		1996		1995		1994		1993		1992		1991	
Total:	537		554		586		516		493		567		469		526		430		461	
Male:	379	71%	367	66%	423	72%	368	71%	377	76%	426	75%	345	74%	381	72%	327	76%	349	76%
Female:	158	29%	187	34%	163	28%	148	29%	116	24%	141	25%	124	26%	145	28%	103	24%	112	24%

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 visit the AMS web site for a choice of electronic versions at `www.ams.org/coversheet/`), fill in the answers which apply to *all* of your academic applications. Make photocopies.

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 purpose of the cover form is to aid department staff in tracking and responding to each application for employment. Mathematics departments in Bachelor's-, Master's-, and Doctorate-granting institutions are expecting to receive the form from each applicant, along with the other application materials they require.

The AMS suggests that applicants and employers visit the Job Application Database for Mathematicians (`www.mathjobs.com`), a new electronic resource being offered by the AMS (in partnership with Duke University) for the first time in 2001-02. The system provides a way for applicants to produce printed coversheet forms, apply for jobs, or publicize themselves in the "Job Wanted" list. Employers can post a job listing, and once applications are made, search and sort among their applicants. Note-taking, rating, e-mail, data downloading and customizable EOE funnctions are available to employers. Also, reference writers can submit their letters online. A paperless application process is possible with this system, however; employers can choose to use any portion of the service. It is hoped that departments hiring for postdoc positions, especially, will utilize the system this year. There will be no fees for any services this year. This system was developed at the Duke University Department of Mathematics, and was tested by a group of departments in 2000-01.

Please direct all questions and comments to: `emp-info@ams.org`.

Academic Employment in Mathematics

AMS Standard Cover Sheet

Last Name _____

First Name _____

Middle Names _____

Address *through next June* _____ **Home Phone**

_____ _____

_____ **e-mail Address**

_____ _____

Current Institutional Affiliation **Work Phone**

_____ _____

Highest Degree Held or Expected _____

Granting Institution _____ **Date (optional)** _____

Ph.D. Advisor _____

Ph.D. Thesis Title (optional) _____

Indicate *the mathematical subject area(s) in which you have done research using, if applicable, the Mathematics Subject Classification printed on the back of this form or on e-MATH. If listing more than one number, list first the one number which best describes your current primary interest.*

Primary Interest _____

Secondary Interests *optional* _____

Give a brief synopsis *of your current research interests (e.g. finite group actions on four-manifolds). Avoid special mathematical symbols and please do not write outside of the boxed area.*

_____

_____

Most recent, if any, position held *post Ph.D.*

University or Company _____

Position Title _____

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 recommendation if asked. Mark the box provided for each individual whom you have already asked to send a letter.*

☐ _____

☐ _____

☐ _____

☐ _____

This form is provided courtesy of the American Mathematical Society.

This cover sheet is provided as an aid to departments in processing job applications. It should be included with your application material.

Please print or type. Do not send this form to the AMS.

2000 Mathematics Subject Classification

00 General
01 History and biography
03 Mathematical logic and foundations
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General algebraic systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra, matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 *K*-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
37 Dynamical systems and ergodic theory
39 Difference and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
49 Calculus of variations and optimal control, optimization
51 Geometry
52 Convex and discrete geometry
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
74 Mechanics of deformable solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum theory
82 Statistical mechanics, structure of matter
83 Relativity and gravitational theory
85 Astronomy and astrophysics
86 Geophysics
90 Operations research, mathematical programming
91 Game theory, economics, social and behavioral sciences
92 Biology and other natural sciences
93 Systems theory, control
94 Information and communication, circuits
97 Mathematics education

Geometriae Dedicata

Geometriae Dedicata aims to be a vehicle for excellent publications in geometry and its relationship to topology, group theory and the theory of dynamical systems.
Features of the journal include:

1. A fast turn-around time for articles.
2. A "Surveys in Geometry" series: this will be a series of survey articles on active areas in geometry, directed to other geometers.
3. Special issues centered on specific topics.

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SUBSCRIPTION INFORMATION

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Paper Version: NLG 1473.00 / USD 1400.00
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Combined Paper & Online Version: EURO 1767.00 / USD 1680.00

Mathematics Calendar

The most comprehensive and up-to-date Mathematics Calendar information is available on e-MATH at `http://www.ams.org/mathcal/`.

December 2001

1-3 **First International Conference on Neutrosophy, Neutrosophic Logic, Set, Probability and Statistics**, University of New Mexico, Gallup, New Mexico. (May 2001, p. 531)

2-4 **DIMACS-CTS (Chiaotung University) Conference on the Interconnections among Codes, Designs, Graphs and Molecular Biology**, Center of Theoretical Science, Chiaotung University, Hsinchu, Taiwan. (Aug. 2001, p. 750)

2-8 **Quantum and Classical Integrability and Infinite Dimensional Systems**, International Centre for Mathematical Sciences, Edinburgh, UK. (June/July 2001, p. 629)

3-7 **LPAR'2001: 8th International Conference on Logic for Programming, AI and Reasoning**, Havana, Cuba. (June/July 2001, p. 629)

3-7 **Workshop on Applied Cryptology**, Institute for Mathematical Sciences, National University of Singapore, Singapore. (June/July 2001, p. 629)

3-8 **NIPS 2001, Neural Information Processing Systems: Natural and Synthetic**, Vancouver, Canada. (June/July 2001, p. 629)

3-8 **Second International Gabor Workshop**, University of Vienna, Vienna, Austria. (Nov. 2001, p. 1226)

4-7 **DIMACS Workshop on Codes and Complexity**, DIMACS Center, Rutgers University, Piscataway, New Jersey.
Short Description: This workshop will bring together researchers in coding and information theory, theoretical computer science, and physics. It will be preceded by a tutorial on low-density parity-check codes intended to bring graduate students and other researchers with little or no previous background up to speed in this area. There will be several invited talks, as well as contributed talks.
Organizers: A. Shokrollahi, Digital Fountain; D. Spielman, MIT; R. Urbanke, École Polytechnique Federale de Lausanne (EPFL).
Contacts: A. Shokrollahi, Digital Fountain; `amin@digitalfountain.com`.
Local Arrangements: J. Herold, DIMACS Center, `jessicah@dimacs.rutgers.edu`, 732-445-5928.
Information: `http://dimacs.rutgers.edu/Workshops/index.html`.

7-10 **2001 Annual Australasian Research Symposium on Lie Groups, Algebraic Groups, Quantum Groups, and Their Representations (LAQ'2001)**, The University of Auckland, Auckland, New Zealand. (June/July 2001, p. 629)

10-13 **International Congress on Modelling and Simulation-Modsim 2001**, Australian National University, Canberra, Australia. (June/July 2001, p. 629)

10-14 **ICMI Study Conference on the Future of the Teaching and Learning of Algebra**, University of Melbourne, Australia. (Jan. 2001, p. 55)

10-14 **Macroscopic Organisation from Microscopic Behaviour in Immunology, Ecology and Epidemiology**, Isaac Newton Institute, Cambridge, UK. (May 2001, p. 531)

10-14 **QMath-8. Mathematical Results in Quantum Mechanics**, Taxco, Mexico. (May 2001, p. 531)

13-14 **SAGA 2001—1st Symposium on Stochastic Algorithms, Foundations and Applications**, Berlin, Germany. (Nov. 2001, p. 1226)

* 14 **DIMACS Workshop on Computational Complexity, Entropy and Statistical Physics**, DIMACS Center, Rutgers University, Piscataway, New Jersey.

This section contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings and symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete list of meetings of the Society can be found on the last page of each issue.
An announcement will be published in the *Notices* if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in every third issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.
In general, announcements of meetings and conferences held in North America carry only the date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the *Notices* in care of the American Mathematical Society in Providence or electronically to `notices@ams.org` or `mathcal@ams.org`.
In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence **six months** prior to the scheduled date of the meeting.
The complete listing of the Mathematics Calendar will be published only in the September issue of the *Notices*. The March, June, and December issues will include, along with new announcements, references to any previously announced meetings and conferences occurring within the twelve-month period following the month of those issues. New information about meetings and conferences that will occur later than the twelve-month period will be announced once in full and will not be repeated until the date of the conference or meeting falls within the twelve-month period.
The Mathematics Calendar, as well as Meetings and Conferences of the AMS, is now available electronically through the AMS website on the World Wide Web. To access the AMS website, use the URL: `http://www.ams.org/`.

Short Description: The workshop will explore connections between biology, computational complexity, discrete mathematics, dynamical systems and statistical physics. All of these disciplines use entropy in one way or another. But just what is entropy? It is frequently said it is a measure of disorder, and while this needs many qualifications and clarifications it does represent something essential about it. We hope that by comparing the uses of entropy in these various contexts we will be able to gain new insights into some universal aspects common to all of them.
Sponsors: DIMACS Center.
Organizers: M. Fredman, Rutgers Univ.; J. Komlos, Rutgers Univ.; J. Lebowitz, Rutgers Univ.
Contacts: J. Komlos, Rutgers Univ., komlos@math.rutgers.edu.
Local Arrangements: J. Herold, DIMACS Center, jessicah@dimacs.rutgers.edu, 732-445-5928.
Information: http://dimacs.rutgers.edu/Workshops/index.html

14-18 **NSF-CBMS Regional Research Conference: Using Spectral Data to Solve Inverse Problems**, The University of Texas-Pan American, Edinburg, Texas. (Nov. 2001, p. 1227)

14-20 **School on Quantum Markov Chains**, Grand Hotel Bellavista, Levico, Terme (Trento), Italy. (Aug. 2001, p. 750)

15-19 **International Conference on the Use of Technology in Teaching and Learning Mathematics and Biomathematics (UTELMB 2001)**, University of Delhi, Delhi, India. (Oct. 2001, p. 1049)

15-19 **The Sixth Asian Technology Conference in Mathematics (ATCM2001) (Applications of Technology in Teaching and Research for the 21st Century)**, RMIT University, Melbourne, Australia. (Apr. 2001, p. 439)

17-19 **Eighth Cryptography and Coding**, Royal Agricultural College, Cirencester, UK. (Sept. 2000, p. 980)

17-21 **2nd WSES Conference: Algorithms Theory, Discrete Mathematics, Systems and Control (ADISC 2001)**, Cairns, Queensland, Australia. (June/July 2001, p. 630)

17-22 **First Announcement and Call for Papers, The Second International Congress of Chinese Mathematicians (ICCM 2001)**, The Grand Hotel, Taipei, Taiwan. (Apr. 2001, p. 439)

19-21 **International Conference on Statistics, Combinatorics and Related Areas and The Eighth International Conference of the Forum for Interdisciplinary Mathematics**, University of Wollongong, Wollongong, NSW, Australia. (Mar. 2001, p. 338)

20-23 **The First International Conference of the New Millennium on History of Mathematical Sciences**, Ramjas College, University of Delhi, Delhi, India. (Oct. 2001, p. 1049)

January 2002

2-4 **Seventh International Symposium on Artificial Intelligence and Mathematics**, Fort Lauderdale, Florida. (Nov. 2001, p. 1227)

5-10 **Mathematics and Molecular Biology VII: Modeling across the Scales—Atoms to Organisms**, La Fonda Hotel, Santa Fe, New Mexico. (Nov. 2001, p. 1227)

6-9 **Joint Mathematics Meetings**, San Diego Convention Center, San Diego, California. (Nov. 1998, p. 1378)

7-12 **International Conference on Long Range Dependent Stochastic Processes and Their Applications**, Indian Institute of Science, Bangalore, India. (Oct. 2001, p. 1049)

7-12 **School on Stochastic Partial Differential Equations and Applications-VI**, Grand Hotel Bellavista, Levico, Terme (Trento), Italy. (Aug. 2001, p. 750)

9-12 **International Conference on Inverse Problems—Recent Development in Theories and Numeric**, City University of Hong Kong, Hong Kong. (June/July 2001, p. 630)

11-15 **NSF-CBMS Regional Research Conference Arrangements and Mathematical Physics**, Louisiana State University, Baton Rouge, Louisiana. (Sept. 2001, p. 906)

14-17 **International Conference on Combinatorial Matrix Theory**, Postech, Pohang, Korea. (June/July 2001, p. 630)

21-25 **2nd MaPhySto Conference on Lévy Processes—Theory and Applications**, University of Aarhus, Denmark. (Sept. 2001, p. 906)

21-28 **Winter School on Computations in Coxeter Groups**, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 750)

21-February 1 **DynamicSummer: Topics in Nonlinear Dynamics**, The Australian National University, Canberra, Australia. (Nov. 2001, p. 1227)

28-February 1 **The International Conference on Factorization, Singular Operators and Related Problems, Dedicated to the 70th Anniversary of Professor Gueorguii Litvinchuk**, Madeira University, Madeira, Portugal. (June/July 2001, p. 630)

February 2002

1-April 30 **Special Research Trimester on Dynamical Systems**, Scuola Normale Superiore, Pisa, Italy. (Oct. 2001, p. 1049)

2-3 **9th Southern California Geometric Analysis Seminar**, University of California at Irvine, Irvine, California. (June/July 2001, p. 630)

13-15 **DIMACS Workshop on Internet and WWW Measurement, Mapping and Modeling**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Nov. 2001, p. 1227)

21-23 **Pacific Institute for Mathematical Sciences (PIMS) Workshop on Representations of Reductive p-Adic Groups**, Banff, Alberta, Canada. (Nov. 2001, p. 1228)

27-March 3 **Group Actions on Rational Varieties**, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 750)

March 2002

4-6 **RTST 2002: Research Trends in Science and Technology**, Lebanese American University, Beirut and Byblos, Lebanon. (Oct. 2001, p. 1050)

15-17 **SEAM XVIII (South Eastern Analysis Meeting XVIII)**, University of North Carolina, Chapel Hill, North Carolina. (Nov. 2001, p. 1228)

15-17 **The 49th Midwest Partial Differential Equations Seminar in Honor of David Adams, Ron Gariepy, and John Lewis**, University of Kentucky, Lexington, Kentucky. (Sept. 2001, p. 906)

18-20 **International Conference on Algebra and Its Applications**, Chulalongkorn University, Bangkok, Thailand. (Sept. 2001, p. 906)

21-22 **8th Rhine Workshop on Computer Algebra**, Mannheim, Germany. (May 2001, p. 531)

21-23 **Spring Topology and Dynamics Conference**, University of Texas, Austin, Texas. (Aug. 2001, p. 751)

26-30 **The 2002 UAB International Conference on Differential Equations and Mathematical Physics**, University of Alabama at Birmingham, Birmingham, Alabama. (Aug. 2001, p. 751)

26-April 4 **Instructional Conference on Combinatorial Aspects of Mathematical Analysis**, International Centre for Mathematical Sciences, Edinburgh, UK. (June/July 2001, p. 630)

April 2002

1-6 **International Workshop on Relaxation Oscillations and Hysteresis**, University College Cork, Cork, Ireland. (Oct. 2001, p. 1050)

* 8-10 **DIMACS Workshop on Complexity in Biosystems: Innovative Approaches at the Interface of Experimental and Computational**

Modeling, DIMACS Center, Rutgers University, Piscataway, New Jersey.
Short Description: The goal of this workshop is to bring together scientists currently working in the novel field of complex biosystems modeling and simulations from different points of view and "newcomers" interested in getting involved in this exciting research area. The focus is on challenging interface between experimental modeling (e.g. assay design and engineering) and computational simulation. The goal is to introduce and discuss innovative concepts, experimental and computational biosystems models and mathematical algorithms, as well as to establish new collaborations beyond institutional or departmental boundaries.
Sponsor: DIMACS Center.
Organizers: T. Deisboeck, Harvard Medical School; L. Segel, Weizmann Institute; E. Sontag, Rutgers Univ.; R. Winslow, The Johns Hopkins University.
Contacts: T. Deisboeck, Harvard Medical School, deisboec@helix.mgh.harvard.edu.
Local Arrangements: J. Herold, DIMACS Center, jessicah@dimacs.rutgers.edu, 732-445-5928.
Information: http://dimacs.rutgers.edu/Workshops/index.html

8-19 **Invariant Theory**, Queen's University, Kingston, Ontario, Canada. (Aug. 2001, p. 751)

22-24 **Heat Transfer 2002: Seventh International Conference on Advanced Computational Methods in Heat Transfer**, Halkidiki, Greece. (Nov. 2001, p. 1228)

30-May 17 **Concentration Period on the Langlands Programme for Function Fields**, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 751)

May 2002

19-25 **Canadian Number Theory Association-VII Meeting**, Centre de Recherches Mathématiques (CRM), Montréal (Québec), Canada. (Nov. 2001, p. 1228)

20-21 **Improving the Reasoning of College Students**, Virginia Commonwealth University, Richmond, Virginia. (Oct. 2001, p. 1050)

20-25 **6th International Conference on Clifford Algebras and Their Applications in Mathematical Physics**, Tennessee Technological University, Cookeville, Tennessee. (Aug. 2001, p. 751)

20-31 **Tamagawa Numbers and Special Values of L-Functions**, Institut Galilée, Université Paris 13, France. (Oct. 2001, p. 1050)

24-27 **The Fourth International Conference on "Dynamical Systems and Differential Equations"**, University of North Carolina at Wilmington, Wilmington, North Carolina. (Aug. 2001, p. 751)

27-June 10 **Computational Lie Theory**, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 751)

June 2002

3-8 **Abel Bicentennial Conference 2002**, University of Oslo, Oslo, Norway. (Nov. 2001, p. 1228)

4-13 **3rd Linear Algebra Workshop**, Bled, Slovenia. (Sept. 2001, p. 908)

5-9 **A Conference in Honour of Hans Wallin**, Umeå, Sweden. (Oct. 2001, p. 1050)

* 6-15 **Fourth International Conference on Geometry, Integrability and Quantization**, Sts. Constantine and Elena resort (near Varna), Bulgaria.
Goal: This fourth edition of the conference aims, like the previous ones, to bring together experts in classical and modern differential geometry, complex analysis, mathematical physics, and related fields in order to assess recent developments in these areas and to stimulate research in related topics.
Organizers: I. M. Mladenov, mladenov@bgcict.acad.bg; G. L. Naber, gnaber@csuchico.edu.
Information: For more information please visit the conference Web page, http://obzor.bio21.bas.bg/conference/.

10-13 **The Tenth Conference of the International Linear Algebra Society**, Auburn University, Auburn, Alabama. (June/July 2001, p. 630)

10-15 **Algebraic Transformation Groups**, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 752)

10-16 **Aarhus Topology 2002**, University of Aarhus, Aarhus, Denmark. (Jan. 2001, p. 55)

12-15 **Bachelier Finance Society: 2nd World Congress**, Crete, Greece. (Nov. 2001, p. 1228)

13-15 **19th Annual Workshop in Geometric Topology**, Calvin College, Grand Rapids, Michigan. (Nov. 2001, p. 1228)

17-19 **24th International Conference on Boundary Element Methods and Meshless Solutions Seminar**, Sintra, Portugal. (Nov. 2001, p. 1228)

17-21 **Seventh International Conference on p-Adic Functional Analysis**, University of Nijmegen, The Netherlands. (June/July 2001, p. 630)

23-28 **Fourteenth U.S. National Congress of Theoretical and Applied Mathematics**, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. (Dec. 2000, p. 1437)

24-28 **Tenth International Conference on Fibonacci Numbers and Their Applications**, Flagstaff, Arizona. (Oct. 2001, p. 1050)

25-29 **The Twenty-sixth Summer Symposium in Real Analysis**, Washington and Lee University, Lexington, Virginia. (Oct. 2001, p. 1050)

30-July 14 **5th Summer School/Conference: Let's Face Chaos through Nonlinear Dynamics**, Maribor, Slovenia. (Aug. 2001, p. 752)

July 2002

1-6 **2nd International Conference on the Teaching of Mathematics**, Crete, Greece. (June/July 2001, p. 631)

* 8-12 **An International Conference on Boundary and Interior Layers—Computational & Asymptotic Methods**, University of Western Australia, Perth, Australia.
Information: All details can be found at http://thysanotus.maths.uwa.edu.au/general/BAIL2002/.

* 8-19 **SMS-NATO ASI: Normal Forms, Bifurcations, and Finiteness Problems in Differential Equations**, Université de Montréal, Canada.
Program: Differential equations, normal forms, bifurcations, cyclicity, families of vector fields, analytic invariants, finiteness problems of differential equations.
Invited Speakers: A. Bolibrukh, F. Dumortier, J. Ecalle, V. Gelfreich, A. Glutsuk, J. Guckenheimer, Y. Ilyashenko, V. Kaloshin, A. Khovanskii, J.-P. Ramis, R. Roussarie, C. Rousseau, D. Schlomiuk, S. Yakovenko.
Application Deadline: February 28, 2002.
Information: http://www.dms.umontreal.ca/sms/; e-mail: sms@dms.umontreal.ca.

* 9-13 **Genetic and Evolutionary Computation Conference GECCO-2002**, New York City, New York.
Topics: Genetic algorithms (GA); genetic programming (GP); evolution strategies (ES); evolutionary programming (EP); evolvable hardware (EH); evolutionary robotics (ER); real-world applications (RWA); classifier systems (CS); DNA, molecular and quantum computing (DNA); artificial life, adaptive behavior and agents, and ant colony optimization (AAAA); methodology, pedagogy, and philosophy (MPP); evolutionary scheduling and routing (ESR), and other areas to be announced.

Conference Chair: E. Cantu-Paz, Lawrence Livermore National Laboratory.
Editor-in-Chief of Proceedings: W. Langdon.
Chairs of Program Policy Committees: GP: R. Poli; GA: K. Mathias; ES & EP: G. Rudolph; RWA: L. D. Davis.
Information: For technical matters and tutorial proposals contact E. Cantu-Paz, General Chair, cantupaz@llnl.gov. For administrative matters contact gecco@aaai.org, http://www.isgec.org/GECCO-2002/.

13-19 **Symbolic Computational Algebra 2002: Fields Institute Special Meeting on Symbolic and Numeric Computation in Geometry, Algebra and Analysis**, Univ. of Western Ontario, London, Ontario, Canada. (Sept. 2001, p. 909)

14-18 **The Fourth International Conference on Matrix Analytic Methods in Stochastic Models**, University of Adelaide, Adelaide, Australia. (June/July 2001, p. 631)

15-20 **IV Brazilian Workshop on Continuous Optimization**, IMPA-Instituto de Matematica Pura e Aplicada, Rio de Janeiro, Brazil. (Nov. 2001, p. 1229)

* 15-August 10 **Conference on Representation Theory of Algebras and Related Topics (ICRA X)**, The Fields Institute for Research in Mathematical Sciences, Toronto, Canada.
Description: The purpose of these meetings is not only to exchange the latest result in a rapidly developing area but to bring together leading and well-established experts with young researchers just starting out who will profit greatly from the possibilities of exchange and contact provided and from workshops where recent advances are presented in detailed exposition. July 15-July 20, 2002: Instructional Workshop; July 22-July 31, 2002: The 10th International Conference on Representations of Algebras (ICRA X); August 1-August 10, 2002: Specialized Workshops. At this point the list of specialized workshops is still tentative, as the time leading up to the proposed programme is certain to produce developments that will have to be taken into account. Currently 3 specialized workshops are being organized: (i) Commutative Algebra, Algebraic Geometry and Representation Theory; (ii) Finite Dimensional Algebras, Algebraic Groups and Lie Theory; (iii) Quantum Groups and Hall Algebras.
Organizers: S. Berman, Y. Billig, R.-O. Buchweitz, V. Dlab, E. Neher, S. Liu.
Information: http://www.fields.utoronto.ca/programs/scientific/02-03/ICRA-X/or contact icrax@fields.utoronto.ca.

23-August 2 **EDGE Mid-Term Summer School and Conference**, ICMS, Edinburgh, Scotland, UK. (Nov. 2001, p. 1229)

29-August 10 **50 Years of the Cauchy Problem in General Relativity-Summer School**, Corsica, France. (Oct. 2001, p. 1050)

August 2002

3-10 **Logic Colloquium 2002 (ASL European Summer Meeting)**, Westfälische Wilhelms-Universität, Münster, Germany. (June/July 2001, p. 631)

5-9 **Conference on Ill-Posed and Inverse Problems**, Sobolev Institute of Mathematics, Novosibirsk, Russia. (Sept. 2001, p. 909)

5-15 **New Directions in Dynamical Systems 2002 (ICM 2002 Satellite Conference)**, Ryukoku University and Kyoto University, Kyoto, Japan. (June/July 2001, p. 631)

7-10 **The Second International Conference on Neural, Parallel, and Scientific Computations**, Morehouse College, Atlanta, Georgia. (Nov. 2001, p. 1229)

* 7-12 **Marsden Workshop on Geometry, Mechanics and Dynamics**, The Fields Institute for Research in Mathematical Sciences, Toronto, Canada.
Description: The workshop will be organized along the seven main themes of Professor Marsden's work: (1) geometric mechanics, (2) fluid mechanics, (3) elasticity and analysis, (4) numerical algorithms, (5) relativity and quantum mechanics, (6) geometric control theory (7) dynamical systems. The common thread running throughout is the use of geometric methods which serve to unify these diverse disciplines and help bring a wide variety of scientists and mathematicians together, speaking a language which encourages cross-fertilization. Professor Marsden is a unique figure in this regard, as his work has significantly influenced the three distinctly separate communities of mathematicians, physicists, and engineers. The workshop will bring together the world's leading figures in each of these seven theme areas who will give invited lectures.
Organizers: A. Bloch, P. Newton, T. Ratiu, S. Shkoller, A. Weinstein.
Information: http://www.fields.utoronto.ca/programs/scientific/02-03/marsden_workshop/ or contact marsden60@fields.utoronto.ca.

12-16 **Infinite Dimensional Function Theory**, Pohang University of Science and Technology (POSTECH), Pohang, South Korea. (Nov. 2001, p. 1229)

12-16 **Integrability and Topology**, South Ural State University, Chelyabinsk, Russia. (Sept. 2001, p. 910)

12-16 **MTNS 2002, Fifteenth International Symposium on Mathematical Theory of Networks and Systems**, University of Notre Dame, Notre Dame, Indiana. (Dec. 2001, p. 1437)

15-17 (NEW DATE) **Symposium on Stochastics and Applications (SSA)—An ICM-2002 Satellite Conference**, National University of Singapore, Singapore. (June/July 2001, p. 631)

* 15-18 **The International Conference on Mathematical Biology (a Satellite Meeting of ICM-2002)**, Guangxi Normal University, Guilin, Guangxi Province, P. R. China.
Topics: Scientific Program Sessions: Mathematical Ecology, Epidemiology, Biometrics, Bio-informatics, Mathematical Neuroscience, Related Mathematical Problems in Biology.
Organizers: The Chinese Society of Biomathematics, CMS.
Academic Committee: R. M. May (U.K.), L. Chen (China), K. Sigmund (Austria). Members: Castillo-Chivez (USA), B. D. Sleeman (U.K.), F. Brauer (Canada), G. Lu (China), H. L. Smith (USA), J. Wu (Canada), J. M. Cushing (USA), J. Zhu (China), L. Liu (China), L. M. Ricciardi (Italy), O. Diekmann (Netherlands), P. Waltman (USA), S. A. Levin (USA), S. Ruan (Canada), S. Rionero (Italy), T. Yanagawa (Japan), T. G. Hallam (USA), Y. Kuang (USA), Z. Lu (China), Z. Ma (China), Z. Shen (China).
Information: http://math.la.asu.edu/~kuang/guilin.html. For further information, please contact Xiao-he Qin or Jia-yi Dai, Conference Secretariat, Office of International Exchanges, Guangxi Normal University, Guilin, 541001, China; tel: (0086) 773-5850305 or (0086) 773-5850311; fax: (0086) 773-5850305 or (0086) 773-5812383; e-mail: gxnu@public.glptt.gx.cn.

20-28 **ICM-2002**, Beijing, China. (Oct. 2000, p. 1146)

20-28 **Satellite Conferences for ICM 2002**, Beijing, China. (Aug. 2001, p. 752)

24-28 **Compstat 2002—Conference for Computational Statistics**, Humboldt-Universität zu Berlin, Berlin, Germany. (Nov. 2001, p. 1229)

* 26-28 **The Sixth Iranian International Statistics Conference (ISC6)**, Tarbiat Modarres University, Tehran, Iran.
Sponsor: The Iranian Statistical Society.
Description: The program includes invited and contributed talks in the areas of theory and applications of statistics and probability, short introductory sessions on current popular fields in statistics, sessions on promoting statistical culture in the society, and sessions on statistical education. Presenters of accepted papers from abroad will be exempt from registration fees, local hotel and meal expenses.
Information: For more information please contact Department of Statistics, Tarbiat Modarres University, P.O. Box 14115 -175, Tehran, Iran; tel: +98 (21) 8003388; fax: +98 (21) 8013658; e-mail: ISC6@modares.ac.ir; http://www.modares.ac.ir/isc6/.

29–September 2 **International Conference on Nonlinear Partial Differential Equations—Theory and Approximation**, City University of Hong Kong, Hong Kong. (Nov. 2001, p. 1229)

September 2002

September–December 2002 **Set Theory and Analysis Program**, The Fields Institute, Toronto, Ontario, Canada. (Oct. 2001, p. 1051)

4–7 **International Conference on Dynamical Methods for Differential Equations**, Medina del Campo, Valladolid, Spain. (Oct. 2001, p. 1051)

13–14 **Topics in Linear Algebra**, Iowa State University, Ames, Iowa. (Oct. 2001, p. 1051)

20–25 **International Conference on Computational and Mathematical Methods in Science and Engineering (CMMSE 2002)**, Alicante, Spain. (Oct. 2001, p. 1051)

23–27 **Ramification in Arithmetic and Geometry**, Institut Galilée, Université Paris 13, France. (Oct. 2001, p. 1051)

* 23–28 **Workshop on Categorical Structures for Descent and Galois Theory, Hopf Algebras and Semiabelian Categories**, The Fields Institute for Research in Mathematical Sciences, Toronto, Canada.
Description: The goal of the meeting is to spread and to advance categorical methods and their application amongst researchers working in three overlapping areas of algebra, namely in the study of: (i) algebraic structures in monoidal categories and their classical examples, such as Hopf, Frobenius, and Azumaya algebras, and others, particularly those occurring in quantum field theory; (ii) Galois theory vis-a-vis Grothendieck's descent theory, as well as the general theory of separability and decidability, applied particularly to the structures mentioned in (i); (iii) homological algebra of nonabelian structures, such as groups, rings and (associative or Lie) algebras, and its extension to the structures mentioned in (i).
Organizers: G. Janelidze, B. Pareigis, W. Tholen.
Information: `http://www.fields.utoronto.ca/programs/scientific/02-03/galois_and_hopf/` or contact `tholen@mathstat.yorku.ca`.

The following new announcements will not be repeated until the criteria in the next to the last paragraph at the bottom of the first page of this section are met.

January 2003

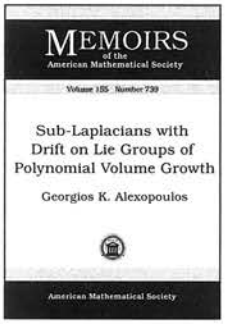
* January–August **Thematic Program on Automorphic Forms**, The Fields Institute for Research in Mathematical Sciences, Toronto, Canada.
Description: The theory of automorphic forms is a wide and deep subject touching many areas of mathematics. Our purpose is to concentrate on the geometric and analytic aspects of the subject. These have far-reaching applications in classical number theory. The Langlands-Shahidi method and the converse theorem of Cogdell-Piatetski-Shapiro have seen exciting new developments recently. These include new cases of functoriality, as well as analytic continuation of symmetric power L-functions. The work of Kim-Shahidi will be one of the central themes of the program. The analytic theory of L-functions and its applications has also seen many advances in recent years. We hope to cover some aspects of these, especially those connected with the analyticity of symmetric power L-functions as well as those of Hasse-Weil zeta functions. An important problem is to express the Hasse-Weil zeta function of a Shimura variety in terms of automorphic L-functions. Here in order to define the local factors not just at primes of good reduction, we need to study the variety at the finite set of primes of bad reduction. Such a description would allow one to apply the aforementioned progress in L-functions to the study of deep arithmetic properties of these varieties. One of the major remaining obstacles to proving such a description is the so-called "fundamental lemma", a conjecture in local harmonic analysis that asserts the equality of certain orbital integrals on a p-adic group and on a related (endoscopic) group. We plan to review recent work of Goresky-Kottwitz-MacPherson and others which gives a geometric approach to this problem.
Organizers: J. Arthur, T. Haines, H. Kim, R. Murty, G. Pappas, F. Shahidi.
Information: To be informed of when registration is open and to receive updates about the Thematic Program on Automorphic Forms, please subscribe to the mail list at `http://www.fields.utoronto.ca/maillist/`, or contact `automorphic@fields.utoronto.ca`.

May 2003

* 3–5 **First International Conference on Smarandache Geometries**, Griffith University, Gold Coast Campus, Australia.
Description: An axiom is said to be smarandachely denied if in the same space the axiom behaves differently (i.e., validated and invalidated or only invalidated, but in at least two distinct ways). A Smarandache geometry is a geometry which has at least one smarandachely denied axiom (1969). Thus, as a particular case, Euclidean, Lobachevsky-Bolyai-Gauss, and Riemannian geometries may be united altogether, in the same space, by some Smarandache geometries. These last geometries can be partially Euclidean and partially non-Euclidean. It seems that Smarandache geometries are connected with the theory of relativity (because they include the Riemannian geometry in a subspace) and with the parallel universes.
Speakers: M. Antholy (Canada), H. Iseri (USA), M. Bencze (Romania).
Deadline for Submission of Abstracts: April 30, 2003. Papers are welcome and will be published in a collected papers book. See a club about these geometries at `http://clubs.yahoo.com/clubs/smarandachegeometries/`.
Information: J. Allen, Office 2.36 Education Building, Griffith University, Gold Coast Campus, Australia. Conference home page: `http://www.gallup.unm.edu/~smarandache/geometries.htm`.

New Publications Offered by the AMS

Algebra and Algebraic Geometry



Sub-Laplacians with Drift on Lie Groups of Polynomial Volume Growth

Georgios K. Alexopoulos, *University of Paris, Orsay, France*

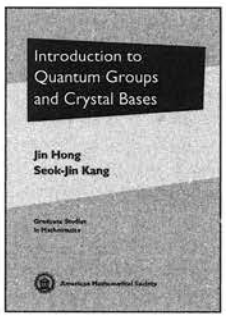
This item will also be of interest to those working in analysis.

Contents: Introduction and statement of the results; The control distance and the local Harnack inequality; The proof of the Harnack inequality from Varopoulos's theorem and propositions 1.6.3 and 1.6.4; Hölder continuity; Nilpotent Lie groups; Sub-Laplacians on nilpotent Lie groups; A function which grows linearly; Proof of propositions 1.6.3 and 1.6.4 in the case of nilpotent Lie groups; Proof of the Gaussian estimate in the case of nilpotent Lie groups; Polynomials on nilpotent Lie groups; A Taylor formula for the heat functions on nilpotent Lie groups; Harnack inequalities for the derivatives of the heat functions on nilpotent Lie groups; Harmonic functions of polynomial growth on nilpotent Lie groups; Proof of the Berry-Esseen estimate in the case of nilpotent Lie groups; The nil-shadow of a simply connected solvable Lie group; Connected Lie groups of polynomial volume growth; Proof of propositions 1.6.3 and 1.6.4 in the general case; Proof of the Gaussian estimate in the general case; A Berry-Esseen estimate for the heat kernels on connected Lie groups of polynomial volume growth; Polynomials on connected Lie groups of polynomial growth; A Taylor formula for the heat functions on connected Lie groups of polynomial volume growth; Harnack inequalities for the derivatives of the heat functions; Harmonic functions of polynomial growth; Berry-Esseen type of estimates for the derivatives of the heat kernel; Riesz transforms; Bibliography.

Memoirs of the American Mathematical Society, Volume 155, Number 739

January 2002, 101 pages, Softcover, ISBN 0-8218-2764-2, LC 2001045834, 2000 *Mathematics Subject Classification*: 22E25, 22E30, 43A80, 22E15, **Individual member $29**, List $49, Institutional member $39, Order code MEMO/155/739N

Recommended Text



Introduction to Quantum Groups and Crystal Bases

Jin Hong and **Seok-Jin Kang**, *Korea Institute for Advanced Study, Seoul, Korea*

The notion of a "quantum group" was introduced by V.G. Dinfeld and M. Jimbo, independently, in their study of the quantum Yang-Baxter equation arising from 2-dimensional solvable lattice models. Quantum groups are certain families of Hopf algebras that are deformations of universal enveloping algebras of Kac-Moody algebras. And over the past 20 years, they have turned out to be the fundamental algebraic structure behind many branches of mathematics and mathematical physics, such as solvable lattice models in statistical mechanics, topological invariant theory of links and knots, representation theory of Kac-Moody algebras, representation theory of algebraic structures, topological quantum field theory, geometric representation theory, and C^*-algebras.

In particular, the theory of "crystal bases" or "canonical bases" developed independently by M. Kashiwara and G. Lusztig provides a powerful combinatorial and geometric tool to study the representations of quantum groups. The purpose of this book is to provide an elementary introduction to the theory of quantum groups and crystal bases, focusing on the combinatorial aspects of the theory.

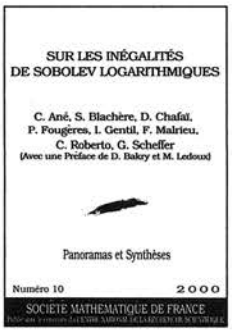
The authors start with the basic theory of quantum groups and their representations, and then give a detailed exposition of the fundamental features of crystal basis theory. They also discuss its applications to the representation theory of classical Lie algebras and quantum affine algebras, solvable lattice model theory, and combinatorics of Young walls.

Contents: Lie algebras and Hopf algebras; Kac-Moody algebras; Quantum groups; Crystal bases; Existence and uniqueness of crystal bases; Global bases; Young tableaux and crystals; Crystal graphs for classical Lie algebras; Solvable lattice models; Perfect crystals; Combinatorics of young walls; Bibliography; Index of symbols; Index.

Graduate Studies in Mathematics

March 2002, approximately 328 pages, Hardcover, ISBN 0-8218-2874-6, LC 2001053274, 2000 *Mathematics Subject Classification*: 17B37, 17B65; 81R50, 82B23, **All AMS members $39**, List $49, Order code GSM-KANGN

Analysis



Sur Les Inégalités de Sobolev Logarithmiques

S Blanchere, D Chafai, P Fougeres, I Gentil, F Malrieu, C Roberto, and **G Scheffer**

A publication of the Société Mathématique de France.

This book is an overview of logarithmic Sobolev inequalities. These inequalities have been the subject of intense activity in recent years, from analysis and geometry in finite and infinite dimensions to probability theory and statistical mechanics. And many developments are still to come.

The book is a "pedestrian approach" to logarithmic Sobolev inequalities, accessible to a wide audience. It is divided into several chapters of independent interest. The fundamental example of the Bernoulli and Gaussian distributions is the starting point for logarithmic Sobolev inequalities, as they were defined by Gross in the mid-seventies. Hypercontractivity and tensorisation form two main aspects of these inequalities, which are actually part of the larger family of classical Sobolev inequalities in functional analysis.

A chapter is devoted to the curvature-dimension criterion, which is an efficient tool for establishing functional inequalities. Another chapter describes a characterization of measures which satisfy logarithmic Sobolev or Poincaré inequalities on the real line, using Hardy's inequalities.

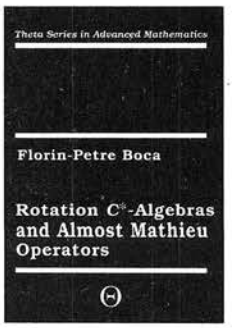
Interactions with various domains in analysis and probability are developed. A first study deals with the concentration of measure phenomenon, which is useful in statistics as well as geometry. The relationships between logarithmic Sobolev inequalities and the transportation of measures are considered, in particular through their approach to concentration. A control of the speed of convergence to equilibrium of finite state Markov chains is described in terms of the spectral gap and the logarithmic Sobolev constants. The last part is a modern reading of the notion of entropy in information theory and of the several links between information theory and the Euclidean form of the Gaussian logarithmic Sobolev inequality. The genesis of these inequalities can be traced back to the early contributions of Shannon and Stam.

This book focuses on the specific methods and the characteristics of particular topics, rather than the most general fields of study. Chapters are mostly self-contained. The bibliography, without being encyclopedic, tries to give a rather complete state of the art on the topic, including some very recent references.

Contents: Preface; Avant-propos; L'exemple des lois de Bernouilli de Gauss; Sobolev logarithmique et hypercontractivité; Tensorisation et perturbation; Familles d'inégalités fonctionnelles; Le critere de courbure-dimension; Inégalités sur la droite réelle; Concentration de la mesure; Inégalités de Sobolev logarithmique et de transport; Sobolev logarithmique et chaines de Markov finies; Inégalités entropiques en théorie de l'information; Bibliographie; Index.

Panoramas et Synthèses, Number 10

July 2001, 213 pages, Softcover, ISBN 2-85629-105-8, 2000 *Mathematics Subject Classification*: 60J60, 26D10, 58D25, 39B72, 58J65, 47D07, 60J10, 94A15, 94A17, **Individual member $40**, List $44, Order code PASY/10N



Rotation C*-Algebras and Almost Mathieu Operators

Florin-Petre Boca, *Cardiff University, UK*

A publication of the Theta Foundation.

This book delivers a swift, yet concise, introduction to some aspects of rotation C^*-algebras and almost Mathieu operators. The two topics come from different areas of analysis: operator algebras and the spectral theory of Schrödinger operators, but can be approached in a unified way. The book does not try to be the definitive treatise on the subject, but rather presents a survey highlighting the important results and demonstrating this unified approach.

For each real number α, the rotation C^*-algebra A_α can be abstractly defined as the universal C^*-algebra generated by two elements U and V subject to the relation $UV = e^{2\pi i\alpha}VU$. When α is an integer, A_α is isomorphic to the commutative C^*-algebra of continuous functions on a two-dimensional torus. When α is not an integer, the algebra is sometimes called a non-commutative 2-torus. In this respect, some of the methods you will find here can be regarded as a sort of non-commutative Fourier analysis. An almost Mathieu operator is a type of self-adjoint operator on the Hilbert space $\ell^2 = \ell^2(\mathbf{Z})$.

The exposition is geared toward a wide audience of mathematicians: researchers and advanced students interested in operator algebras, operator theory and mathematical physics. Readers are assumed to be acquainted with some functional analysis, such as definitions and basic properties of C^*-algebras and von Neumann algebras, some general results from ergodic theory, as well as the Fourier transform (harmonic analysis) on elementary abelian locally compact groups of the form $\mathbf{R}^d \times \mathbf{Z}^k \times \mathbf{T}^1 \times F$, where F is a finite group.

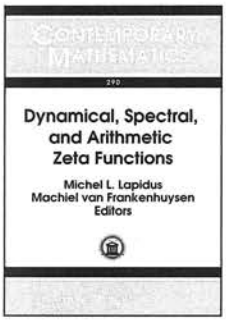
Much progress has been made on these topics in the last twenty years. The present book will introduce you to the subjects and to the significant results.

Distributed worldwide, except in Romania, by the AMS.

Contents: Prerequisites on rotation C^*-algebras; Almost Mathieu operators and automorphisms of A_α; Perturbations of the spectrum of $H_{\alpha,\lambda}$; The spectrum of almost Mathieu operators for rational α; The absence of isolated points in the spectrum of $H_{\alpha,\lambda}$; Lyapunov exponents and pure point spectrum; The Lebesgue measure of $\mathrm{spec}_{(p/q,\lambda)}$; Some estimates for the Lebesgue measure of $\mathrm{spec}(H_{(p/q,\lambda)})$; Spectral computations for certain non-self-adjoint operators; Projections in rotation C^*-algebras; The approximation of irrational rotation C^*-algebras; The approximation of irrational non-commutative spheres; Subject index; Notation.

International Book Series of Mathematical Texts

June 2001, 172 pages, Hardcover, ISBN 973-99097-7-9, 2000 *Mathematics Subject Classification*: 46L35, 81Q15, 47B39; 46L85, 81Q10, 47B36, **All AMS members $22**, List $28, Order code THETA/2N



Dynamical, Spectral, and Arithmetic Zeta Functions

Michel L. Lapidus, *University of California, Riverside,* and **Machiel van Frankenhuysen**, *Rutgers University, Piscataway, NJ,* Editors

The original zeta function was studied by Riemann as part of his investigation of the distribution of prime numbers. Other sorts of zeta functions were defined for number-theoretic purposes, such as the study of primes in arithmetic progressions. This led to the development of L-functions, which now have several guises. It eventually became clear that the basic construction used for number-theoretic zeta functions can also be used in other settings, such as dynamics, geometry, and spectral theory, with remarkable results.

This volume grew out of the special session on dynamical, spectral, and arithmetic zeta functions held at the annual meeting of the American Mathematical Society in San Antonio, but also includes four articles that were invited to be part of the collection. The purpose of the meeting was to bring together leading researchers, to find links and analogies between their fields, and to explore new methods. The papers discuss dynamical systems, spectral geometry on hyperbolic manifolds, trace formulas in geometry and in arithmetic, as well as computational work on the Riemann zeta function.

Each article employs techniques of zeta functions. The book unifies the application of these techniques in spectral geometry, fractal geometry, and number theory. It is a comprehensive volume, offering up-to-date research. It should be useful to both graduate students and confirmed researchers.

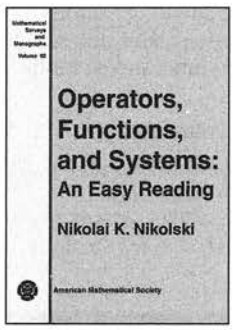
This item will also be of interest to those working in number theory and geometry and topology.

Contents: C.-H. Chang and **D. H. Mayer**, Eigenfunctions of the transfer operators and the period functions for modular groups; **C. Deninger** and **W. Singhof**, A note on dynamical trace formulas; **C. E. Fan** and **J. Jorgenson**, Small eigenvalues and Hausdorff dimension of sequences of hyperbolic three-manifolds; **A. Fel'shtyn**, Dynamical zeta functions and asymptotic expansions in Nielsen theory; **W. F. Galway**, Computing the Riemann zeta function by numerical quadrature; **S. Haran**, On Riemann's zeta function; **M. L. Lapidus** and **M. van Frankenhuysen**, A prime orbit theorem for self-similar flows and Diophantine approximation; **A. M. Odlyzko**, The 10^{22}-nd zero of the Riemann zeta function; **P. Perry**, Spectral theory, dynamics, and Selberg's zeta function for Kleinian groups; **C. Soulé**, On zeroes of automorphic L-functions; **H. M. Stark** and **A. A. Terras**, Artin L-functions of graph coverings.

Contemporary Mathematics, Volume 290

January 2002, approximately 195 pages, Softcover, ISBN 0-8218-2079-6, 2000 *Mathematics Subject Classification*: 11F67, 11Mxx, 11Y35, 11N05, 28A80, 30F40, 37Axx, 58J35, **Individual member $29**, List $49, Institutional member $39, Order code CONM/290N

Independent Study



Operators, Functions, and Systems: An Easy Reading

Volume 1: Hardy, Hankel, and Toeplitz

Nikolai K. Nikolski, *University of Bordeaux I, Talence, France, and Steklov Institute of Mathematics, St. Petersburg, Russia*

This unique book combines together four distinct topics of modern analysis and its applications:

A. Hardy classes of holomorphic functions
B. Spectral theory of Hankel and Toeplitz operators
C. Function models for linear operators and free interpolations, and
D. Infinite-dimensional system theory and signal processing

This volume, Volume I, contains Parts A and B; Volume II will contain Parts C and D.

Hardy classes of holomorphic functions: This topic is known to be the most powerful tool of complex analysis for a variety of applications, starting with Fourier series, through the Riemann ζ-function, all the way to Wiener's theory of signal processing.

Spectral theory of Hankel and Toeplitz operators: These now become the supporting pillars for a large part of harmonic and complex analysis and for many of their applications. In this book, moment problems, Nevanlinna-Pick and Carathéodory interpolation, and the best rational approximations are considered to illustrate the power of Hankel and Toeplitz operators.

Function models for linear operators and free interpolations: This is a universal topic and, indeed, is the most influential operator theory technique in the post-spectral-theorem era. In this book, its capacity is tested by solving generalized Carleson-type interpolation problems.

Infinite-dimensional system theory and signal processing: This topic is the touchstone of the three previously developed techniques. The presence of this applied topic in a pure mathematics environment reflects important changes in the mathematical landscape of the last 20 years, in that the role of the main consumer and customer of harmonic, complex, and operator analysis has more and more passed from differential equations, scattering theory, and probability, to control theory and signal processing.

The book is geared toward a wide audience of readers, from graduate students to professional mathematicians. It develops an elementary approach while retaining an expert level that can be applied in advanced analysis and selected applications.

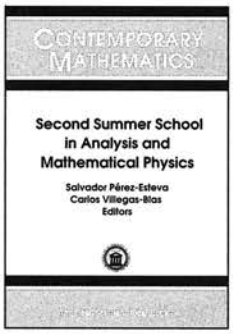
Contents: *An invitation to Hardy classes/Contents:* Invariant subspaces of $L^2(\mu)$; First applications; H^p classes. Canonical factorization; Szegö infimum, and generalized Phragmén-Lindelöf principle; Harmonc analysis in $L^2(\mathbb{T}, \mu)$; Transfer to the half-plane; Time-invariant filtering; Distance formulae and zeros of the Riemann ζ-function; *Hankel and Toeplitz operators/Contents:* Foreword; Hankel operators and their symbols; Compact Hankel operators; Applications to Nevanlinna-Pick interpolation; Essential spectrum. The first step: Elements of Toeplitz operators; Essential spectrum. The second step: The

Hilbert matrix and other Hankel operators; Hankel and Toeplitz operators associated with moment problems; Singular numbers of Hankel operators; Trace class Hankel operators; Inverse spectral problems, stochastic processes, and one-sided invertibility; Subject index; Author index; Symbol index; Bibliography.

Mathematical Surveys and Monographs, Volume 92

January 2002, approximately 480 pages, Hardcover, ISBN 0-8218-1083-9, LC 2001053556, 2000 *Mathematics Subject Classification*: 47-02, 30-02, 93-02, 30D55, 47B35, 47A45, 93B05, 93C05, **Individual member $59**, List $98, Institutional member $78, Order code SURV/92N

Supplementary Reading



Second Summer School in Analysis and Mathematical Physics

Topics in Analysis: Harmonic, Complex, Nonlinear and Quantization

Salvador Pérez-Esteva, *Universidad Nacional Autónoma de México, Cuernavaca, Morelos, México*, and **Carlos Villegas-Blas**, *Universidad Nacional Autónoma de México*, Editors

For the second time, a Summer School in Analysis and Mathematical Physics took place at the Universidad Nacional Autónoma de México in Cuernavaca. The purpose of the schools is to provide a bridge from standard graduate courses in mathematics to current research topics, particularly in analysis. The lectures are given by internationally recognized specialists in the fields. The topics covered in this Second Summer School include harmonic analysis, complex analysis, pseudodifferential operators, the mathematics of quantum chaos, and non-linear analysis.

This item will also be of interest to those working in mathematical physics.

This volume is a joint publication of the American Mathematical Society and the Sociedad Matemática Mexicana. Members of the SMM may order directly from the AMS at the AMS member price.

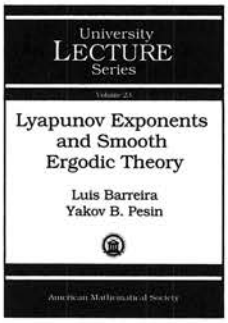
Contents: M. C. Pereyra, Lecture notes on dyadic harmonic analysis; **S. Hofmann**, A short course on the Kato problem; **N. L. Vasilevski**, Toeplitz operators on the Bergman spaces: Inside-the-domain effects; **Y. V. Egorov**, Pseudo-differential operators and quantization; **S. De Bièvre**, Quantum chaos: A brief first visit; **P. Padilla**, Variational methods in nonlinear analysis; **J. Jacobsen**, A globalization of the implicit function theorem with applications to nonlinear elliptic equations.

Contemporary Mathematics

December 2001, approximately 288 pages, Softcover, ISBN 0-8218-2708-1, LC 2001053624, 2000 *Mathematics Subject Classification*: 40-02, 30-02, 81-02, 42B25, 47F05, 30C40, 35S30, 81Q50, 35A15, 35J65, **Individual member $41**, List $69, Institutional member $55, Order code CONM-289N

Differential Equations

Supplementary Reading



Lyapunov Exponents and Smooth Ergodic Theory

Luis Barreira, *Instituto Superior Técnico, Lisbon, Portugal*, and **Yakov B. Pesin**, *Pennsylvania State University, University Park*

This book is a systematic introduction to smooth ergodic theory. The topics discussed include the general (abstract) theory of Lyapunov exponents and its applications to the stability theory of differential equations, stable manifold theory, absolute continuity, and the ergodic theory of dynamical systems with nonzero Lyapunov exponents (including geodesic flows).

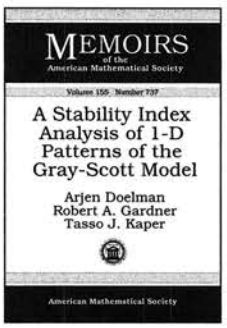
The authors consider several nontrivial examples of dynamical systems with nonzero Lyapunov exponents to illustrate some basic methods and ideas of the theory.

This book is self-contained. The reader needs a basic knowledge of real analysis, measure theory, differential equations, and topology. The authors present basic concepts of smooth ergodic theory and provide complete proofs of the main results. They also state some more advanced results to give readers a broader view of smooth ergodic theory. This volume may be used by those nonexperts who wish to become familiar with the field.

Contents: Introduction; Lyapunov stability theory of differential equations; Elements of nonuniform hyperbolic theory; Examples of nonuniformly hyperbolic systems; Local manifold theory; Ergodic properties of smooth hyperbolc measures; Bibliography; Index.

University Lecture Series, Volume 23

November 2001, 151 pages, Softcover, ISBN 0-8218-2921-1, LC 2001045882, 2000 *Mathematics Subject Classification*: 37D25, 37C40, **All AMS members $23**, List $29, Order code ULECT/23N



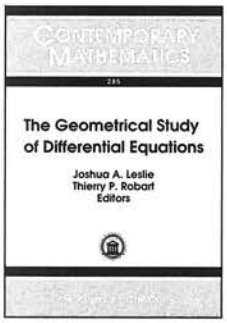
A Stability Index Analysis of 1-D Patterns of the Gray-Scott Model

Arjen Doelman, *University of Amsterdam, Netherlands*, **Robert A. Gardner**, *University of Massachusetts, Amherst, MA*, and **Tasso J. Kaper**, *Boston University*

Contents: Introduction; The Evans function and the stability index; Tracking the fast subbundle; The slow subbundle; Calculation of the stability index; Concluding remarks; Bibliography.

Memoirs of the American Mathematical Society, Volume 155, Number 737

January 2002, 64 pages, Softcover, ISBN 0-8218-2739-1, LC 2001045832, 2000 *Mathematics Subject Classification*: 35K57, 35B35, 35B25; 35B32, 34C37, 34E15, **Individual member $25**, List $42, Institutional member $34, Order code MEMO/155/737N



The Geometrical Study of Differential Equations

Joshua A. Leslie and **Thierry P. Robart**, *Howard University, Washington, DC*, Editors

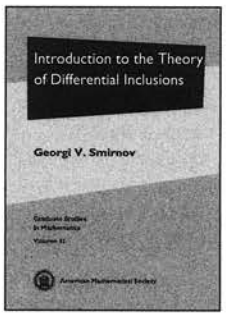
This volume contains papers based on some of the talks given at the NSF-CBMS conference on "The Geometrical Study of Differential Equations" held at Howard University (Washington, DC). The collected papers present important recent developments in this area, including the treatment of nontransversal group actions in the theory of group invariant solutions of PDEs, a method for obtaining discrete symmetries of differential equations, the establishment of a group-invariant version of the variational complex based on a general moving frame construction, the introduction of a new variational complex for the calculus of difference equations and an original structural investigation of Lie-Bäcklund transformations. The book opens with a modern and illuminating overview of Lie's line-sphere correspondence and concludes with several interesting open problems arising from symmetry analysis of PDEs. It offers a rich source of inspiration for new or established researchers in the field.

This book can serve nicely as a companion volume to a forthcoming book written by the principle speaker at the conference, Professor Niky Kamran, to be published in the AMS series, CBMS Regional Conference Series in Mathematics.

Contents: R. Milson, An overview of Lie's line-sphere correspondence; **V. Torrisi** and **M. C. Nucci**, Application of Lie group analysis to a mathematical model which describes HIV transmission; **R. Beals**, Geometry and PDE on the Heisenberg group: A case study; **G. Marí Beffa**, Invariant evolutions of curves and surfaces and completely integrable Hamiltonian systems; **B. A. Shipman**, On the fixed points of the Toda hierarchy; **I. M. Anderson**, **M. E. Fels**, and **C. G. Torre**, Group invariant solutions in mathematical physics and differential geometry; **P. E. Hydon**, Discrete symmetries of differential equations; **T. A. Ivey**, Integrable geometric evolution equations for curves; **J. A. Sanders** and **J. P. Wang**, On integrability of evolution equations and representation theory; **M. Oberguggenberger**, Symmetry groups, nonlinear partial differential equations, and generalized functions; **R. H. Heredero**, Lie symmetries of differential-difference equations; **E. L. Mansfield** and **P. E. Hydon**, On a variational complex for difference equations; **I. A. Kogan** and **P. J. Olver**, The invariant variational bicomplex; **E. G. Reyes**, On geometrically integrable equations and hierarchies of pseudo-spherical type; **I. A. Kogan**, Inductive construction of moving frames; **V. Itskov**, Orbit reduction of contact ideals and group-invariant variational problems; **T. Robart**, About the local and formal geometry of PDE; **P. A. Clarkson** and **E. L. Mansfield**, Open problems in symmetry analysis.

Contemporary Mathematics, Volume 285

December 2001, 205 pages, Softcover, ISBN 0-8218-2964-5, LC 2001045702, 2000 *Mathematics Subject Classification*: 17-XX, 20-XX, 22-XX, 34-XX, 35-XX, 39-XX, 51-XX, 53-XX, **Individual member $30**, List $50, Institutional member $40, Order code CONM/285N



Introduction to the Theory of Differential Inclusions

Georgi V. Smirnov, *University of Porto, Portugal*

A differential inclusion is a relation of the form $\dot{x} \in F(x)$, where F is a set-valued map associating any point $x \in R^n$ with a set $F(x) \subset R^n$. As such, the notion of a differential inclusion generalizes the notion of an ordinary differential equation of the form $\dot{x} = f(x)$. Therefore, all problems usually studied in the theory of ordinary differential equations (existence and continuation of solutions, dependence on initial conditions and parameters, etc.) can be studied for differential inclusions as well. Since a differential inclusion usually has many solutions starting at a given point, new types of problems arise, such as investigation of topological properties of the set of solutions, selection of solutions with given properties, and many others.

Differential inclusions play an important role as a tool in the study of various dynamical processes described by equations with a discontinuous or multivalued right-hand side, occurring, in particular, in the study of dynamics of economical, social, and biological macrosystems. They also are very useful in proving existence theorems in control theory.

This text provides an introductory treatment to the theory of differential inclusions. The reader is only required to know ordinary differential equations, theory of functions, and functional analysis on the elementary level.

Chapter 1 contains a brief introduction to convex analysis. Chapter 2 considers set-valued maps. Chapter 3 is devoted to the Mordukhovich version of nonsmooth analysis. Chapter 4 contains the main existence theorems and gives an idea of the approximation techniques used throughout the text. Chapter 5 is devoted to the viability problem, i.e., the problem of selection of a solution to a differential inclusion that is contained in a given set. Chapter 6 considers the controllability problem. Chapter 7 discusses extremal problems for differential inclusions. Chapter 8 presents stability theory, and Chapter 9 deals with the stabilization problem.

This item will also be of interest to those working in applications.

Contents: *Foundations:* Convex analysis; Set-valued analysis; Nonsmooth analysis; *Differential inclusions:* Existence theorems; Viability and invariance; Controllability; Optimality; Stability; Stabilization; Comments; Bibliography; Index.

Graduate Studies in Mathematics, Volume 41N

December 2001, 226 pages, Hardcover, ISBN 0-8218-2977-7, LC 2001053414, 2000 *Mathematics Subject Classification*: 34A60, 34D20, 49K24; 49J24, 49J52, 93D15, **All AMS members $27**, List $34, Order code GSM/41N

General and Interdisciplinary

Assistantships and Graduate Fellowships 2001

Review of a previous edition:

This directory is a tool for undergraduate mathematics majors seeking information about graduate programs in mathematics. Although most of the information can be gleaned from the Internet, the usefulness of this directory for the prospective graduate student is the consistent format for comparing different mathematics graduate programs without the hype. Published annually, the information is up-to-date, which is more than can be said of some Websites. Support for graduate students in mathematics is a high priority of the American Mathematical Society, which also provides information for fellowships and grants they offer as well as support from other societies and foundations. The book is highly recommended for academic and public libraries.

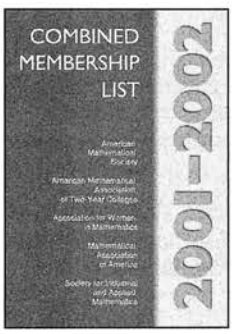
—American Reference Books Annual

This publication is an indispensable source of information for students seeking support for graduate study in the mathematical sciences. Providing data from a broad range of academic institutions, it is also a valuable resource for mathematical sciences departments and faculty.

Assistantships and Graduate Fellowships brings together a wealth of information about resources available for graduate study in mathematical sciences departments in the U.S. and Canada. Information on the number of faculty, graduate students, and degrees awarded (bachelor's, master's, and doctoral) is listed for each department when available. Stipend amounts and the number of awards available are given, as well as information about foreign language requirements. Numerous display advertisements from mathematical sciences departments throughout the country provide additional information.

Also listed are sources of support for graduate study and travel, summer internships, and graduate study in the U.S. for foreign nationals. Finally, a list of reference publications for fellowship information makes *Assistantships and Graduate Fellowships* a centralized and comprehensive resource.

November 2001, approximately 144 pages, Softcover, ISBN 0-8218-2881-9, 2000 *Mathematics Subject Classification*: 00-XX, **Individual member $12**, List $21, Order code ASST/2001N



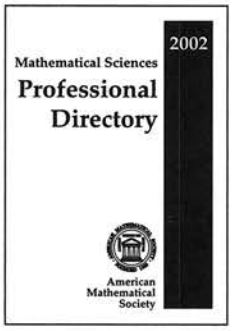
Combined Membership List 2001-2002

The *Combined Membership List* (CML) is a comprehensive directory of the membership of the American Mathematical Society, the American Mathematical Association of Two-Year Colleges, the Association for Women in Mathematics, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

The CML is a complete alphabetical list of all individual members in all five organizations. For each member, the CML provides his or her address, title, department, institution, telephone number (if available), and electronic address (if indicated), and also indicates membership in the five participating societies.

The CML is distributed on request to AMS members in even-numbered years. MAA members can request the CML in odd-numbered years from the MAA. The CML is an invaluable reference for keeping in touch with colleagues and for making connections in the mathematical sciences community in the United States and abroad.

January 2002, approximately 304 pages, Softcover, ISBN 0-8218-2882-7, 2000 *Mathematics Subject Classification*: 00-XX, **Individual member $41**, List $68, Institutional member $54, Order code CML/2001/2002N

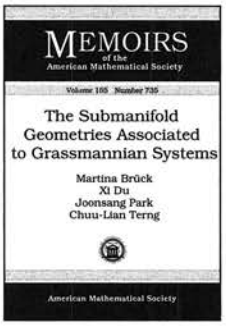


Mathematical Sciences Professional Directory, 2002

This annual directory provides a handy reference to various organizations in the mathematical sciences community. Listed in the directory are the following: officers and committee members of over thirty professional mathematical organizations (terms of office and other pertinent information are also provided in some cases); key mathematical sciences personnel of selected government agencies; academic departments in the mathematical sciences; mathematical units in nonacademic organizations; and alphabetic listings of colleges and universities. Current addresses, telephone numbers, and electronic addresses for individuals when provided are listed in the directory.

March 2002, approximately 240 pages, Softcover, ISBN 0-8218-2883-5, 2000 *Mathematics Subject Classification*: 00-XX, List $53, Institutional member $42, Order code PRODIR/2002N

Geometry and Topology



The Submanifold Geometries Associated to Grassmannian Systems

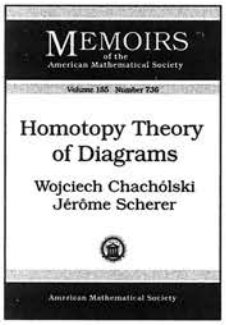
Martina Brück and **Xi Du**, **Joonsang Park**, *Dongguk University, Seoul, Korea*, and **Chuu-Lian Terng**, *Northeastern University, Boston*

Contents: Introduction; The U/K-system; $G_{m,n}$-systems; $G^1_{m,n}$-systems; Moving frame method for submanifolds; Submanifolds associated to $G_{m,n}$-systems; Submanifolds asso-

ciated to $G^1_{m,n}$-systems; $G^1_{m,1}$-systems and isothermic surfaces; Loop group action for $G_{m,n}$-systems; Ribaucour transformations for $G_{m,n}$-systems; Loop group action for $G^1_{m,n}$-systems; Ribaucour transformations for $G^1_{m,n}$-systems; Darboux transformations for $G^1_{m,1}$-systems; Bäcklund transformations and loop group factorizations; Permutability formula for ribaucour transformations; The U/K-hierarchy and finite type solutions; Pictures; Bibliography.

Memoirs of the American Mathematical Society, Volume 155, Number 735

January 2002, 95 pages, Softcover, ISBN 0-8218-2753-7, LC 2001045782; 2000 *Mathematics Subject Classification*: 53-XX, 35-XX, **Individual member $29**, List $48, Institutional member $38, Order code MEMO/155/735N



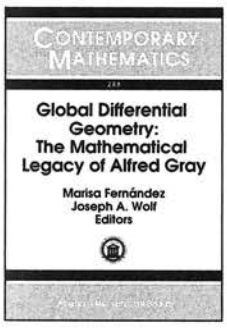
Homotopy Theory of Diagrams

Wojciech Chachólski, *Yale University, New Haven*, and **Jérôme Scherer**, *Université de Lausanne, Switzerland*

Contents: Introduction; Model approximations and bounded diagrams; Homotopy theory of diagrams; Properties of homotopy colimits; Appendix A. Left Kan extensions preserve boundedness; Appendix B. Categorical preliminaries; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 155, Number 736

February 2002, 90 pages, Softcover, ISBN 0-8218-2759-6, LC 2001045783, 2000 *Mathematics Subject Classification*: 55U35, 18G55; 18G10, 18F05, 55U30, 55P65, **Individual member $29**, List $48, Institutional member $38, Order code MEMO/155/736NN



Global Differential Geometry: The Mathematical Legacy of Alfred Gray

Marisa Fernández, *University of the Basque Country, Bilbao, Spain*, and **Joseph A. Wolf**, *University of California at Berkeley*, Editors

Alfred Gray's work covered a great part of differential geometry. In September 2000, a remarkable International Congress on Differential Geometry was held in his memory in Bilbao, Spain. Mathematicians from all over the world, representing 24 countries, attended the event.

This volume includes major contributions by well known mathematicians (T. Banchoff, S. Donaldson, H. Ferguson, M. Gromov, N. Hitchin, A. Huckleberry, O. Kowalski, V. Miquel, E. Musso, A. Ros, S. Salamon, L. Vanhecke, P. Wellin and J.A. Wolf), the interesting discussion from the round table moderated by J.-P. Bourguignon, and a carefully selected and refereed selection of the Short Communications presented at the Congress.

This book represents the state of the art in modern differential geometry, with some general expositions of some of the more active areas: special Riemannian manifolds, Lie groups and homogeneous spaces, complex structures, symplectic manifolds, geometry of geodesic spheres and tubes and related problems, geometry of surfaces, and computer graphics in differential geometry.

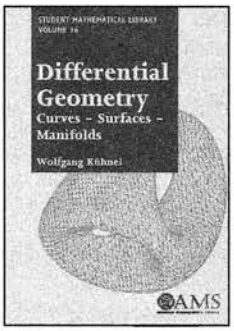
Contents: I. K. Babenko and **I. A. Taimanov**, On the formality problem for symplectic manifolds; **T. F. Banchoff**, Osculating tubes and self-linking for curves on the three-sphere; **E. Boeckx** and **L. Vanhecke**, Isoparametric functions and harmonic and minimal unit vector fields; **S. K. Donaldson**, The Seiberg-Witten equations and almost-Hermitian geometry; **H. Ferguson**, Sculpture inspired by work with Alfred Gray: Kepler elliptic curves and minimal surface sculptures of the planets; **M. Gromov**, Mesoscopic curvature and hyperbolicity; **N. Hitchin**, Stable forms and special metrics; **A. Huckleberry** and **M. Völler**, A CR-momentum Ansatz for nilpotent groups; **O. Kowalski**, **M. Sekizawa**, and **Z. Vlášek**, Can tangent sphere bundles over Riemannian manifolds have strictly positive sectional curvature?; **V. Miquel**, Volumes of geodesic balls and spheres associated to a metric connection with torsion; **E. Musso** and **L. Nicolodi**, Special isothermic surfaces and solitons; **A. Ros**, The isoperimetric and Willmore problems; **S. Salamon**, Almost parallel structures; **P. Wellin**, Technical computing with *Mathematica*; **J. A. Wolf**, Complex geometry and representations of Lie groups; **J. A. Aledo** and **J. A. Pastor**, On the volume of compact spacelike hypersurfaces with hyperbolic boundary in Minkowski space; **L. J. Alías** and **B. Palmer**, Stability of zero mean curvature surfaces in flat Lorentzian 4-manifolds; **L. Álvarez-Cónsul** and **O. García-Prada**, Hitchin-Kobayashi correspondence for equivariant bundles on $X \times \mathbb{P}^1$; **J. Arroyo** and **O. J. Garay**, Hopf vesicles in $\mathbf{S}^3(1)$; **V. V. Balashchenko**, Invariant nearly Kähler f-structures on homogeneous spaces; **N. Bokan**, **M. Djorić**, and **U. Simon**, An extension of A. Gray's investigations on small geodesic balls; **V. Borrelli**, **F. Brito**, and **O. Gil-Medrano**, An energy minimizing family of unit vector fields on odd-dimensional spheres; **L. Bruna** and **J. Girbau**, Is it admissible to linearize the Einstein equation in the presence of matter?; **J. Bureš**, Solutions of some conformally invariant equations of the first order; **R. Caddeo**, **S. Montaldo**, and **P. Piu**, On biharmonic maps; **M. A. Cañadas-Pinedo** and **C. Ruiz**, Characterizations of Pfaffian systems. Consequences in dimension five; **J. T. Cho**, On a new class of contact Riemannian manifolds; **N. Cohen**, **C. J. C. Negreiros**, and **L. A. B. San Martin**, Description of (1,2)-symplectic metrics on flag manifolds; **G. Dloussky**, Complex surfaces with Betti numbers $b_1 = 1$, $b_2 > 0$ and finite quotients; **I. G. Dotti** and **A. Fino**, Hypercomplex nilpotent Lie groups; **M. J. Druetta**, $\mathfrak{C}$-spaces of Iwasawa type and Damek-Ricci spaces; **M. E. E. L. Galvão** and **C. Góes**, Deformations of constant mean curvature surfaces in half space models; **P. Gilkey** and **R. Ivanova**, The geometry of the skew-symmetric curvature operator in the complex setting; **H. Gollek**, Representing minimal curves in $\mathbb{C}^3$ by differential operators; **L. Guijarro**, Isometric immersions without positive Ricci curvature; **J. Janyška**, Natural Poisson and Jacobi structures on the tangent bundle of a pseudo-Riemannian manifold; **H. Jiménez** and **S. López de Medrano**, On Alfred Gray's elliptical catenoid; **J. Koiller**, **P. R. Rodrigues**, and **P. Pitanga**, Sub-riemannian geometry and non-holonomic mechanics; **M. Kureš**, Weil algebras of generalized higher order velocities bundles; **J. Lauret**, The variety of Lie algebras from certain Riemannian viewpoint; **R. López**, How to use Mathematica^{TM} to find cyclic surfaces of constant curvature in Lorentz-Minkowski space; **E. Loubeau**, The Fuglede-Ishihara and Baird-Eells theorems for $p > 1$; **D. V. Millionschikov**, Cohomology of nilmanifolds and

Gontcharova's theorem; **V. Muñoz, F. Presas,** and **I. Sols,** Asymptotically holomorphic embeddings of contact manifolds in projective spaces; **H. Omori, Y. Maeda, N. Miyazaki,** and **A. Yoshioka,** Convergent star products on Fréchet linear Poisson algebras of Heisenberg type; **A. Onischenko, D. Repovš**, and **A. Skopenkov,** Resolutions of 2-polyhedra by fake surfaces and embedings into $\mathbb{R}^4$; **L. Ornea** and **P. Piccinni,** Cayley 4-frames and a quaternion Kähler reduction related to Spin(7); **M. Parton,** Old and new structures on products of spheres; **L. Del Riego,** 1-homogeneous sprays in Finsler manifolds; **J. I. R. Prieto,** The Gysin sequence for riemannian flows; **T. Rybicki,** On contact groupoids and Legendre bisections; **M. Salvai,** Affine maximal tori intersecting a fixed one; **A. Savo,** On the asymptotic series of the heat content; **Y. Tazawa,** Visualization of flat slant surfaces in $\mathbb{C}^2$; **A. Tralle,** On solvable Lie groups without lattices; **J.-P. Bourguignon, E. Calabi, J. Eells, O. Garcia-Prada,** and **M. Gromov,** Where does geometry go? A research and education perspective.

Contemporary Mathematics, Volume 288

January 2002, approximately 474 pages, Softcover, ISBN 0-8218-2750-2, LC 2001053300, 2000 *Mathematics Subject Classification*: 22E15, 53A10, 53A30, 53B35, 53C15, 53C20, 53C23, 53C25, 53C55, 53D05, **Individual member $71**, List $118, Institutional member $94, Order code CONM/288

Recommended Text



Differential Geometry

Curves - Surfaces - Manifolds

Wolfgang Kühnel, *University of Stuttgart, Germany*

From a review for the German Edition:

The book covers all the topics which could be necessary later for learning higher level differential geometry. The material is very carefully sorted and easy to read.

—Mathematical Reviews

Our first knowledge of differential geometry usually comes from the study of the curves and surfaces in $\mathbf{R}^3$ that arise in calculus. Here we learn about line and surface integrals, divergence and curl, and the various forms of Stokes' Theorem. If we are fortunate, we may encounter curvature and such things as the Serret-Frenet formulas.

With just the basic tools from multi-variable calculus, plus a little knowledge of linear algebra, it is possible to begin a much richer and rewarding study of differential geometry, which is what is presented in this book. It starts with an introduction to the classical differential geometry of curves and surfaces in Euclidean space, then leads to an introduction to the Riemannian geometry of more general manifolds, including a look at Einstein spaces. An important bridge from the low-dimensional theory to the general case is provided by a chapter on the intrinsic geometry of surfaces.

The first half of the book, covering the geometry of curves and surfaces, would be suitable for a one-semester undergraduate course. The local and global theories of curves and surfaces are presented, including detailed discussions of surfaces of rotation, ruled surfaces and minimal surfaces.

The second half of the book, which could be used for a more advanced course, begins with an introduction to differentiable manifolds, Riemannian structures and the curvature tensor. Two special topics are treated in detail: spaces of constant curvature and Einstein spaces.

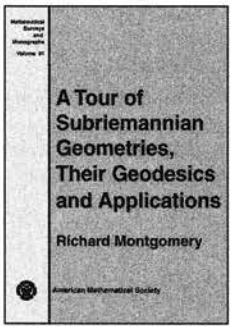
The main goal of the book is to get started in a fairly elementary way, then to guide the reader toward more sophisticated concepts and more advanced topics. There are many examples and exercises to help along the way. Numerous figures help the reader visualize key concepts and examples, especially in lower dimensions.

Contents: Notations and prerequisites from analysis; Curves in $\mathbb{R}^n$; The local theory of surfaces; The intrinsic geometry of surfaces; Riemannian manifolds; The curvature tensor; Spaces of constant curvature; Einstein spaces; Bibliography; Index.

Student Mathematical Library

December 2001, approximately 376 pages, Softcover, ISBN 0-8218-2656-5, LC 2001045888, 2000 *Mathematics Subject Classification*: 53-01, **All AMS members $39**, List $49, Order code STML-KUEHNELN

Independent Study



A Tour of Subriemannian Geometries, Their Geodesics and Applications

Richard Montgomery, *University of California, Santa Cruz*

Subriemannian geometries, also known as Carnot-Caratheodory geometries, can be viewed as limits of Riemannian geometries. They also arise in physical phenomenon involving "geometric phases" or holonomy. Very roughly speaking, a subriemannian geometry consists of a manifold endowed with a distribution (meaning a k-plane field, or subbundle of the tangent bundle), called *horizontal* together with an inner product on that distribution. If $k = n$, the dimension of the manifold, we get the usual Riemannian geometry. Given a subriemannian geometry, we can define the distance between two points just as in the Riemannin case, except we are only allowed to travel along the horizontal lines between two points.

The book is devoted to the study of subriemannian geometries, their geodesics, and their applications. It starts with the simplest nontrivial example of a subriemannian geometry: the two-dimensional isoperimetric problem reformulated as a problem of finding subriemannian geodesics. Among topics discussed in other chapters of the first part of the book we mention an elementary exposition of Gromov's surprising idea to use subriemannian geometry for proving a theorem in discrete group theory and Cartan's method of equivalence applied to the problem of understanding invariants (diffeomorphism types) of distributions. There is also a chapter devoted to open problems.

The second part of the book is devoted to applications of subriemannian geometry. In particular, the author describes in detail the following four physical problems: Berry's phase in quantum mechanics, the problem of a falling cat righting herself, that of a microorganism swimming, and a phase

problem arising in the N-body problem. He shows that all these problems can be studied using the same underlying type of subriemannian geometry: that of a principal bundle endowed with G-invariant metrics.

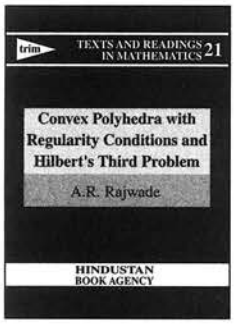
Reading the book requires introductory knowledge of differential geometry, and it can serve as a good introduction to this new exciting area of mathematics.

Contents: *Geodesics in subriemannian manifolds:* Dido meets Heisenberg; Chow's theorem: Getting from A to B; A remarkable horizontal curve; Curvature and nilpotentization; Singular curves and geodesics; A zoo of distributions; Cartan's approach; The tangent cone and Carnot groups; Discrete groups tending to Carnot geometries; Open problems; *Mechanics and geometry of bundles:* Metrics on bundles; Classical particles in Yang-Mills fields; Quantum phases; Falling, swimming, and orbiting; *Appendices:* Geometric mechanics; Bundles and the Hopf fibration; The Sussmann and Ambrose-Singer theorems; Calculus of the endpoint map and existence of geodesics; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 91

December 2001, 259 pages, Hardcover, ISBN 0-8218-1391-9, LC 2001053538, 2000 *Mathematics Subject Classification*: 58E10, 53C17, 53C23, 49Q20, 58A30, 53C22, 58A15, 58D15, 58E30, **Individual member $41**, List $69, Institutional member $55, Order code SURV/91N

Supplementary Reading



Convex Polyhedra with Regularity Conditions and Hilbert's Third Problem

A. R. Rajwade, *Panjab University, Chandigarh, India*

A publication of the Hindustan Book Agency.

Since antiquity, people knew that there are only five regular solids, i.e. polyhedra whose all faces are regular polygons and all solid angles are also regular. These solids are, of course, the tetrahedron, the octahedron, the cube, the icosahedron, and the dodecahedron. Later, much attention was drawn to the question of how to describe polyhedra with other types of regularity conditions. The author puts together many facts known in this direction. He formulates four regularity conditions (two for faces and two for solid angles) and for any combination of their conditions lists all the corresponding polyhedra. In this way, he obtains such very interesting classes of solids as 13 semiregular solids, or 8 deltahedra, or 92 regularly faces polyhedra, etc. In later chapters the author presents some related topics of geometry of solids, like star polyhedra and plane tessellations. In the concluding chapter, a complete solution of the Hilbert 3rd problem is given.

Supplied with many figures, the book can be easily read by anyone interested in this beautiful classical geometry.

This item will also be of interest to those working in general and interdisciplinary areas.

Distributed worldwide except in India by the American Mathematical Society.

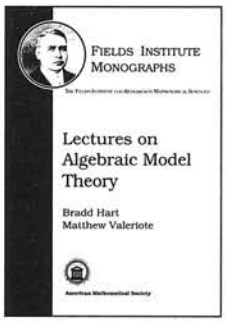
Contents: Introduction; Definitions and notations; Theorems of Euler and Descartes; The regularity restrictions and the five bodies of Plato; Metrical properties of the five Platonic polyhedra; The fourteen bodies of Archimedes; Another method of enumerating the semi-regular polyhedra; The eight Deltahedra; Finiteness of the number of convex regular faced polyhedra (RFP) and the remaining cases of regularity restrictions; Star polyhedra and plane tessellations; A theorem of Johnson and Grunbaum; Description of the ninety-two RFP and their derivation from the simple ones; Hilbert's third problem; Bibliography; Index.

Number 8

August 2001, 120 pages, Hardcover, ISBN 81-85931-28-3, 2000 *Mathematics Subject Classification*: 13-XX, 14-XX, **All AMS members $26**, List $32, Order code HIN/8N

Logic and Foundations

Lectures on Algebraic Model Theory



Bradd Hart and **Matthew Valeriote,** *McMaster University, Hamilton, ON, Canada,* Editors

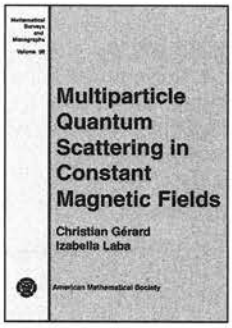
In recent years, model theory has had remarkable success in solving important problems as well as in shedding new light on our understanding of them. The three lectures collected here present recent developments in three such areas: Anand Pillay on differential fields, Patrick Speissegger on o-minimality and Matthias Clasen and Matthew Valeriote on tame congruence theory.

Contents: *Differential fields:* Differential fields; *Lectures on o-minimality:* Lectures on o-minimality; *Tame congruence theory:* The structure of finite algebras; Varieties; Bibliography.

Fields Institute Monographs, Volume 15

December 2001, 111 pages, Hardcover, ISBN 0-8218-2705-7, LC 2001053718, 2000 *Mathematics Subject Classification*: 03C64; 12L12, 03C05, **Individual member $18**, List $30, Institutional member $24, Order code FIM/15N

Mathematical Physics



Multiparticle Quantum Scattering in Constant Magnetic Fields

Christian Gérard, *Ecole Polytechnique, Paris, France,* and **Izabella Łaba,** *University of British Columbia, Vancouver, BC, Canada*

This monograph offers a rigorous mathematical treatment of the scattering theory of quantum N-particle systems in an external constant magnetic field. In particular, it addresses the question of *asymptotic completeness*, a classification of all possible trajec-

tories of such systems according to their asymptotic behaviour. The book adopts the so-called time-dependent approach to scattering theory, which relies on a direct study of the Schrödinger unitary group for large times. The modern methods of spectral and scattering theory introduced in the 1980's and 1990's, including the Mourre theory of positive commutators, propagation estimates, and geometrical techniques, are presented and heavily used. Additionally, new methods were developed by the authors in order to deal with the (much less understood) phenomena due to the presence of the magnetic field.

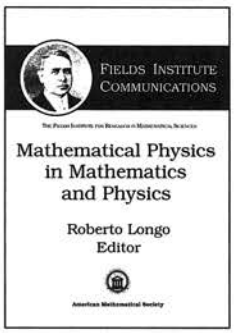
The book is a good starting point for graduate students and researchers in mathematical physics who wish to move into this area of research. It includes expository material, research work previously available only in the form of journal articles, as well as some new unpublished results. The treatment of the subject is comprehensive and largely self-contained, and the text is carefully written with attention to detail.

This item will also be of interest to those working in differential equations.

Contents: Fundamentals; Geometrical methods I; The Mourre theory; Basic propagation estimates; Geometrical methods II; Wave operators and scattering theory; Open problems; Appendix; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 90

January 2002, 242 pages, Hardcover, ISBN 0-8218-2919-X, LC 2001053521, 2000 *Mathematics Subject Classification*: 35P25, 35Q40, 34L25, 47A40, 81U10, **Individual member $38**, List $64, Institutional member $51, Order code SURV/90N



Mathematical Physics in Mathematics and Physics

Quantum and Operator Algebraic Aspects

Roberto Longo, *University of Rome II, Italy*, Editor

The beauty and the mystery surrounding the interplay between mathematics and physics is captured by E. Wigner's famous expression, "The unreasonable effectiveness of mathematics". We don't know why, but physical laws are described by mathematics and good mathematics sooner or later finds applications in physics, often in a surprising way.

In this sense, mathematical physics is a very old subject—as Egyptian, Phoenician, or Greek history tells us. But mathematical physics is a very modern subject as any working mathematician or physicist can witness. It is a challenging discipline that has to provide results of interest for both mathematics and physics. Ideas and motivations from both these sciences give it a vitality and freshness that is difficult to find anywhere else.

One of the big physical revolutions in the twenty-first century, quantum physics, opened a new magnificent era for this interplay. With the appearance of noncommutative analysis, the role of classical calculus has been taken by commutation relations, a subject still growing in an astonishing way.

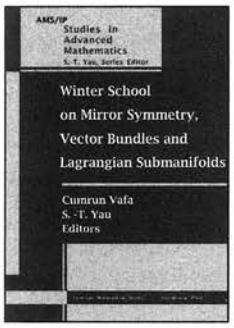
A good example where mathematical physics showed its power, beauty, and interdisciplinary character is the Doplicher-Haag-Roberts analysis of superselection sectors in the late 1960s. Not only did this theory explain the origin of statistics and classify it, but year after year, new connections have merged, for example with Tomita-Takesaki modular theory, Jones theory of subfactors, and Doplicher-Roberts abstract duality for compact groups.

This volume contains the proceedings of the conference, "Mathematical Physics in Mathematics and Physics", dedicated to Sergio Doplicher and John E. Roberts held in Siena (Tuscany, Italy). The articles offer current research in various fields of mathematical physics, primarily concerning quantum aspects of operator algebras.

Contents: H. Baumgärtel and **F. Lledó**, An application of the DR-duality theory for compact groups to endomorphism categories of C*-algebras with nontrivial center; **J. Böckenhauer** and **D. E. Evans**, Modular invariants and subfactors; **H. J. Borchers** and **J. Yngvason**, On the PCT-theorem in the theory of local observables; **D. Buchholz**, **J. Mund**, and **S. J. Summers**, Transplantation of local nets and geometric modular action on Robertson-Walker space-times; **S. Carpi** and **R. Conti**, Classification of subsystems, local symmetry generators and intrinsic definition of local observables; **A. Connes** and **D. Kreimer**, From local perturbation theory to Hopf- and Lie-algebras of Feynman graphs; **C. D'Antoni** and **L. Zsidó**, The flat tube theorem for vector valued functions; **G. Dell'Antonio**, Point interactions; **M. Dütsch** and **K. Fredenhagen**, Perturbative algebraic field theory, and deformation quantization; **F. Guerra**, Sum rules for the free energy in the mean field spin glass model; **D. Guido** and **T. Isola**, Fractals in noncommutative geometry; **R. Haag**, What I would like to understand; **M. Izumi**, The Rohlin property for automorphisms of C^*-algebras; **G. Jona-Lasinio**, **C. Presilla**, and **C. Toninelli**, Environment induced localization and superselection rules in a gas of pyramidal molecules; **D. Kastler**, Connes-Moscovici-Kreimer Hopf algebras; **Y. Katayama** and **M. Takesaki**, The structure of the automorhpism group of an approximately finite dimensional factor; **Y. Kawahigashi**, Braiding and extensions of endomorphisms of subfactors; **N. P. Landsman**, Bicategories of operator algebras and Poisson manifolds; **R. Longo**, Notes for a quantum index theorem—introduction; **M. Müger**, Conformal field theory and Doplicher-Roberts reconstruction; **S. Popa**, On the distance between MASA's in type II_1 factors; **R. T. Powers**, Recent results concerning E_o-semigroups of $\mathfrak{B}(\mathfrak{H})$; **K.-H. Rehren**, Locality and modular invariance in 2D conformal QFT; **S. Sakai**, Tensor products of Banach spaces and the Stone-Weierstrass problem of C^*-algebras; **R. Schrader**, Perron-Frobenius theory for positive maps on trace ideals; **B. Schroer**, Space- and time-like superselection rules in conformal quantum field theory; **K. Szlachányi**, Finite quantum groupoids and inclusions of finite type; **R. Verch**, On generalizations of the spectrum condition; **F. Xu**, Algebraic orbifold conformal field theories; List of participants.

Fields Institute Communications, Volume 30

December 2001, 451 pages, Hardcover, ISBN 0-8218-2814-2, LC 2001045989, 2000 *Mathematics Subject Classification*: 81-06, 46-06; 81T05, 47L90, **Individual member $71**, List $119, Institutional member $95, Order code FIC/30N



Winter School on Mirror Symmetry, Vector Bundles and Lagrangian Submanifolds

Cumrun Vafa and **S.-T. Yau**, *Harvard University, Cambridge, MA*, Editors

The collection of articles in this volume are based on lectures presented during the Winter School on Mirror Symmetry held at Harvard University. There are many new directions suggested by mirror symmetry which could potentially have very rich connections in physics and mathematics.

This book brings together the latest research in a major area of mathematical physics, including the recent progress in mirror manifolds and Lagrangian submanifolds. In particular, several articles describing homological approach and related topics are included.

Other AMS titles edited by S.-T Yau published in the AMS/IP Studies in Advanced Mathematics series include, *Mirror Symmetry III*, Volume 10, *Mirror symmetry II*, Volume 1, and *Mirror Symmetry I*, Volume 9.

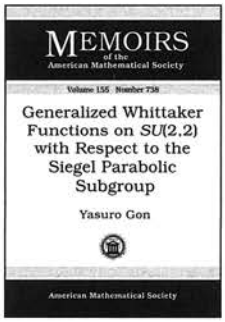
This item will also be of interest to those working in algebra and algebraic geometry.

Contents: B. S. Acharya, Exceptional mirror symmetry; **K. Fukaya**, Floer homology and mirror symmetry I; **R. Gopakumar** and **C. Vafa**, On the gauge theory/geometry correspondence; **M. Gross**, Special Lagrangian fibrations I: Topology; **M. Gross**, Special Lagrangian fibrations II: Geometry. A survey of techniques in the study of special Lagrangian fibrations; **N. Hitchin**, Lectures on special Lagrangian submanifolds; **A. Klemm** and **E. Zaslow**, Local mirror symmetry at higher genus; **N. C. Leung**, **S.-T. Yau**, and **E. Zaslow**, From special Lagrangian to Hermitian-Yang-Mills via Fourier-Mukai transform; **P. Berglund** and **P. Mayr**, $N = 1$ heterotic string vacua from mirror symmetry; **A. Polishchuk**, Homological mirror symmetry with higher products; **D. Arinkin** and **A. Polishchuk**, Fukaya category and Fourier transform; **A. Polishchuk** and **E. Zaslow**, Categorical mirror symmetry in the eliptic curve; **W.-D. Ruan**, Lagrangian torus fibration of quintic hypersurfaces I: Fermat quintic case; **A. Strominger**, **S.-T. Yau**, and **E. Zaslow**, Mirror symmetry is T-duality; **R. P. Thomas**, Derived categories for the working mathematician; **R. P. Thomas**, Mirror symmetry and actions of braid groups on derived categories.

AMS/IP Studies in Advanced Mathematics

December 2001, approximately 377 pages, Softcover, ISBN 0-8218-2159-8, LC 2001045675, 2000 *Mathematics Subject Classification*: 14-06, 32-06, 81-06, 53D12, 14F05, 14J32, **All AMS members $34**, List $42, Order code AMSIP/23N

Number Theory



Generalized Whittaker Functions on $SU(2,2)$ with Respect to the Siegel Parabolic Subgroup

Yasuro Gon, *Saitama University, Japan*

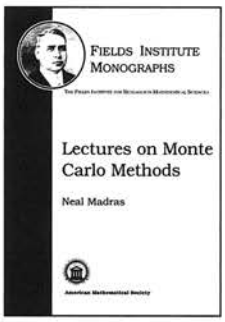
Contents: Introduction; Generalized Whittaker functions and representation theory of $SU(2,2)$; Generalized Whittaker functions for P_J principal series representations; Generalized Whittaker functions for the discrete series representations; Bibliography.

Memoirs of the American Mathematical Society, Volume 155, Number 738

January 2002, 116 pages, Softcover, ISBN 0-8218-2763-4, LC 2001045784, 2000 *Mathematics Subject Classification*: 11F70; 22E45, **Individual member $29**, List $49, Institutional member $39, Order code MEMO/155/738N

Probability

Recommended Text



Lectures on Monte Carlo Methods

Neal Madras, *York University, Toronto, ON, Canada*

Monte Carlo methods form an experimental branch of mathematics that employs simulations driven by random number generators. These methods are often used when others fail, since they are much less sensitive to the "curse of dimensionality", which plagues deterministic methods in problems with a large number of variables. Monte Carlo methods are used in many fields: mathematics, statistics, physics, chemistry, finance, computer science, and biology, for instance.

This book is an introduction to Monte Carlo methods for anyone who would like to use these methods to study various kinds of mathematical models that arise in diverse areas of application. The book is based on lectures in a graduate course given by the author. It examines theoretical properties of Monte Carlo methods as well as practical issues concerning their computer implementation and statistical analysis. The only formal prerequisite is an undergraduate course in probability.

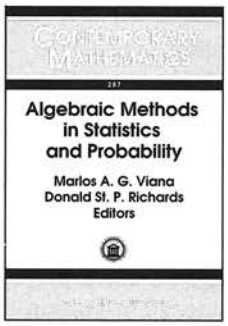
The book is intended to be accessible to students from a wide range of scientific backgrounds. Rather than being a detailed treatise, it covers the key topics of Monte Carlo methods to the depth necessary for a researcher to design, implement, and analyze a full Monte Carlo study of a mathematical or scientific problem. The ideas are illustrated with diverse running examples. There are exercises sprinkled throughout the text. The topics covered include computer generation of random variables, techniques and examples for variance reduction of

Monte Carlo estimates, Markov chain Monte Carlo, and statistical analysis of Monte Carlo output.

Contents: Introduction; Generating random numbers; Variance reduction techniques; Markov chain Monte Carlo; Statistical analysis of simulation output; The Ising model and related examples; Bibliography.

Fields Institute Monographs, Volume 16

January 2002, 103 pages, Hardcover, ISBN 0-8218-2978-5, LC 2001053551, 2000 *Mathematics Subject Classification*: 65C05, 60-01; 60J10, 65C10, 82B80, **All AMS members $24**, List $30, Order code FIM/16N



Algebraic Methods in Statistics and Probability

Marlos A. G. Viana, *University of Illinois at Chicago*, and **Donald St. P. Richards**, *University of Virginia, Charlottesville*, Editors

Algebraic methods and arguments in statistics and probability are well known, from Gauss's least squares principle through Fisher's method of variance decomposition. The relevance of group-theoretic arguments, for example, became evident in the 1980s. Such techniques continue to be of interest today, along with other developments, such as the use of graph theory in modelling complex stochastic systems.

This volume is based on lectures presented at the AMS Special Session on Algebraic Methods and Statistics held at the University of Notre Dame (Indiana) and on contributed articles solicited for this volume. The articles are intended to foster communication between representatives of the diverse scientific areas in which these functions are utilized and to further the trend of utilizing algebraic methods in the areas of statistics and probability.

This is one of few volumes devoted to the subject of algebraic methods in statistics and probability. The wide range of topics covered in this volume demonstrates the vigorous level of research and opportunities ongoing in these areas.

Contents: **J. Aitchison**, Simplicial inference; **J.-F. Burnol**, A note on Nyman's equivalent formulation of the Riemann hypothesis; **D. Collombier** and **A. Jourdan**, On the construction of linear orthogonal arrays by extension; **A. Di Bucchianico** and **D. E. Loeb**, A coordinate-free approach to multivariate exponential families; **M. L. Eaton** and **W. D. Sudderth**, Best invariant predictive distributions; **W. Ehm**, A family of probability densities related to the Riemann zeta function; **S. N. Evans**, Local field U-statistics; **P. Feinsilver** and **J. Kocik**, Krawtchouk matrices from classical and quantum random walks; **Y. Gao** and **J. I. Marden**, Some rank-based hypothesis tests for covariance structure and conditional independence; **P. Graczyk**, Gaussian measures as limits on irreducible symmetric spaces and cones; **R. D. Gupta** and **D. St. Richards**, The covariance structure of the multivariate Liouville distributions; **I. S. Helland**, Reduction of regression models under symmetry; **P. T. Kim** and **D. St. Richards**, Deconvolution density estimation on compact Lie groups; **C. A. J. Klaassen**, **E.-J. Lee**, and **F. H. Ruymgaart**, On efficiency of indirect estimation of nonparametric regression functions; **T. Kollo** and **D. von Rosen**, Patterned matrices treated via linear spaces; **S. P. Lalley**, Random walks on regular languages and algebraic systems of generating functions; **G. Letac** and **H. Massam**, The normal quasi-Wishart distribution; **T. Neeman** and **T. Chang**, Rank score statistics for spherical data; **M. D. Perlman**, Graphical model search via essential graphs; **G. Pistone**, **E. Riccomagno**, and **H. P. Wynn**, Computational commutative algebra in discrete statistics; **A. Takemura** and **S. Kuriki**, Maximum covariance difference test for equality of two covariance matrices; **M. A. G. Viana**, The covariance structure of random permutation matrices; **E. Wit** and **P. McCullagh**, The extendibility of statistical models.

Contemporary Mathematics, Volume 287

December 2001, 340 pages, Softcover, ISBN 0-8218-2687-5, LC 2001045884, 2000 *Mathematics Subject Classification*: 05B20, 60F05, 62A01, 62C10, 62H15; 13P10, 15A52, 20B30, 30E20, 62G08, **Individual member $48**, List $80, Institutional member $64, Order code CONM/287N

Previously Announced Publications

Ramanujan: Essays and Surveys

Bruce C. Berndt, *University of Illinois, Urbana-Champaign, IL*, and **Robert A. Rankin**, *University of Glasgow, Scotland*, Editors

This book contains essays on Ramanujan and his work that were written especially for this volume. It also includes important survey articles in areas influenced by Ramanujan's mathematics. Most of the articles in the book are nontechnical, but even those that are more technical contain substantial sections that will engage the general reader.

The book opens with the only four existing photographs of Ramanujan, presenting historical accounts of them and information about other people in the photos. This section includes an account of a cryptic family history written by his younger brother, S. Lakshmi Narasimhan. Following are articles on Ramanujan's illness by R. A. Rankin, the British physician D. A. B. Young, and Nobel laureate S. Chandrasekhar. They present a study of his symptoms, a convincing diagnosis of the cause of his death, and a thorough exposition of Ramanujan's life as a patient in English sanitariums and nursing homes.

Following this are biographies of S. Janaki (Mrs. Ramanujan) and S. Narayana Iyer, Chief Accountant of the Madras Port Trust Office, who first communicated Ramanujan's work to the *Journal of the Indian Mathematical Society*. The last half of the book begins with a section on "Ramanujan's Manuscripts and Notebooks". Included is an important article by G. E. Andrews on Ramanujan's lost notebook.

The final two sections feature both nontechnical articles, such as Jonathan and Peter Borwein's "Ramanujan and pi", and more technical articles by Freeman Dyson, Atle Selberg, Richard Askey, and G. N. Watson.

This volume complements the book *Ramanujan: Letters and Commentary*, Volume 9, in the AMS series, History of Mathematics. For more on Ramanujan, see these AMS publications *Ramanujan: Twelve Lectures on Subjects Suggested by His Life and Work*, Volume 136.H, and *Collected Papers of Srinivasa Ramanujan*, Volume 159.H, in the AMS Chelsea Publishing series.

Copublished 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 22

November 2001, 347 pages, Hardcover, ISBN 0-8218-2624-7, LC 2001045097, 2000 *Mathematics Subject Classification*: 01A61; 11P83, 11P82, 33C05, 33C20, 11A99, 33D15, 11-03, 33-03, **All AMS members $63**, List $79, Order code HMATH/22RT112

Classical Groups and Geometric Algebra

Larry C. Grove, *University of Arizona, Tuscon, AZ*

"Classical groups", named so by Hermann Weyl, are groups of matrices or quotients of matrix groups by small normal subgroups.

Thus the story begins, as Weyl suggested, with "Her All-embracing Majesty", the general linear group $GL_n(V)$ of all invertible linear transformations of a vector space V over a field F. All further groups discussed are either subgroups of $GL_n(V)$ or closely related quotient groups.

Most of the classical groups consist of invertible linear transformations that respect a bilinear form having some geometric significance, e.g., a quadratic form, a symplectic form, etc. Accordingly, the author develops the required geometric notions, albeit from an algebraic point of view, as the end results should apply to vector spaces over more-or-less arbitrary fields, finite or infinite.

The classical groups have proved to be important in a wide variety of venues, ranging from physics to geometry and far beyond. In recent years, they have played a prominent role in the classification of the finite simple groups.

This text provides a single source for the basic facts about the classical groups and also includes the required geometrical background information from the first principles. It is intended for graduate students who have completed standard courses in linear algebra and abstract algebra. The author, L. C. Grove, is a well-known expert who has published extensively in the subject area.

Graduate Studies in Mathematics, Volume 39

October 2001, 169 pages, Hardcover, ISBN 0-8218-2019-2, LC 2001046251, 2000 *Mathematics Subject Classification*: 20G15, 20G40, 11E57; 11E39, 11E88, 51N30, **All AMS members $28**, List $35, Order code GSM/39RT112

Council for African American Researchers in the Mathematical Sciences: Volume IV

Gaston M. N'Guérékata and **Asamoah Nkwanta**, *Morgan State University, Baltimore, MD*, Editors

This volume contains selected papers from the Sixth Conference for African American Researchers in the Mathematical Sciences (CAARMS), held at Morgan State University in Baltimore (MD). The CAARMS organizes this annual conference showcasing the current research primarily, but not exclusively, of African Americans in the mathematical sciences. Since the first conference in 1995, significant numbers of researchers have presented their current work in technical talks, and graduate students have presented their work in organized poster sessions.

Research topics include mathematics (number theory, analysis, topology, differential equations, algebra, combinatorics, etc.), mathematical physics, mathematical biology, operations research, probability and statistics, and computer science. In addition to the invited talks, tutorials and group discussions on various topics are organized to stimulate, nurture, and encourage increased participation by African Americans and other underrepresented groups in the mathematical sciences. These events create an ideal forum for mentoring and networking where attendees can meet researchers and graduate students who are interested in the same fields.

For volumes based on previous CAARMS proceedings, see *African Americans in Mathematics*, Volume 34, in the AMS Series in Discrete Mathematics and Theoretical Computer Science, *African Americans in Mathematics II*, Volume 252, and *Council for African American Researchers in the Mathematical Sciences: Volume III*, Volume 275, in the AMS series, Contemporary Mathematics.

Contributors include: K. M. Lewis, E. Goins, I. Assani, C. Castillo-Chavez, A.-A. Yakubu, K. F. Sellers, M. C. Jackson, C. R. Handy, and J. L. Houston.

Contemporary Mathematics, Volume 284

September 2001, 135 pages, Softcover, ISBN 0-8218-2793-6, LC 2001045833, 2000 *Mathematics Subject Classification*: 01A30, 37A30, 28D05, 92B05, 92B99, 81Q99, 03B05, 03E72, 90B10, 47A15, **Individual member $26**, List $44, Institutional member $35, Order code CONM/284RT112

Classified Advertisements

Positions available, items for sale, services available, and more

CALIFORNIA

CAL STATE POLYTECH. UNIV., POMONA
Department of Mathematics

Four tenure-track positions in math education (two positions: asst. prof. and assoc./asst. prof.). Teach major courses in math ed. and service courses in math ed. and math; advise students seeking secondary teaching credential; assist or coordinate in-service activities; help develop master's degree in math teaching; interact with Center for Ed. and Equity in Math., Sci. and Tech. and College of Ed. Preference given to applicants able to supervise student teaching for math credential students. Min. qual.: Doctorate in math ed. with strong background in graduate level math or Ph.D. in math, appl. math, or stat. with strong background in math ed. Initial review of applications 1/25/02.

Statistics (assoc./asst. prof.) Teach graduate stat. courses and undergraduate and service courses in stat. or math.; advise graduate students. Preference given to applicants with expertise in more than one of: statistical modeling, multivariate stat., biostatistics, design of experiment, estimation theory, statistical consulting. Min. qual.: Ph.D. in stat. or math or related area. Initial review of applications 2/8/02.

Pure Math (asst. prof.). Teach major courses in pure math and service courses in math.; advise undergraduate and graduate students. Preference given to applicants with expertise in more than one of: algebra, complex analysis, geometry, history of math, logic, number theory, real analysis, set theory, topology and/or those who have participated in math ed. activities. Min. qual.: Ph.D. in math. Initial review of applications 2/8/02.

All positions: Salary dependent on qualifications. Required: evidence of teaching excellence, ability to direct master's theses, potential for conducting scholarly activities, ability to work with diverse student body. Completion of terminal degree by Sept. '02. Review of applications continues until position is filled or closed. Submit application form (with name of position), curriculum vitae, transcripts, and min. of 3 reference letters to: Faculty Search Committee, Math Dept., CSPU Pomona, 3801 W. Temple Ave., Pomona, CA 91768-4007; lmborchert@csupomona.edu/; 909-869-4008; fax: 909-869-4904; http://www.csupomona.edu/~math/. AA/EEO.

CALIFORNIA STATE UNIVERSITY, LOS ANGELES
Department of Mathematics

Applications are invited for a tenure-track position in mathematics education at the level of assistant/associate professor, starting June or September 2002. Ph.D. in mathematics with a commitment to mathematics education or a doctorate in education with a strong background in mathematics required. Doctorate degrees must be from an accredited institution of higher education. Successful candidate will teach both mathematics and mathematics education classes. Publications in peer-reviewed journals and/or grant activity is required. CSULA is on the quarter system. Review of applications will begin March 1, 2002. Send a letter of applications and vita to: Dr. P. K. Subramanian, Chair, Department of Mathematics, California State University at Los Angeles, 5151 State University Drive, Los Angeles, CA 90032. An Equal Opportunity/Affirmative Action/Title IX/ADA Employer. Qualified women and minorities are encouraged to apply.

HARVEY MUDD COLLEGE
Department of Mathematics

Harvey Mudd College invites applications for a tenure-track assistant professorship. Excellence in teaching is absolutely essential, as is evidence of a strong and ongoing research program. Areas of special interest in pure or applied mathematics include analysis, topology, algebraic geometry, dynamical systems, partial differential equations, and mathematical modeling, but all research specialities will be considered. Candidates must be willing to supervise undergraduate research and work with others in the development of departmental programs.

Harvey Mudd College is a highly selective undergraduate institution of science, engineering, and mathematics; the average SAT score of entering students is over 1480. More than one-third of the student body are National Merit Finalists, and one year of high school calculus is a requirement for admission. Each year there are over 20 graduates in mathematics, with approximately half going to graduate school. Over 40% of mathematics alumni from

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Suggested uses for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

The 2001 rate is $100 per inch or fraction thereof on a single column (one-inch minimum), calculated from top of headline. Any fractional text of 1/2 inch or more will be charged at the next inch rate. No discounts for multiple ads or the same ad in consecutive issues. For an additional $10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

Advertisements in the "Positions Available" classified section will be set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Headlines will be centered in boldface at no extra charge. Ads will appear in the language in which they are submitted.

There are no member discounts for classified ads. Dictation over the telephone will not be accepted for classified advertising.

Upcoming deadlines for classified advertising are as follows: January 2002 issue–October 24, 2001; February 2002 issue–November 20, 2001; March 2002 issue–December 28, 2001; April 2001 issue–January 25, 2002; May 2002 issue–February 26, 2002; June/July 2002 issue–April 24, 2002.

U.S. laws prohibit discrimination in employment on the basis of color, age, sex, race, religion, or national origin. "Positions Available" advertisements from institutions outside the U.S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U.S. laws. Details and specific wording may be found on page 1373 (vol. 44).

Situations wanted advertisements from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-321-4AMS (321-4267) in the U.S. and Canada or 401-455-4084 worldwide for further information.

Submission: Promotions Department, AMS, P. O. Box 6248, Providence, Rhode Island 02940; or via fax: 401-331-3842; or send e-mail to classads@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.

HMC have obtained a Ph.D. degree. The college enrolls about 680 students and is a member of the Claremont College consortium, which consists of four other undergraduate colleges and two graduate institutions, forming an academic community of about 5,000 students. There is an active and vital research community of over 40 mathematicians in Claremont.

Claremont is situated approximately 35 miles east of downtown Los Angeles, in the foothills of the San Gabriel Mountains. The community is known for its tree-lined streets and village charm. It is an easy drive from Claremont to the cultural attractions and universities of the greater Los Angeles area, as well as the ocean, mountains, and deserts of southern California.

Applicants should send a curriculum vitae, a description of their teaching philosophy and experience, and a description of their current research program, and arrange to have sent three letters of recommendation to the address that appears below. Further information about the college, department, and position may be found at `http://www.math.hmc.edu/`. Preference will be given to applications completed by January 4, 2002.

Harvey Mudd College is an Equal Opportunity Employer and is committed to the recruitment of applicants historically underrepresented on college faculties. Address for applications:

Professor Arthur T. Benjamin
Chair, Search Committee
Department of Mathematics
Harvey Mudd College
Claremont, CA 91711-5990

STANFORD UNIVERSITY
Department of Mathematics

Two-year postdoctoral research position. Research in area of computational topology. Candidates should have some knowledge of topology and preferably some knowledge of statistics and computing.

Candidates should send letter of application and curriculum vitae, including list of publications. Please include and clearly state the following: area of specialization, institution, (expected) date of Ph.D., and Ph.D. advisor. Send to: Prof. G. Carlsson, Department of Mathematics, Stanford University, Stanford, CA 94305-2125, by January 31, 2002. Also, candidates should arrange for three letters of recommendation to be sent to above address (`gunnar@math.stanford.edu`). Stanford is an Equal Opportunity/Affirmative Action Employer and welcomes applications from women and minorities.

UNIVERSITY OF CALIFORNIA, LOS ANGELES
Department of Mathematics

Subject to availability of resources and administrative approval, the following positions are available:

1) Several tenure-track and senior positions in all areas of mathematics.

2) Several E. R. Hedrick Assistant Professorships. Salary is $52,900. Three-year appointment. Teaching load: four quarter-courses per year, which may include one advanced course in the candidate's field.

3) Several Research Assistant Professorships in Computational and Applied Mathematics (CAM). Salary is $52,900. Three-year appointment. Teaching load: normally reduced to two or three quarter-courses per year by research funding as available; may include one advanced course in the candidate's field.

4) Several Adjunct Assistant Professorships or Lectureships in the Program in Computing (PIC). Applicants for the Adjunct position must show very strong promise in teaching and research in an area related to computing. Teaching load: four one-quarter programming courses each year and one seminar every two years. One-year initial appointment, with the option of applying for renewal for a second year and possibly longer, up to a maximum service of four years. Salary is $56,600. Applicants for the Lectureship must show very strong promise in the teaching of programming. An M.S. in Computer Science or equivalent degree is preferred. Teaching load: 6 one-quarter programming courses per year. One-year appointment, probably renewable one or more times, depending on the needs of the program. Salary is $43,152 or more, depending on experience.

5) Several VIGRE Assistant Professorships. Hedrick, CAM, or PIC applicants who are U.S. citizens or permanent residents may also apply for a VIGRE Assistant Professor position. Three-year appointment. Salary is $52,900. The successful recipient will receive a summer stipend of $6,500 for two summers and $2,500 per year for travel, equipment, and supplies for three years. Teaching load: 3 courses per year.

6) Several Adjunct Assistant Professorships and Research Postdocs. Up to one-year appointment, with the possibility of renewal. Strong research and teaching background required. Salary $48,700–$52,900. Teaching load for adjuncts: 5 quarter-courses per year.

7) Several visiting instructorships.

For more details, see `http://www.math.ucla.edu/~search/`. To apply, complete the application on the website, or send e-mail to `search@math.ucla.edu`, or write to: Staff Search, Department of Mathematics, University of California, Los Angeles, CA 90095-1555. Preference will be given to applications completed by January 7, 2002.

UCLA is an Equal Opportunity/Affirmative Action Employer. Under federal law, the University of California may employ only individuals who are legally authorized to work in the United States as established by providing documents specified in the Immigration Reform and Control Act of 1986.

UNIVERSITY OF CALIFORNIA, SAN DIEGO
Mathematics Department

The Mathematics Department of The University of California, San Diego, has an opening for a lecturer with the potential of security of employment (PSOE). A Lecturer-PSOE closely parallels that of an assistant professor on track for tenure. The position is full-time and will involve teaching a variety of undergraduate courses, assisting with the training of teaching assistants, and other coordination tasks related to undergraduate instruction. Applicants must have a Ph.D. degree and a record of excellence in teaching. The appointment will begin in fall 2002. Salary is commensurate with experience and based on the University of California pay scale.

To apply for this position, please submit your curriculum vitae and arrange for three letters of reference to be sent to: Lecturer-PSOE, Department of Mathematics, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0112. All applications received by January 2, 2002, will receive thorough consideration. All supporting material must be received no later than January 8, 2002. In compliance with the Immigration Reform and Control Act of 1986, individuals offered employment by the University of California will be required to show documentation to prove identity and authorization to work in the United States before hiring can occur. UCSD is an Equal Opportunity/Affirmative Action Employer with a strong institutional commitment to the achievement of diversity among its faculty and staff.

UNIVERSITY OF CALIFORNIA, SAN DIEGO
Department of Mathematics

The Department of Mathematics of The University of California, San Diego, is seeking outstanding candidates for a special two-year assistant professorship, the S. E. Warschawski Assistant Professorship. The nine-month salary is $48,000. Applicants (of any age) should possess a recent Ph.D. degree (received no earlier than 1999) in mathematics or expect to receive one prior to July 2002 and should show outstanding promise in both research and teaching. To apply for this position, please submit your placement file including vitae and publications, and arrange for three letters of reference to be sent to the "SEW Search Committee", Department of Mathematics, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0112. Please indicate primary research area (field and #) using the AMS Mathematical Reviews Classification List. All applications received by January 2,

2002, will receive thorough consideration. All supporting material must be received no later than January 8, 2002. In compliance with the Immigration Reform and Control Act of 1986, individuals offered employment by the University of California will be required to show documentation to prove identity and authorization to work in the United States before hiring can occur. UCSD is an Equal Opportunity/Affirmative Action Employer with a strong institutional commitment to the achievement of diversity among its faculty and staff.

UNIVERSITY OF CALIFORNIA, SAN DIEGO
Department of Mathematics

University of California, San Diego, Professorships: The Department of Mathematics of the University of California, San Diego, is seeking outstanding candidates for up to seven faculty positions to start July 2002. One of these positions is for a very senior full professor with a distinguished record of research and teaching and is open to applicants in all areas of mathematics. The strongly preferred level for the other positions is at the assistant professor level, but applicants with all levels of experience from assistant professor to full professor will be considered.

Applicants should hold a Ph.D. in mathematics or a related field and should show outstanding promise and/or accomplishments in both research and teaching. Areas of special interest in applied mathematics include statistics, biostatistics, bioinformatics and logic. Areas of special interest in pure mathematics include geometry, number theory, probability, representation theory and topology. However, we encourage applications from any area of pure or applied mathematics. Level of appointment will be based on qualifications with appropriate salary per UC pay scales.

To apply for any of these positions, please submit your placement file, including vita and publications, and arrange for three letters of reference to be sent under separate cover to the Faculty Search Committee, Department of Mathematics, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0112. Please indicate primary research area (field and #) using the AMS Mathematical Reviews Classification List. All applications received by January 2, 2002, will receive thorough consideration. All supporting material must be received no later than January 8, 2002. In compliance with the Immigration Reform and Control Act of 1986, individuals offered employment by the University of California will be required to show documentation to prove identity and authorization to work in the United States before hiring can occur. UCSD is An Equal Opportunity/Affirmative Action Employer with a strong institutional commitment to the achievement of diversity among its faculty and staff.

UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Department of Statistics and Applied Probability

Applications invited for open-level and junior positions, starting July 1, 2002. Specializations in statistics, applied probability or mathematical finance considered. Require Ph.D. in relevant field, research and teaching excellence.

Applicants should submit current résumé and papers and have three letters of reference sent to: Search Committee, Department of Statistics and Applied Probability, University of California, Santa Barbara, CA 93106-3110. Apply by November 16, 2001, for primary consideration; positions open until filled. An EE/AAO Employer. Women and minorities are encouraged to apply.

DISTRICT OF COLUMBIA

MATHEMATICAL ASSOCIATION OF AMERICA
Director
Programs and Services
Washington, DC

The Mathematical Association of America seeks a director for programs and services to begin by July 2002. The association, with 30,000 members, is dedicated to the advancement of mathematics, particularly at the collegiate level. The director will oversee member services which include professional development activities; program development; support of member run activities, including those of committees, sections, and special interest groups; grant management and support; preparation and submission of proposals to foundations and government agencies. Appointments are for two to three years and may be renewed for multiple years.

Candidates should hold a doctorate or the equivalent in a mathematical science or mathematics education and at least six years of experience as a collegiate faculty member. A candidate should have successful experiences in all or most of the following areas: grant proposal writing and project management; administration; improvements of teaching and learning; and MAA committees, sections, or programs.

The deadline for submission of applications is January 21, 2002. Candidates should send a résumé and letter of interest to:

Ms. Julie Kraman
Mathematical Association of America
1529 18th Street, NW
Washington, DC 20036

Applications may be submitted electronically to jkraman@maa.org. References will be requested after review of applications. Applications from individuals from underrepresented groups are encouraged. Additional information on this position, the MAA, and its programs and services may be found on MAA's website, http://www.maa.org/, and in the October issue of *FOCUS*. AA/EOE.

GEORGIA

GEORGIA SOUTHERN UNIVERSITY
Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science at Georgia Southern University invites applications for at least one tenure-track and at least one visiting position at the assistant professor level, starting August 1, 2002. A Ph.D. in pure or applied mathematics is required by the starting date. Applicants must demonstrate a potential for scholarly activity, as well as a commitment to excellence in teaching. Command of written and spoken English is required. Qualified applicants in all areas will be considered.

Duties will include teaching undergraduate and graduate courses in mathematics, conducting research, and supervising research projects for master's degree candidates. Departmental representatives will be available at the Joint Mathematics Meetings in San Diego in January 2002 to discuss these positions with interested candidates. More information on our department is available at http://www.cs.gasou.edu/.

To apply, please submit a cover letter, a curriculum vitae, unofficial transcripts of all graduate work, a description of commitment to excellence in teaching, and a brief description of planned scholarly activities to: Dr. Richard J. Hathaway, Mathematics Search Chair, Department of Mathematics and Computer Science, Georgia Southern University, P.O. Box 8093, Statesboro, GA 30460-8093. Please specify in your cover letter the position (tenure-track and/or visiting) for which you are applying. In addition, three confidential letters of recommendation should be mailed directly by the references to the Mathematics Search Chair. Screening of complete applications will begin November 30, 2001.

Georgia Southern University, a member of the University System of Georgia, is the largest and most comprehensive center of higher education in the southern half of Georgia. A residential university serving over 14,000 students, Georgia Southern's hallmark is a superior undergraduate experience emphasizing academic distinction, excellent teaching, and student success. The university offers 130 degree programs at the baccalaureate, master's, and doctoral levels through six colleges. Founded in 1906, Georgia Southern became a regional university in 1990. The 634-acre campus is located in Statesboro, a community of approximately 30,000 residents, 50 miles northwest of historic Savannah and 200 miles southeast of Atlanta.

Georgia Southern is an Equal Opportunity/Affirmative Action Institution. Georgia is an Open Records state. Individuals who need reasonable accommodations under the Americans with Disabilities Act in order to participate in the search process should notify the search chair.

GEORGIA STATE UNIVERSITY
Department of Risk Management and Insurance

The Department of Risk Management and Insurance in the Robinson College of Business invites applications for a full-time, tenure-track position at the rank of assistant/associate professor for persons who have research and teaching interests in the area of mathematical finance. Applicants should hold a Ph.D. in finance, mathematics, statistics, or related field. The successful applicant will demonstrate potential for significant academic research in the area of mathematical finance. Primary teaching responsibility will be graduate-level course work in the department's Mathematical Risk Management program. A secondary interest teaching actuarial science course work is beneficial.

About the Environment: The Department of Risk Management and Insurance houses one of the oldest and most influential actuarial science programs in the U.S. The department is expanding its research and educational mission by developing an area of financial mathematics through cooperative efforts with the Departments of Finance and Economics. The department maintains strong ties with the risk management profession and is well supported financially. The academic finance community of Atlanta is intellectually vibrant, home to many faculty and researchers with international reputations housed at Georgia State University, Georgia Tech, Emory University, and the Federal Reserve Bank of Atlanta.

Application Procedure: Applicants should send a current curriculum vitae, three letters of recommendation, and recent publications or working papers to:

Richard D. Phillips, Chair
Search Committee
Department of Risk Management and Insurance
Robinson College of Business
Georgia State University
P.O. Box 4036
Atlanta, GA 30302-4036
Tel: 404-651-3397

Applications may be submitted electronically via e-mail to: rphillips@gsu.edu.

An interview can be scheduled for the 2002 Annual Meeting of the American Mathematical Society in San Diego. Preference will be given to applications received by December 1, 2001. For more information see http://www.rmi.gsu.edu/.

Georgia State University is an Equal Opportunity/Educational Institution/Affirmative Action Employer and encourages applications from qualified minorities.

ILLINOIS

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE
Department of Mathematics
Algebra/Analysis Positions

Applications are invited for two tenure-track positions at the assistant professor level to begin on August 16, 2002. Applicants from all areas of pure and applied algebra (including abstract algebra, number theory, combinatorics, coding theory and cryptography) and all areas of pure and applied analysis (including geometric, harmonic, and stochastic analysis, differential equations, dynamical systems, and mathematical physics) will be considered. Applicants must demonstrate evidence of, or potential for, excellence both in research and in teaching at all university levels. Ph.D. in mathematics required by August 15, 2002. Send letter of application, CV, and three letters of recommendation to: Algebra/Analysis Positions, Department of Mathematics, Southern Illinois University Carbondale, Carbondale, IL 62901-4408. Review of applications will begin December 7, 2001, and will continue until positions are filled. Southern Illinois University Carbondale is an Equal Opportunity/Affirmative Action Employer. Women and minorities are particularly encouraged to apply.

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE
Department of Mathematics

Applications are invited for a tenure-track position at the assistant professor level designated to support a Teaching Excellence in Mathematics and Science initiative. Appointment to begin on August 16, 2002. Ph.D. in mathematics required. The person in this position will be expected to maintain an active research program in an area of pure or applied mathematics. Teaching and service duties of the position will support training programs for teachers at the elementary and secondary levels. Applicants must demonstrate evidence of, or potential for, excellence in research in a field of pure or applied mathematics and excellence in teaching at all university levels and an interest in and aptitude for teaching prospective teachers. For appointment at the associate professor rank, the candidate must have an established record of both research and teaching excellence. To apply, please send letter of application and CV and have at least three letters of recommendation sent to: TEMS Position, Department of Mathematics, Southern Illinois University Carbondale, Carbondale, IL 62901-4408. Review of applications will begin December 7, 2001, and will continue until position is filled. Southern Illinois University Carbondale is an Equal Opportunity/Affirmative Action Employer. Women and minorities are particularly encouraged to apply.

INDIANA

BALL STATE UNIVERSITY
Muncie, Indiana
Department of Mathematical Sciences
Faculty Position in Mathematics or Statistics

Applications are invited for a tenure-track faculty position in mathematics, with the possibility of a second position pending budgetary approval. Appointment will typically be at the rank of assistant professor, but appointment at higher rank can be considered for the qualified candidate. The starting date will be August 16, 2002. Duties include: teaching approximately 8 to 9 hours per semester predominately at the undergraduate level, research in mathematics or statistics, and professional service. Salary and benefits are competitive and commensurate with qualifications. In addition, one or more temporary positions may be available, pending budgetary approval.

Minimum qualification: All requirements for a doctorate in one of the mathematical sciences or statistics completed by August 1, 2002. **Preferred qualification:** research interests compatible with present faculty. Ongoing faculty research interests include work in Lie groups, geometric topology, differential equations, applied mathematics, financial mathematics, and statistics.

The Department of Mathematical Sciences includes faculty in pure and applied mathematics, financial mathematics, statistics, actuarial science, and mathematics education. The department offers a range of academic programs leading to B.A., B.S., M.A., M.S., and M.A.E. degrees in these areas. More information about the department, its programs, and its faculty is available at the URL http://www.cs.bsu.edu/~math/.

An applicant's file is complete when all of the following have been received: (1) letter of application; (2) AMS Standard Cover Sheet available from the AMS or from the department; (3) curriculum vitae; (4) research summary; and (5) three letters of reference, at least one of which substantially addresses the candidate's teaching ability and performance. Send materials to: John D. Lorce, Chair, Mathematics Search Committee, Department of Mathematical Sciences, Ball State University, Muncie, IN 47306 (e-mail: msearch@math.bsu.edu, tel: 765-285-8641, fax: 765-285-1721). Review of applications will begin immediately and will continue until the position is filled. Interested applicants should also notify the committee chair if they intend to attend

the 2002 AMS/MAA Joint Meetings in San Diego.

Ball State University is an Equal Opportunity/Affirmative Action Employer and is strongly and actively committed to diversity within its community.

INDIANA UNIVERSITY SOUTH BEND
Department of Mathematical Sciences

Subject to approval, the department invites applications for a tenured or tenure-track faculty position in mathematics starting August 2002. Rank and salary are commensurate with professional experience. Candidates must have completed all requirements for a doctoral degree in mathematics or a closely related field by August 2002. Preference will be given to applicants with background in applied mathematics. The department currently has 15 full-time faculty and 24 associate faculty.

IUSB is an Equal Opportunity/Affirmative Action Employer; women and minority candidates are encouraged to apply. Send curriculum vitae, a statement on teaching, and three letters of recommendation, at least two of which should address teaching, to: Dr. Morteza Shafii-Mousavi, Chair, Department of Mathematical Sciences, Indiana University South Bend, South Bend, IN 46634. Completed applications received by January 31, 2002, will be given full consideration.

UNIVERSITY OF NOTRE DAME
Department of Mathematics
Notre Dame, IN 46556
Regular Position in Mathematics

The Department of Mathematics of the University of Notre Dame invites applications for the John P. McAndrews Assistant Professorship in Mathematics starting August 24, 2001. Outstanding candidates in any field of pure or applied mathematics are encouraged to apply. The position is at the tenure-track level, though a tenured associate professor appointment may be possible for an exceptional candidate. The teaching load is one course one semester and two courses the other semester. Salaries are competitive, and a research fund is included. Applications, including a curriculum vitae, a letter of application, and a completed AMS Standard Cover Sheet, should be sent to Steven A. Buechler, Chair, at the above address. Applicants should also arrange for at least three letters of recommendation to be sent to the chair. These letters should address the applicant's research accomplishments and supply evidence that the applicant can communicate articulately and teach effectively. Notre Dame is an Equal Opportunity Employer. Women and minorities are urged to apply. The evaluation of candidates will begin December 1. Information about the department is available at `http://www.math.nd.edu/math/`.

UNIVERSITY OF NOTRE DAME
Department of Mathematics
Notre Dame, IN 46556
Regular Position in Stochastic Analysis

The Department of Mathematics of the University of Notre Dame invites applications for a position in the field of applied stochastic analysis to start on August 24, 2001. The position is at the tenure-track level, but a tenured appointment may be possible for an exceptional candidate. The teaching load is one course one semester and two courses the other semester. The salary is competitive. Applications, including a curriculum vitae, a letter of application, and a completed AMS Standard Cover Sheet, should be sent to Steven A. Buechler, Chair, at the above address. Applicants should also arrange for at least three letters of recommendation to be sent to the chair. These letters should address the applicant's research accomplishments and supply evidence that the applicant has the ability to communicate articulately and teach effectively. Notre Dame is an Equal Opportunity Employer. Women and minorities are urged to apply. The evaluation of candidates will begin December 1. Information about the department is available at `http://www.math.nd.edu/math/`.

IOWA

UNIVERSITY OF IOWA
Department of Mathematics

Tenure-track assistant professor in actuarial science starting 08/02. Promise for excellence in teaching and creative research, Ph.D., fellowship or associateship in professional actuarial society. Practical actuarial experience plus training in economics and finance desirable. Selection begins 10/15/01; continues until position filled. CV, three letters of reference to: Actuarial Search, Statistics & Actuarial Science, Univ. of Iowa, Iowa City, IA 52242; Web: `http://www.stat.uiowa.edu/`; e-mail: `broffitt@stat.uiowa.edu`. Women and minorities encouraged to apply. The Univ. of Iowa is an AA/EOE.

KANSAS

KANSAS STATE UNIVERSITY
Department of Mathematics

Subject to budgetary approval, applications are invited for a tenure-track position commencing August 4, 2002. Preference will be given to specialists in analysis.

Applicants must have strong research credentials and a commitment to excellence in teaching. A Ph.D. in mathematics or a Ph.D. dissertation accepted with only formalities to be completed is required. Letter of application, current vita, description of research, three letters of reference evaluating research, and one reference letter evaluating teaching should be sent to:

Louis Pigno
Department of Mathematics
Cardwell Hall 138
Kansas State University
Manhattan, KS 66506

Position may be available December 3, 2001, but applications for position will be reviewed until February 1, 2002, or until position is closed. AA/EOE.

UNIVERSITY OF KANSAS
Department of Mathematics

Applications are invited for one or more tenure-track positions at the assistant professor level beginning August 18, 2002; January 1, 2003; or as negotiated. (This position(s) is contingent on final budgetary approval.) Preference will be given to candidates in analysis, algebra/algebraic geometry, and stochastic analysis/control. Candidates must have a Ph.D. in math or a related field or its requirements completed by August 18, 2002. Postdoctoral experience is preferred.

Letter of application, detailed résumé with description of research, completed AMS application form, and at least three recommendation letters should be mailed to: Jack Porter, Chair, Department of Mathematics, University of Lawrence, 1460 Jayhawk Boulevard, Lawrence, KS 66045-7567 (or faxed to 785-864-5255). For more details see `http://www.math.ukans.edu/jobs`, or contact `kumath@math.ukans.edu`.

Deadlines: Review of applications will begin on November 10, 2001, and will continue until the position(s) is filled. EO/AA Employer.

UNIVERSITY OF KANSAS
Department of Mathematics

Applications are invited for a temporary position at the assistant professor level beginning August 18, 2002; January 1, 2003; or as negotiated. (This position is contingent on final budgetary approval.) This position is normally renewable for a second and third year. Preference will be given to candidates in complex dynamics, dynamical systems, or probabilistic analysis. Candidates must have a Ph.D. in math or related field or its requirements completed by August 18, 2002.

Letter of application, detailed résumé with description of research, completed AMS application form, and at least three recommendation letters should be mailed to: Jack Porter, Chair, Department of Mathematics, University of Kansas, 1460 Jayhawk Boulevard, Lawrence, KS 66045-7567 (or faxed to 785-864-5255). For more details see `http://www.math.ukans.edu/jobs/`, or contact `kumath@math.ukans.edu`.

Deadlines: Review of applications will begin on November 10, 2001, and will

continue until the position is filled. EO/AA Employer.

WICHITA STATE UNIVERSITY
Department of Mathematics & Statistics

Applications are invited for tenure-eligible assistant, associate, or full professors in mathematics August 2002. (Positions contingent on available funding.) Required Qualifications: Ph.D. in mathematics, active research and strong research potential, strong commitment to excellence in teaching, effective communication skills, and successful experience with diverse populations. Preference given to classroom teaching experience, research area closely related to our doctoral program in mathematics or consonant with our current faculty. Preference given to junior-level applicants with progress toward a strong research record. Preference given to senior-level applicants with a strong research record. Women and minorities are especially urged to apply. Deadline for receipt of complete application package: 01/15/02; position remains open until filled. Send CV, a statement about teaching, and three reference letters to: Professor Stephen W. Brady, Search Committee Chair, Department of Mathematics & Statistics, Wichita State University, Wichita, KS 67260-0033; e-mail: brady@math.twsu.edu; fax: 316-978-3748. AA/EOE.

KENTUCKY

UNIVERSITY OF LOUISVILLE
Department of Mathematics

The Department of Mathematics at the University of Louisville invites applications for two tenure-track positions, one at the assistant professor level and the other at the associate professor level, to begin July 1, 2002. Ph.D. required. Preference will be given to candidates whose research interests lie in applied analysis, applied algebra, differential equations, discrete mathematics, probability and statistics. Applicants who can strengthen the department's new internship program are also preferred. Candidates must show strong potential in research and teaching and have effective communications skills. Applications should include: 1) American Mathematical Society's Standard Cover Sheet; 2) curriculum vitae; 3) summary of research interests; 4) statement of teaching qualifications; and 5) at least four letters of recommendation, including letters which discuss in some detail the candidate's teaching and research qualifications. Be sure to state whether the application is for the assistant or associate professor position. Applications should be sent to: Search Committee, University of Louisville, Louisville, KY 40292. Review of applications will begin January 14, 2002, and will continue until the positions are filled. E-mail questions to math@louisville.edu. The University of Louisville is an Affirmative Action/Equal Opportunity Employer and encourages women and underrepresented minorities to apply. Applicants must comply with the provisions of the Immigration Reform and Control Act.

LOUISIANA

LOUISIANA TECH UNIVERSITY
Department of Mathematics

The Mathematics & Statistics Program at Louisiana Tech University anticipates two faculty openings for 2002–03. Ph.D. in mathematics or statistics is required. One of these is expected to be a senior-level position to be filled by an applied mathematician with a national reputation and a proven record of externally funded research centered on mathematical modeling. The successful candidate is expected to assume a leadership position in our Center for Numerical Simulation and Modeling (CNSM) and the interdisciplinary Ph.D. program in Computational Analysis and Modeling (CAM). The second position is expected to be filled by an applied mathematician who has the potential to become nationally competitive in externally funded research in a short time. We expect both hires to establish cross-disciplinary collaborations and to develop strong, externally funded research programs involving graduate students.

Send curriculum vitae, synopsis of research interests and goals, a description of teaching experience, and contact information for at least three references to: Dr. Ramu Ramachandran, College of Engineering and Science, Louisiana Tech University, P.O. Box 10348, Ruston, LA 71272; fax: 318-257-3823; e-mail: ramu@coes.latech.edu. Applications will be reviewed starting November 1, 2001, until the positions are filled. Louisiana Tech University is an EEO/AA Employer. Women and minorities are encouraged to apply.

MARYLAND

UNIVERSITY OF MARYLAND, COLLEGE PARK
Computational Nonlinear Dynamics Faculty Position

A nonlinear dynamicist with strong interest in computation is sought for a tenured or tenure-track appointment in the Department of Mathematics, possibly joint with the Institute for Physical Science and Technology. An outstanding record of research accomplishments and a proven ability to attract research support are important for a senior position. Good teaching is a priority of the university.

Applications should be sent to: Chair's Office, Computational Nonlinear Dynamics, Department of Mathematics, University of Maryland, College Park, MD 20742-4015. Priority will be given to applications received by December 1, 2001. Appointments will commence in fall 2002. The University of Maryland is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF MARYLAND, COLLEGE PARK
Department of Mathematics

Applications are invited for tenured and tenure-track positions in the Department of Mathematics. Strong preference will be given to candidates in (1) applied statistics, (2) algebraic geometry, (3) dynamics, and (4) geometry, but candidates from all areas will be considered.

Priority will be given to applications received by December 1, 2001. Appointments will commence in fall 2002.

The University of Maryland is an Equal Opportunity/Affirmative Action Employer that strongly encourages applications from female and minority candidates.

Please send a curriculum vitae and AMS Standard Cover Sheet, and three letters of recommendation to:

The Hiring Committee
Department of Mathematics
University of Maryland
College Park, MD 20742

UNIVERSITY OF MARYLAND, COLLEGE PARK
Lectureships in the Department of Mathematics

Applications are invited for Avron Douglis Lectureships, starting in fall 2002. These positions are for recent Ph.D. recipients, with a preference for those not more than one year past the Ph.D. degree. The lectureship is for two years and is nonrenewable. Candidates must have superior research potential and a strong commitment to teaching. The Department of Mathematics provides an excellent scientific environment to foster the professional development of junior mathematicians. The teaching duties consist of three courses per year. The salary is $47,000 per academic year, supplemented by a $1,000 research stipend. Priority will be given to applications completed by December 15, 2001.

The University of Maryland is an Equal Opportunity/Affirmative Action Employer that strongly encourages applications from female and minority candidates.

Please send a curriculum vitae and AMS Standard Cover Sheet, and three or more letters of recommendation, at least one of which speaks to the applicant's teaching credentials, to:

Douglis Lectureship Committee
Department of Mathematics
University of Maryland
College Park, MD 20742

MASSACHUSETTS

BOSTON UNIVERSITY
Center for BioDynamics
Predoctoral and Postdoctoral Positions

The Center for BioDynamics (CBD) at Boston University has predoctoral and postdoctoral positions available. The CBD is a multidisciplinary center devoted to research and training at the interfaces of dynamical systems, biology, and engineering. Current research themes include computational neurobiology, genetic regulatory networks, fluid and solid mechanics, and applied biodynamics. We seek candidates interested in working across disciplinary boundaries with multiple members of the CBD.

The CBD is connected to many departments and other research centers at Boston University, providing a stimulating research environment. Associated senior faculty members are T. Kaper, N. Kopell, G. Wayne (math), J. Collins, J. White (biomedical engineering), M. Hasselmo (psychology), P. Barbone and J. Baillieul (aerospace and mechanical engineering), S. Redner (physics). For further information about the CBD, please see our Web page at `http://cbd.bu.edu/`.

To apply for a Postdoctoral Fellowship, please send (1) a statement that includes your background, career goals, how this position satisfies those goals, and your suitability for this position; (2) your CV; and (3) three letters of recommendation to:

Ms. Geri Duffy
Center for BioDynamics
Department of Mathematics
111 Cummington Street
Boston University
Boston, MA 02215

Interested Ph.D. candidates should apply to one of the associated departments and mention interest in the CBD. Please refer to the BU Graduate School Admissions Office (`http://www.bu.edu/apply/#graduate/`) for all application materials.

Related predoctoral and postdoctoral positions are available in PMCN (see ad).

BOSTON UNIVERSITY
Predoctoral and Postdoctoral Fellowship
Burroughs Wellcome Training Program in Mathematical and Computational Neuroscience (PMCN)

The goal of PMCN is to facilitate the transition of a small and outstanding set of predoctoral and postdoctoral fellows from the mathematical and physical sciences to a range of areas in neuroscience. Financial support for both Ph.D. candidates and postdoctoral fellows is available. The program features special seminars, mentoring by faculty and advanced trainees, and a dynamic and well-networked intellectual life provided by multiple supporting institutional modules. These include a new degree-granting Program in Neuroscience (PIN, `http://www.bu.edu/pin/`); the graduate program of the Biomedical Engineering department (BME, `http://bme.bu.edu/`); and the Center for BioDynamics (CBD, http://cbd.bu.edu/).

Predoctoral fellows will enroll in one of two Ph.D. programs (PIN or BME) that focus on the combination of experimental and computational neuroscience. Burroughs Wellcome Postdoctoral Fellows will design individualized programs that include neuroscience courses and one or more research projects that emphasize combined computational and experimental approaches to neuroscience. In addition, fellows may participate in the CBD, which helps physical scientists and engineers to address research problems at the interfaces among mathematics, physics, biology, and engineering.

PMCN is directed by H. Eichenbaum and N. Kopell. The senior faculty members are P. Cook, K. Harris (biology), M. Hasselmo, H. Eichenbaum, D. Somers, C. Stern (psychology), S. Colburn, J. Collins, J. White (biomedical engineering), T. Kaper, N. Kopell, G. Wayne (math). For further information and instructions about applications, see our website at `http://pmcn.bu.edu/` or e-mail: `pmcn@bu.edu`. Our mailing address is PMCN, c/o G. Duffy, Department of Mathematics, Boston University, 111 Cummington St., Boston, MA 02215.

Related predoctoral and postdoctoral positions are available at the CBD (see ad).

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics
Tenured or Tenure-Track Faculty
Non-Tenure-Track Faculty

The Department of Mathematics may make appointments, at the level of lecturer and assistant professor or higher, in pure mathematics for the year 2002–03. The teaching load will be nine hours for the academic year (eight hours for assistant professor appointments). These positions are open to mathematicians with doctorates who show definite promise in research. Applications should be complete by January 15. Applicants should arrange to have sent (a) vita, (b) three letters of reference, (c) a description of their most recent research, and (d) a research plan for the immediate future to: Pure Mathematics Committee, Massachusetts Institute of Technology, Room 2-263, 77 Massachusetts Ave., Cambridge, MA 02139-4307. MIT is an Equal Opportunity/Affirmative Action Employer.

For more information about the position or institution see `http://www-math.mit.edu/`.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics
Non-Tenure-Track Faculty

C.L.E. Moore Instructorships in Mathematics. These positions are open to mathematicians with doctorates who show definite promise in research. The teaching load will be nine hours for the academic year. Applications should be complete by January 15. Applicants should arrange to have sent (a) a vita, (b) three letters of reference, (c) a description of the research in their thesis, and (d) a research plan for the next year to: Pure Mathematics Committee, Massachusetts Institute of Technology, Room 2-263, Cambridge, MA 02139-4307. MIT is an Equal Opportunity/Affirmative Action Employer.

For more information about the position or institution see `http://www-math.mit.edu/`.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics
Tenured or Tenure-Track Faculty
Non-Tenure-Track Faculty

APPLIED MATHEMATICS:

Applications are invited for a limited number of positions in applied mathematics starting fall 2002. Available positions include instructorships, lectureships, assistant professorships, and possibly higher levels. Appointments will be made mainly on the basis of demonstrated research accomplishments and potential. Complete applications must be received by January 3. To apply, please send a vita with a description of your recent research and research plans and arrange to have sent three letters of reference to: Committee on Applied Mathematics, Department of Mathematics, Room 2-345, MIT, 77 Massachusetts Ave., Cambridge, MA 02139-4307. MIT is an Equal Opportunity/Affirmative Action Employer.

For more information about the position or institution see `http://www-math.mit.edu/`.

UNIVERSITY OF MASSACHUSETTS AMHERST
Department of Mathematics and Statistics

The Department of Mathematics and Statistics (`http://www.math.umass.edu/`) invites applications for tenure-track positions at the assistant professor level. In addition, multiyear visiting assistant professor positions will be available. The search will encompass the following areas: analysis and PDE/dynamical systems, applied and computational mathematics, geometry and topology, Lie theory, number theory, probability and statistics. Exceptional promise in research and teaching (at

all levels of the curriculum) is required. Although this search focuses on junior-level appointments, candidates for more senior-level appointments will be considered.

Applicants should send a curriculum vitae and arrange to have sent at least three letters of recommendation to: Search Committee, Department of Mathematics and Statistics, University of Massachusetts Amherst, Lederle Graduate Research Center, 710 North Pleasant St., Amherst, MA 01003-9305. Review of applications will begin on November 1. Applications will continue to be accepted until all positions are filled. Please include the AMS Standard Cover Sheet.

Women and members of minority groups are encouraged to apply. Equal Opportunity/Affirmative Action Employer.

WILLIAMS COLLEGE
Department of Mathematics and Statistics
Williamstown, MA 01267

Tenure-track position in mathematics or statistics, beginning fall 2002, at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research and a Ph.D. by time of appointment are required.

Please send a vita and have sent three letters of recommendation on teaching and research to the Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Evaluation of applications will begin on or after December 10. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

WILLIAMS COLLEGE
Department of Mathematics and Statistics
Williamstown, MA 01267

Tenure-track position in statistics, beginning fall 2002, at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research and a Ph.D. at the time of appointment are required.

Please send a vita and have sent three letters of recommendation on teaching and research to the Statistics Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Evaluation of applications will begin on or after December 10. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

WORCESTER POLYTECHNIC INSTITUTE
Mathematical Sciences Department

The Worcester Polytechnic Institute (WPI) Department of Mathematical Sciences invites applications for one or more anticipated tenure-track faculty positions in applied or computational mathematics in 2002. Candidates at all academic ranks will be considered.

An earned Ph.D. or equivalent degree is required. Successful candidates must be able to contribute strongly to both the department's research activities and its innovative, project-based educational programs. Areas of research in the department include partial differential equations with applications in fluid and continuum mechanics, composite materials, computational modeling and simulation, numerical analysis, optimization, control theory, discrete mathematics, applied probability, and applied statistics.

WPI is a private and highly selective technological university with an enrollment of 2,700 undergraduates and about 1,100 full- and part-time graduate students. Worcester, located forty miles west of Boston, offers ready access to the diverse economic, cultural, and recreational resources of the region.

The Mathematical Sciences Department has 24 tenured/tenure-track faculty and supports B.S., M.S., and Ph.D. programs in applied and computational mathematics and applied statistics. For additional information, see `http://www.wpi.edu/+math/`.

Qualified applicants should send a detailed curriculum vitae, a one-page statement of specific teaching and research objectives, and the names of four references with mail/e-mail addresses and telephone/fax numbers to: Mathematics Search Committee, Mathematical Sciences Department, WPI, 100 Institute Road, Worcester, MA 01609-2280.

Applications will be considered on a continuing basis beginning October 1, 2001, until the position is filled.

To enrich education through diversity, WPI is an Affirmative Action/Equal Opportunity Employer.

MICHIGAN

EASTERN MICHIGAN UNIVERSITY
Department of Mathematics Head

Eastern Michigan University invites nominations and applications for the position of head of the Department of Mathematics. The appointment will be at the rank of professor with tenure and will be effective August 1, 2002. EMU is located in Ypsilanti, MI (10 miles from Ann Arbor and 30 miles from Detroit), with a total enrollment of approximately 24,000. The mathematics department offers undergraduate degrees with concentrations in mathematics, mathematics education (both elementary and secondary), and statistics, plus a joint actuarial science concentration with the Department of Economics. The department also offers master's degrees in mathematics, mathematics education, and statistics, as well as a joint degree with the Department of Computer Science.

Candidates for the position of head of the Department of Mathematics should possess a Ph.D. in mathematics, an established record of research/scholarly activity, and university/professional service appropriate for a tenured appointment at the rank of professor. Candidates should also demonstrate effective leadership that includes good communication and administrative skills. Additionally, the candidate should be actively supportive of innovative technological and pedagogical initiatives that promote the mathematics department's goal for teaching excellence. Further information about the department may be found at `http://www.math.emich.edu/` and about EMU at `http://www.emich.edu/`.

To apply, please send a vita, a letter of application, a separate statement that describes the applicant's approach to the responsibilities of a department head, and four letters of recommendation to: Posting #APAA 0203, Eastern Michigan University, 202 Boone Hall, Ypsilanti, MI 48197. Applications will be considered until the position is filled. Completed applications (including letters of recommendation) received by January 15, 2002, will be assured of full consideration. Applications are strongly encouraged from members of groups that are traditionally underrepresented in mathematics. EMU is an Affirmative Action/Equal Opportunity Institution.

HILLSDALE COLLEGE
Department of Mathematics and Computer Science
Applied Mathematics Position

Applications are invited for a tenure-track position in mathematics at the assistant professor level, beginning in August 2002. Candidates are required to have a Ph.D. in mathematics with a speciality in applied mathematics and to have a strong commitment to excellence in teaching undergraduate mathematics. In order to build our expertise in applied mathematics and to complement our existing strengths, candidates must be willing to teach mathematical modelling, differential equations, numerical analysis, and vector analysis. Duties include a 12-hour (3-course) teaching load per semester, which will include all levels of undergraduate mathematics, academic advising, college service, and continued mathematical activity.

Hillsdale College, founded in 1844, is an independent, coeducational, four-year liberal arts college of 1,200 students. Hillsdale has traditionally upheld two concepts: academic excellence and institutional independence. For additional college information see our website, `http://www.hillsdale.edu/`.

Send a letter of application which includes a personal statement addressing

the applicant's teaching philosophy and qualifications for the position, curriculum vitae, graduate transcript, a short summary of teaching evaluations, and at least three letters of recommendation to: Professor Mark J. Watson, Chair, Department of Mathematics and Computer Science, Hillsdale College, Hillsdale, MI 49242. Review of applications will begin December 15, 2001, and will continue until the position is filled. EOE.

MICHIGAN STATE UNIVERSITY
proMSc Program in
Industrial Mathematics
East Lansing, MI 48824

Direct your students toward one of the professional M.Sc. programs. Industry needs business-savvy mathematicians. See http://www.sciencemasters.com/.

NEVADA

UNIVERSITY OF NEVADA
COLLEGE OF ARTS & SCIENCE
Department of Mathematics
Assistant Professor in Mathematics
Position Type: Academic
Rank/Range: II

Job Description: The teaching load is approximately 6 to 8 credit hours per semester and may include calculus, upper-division, and graduate courses. The candidate is expected to exhibit excellence in teaching, maintain a strong research program, serve conscientiously on departmental committees, and communicate effectively with faculty and students.

Qualifications: Minimum qualifications include a Ph.D. in a mathematical science with a specialization in geometry and/or topology as well as documented excellence in teaching and evidence of strong potential for significant research.

Evidence of excellence in teaching may include extent and variety of classroom teaching experience; student evaluation of instruction (if available); letters from responsible faculty; and results of oral interviews, including communication skills. At least one reference letter must address teaching ability and experience.

Evidence of research potential may include letters from competent faculty, papers accepted by or submitted to refereed journals, presentations given at professional meetings, results of oral interviews, and compatibility with research interests of existing mathematics faculty (for faculty research interests, see http://www.unr.edu/math/faculty/).

Contact Information: Send curriculum vitae, research summary, and three letters of recommendation to:

Geometry/Topology Committee
Department of Mathematics/084
University of Nevada
Reno, NV 89557

Applicants may also include selected preprints. If possible, please include the Academic Employment in Mathematics Standard Cover Sheet, which can be downloaded from http://www.ams.org/.

Closing Date: For full consideration, complete applications must be received by January 4, 2002.

Search Chair: Chris Herald; Search Coordinator: Sharon Vietti; Web page: http://www.unr.edu/artsci/math/; email: Search Chair: herald@unr.edu.

The University of Nevada is an Equal Opportunity/Affirmative Action Employer and does not discriminate on the basis of race, color, religion, sex, age, creed, national origin, veteran status, physical or mental disability, sexual orientation in any program or activity it operates. University of Nevada employs only United States citizens and aliens lawfully authorized to work in the United States.

UNIVERSITY OF NEVADA
COLLEGE OF ARTS & SCIENCE
Department of Mathematics
Assistant Professor in Mathematics
Position Type: Academic
Rank/Range: II

Job Description: The teaching load is approximately 6 to 8 credit hours per semester and may include calculus, upper-division, and graduate courses. The candidate is expected to exhibit excellence in teaching, maintain a strong research program, serve conscientiously on departmental committees, and energetically participate in the ongoing development of a strong statistics and applied mathematics program by interacting with faculty and students across the university.

Qualifications: Minimum qualifications include a Ph.D. in a mathematical science with a specialization in statistics and/or probability as well as documented excellence in teaching and evidence of strong potential for significant research.

Evidence of excellence in teaching may include extent and variety of classroom teaching experience; student evaluation of instruction (if available); letters from responsible faculty; and results of oral interviews, including communication skills. At least one reference letter must address teaching ability and experience, including the teaching of statistics.

Evidence of research potential may include letters from competent faculty, papers accepted by or submitted to refereed journals, presentations given at professional meetings, results of oral interviews, and compatibility with research interests of existing mathematics faculty (for faculty research interests, see http://www.unr.edu/math/faculty/).

Contact Information: Send curriculum vitae, research summary, and three letters of recommendation to:

Statistics Search Committee
Department of Mathematics/084
University of Nevada
Reno, NV 89557

If possible, please include the Academic Employment in Mathematics Standard Cover Sheet, which can be downloaded from http://www.ams.org/. Search Chair: Inmaculada Aban.

Closing Date: To receive full consideration, complete applications must be received by January 4, 2002.

Web page: http://www.unr.edu/artsci/math/; email: Search Chair: aban@unr.edu. The University of Nevada is an Equal Opportunity/Affirmative Action Employer and does not discriminate on the basis of race, color, religion, sex, age, creed, national origin, veteran status, physical or mental disability, sexual orientation in any program or activity it operates. University of Nevada employs only United States citizens and aliens lawfully authorized to work in the United States.

NEW HAMPSHIRE

DARTMOUTH COLLEGE
Department of Mathematics

The Department of Mathematics anticipates three tenure-track openings with initial appointment in the 2002–03 academic year. The positions are in logic/set theory, or number theory, or "applicable mathematics". The work of candidates in applicable mathematics should straddle the line of pure and applied mathematics. The successful candidate will be a researcher working in core mathematics who has a proven track record in pursuing both the theoretical development of his/her subject, as well as potential applications. Examples include (but are not limited to) number theorists with interests in cryptography or coding theory, representation theorists who work in signal processing, combinatorialists with interests in computing, probabilists with interests in statistics, as well as more classical applied mathematicians. Various projects are currently funded by NSF and DoD. Active collaborations with the medical and engineering schools, and programs in computer science and cognitive neuroscience exist. Collaborations and or appointments in Dartmouth's M.D./Ph.D. program as well as Dartmouth's Institute for Secure Technologies Studies are also possible. In exceptional cases an appointment at a higher level may be possible.

Candidates for any position must be committed to outstanding teaching at all levels of the undergraduate and graduate curriculum and must give evidence of a well-regarded research program that shows real promise for the future. Candidates with several years of experience should in addition be ready to direct Ph.D. theses.

To create an atmosphere supportive of research, Dartmouth offers new faculty

members grants for research-related expenses, a quarter of sabbatical leave for each three academic years in residence, and flexible scheduling of teaching responsibilities. The teaching responsibility in mathematics is four courses spread over two or three quarters. The department encourages good teaching with a combination of committed colleagues and bright, responsive students.

To apply, send a letter of application, curriculum vitae, and a brief statement of research results and interests. Also arrange for four letters of reference to be sent, at least one of which addresses teaching, and, if the applicant's native language is not English, the applicant's ability to use English in a classroom. All application materials should be addressed to Betty Harrington, Recruiting Secretary, Department of Mathematics, Dartmouth College, 6188 Bradley Hall, Hanover, NH 03755-3551. Applications completed by January 5 will receive first consideration. Dartmouth is committed to Affirmative Action and encourages applications from African Americans, Asian Americans, Hispanics, Native Americans, and women. Inquiries about the progress of the selection process can be directed to Dwight Lahr, Recruiting Chair.

DARTMOUTH COLLEGE
Department of Mathematics
6188 Bradley Hall
Hanover, NH 03755-3551

Dartmouth College is the recent recipient of an NSF/NIMH award to establish a fMRI Data Center (see `http://www.fmridc.org/`). This is a joint effort of Dartmouth's Department of Mathematics, Center for Cognitive Neuroscience, and Department of Computer Science. In conjunction with the center, the Department of Mathematics is now accepting applications for a two-year postdoctoral fellow in applied mathematics, initial appointment in the 2002–03 academic year. Fellows will be expected to teach one graduate seminar each year (in their specialty) and to help in the implementation and development of novel postprocessing tools for the center. Fellows will interact with all of the cooperating departments. The ideal applicant will have strong interdisciplinary interests and have a background in informatics, image or signal processing, or medical imaging, but applicants with strong mathematical backgrounds who are looking to become more applied and learn about data mining, medical imaging, or image processing may also be excellent candidates.

Send letter of application, résumé, graduate transcript, thesis abstract (and description of other research activities and interests if appropriate), and 3 or preferably 4 letters of recommendation (at least one should discuss teaching) to Betty Harrington at the address above. Dartmouth College is committed to Affirmative Action and strongly encourages applications from minorities and women.

DARTMOUTH COLLEGE
John Wesley Young
Research Instructorship

The John Wesley Young Research Instructorship is a two-year postdoctoral appointment for promising new or recent Ph.D's whose research interests overlap a department member's. Current departmental interests include areas in algebra, analysis, algebraic geometry, combinatorics, differential geometry, logic and set theory, number theory, probability, and topology. Teaching duties of four 10-week courses spread over two or three quarters typically include at least one course in the instructor's speciality and include elementary, advanced, and (at instructor's option) graduate courses. Nine-month salary of $43,000 supplemented by summer research stipend of $9,555 for instructors in residence for two months in summer. Send letter of application, résumé, graduate transcript, thesis abstract, description of order research activities and interests if appropriate, and 3 or preferably 4 letters of recommendation (at least one should discuss teaching) to: Betty Harrington, Department of Mathematics, 6188 Bradley Hall, Hanover, NH 03755-3551. Applications received by January 5 will receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to Affirmative Action and strongly encourages applications from minorities and women.

NEW JERSEY

RUTGERS UNIVERSITY, CAMDEN
Department of Mathematical Sciences

The Department of Mathematical Sciences invites applications for a tenure-track appointment at the assistant professor level in mathematics beginning in fall 2002. Candidates should have significant research accomplishments beyond the doctoral dissertation and a demonstrated skill in teaching. Applicants should send curriculum vitae, which includes a publication list, brief descriptions of research and teaching accomplishments and goals, and three letters of reference to:

Search Committee
Rutgers University
Camden, NJ 08102
Department of Mathematical Sciences

Screening will begin immediately and will continue until the position is filled.

Rutgers University is an Equal Opportunity/Affirmative Action Employer. Women and minorities are strongly encouraged to apply.

RUTGERS UNIVERSITY, NEWARK
Assistant Professor of Mathematics

The Department of Mathematics and Computer Science invites applications for a tenure-track assistant professor position in mathematics to begin September 2002. Candidates must have a Ph.D. and a strong research record, show outstanding promise for future work, and demonstrate a commitment to effective teaching.

In addition to participating in our undergraduate and Ph.D. math programs, candidates must be prepared to teach courses and advise students in our department's undergraduate computer science program. Preference will be given to candidates with a willingness to take a leadership role in this area.

Applicants should arrange for (1) an AMS Standard Cover Sheet; (2) a curriculum vitae; (3) a research statement; and (4) at least four letters of recommendation, one of which addresses teaching, to be sent to:

Personnel Committee
Department of Mathematics
and Computer Science
Rutgers University
Newark, NJ 07102

The review process will begin January 15, 2002. Applications may be accepted until the position is filled.

Rutgers University is an Equal Opportunity/Affirmative Action Employer.

NEW YORK

BINGHAMTON UNIVERSITY
(The State University of New York at Binghamton)
Department of Mathematical Sciences

The Department of Mathematical Sciences at Binghamton University (The State University of New York at Binghamton) invites applications for an assistant/associate professor in mathematics. Qualifications: A substantial research program in progress and a solid record of effective teaching. Desired: Graduate-level teaching and research grants. Areas of interest related to activities of our current faculty have priority. Screening begins January 1, 2002. Send CV, evidence of research teaching credentials, and three letters of recommendation to: Erik Pedersen, Chair, Department of Mathematical Sciences, Binghamton University, Binghamton, NY 13902-6000. Applications will also be accepted through `http://www.mathjobs.org/`, tel: 607-777-2148, fax: 607-777-2450, e-mail: `Junior_Rec@math.binghamton.edu`. Binghamton University is an Equal Opportunity/Affirmative Action Employer.

MANHATTAN COLLEGE
Department of Mathematics and Computer Science

Manhattan College, located in the Riverdale section of NYC, is an independent Catholic

coeducational institution in the Lasallian tradition, with Schools of Arts, Business, Education, Engineering and Science. Applications are invited for a tenure-track assistant professor position in mathematics for August 2002. A Ph.D. in the mathematical sciences is required. There is also a position available in computer science. A commitment to excellence in teaching is essential. Classes are small. The department typically graduates 10–15 math/math-ed majors per year.

Candidates should submit a letter of application, a résumé, three letters of recommendation (at least two of which should address teaching ability), and a statement of teaching philosophy to the Search Committee, Department of Mathematics and Computer Science, School of Science, Manhattan College, Riverdale, NY 10471. Review of applications will start upon receipt and will continue until the position is filled. Women and minorities are encouraged to apply. We are committed to a diverse work force. An AA/EO Employer M/F/D/V.

NEW YORK UNIVERSITY
Courant Institute of Mathematical Sciences

The Courant Institute is a center for advanced training and research in the mathematical sciences. It has long been a leader in mathematical analysis, differential geometry, probability theory, applied mathematics, and scientific computation, with special emphasis on partial differential equations and their applications. Its scientific activities include an extensive array of research seminars and advanced graduate courses.

Each year a limited number of Courant Instructorships are awarded to postdoctoral scientists. These appointments carry a light teaching load of one course per semester and ordinarily are for a three-year term. These positions are primarily for recent Ph.D.'s, and candidates must have a degree in mathematics or an affiliated field.

For an application and further information, write to: Visiting Membership Committee, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, NY 10012-1185. Forms may also be obtained directly from the Web at `http://www.cims.nyu.edu/information/brochure/visiting.html` or by sending e-mail to `vm-apply@cims.nyu.edu`. Applications and supporting documents are due by December 15, 2001, for appointments to begin the following academic year.

The Courant Institute at New York University is an Equal Opportunity/Affirmative Action Employer.

QUEENS COLLEGE, CUNY
Department of Mathematics
Assistant Professorship

The Department of Mathematics at Queens College, CUNY, invites applications for a full-time, tenure-track position at the rank of assistant professor, starting in the fall 2002 semester. Applications will be accepted from candidates in all fields, with preference given to specialists in probability and statistics or in applied mathematics. Applicants are expected to hold a Ph.D. in mathematics, to demonstrate a commitment to teaching, and to show significant evidence of scholarly promise.

Queens College is a liberal arts institution with undergraduate and master's-level programs in mathematics and mathematics education. Some members of the department are also members of the doctoral faculty at the Graduate School of the City University. The college is located in Flushing, New York, and is easily accessible from Manhattan by public transportation.

Applicants should send a letter of application, a current curriculum vitae, and a minimum of three letters of recommendation to: Professor Wallace Goldberg, Chair, Search Committee, Department of Mathematics, Queens College, CUNY, 65-30 Kissena Boulevard, Flushing, NY 11367-1597. All material must be received by the search committee by February 1, 2002.

Queens College is an Equal Opportunity/Affirmative Action/Americans with Disabilities Employer.

SYRACUSE UNIVERSITY
Department of Mathematics

The department seeks to fill two positions, without restriction on rank, beginning August 2002. All candidates should have a Ph.D. in mathematics or closely related field and outstanding records of accomplishment and potential in both research and teaching. Exceptional candidates from all areas will be considered, but preference will be given to candidates in algebra or algebraic geometry. Preference will also be given to candidates whose research interests overlap and/or complement those of existing faculty. See `http://math.syr.edu/` for more information.

Applications should include a cover letter, CV, three letters of recommendation about the applicant's research, and at least one letter of recommendation about the applicant's teaching. Address applications to Chair, Department of Mathematics, Syracuse University, Syracuse, NY 13244. Screening of senior level candidates is ongoing. Screening of junior level candidates will begin January 1, 2002. All searches will continue until the positions are filled.

Syracuse University is an Equal Opportunity/Affirmative Action Employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

NORTH CAROLINA

EAST CAROLINA UNIVERSITY
Department of Mathematics
Chair and Professor of Mathematics

Applications and nominations are invited for chair of the Department of Mathematics, East Carolina University. Appointment will be at the level of professor with permanent tenure, beginning on or before August 1, 2002. Qualifications for the position include an earned Ph.D. in the mathematical sciences, administrative experience, a distinguished record of research, and a demonstrated commitment to excellence in teaching and service. Preference will be given to candidates from doctoral-granting institutions. Salary and resources will be highly competitive.

Please send letter of application, CV, and a statement of administrative philosophy with details about personal administrative experience. Three current letters of recommendation or the names of 3 references should also be forwarded. For details, please see `http://www.ecu.edu/math/`. Send all materials to: Dr. Richard C. Kearney, Chair, Mathematics Search Committee, Department of Political Science, East Carolina University, Greenville, NC 27858-4353; phone: 252-328-1066; fax: 252-328-4134; e-mail: `kearneyr@mail.ecu.edu`.

East Carolina University is a constituent institution of the University of North Carolina University System, an Equal Opportunity/Affirmative Action University, and accommodates individuals with disabilities. Applicants must comply with the Immigration Reform and Control Act.

UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL
Department of Mathematics

Applications are invited for the position of postdoctoral fellow in applied mathematics. The appointment is to begin January 1, 2002, and may be renewed through the 2003–04 academic year. Candidates for the 2002–03 academic year are also encouraged to apply now. Candidates should have received a doctorate either in mathematics, applied mathematics, or a closely related field. Applicants with a strong research promise in computational fluid dynamics or scientific computing will be given highest priority. More information on the UNC applied math group can be found at our website, `http://www.amath.unc.edu/jobs/`.

OHIO

DENISON UNIVERSITY
Department of Mathematics and Computer Science

Denison University has a tenure-track position in the Department of Mathematics

and Computer Science beginning August 2002. A Ph.D. is required in mathematics. A commitment to quality instruction of undergraduates is essential. Teaching load is three courses per semester.

Denison University is a liberal arts college of 2,000 students located in a village of 4,000, seven miles from Newark (population 50,000) and 25 miles east of Columbus, Ohio. The Department of Mathematics and Computer Science offers B.A. and B.S. degrees in mathematics and computer science.

To apply, send cover letter, résumé, statement of teaching and research interests, transcripts of graduate work, and three letters of recommendation from individuals who know you well and are in support of your application. Please forward to:

Dr. Michael Westmoreland, Chair
Department of Mathematics
and Computer Science
Denison University
Granville, OH 43023

Applications complete as of December 15, 2001, will be guaranteed full consideration, with later applications reviewed as needed. Denison University is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

KENYON COLLEGE
Mathematics Department

The Mathematics Department at Kenyon College invites applications for two tenure-track positions at the assistant professor level. Kenyon College is a highly selective private liberal arts college of 1,500 students. Applicants for the positions must have a Ph.D. in mathematics. Preference for at least one position will be given to applicants with the ability to teach both mathematics courses and lower-level courses in programming. Candidates with any specialty will be considered, but substantial training in computer science and/or applied mathematics will be an advantage.

the mathematics Department consists of seven full-time faculty members teaching the full range of undergraduate mathematics courses. The department offers a major in mathematics with concentrations in statistics or classical mathematics. The mathematics department, together with faculty in other sciences, has also developed an interdisciplinary concentration in scientific computing. Applicants should bring an interest and ability to participate in this effort.

For a number of years our department has emphasized strategies for student-centered learning. Thus, we will be particularly interested in candidates having some experience in active learning techniques and/or laboratory-based instruction. A typical teaching load consists of five courses per year. In addition to teaching duties, faculty members are expected to be engaged in scholarship and to contribute to the college community in various ways.

A letter of application, vita, transcripts, a teaching statement, and three letters of reference should be sent to:

Chair, Search Committee
Department of Mathematics
Kenyon College
Gambier, OH 43022

At least one letter of reference must address the applicant's teaching ability and experience. To be assured of full consideration, dossiers have to be complete by December 15, 2001; however, we will continue to accept applications until the position is filled. Members of the department will be at the January AMS/MAA meetings in San Diego to conduct some preliminary interviews. Inquiries about the position may be sent to the address above or to mathsearch@kenyon.edu; more information about Kenyon can be found at http://www.kenyon.edu/.

An Equal Opportunity Employer, Kenyon affirms the values and goals of diversity; therefore, the applications of women and minorities are particularly encouraged.

THE UNIVERSITY OF AKRON
Department of Mathematics and Computer Science
Assistant/Associate Professor

Applications are invited for three tenure-track positions starting August 26, 2002: two at the assistant/associate professor rank and one at the assistant professor rank. Applicants should possess a Ph.D. in applied mathematics, Mathematics or a closely related area with research strength in interdisciplinary efforts in science or engineering. Candidates with interests in materials science, scientific computation, or applied analysis are preferred. Salary is commensurate with background and experience. Start-up funds are available.

At the assistant professor level candidates are expected to provide evidence of an ongoing research program including potential for receiving external funding. Candidates should also provide evidence of experience and dedication to teaching.

Applicants at the associate professor level must submit evidence of a strong publication and funding record as well as effective undergraduate and graduate teaching.

The department offers bachelor's and master's degrees in applied mathematics and mathematics. An engineering applied mathematics doctoral program, emphasizing interdisciplinary applied mathematics, is offered cooperatively with the College of Engineering. See http://www.math.uakron.edu/ for more information about the department and its programs.

The University of Akron is a state-assisted comprehensive teaching and research university in northeast Ohio with approximately 23,500 students. The university is known for its interdisciplinary programs and has a world-class polymer science program and recognized departments in engineering, science, business, and education.

All materials (application letter, curriculum vitae, unofficial copy of graduate transcripts, and three letters of recommendation) should be sent to:

G.W. Young, Chair
Search Committee
Department of Mathematics
and Computer Science
The University of Akron
Akron, OH 44325-4002

Inquiries may be sent to gwyoung@uakron.edu. Review of completed applications will begin November 11, 2001, and will continue until the positions are filled.

Women and minorities are encouraged to apply. The University of Akron is an Equal Education and Employment Institution.

OKLAHOMA

THE UNIVERSITY OF OKLAHOMA
Department of Mathematics

Applications are invited for one or more full-time, tenure-track position(s) in mathematics, beginning August 16, 2002. The position(s) is initially budgeted at the assistant professor level, but an appointment at the associate professor level may be possible for an exceptional candidate with qualifications and experience appropriate to that rank. Normal duties consist of teaching two courses per semester, conducting research, and rendering service to the department, university, and profession at a level appropriate to the faculty member's experience. The position(s) requires an earned doctorate and research interests that are compatible with those of the existing faculty; preference will be given to applicants with potential or demonstrated excellence in research and prior successful undergraduate teaching experience. Salary and benefits are commpetitive. For full consideration, applicants should send a completed AMS cover sheet, curriculum vitae, a description of current and planned research, and have sent three letters of recommendation (at least one of which must address the applicant's teaching experience and proficiency) to:

Search Committee
Department of Mathematics
University of Oklahoma
601 Elm, PHSC 423
Norman, OK 73019-0315
phone: 405-325-6711
fax: 405-325-7484
e-mail: search@math.ou.edu

Screening of applications will begin on December 15, 2001, and will continue until the position(s) is filled.

The University of Oklahoma is an Equal Opportunity/Affirmative Action Employer.

Women and minorities are encouraged to apply. OU has a policy of being responsive to the needs of dual-career couples.

PENNSYLVANIA

CARNEGIE MELLON UNIVERSITY
Department of Mathematical Sciences

The Department of Mathematical Sciences expects to appoint a postdoctoral fellow in mathematical finance, beginning in September 2002. Applicants should have a strong record of accomplishment in probability research and a serious interest in the applications of probability to finance. This will be a two-year appointment, with the possibility of a third-year extension. Recipients will teach at most two courses per year. Applicants should send a vita, list of publications, a statement describing current and planned research, and arrange to have at least three letters of recommendation sent. The deadline for applications is January 18, 2002. All communications should be addressed to: Appointments Committee, Center for Computational Finance, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

CARNEGIE MELLON UNIVERSITY
Department of Mathematical Sciences
Tenure-Track Position
Applied Analysis

The Department of Mathematical Sciences at Carnegie Mellon University invites applications for a tenure-track position to begin September 1, 2002.

The position is in applied analysis in the areas of nonlinear partial differential equations and the calculus of variations. Preference will be given to candidates who have shown outstanding promise and/or excellent accomplishments in research in the above areas and who pursue a vigorous research program, including major contributions beyond the doctoral dissertation. Expertise in the areas of nonconvex variational problems, multiscale problems, connections between atomistic and continuum models will be preferred.

Applicants should send a curriculum vitae, list of publications, a statement describing current and planned research, and arrange to have sent at least three letters of recommendation to: Applied Analysis Appointments Committee, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA 15213. The deadline for both tenure-track and tenured applications is January 18, 2002.

The Department of Mathematical Sciences is committed to increasing the number of women and minority faculty. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities.

CARNEGIE MELLON UNIVERSITY
Department of Mathematical Sciences
Zeev Nehari Visiting
Assistant Professorship

The Zeev Nehari Visiting Assistant Professorship was established to honor the memory of Professor Nehari, who had a long and distinguished career in the Department of Mathematical Sciences. This position is available for a period of three years, beginning in September 2002, and carries a teaching load of three courses during the academic year. Applicants are expected to show exceptional research promise as well as clear evidence of achievement and should have research interests which intersect those of current faculty of the department. Applicants should send a vita, list of publications, a statement describing current and planned research, and arrange to have sent at least three letters of recommendation to the committee. The deadline for applications is January 18, 2002. All communications should be addressed to: Zeev Nehari Appointments Committee, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

GANNON UNIVERSITY
Department of Mathematics
Assistant Professor

Gannon, a Catholic university located in Erie, Pennsylvania, invites applications for a nine-month, tenure-track position of asst. professor, mathematics, slated to begin August 2002.

The successful candidate will have responsibilities for teaching a wide variety of undergraduate mathematics courses. Preference will be given to individuals with experience in numerical analysis. Duties include teaching 24 credit hours per academic year, research, student advising, and service on university committees.

This position will remain open until the vacancy is filled. For position requirements and application procedures, visit our website at: `http://www.gannon.edu/jobposts/`.

Gannon University is an Affirmative Action/Equal Opportunity Employer.

MILLERSVILLE UNIVERSITY
OF PENNSYLVANIA
Department of Mathematics

Full-time, tenure-track assistant professorship to begin August 2002 in a department of 20 faculty and approximately 165 majors in mathematics and mathematics education. **Required:** Ph.D. (or completion within one year) in mathematics with expertise in geometry or topology, evidence of strong commitment to excellence in teaching and continued scholarly activity. Must be prepared to teach a broad spectrum of undergraduate mathematics courses and to teach undergraduate geometry as it relates to the preparation of secondary school teachers, must provide evidence of teaching effectiveness, and must complete a successful interview and teaching demonstration. Duties include an annual 24-hour teaching load, scholarly activity, student advisement, curriculum development, and committee work.

Millersville University is a selective, comprehensive, state university of 7,500 students located in historic Lancaster County, PA, within two hours of Philadelphia, Baltimore, and Washington, DC, and within three hours of New York City. Additional information on the university and the department can be found at `http://www.millersville.edu/`.

Send application letter that addresses the position requirements, vita, copies of undergraduate and graduate transcripts, and three letters of reference (at least two of which attest to recent teaching effectiveness) to: Dr. Ximena Catepillán Hearn, Staff Search Committee/AMS1201A, Department of Mathematics, Millersville University of Pennsylvania, P.O. Box 1002, Millersville, PA 17551-0302. Full consideration will be given to applications received by 2/1/2002. An EO/AA Institution. E-mail applications will not be accepted.

MILLERSVILLE UNIVERSITY
OF PENNSYLVANIA
Department of Mathematics

Full-time, tenure-track assistant professorship in mathematics education to begin August 2002 in a department of 20 faculty members and approximately 165 undergraduate majors, offering B.A. and B.S. degrees in mathematics and B.S.Ed. and M.Ed. degrees in mathematics education. **Required:** Doctorate (or completion within one year) in mathematics education or in mathematics with a specialization in mathematics education; broad training in mathematics, with at least 24 semester hours of graduate-level courses in pure or applied mathematics; evidence of strong commitment to excellence in teaching and continued scholarly activity; familiarity with current directions in mathematics education, including the use of technology. Must be prepared to teach a broad spectrum of undergraduate mathematics courses and work effectively with professional and community groups, must provide evidence of teaching effectiveness, and must complete a successful interview and teaching demonstration. Duties include an annual 24-hour teaching load, including mathematics courses for preservice elementary and secondary teachers and a variety of undergraduate mathematics service courses, scholarly activity, student advisement, curriculum development in mathematics

education at both undergraduate and graduate levels, and committee work. Experience teaching mathematics in K–12 setting is preferred.

Millersville University is a selective comprehensive, state university of 7,500 students located in historic Lancaster County, PA, within two hours of Philadelphia, Baltimore, and Washington, DC, and within three hours of New York City. Additional information on the university and the department can be found at http://www.millersville.edu/.

Send application letter that addresses the position requirements, vita, copies of undergraduate and graduate transcripts, and three letters of reference (at least two of which attest to recent teaching effectiveness) to: Dr. Bernie Schroeder, Staff Search Committee/AMS1201B, Department of Mathematics, Millersville University of Pennsylvania, P.O. Box 1002, Millersville, PA 17551-0302. Full consideration will be given to applications received by 2/1/2002. An EO/AA Institution. E-mail applications will not be accepted.

PENN STATE UNIVERSITY
COMMONWEALTH COLLEGE
Department of Mathematics

The Commonwealth College invites applications for tenure-track positions at the rank of assistant professor at two of its campuses beginning in August 2002. Tenure and promotion in the college are based on the following: innovative teaching of courses ranging primarily over the first two years of college mathematics; recognized research and scholarly contributions to mathematics and mathematics pedagogy; service to the campus, college, university, and community at large. Applicants must complete the Ph.D. degree in a mathematical science by the time the appointment begins and will be selected on the basis of their potential for achieving tenure and promotion. To learn more about the campuses and the positions, please visit the "Careers With Us" link on our home page at http://cwchome.psu.edu/. Applicants should submit a résumé including a list of publications, a statement on teaching and research, and the complete contact information for three references, including e-mails if possible, to:

The Pennsylvania State University
Commonwealth College
Faculty Searches
111 Old Main, Box AMS-NOTICES
University Park, PA 16802

Review of applications will begin November 1, 2001, and will continue until the positions are filled. Penn State is committed to Affirmative Action/Equal Opportunity and the diversity of its work force.

RHODE ISLAND

BROWN UNIVERSITY
Division of Applied Mathematics
Position in Statistics and Probability

The Division of Applied Mathematics seeks applicants for a position at the assistant or associate professor level in the general area of statistics and probability. Preference will be given to applicants who combine research in statistical theory and methods with novel applications to science, or applicants who add distinct new dimensions to the research in probability currently in the division. Candidates at the associate professor level are expected to demonstrate substantial contributions in both theory and application. Good communication and teaching skills are expected.

Candidates should submit curriculum vitae, representative preprints or reprints, and a concise description of research interests and goals to:

Professor Chi-Wang Shu, Chairman
Division of Applied Mathematics
Brown University
Box F - Attention: Statistics Search
Providence, RI 02912

Additionally, candidates should arrange to have at least three letters of recommendation sent directly to the Search Committee at this address. To receive full consideration, complete applications should be received by January 7, 2002.

Brown University is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

BROWN UNIVERSITY
Department of Mathematics

One professorship at the associate professor or professor level, with tenure to begin July 1, 2003. Candidates should have a distinguished research record and a strong commitment to excellence in undergraduate and graduate teaching. Preference to be given to applicants with research interests consonant with those of the present members of the department (for more information see http://www.math.brown.edu/faculty/faculty.html). Qualified individuals are invited to send a vita and arrange for at least five letters of recommendation to be forwarded to: Senior Search Committee, Department of Mathematics, Box 1917, Brown University, Providence, RI 02912. Applications must be postmarked by **February 18, 2002**, in order to receive full consideration. E-mail inquiries can be addressed to srsearch@math.brown.edu. Brown University is an Equal Opportunity/Affirmative Action Employer and encourages applications from women and minorities.

TENNESSEE

RHODES COLLEGE
Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science at Rhodes College seeks applications for a tenure-track position in mathematics, the appointment starting fall 2002. A Ph.D. in mathematics is required, demonstrated effectiveness as a teacher is essential, and a continuing program of scholarly work is expected. Teaching duties are three courses per semester. Applicants with specializations in algebra or topology are especially encouraged to apply. A complete application will include a letter of application, a statement of teaching philosophy, a statement describing current and anticipated research activity, a vita, the AMS cover sheet, and three letters of recommendation to: Thomas Barr, Chair, Mathematics and Computer Science Department, Rhodes College, 2000 North Parkway, Memphis, TN 38112. Review of applications will commence 8 December 2001 and will continue until the position is filled.

Rhodes College is a highly selective coeducational college of the liberal arts and sciences founded in 1848. It has been related to the Presbyterian Church USA since 1855. Rhodes College is an Equal Opportunity Employer committed to diversity in the work force.

TEXAS

SOUTHERN METHODIST UNIVERSITY
DEDMAN COLLEGE
Department of Mathematics

Applications are invited for two positions at either the senior level (tenured) or junior level (tenure-track) to begin in the fall semester of 2002. Applicants must have a strong commitment to teaching at all levels and provide evidence of outstanding research. The Department of Mathematics has an active doctoral program in computational and applied mathematics, with twelve of the fifteen present faculty conducting research in these areas. Current research includes numerical analysis of differential equations, dynamical systems, bifurcation theory, finite element methods, perturbation methods, and mathematical software with applications to areas such as nonlinear optics, lasers, solidification, vortex dynamics, reservoir simulation, pattern formation, and nonlinear waves.

To apply, send a letter of application with a curriculum vitae, a list of publications, and a research and teaching statement to: The Faculty Search Committee, Department of Mathematics, Southern Methodist University, P.O. Box 750156, Dallas, TX 75275-0156. Applicants must

also arrange for three letters of recommendation to be forwarded to the Faculty Search Committee.

The committee will begin its review of the applications on or about January 14, 2002. To ensure full consideration for the positions, the application must be postmarked on or before January 14, 2002, but the committee will continue to accept applications until the positions are filled. The committee will notify applicants of its employment decision after the positions are filled.

SMU will not discriminate on the basis of race, color, religion, national origin, sex, age, disability, or veteran status. SMU is also committed to nondiscrimination on the basis of sexual orientation.

Visit the department's home page at `http://www.smu.edu/math/` for more information. The Search Committee can be contacted by sending e-mail to `mathsearch@mail.smu.edu`, tel: (214) 768-2506, fax: (214) 768-2355.

TEXAS A&M UNIVERSITY
Department of Mathematics

Applications are invited for tenured and tenure-eligible faculty positions beginning fall 2002. The field is open, but we particularly seek applications from individuals whose mathematical interests would augment and build upon existing strengths both within the mathematics department as well as other departments in the university. Salary, teaching loads, and start-up funds are competitive.

For a tenured position the applicant should have an outstanding research reputation and would be expected to fill a leadership role in the department. An established research program, including success in attracting external funding and supervision of graduate students, and a demonstrated ability and interest in teaching are required. Informal inquiries are welcome.

For an assistant professorship, we seek strong research potential and evidence of excellence in teaching. Research productivity beyond the doctoral dissertation will normally be expected.

In order to expedite the application process, we request that the AMS Standard Cover Sheet be used. Applicants should arrange to send the completed form, a vita, and letters of recommendation to:

Faculty Hiring
Department of Mathematics
Texas A&M University
College Station, TX 77843-3368

Further information can be obtained from `http://www.math.tamu.edu/hiring/`.

Texas A&M University is an EOE/AA Employer, and the department encourages applications from women and minorities.

TEXAS A&M UNIVERSITY
Department of Mathematics

The department will have several visiting appointments available beginning fall 2002.

Senior positions may be for a semester or one-year period, and the number available will depend on funding.

The Visiting Assistant Professor positions are for a three-year period. They are intended for those who have recently received their Ph.D., and preference will be given to mathematicians whose research interests are close to those of our regular faculty members. Salary and teaching loads are competitive. In addition, as part of our VIGRE grant we expect to have up to four positions carrying a one-course-per-semester teaching load.

In order to expedite the application process, we request that the AMS Standard Cover Sheet be used. Applicants should send the completed form, a vita, and letters of recommendation to:

Visiting Faculty Hiring
Department of Mathematics
Texas A&M University
College Station, TX 77843-3368

For full consideration, the complete dossier should be received by January 15, 2002. Further information can be obtained from our website, `http://www.math.tamu.edu/hiring/`.

Texas A&M University is an EOE/AA Employer, and the department encourages applications from women and minorities.

TEXAS TECH UNIVERSITY
Department of Mathematics and Statistics

Applications are invited for four tenure-track assistant professor positions beginning fall 2002. Higher-level appointments are possible in exceptional cases. All areas of pure and applied mathematics, statistics, and mathematics education will be considered, with priority being given to candidates having research interests compatible with those of the department. Strong promise or accomplishment in research and teaching and a Ph.D. degree at the time of appointment are required. Applications can be either submitted online at `http://www.mathjobs.org/` or mailed to: Alex Wang, Hiring Chair, Department of Mathematics and Statistics, Texas Tech University, Lubbock, TX 79409-1042. Please submit a résumé and a completed AMS Standard Cover Sheet, and arrange to have three letters of reference sent directly. Texas Tech University is committed to diversity among its faculty. Women and minorities are strongly encouraged to apply. Review of applications will begin immediately. Additional information is available at `http://ttmath.ttu.edu/~awang/employ/employ.html`. Texas Tech is an AA/EO Employer.

THE UNIVERSITY OF TEXAS AT ARLINGTON
Department of Mathematics

The department invites applications for an anticipated (pending budgetary approval) tenured full or associate professor position beginning fall 2002. Applicants should have outstanding credentials in some field of mathematics. This should include a Ph.D. in mathematics or related discipline, a nationally recognized record of research, a strong history of external funding, and strong potential for future external funding.

Applications should include a résumé detailing research interests and funding record, and three recommendation letters. In order to expedite the application process, the use of an AMS Standard Cover Sheet is recommended. Screening of applicants will begin December 1, 2001. Applications will be accepted until the position is filled. Applications should be sent to:

D.L. Hawkins, Chairman
Faculty Search Committee
Department of Mathematics
The University of Texas at Arlington
Box 19408
Arlington, TX 76019-0408

The University of Texas at Arlington is an Equal Opportunity/Affirmative Action Employer.

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Mathematics

Openings for fall 2002 include: (a) instructorships, some that have R. H. Bing Faculty Fellowships attached to them and others that are VIGRE Instructorships; and (b) four or more positions at the tenure-track/tenured level.

(a) Instructorships at The University of Texas at Austin are postdoctoral appointments, renewable for two additional years. It is assumed that applicants for instructorships will have completed all Ph.D. requirements by August 28, 2002. Other factors being equal, preference will be given to those whose doctorates were conferred in 2001 or 2002. Candidates should show superior research ability and have a strong commitment to teaching. Consideration will be given only to persons whose research interests have some overlap with those of the permanent faculty. Duties consist of teaching undergraduate or graduate courses and conducting independent research. The projected salary is $39,000 for the nine-month academic year.

Each R. H. Bing Fellow holds an instructorship in the mathematics department, with a teaching load of two courses in one semester and one course in the other. The combined instructorship-fellowship stipend for nine months is $42,000, which is supplemented by a travel allowance of $1,000. Pending satisfactory performance

of teaching duties, the fellowship can be renewed for two additional years. Applicants must show outstanding promise in research. Bing Fellowship applicants will automatically be considered for other departmental openings at the postdoctoral level, so a separate application for such a position is unnecessary.

VIGRE Instructorships are partially funded by an NSF VIGRE grant awarded to the department (in partnership with the Texas Institute for Computational and Applied Mathematics). The combined Instructorship-VIGRE Postdoctoral Fellowship carries a nine-month stipend of $40,000, with an annual allocation of $2,500 to cover equipment, supplies, and travel. The position also includes summer support in the amount of $6,500 for the first two summers of the appointment. The teaching load for VIGRE Instructors is one course per semester. Only citizens, nationals, and permanent residents of the U.S. are eligible for VIGRE Instructor appointments. Furthermore, a VIGRE Instructor must have received the Ph.D. within eighteen months of the date the appointment becomes effective. All eligible applicants for postdoctoral positions in either the mathematics department or TICAM will automatically be considered for a VIGRE Instructorship.

Those wishing to apply for instructor positions are asked to send a vita and a brief research summary to the above address c/o Instructor Committee. Transmission of the preceding items via e-mail (address: instructor@math.utexas.edu) is encouraged.

(b) An applicant for a tenure-track or tenured position must present a record of exceptional achievement in her or his research area and must demonstrate a proficiency at teaching. In addition to the duties indicated above for instructors, such an appointment will typically entail the supervision of M.A. or Ph.D. students. The salary will be commensurate with the level at which the position is filled and the qualifications of the person who fills it.

Those wishing to apply for tenure-track/tenured positions are asked to send a vita and a brief research summary to the above address, c/o Recruiting Committee. Transmission of the preceding items via e-mail (address: recruit@math.utexas.edu) is encouraged.

All applications must be supported by three or more letters of recommendation, at least one of which speaks to the applicant's teaching credentials. The screening of applications will begin on December 1, 2001. The University of Texas at Austin is an Equal Opportunity Employer.

VIRGINIA

UNIVERSITY OF VIRGINIA
Department of Mathematics

The Department of Mathematics invites applications for one or more tenure-track or tenured positions for the fall semester of 2002. Applicants must present evidence of outstanding accomplishment and/or promise in both research and teaching. Strong candidates at all levels and in all fields will be considered, though special attention will be given to fields which fit well with the strengths and interests of its current faculty (see the department's home page at http://www.virginia.edu/).

To apply, please send a letter of application, a curriculum vitae, and at least four letters of recommendation to:

Hiring Committee
Department of Mathematics
University of Virginia
Kerchof Hall
P. O. Box 400137
Charlottesville, VA 22904-4137

WEST VIRGINIA

WEST VIRGINIA UNIVERSITY
Eberly College of Arts and Sciences
Department of Mathematics

Applications and nominations are invited for up to three faculty positions starting August 16, 2002, to be part of the Institute for Math Learning. The Department of Mathematics seeks mathematicians or mathematics educators with excellent teaching skills and strong commitment to extending and developing effective, efficient ways of teaching mathematics students, generating new initiatives with the K–12 community, and aggressively competing for nationally awarded grants that would support the pedagogical dimension of the institute. We are working toward an institute that is regarded for its national leadership in innovative, effective research-based math learning models. The institute is part of the Department of Mathematics in the Eberly College of Arts & Sciences, with its own director and with operational governance that allows tenured and tenure-track faculty to be rewarded and recognized for their roles in teaching excellence and in research and scholarship associated with the goals of the institute and pedagogy associated with math learning. All applicants should have professional credentials qualifying for a tenure-track appointment at least at the rank of assistant professor. A truly outstanding individual with the capacity to provide research leadership will be considered for appointment at the rank of associate/full professor as an Eberly Professor, with benefits accorded to the Eberly Family Distinguished Professors in the Eberly College of Arts and Sciences.

West Virginia University is a land grant institution in the state of West Virginia, enrolling 22,000 students. It is a Doctoral/Research University-Extensive in the Carnegie Classification of Institutions of Higher Education, based on the complexity and breadth of the institution's mission. The Department of Mathematics has 26 full-time faculty members and approximately 30 M.S. and Ph.D. students. The department is housed in newly refurbished facilities that include networked offices and the university's mathematical library. The university is located in Morgantown, an award-winning city with a metropolitan population of 80,000. Morgantown has diverse cultural and recreational opportunities, excellent medical facilities, and a favorable location with ready access to the urban areas of Pittsburgh, PA, and Washington, DC.

Applicants should provide a letter of application including: a statement of teaching philosophy and any experience and vision related to achieving the goals of the institute; a vita; and the names and contact information of three references. Please send applications, references, and inquiries to:

Sherman D. Riemenschneider
Chair, Department of Mathematics
320 Armstrong Hall, P.O. Box 6310
West Virginia University
Morgantown, WV 26506-6310
e-mail: sherm@math.wvu.edu

Priority will be given to applications received by December 1, 2001.

West Virginia University is an Equal Opportunity/Affirmative Action Employer. Minority, disabled, and women candidates are urged to apply.

WISCONSIN

UNIVERSITY OF WISCONSIN-PARKSIDE
Assistant Professor
Position in Mathematics

Tenure-track assistant professor of mathematics, to begin September 1, 2002; preference given to strong applicants in areas of group theory, ring theory, and low-dimensional topology. Duties are teaching undergraduate mathematics and research activities. Position requires a commitment to encouraging student and community involvement in mathematics. Ph.D. in mathematics required. For full information, see listing at: http://www.uwp.edu/academic/mathematics/. UW-Parkside is an AA/EEO Employer D/M/W/V.

UNIVERSITY OF WISCONSIN-MADISON
Department of Mathematics

The Department of Mathematics anticipates openings for three positions to begin August 26, 2002, at the tenure-track (assistant professor) level. Appointment at the beginning associate professor level (tenured) will be considered

for exceptional candidates, but strong preference will be given to hiring at the assistant professor level. Applications are invited in all areas of mathematics. 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 departmental information is available on our website, http://www.math.wisc.edu/.

Applicants should send a completed AMS Standard Cover Sheet, a curriculum vitae which includes a publication list, and brief descriptions of research and teaching to:

Hiring Committee
Dept. of Mathematics, Van Vleck Hall
University of Wisconsin-Madison
480 Lincoln Drive
Madison, WI 53706-1388

Applicants should also arrange to have sent to the above address three or four letters of recommendation, at least one of which must discuss the applicant's teaching experiences and capabilities. Review of applications will begin on November 15, 2001. Applications will be accepted until the positions are filled. Additional letters will be solicited by the department for candidates who are finalists for a tenured position.

The Department of Mathematics is committed to increasing the number of women and minority faculty. The University of Wisconsin is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities. Unless confidentiality is requested in writing, information regarding the applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

UNIVERSITY OF WISCONSIN-MILWAUKEE
Department of Mathematical Sciences
Milwaukee, WI 53201-0413

The Department of Mathematical Sciences anticipates three openings for tenure-track assistant professorships, starting August 2002, subject to budgetary approval. The Department invites applications in algebra, dynamical systems, and numerical analysis. Candidates must have a strong research record, evidence of or strong potential for extramural funding, and a demonstrated commitment to teaching excellence. A successful candidate for the dynamical systems position will have interdisciplinary interests: potential collaborations include, but are not limited to, industrial mathematics, atmospheric science, and Computer Science. Responsibilities include: teaching two courses per semester and taking an active role in the undergraduate, master's, and Ph.D. programs. Additional information is available at http://www.math.uwm.edu/.

Applicants should send the AMS Standard Cover Sheet, a vita, a description of their research program, and a teaching statement to the Hiring Committee at the above address, postmarked by January 7, 2002. At least three letters of recommendation should be sent to the Hiring Committee by the deadline; at least one letter should address the applicant's teaching experience and capabilites. UW-Milwaukee is an EEO/AA Employer. Applications from female and minority candidates are strongly encouraged.

WYOMING

UNIVERSITY OF WYOMING
Department of Mathematics
Analysis Position

Applications are invited for a tenure-track assistant professorship to begin in August 2002. Minimum requirements are (i) an earned Ph.D. in mathematics, (ii) evidence of strong research potential, and (iii) evidence of good teaching and an interest in undergraduate and graduate advising and thesis supervision. Preferred qualifications include research emphasis in complex analysis, functional analysis, operator theory, dynamical systems or other current research areas in the department (see http://math.uwyo.edu/). Teaching load is 6–9 credit hours per semester. Advising undergraduates and outreach teaching may be required. The University of Wyoming mathematics department has 19 full-time faculty and offers the B.S., M.S., and Ph.D. in mathematics and an M.S. in teaching.

Applicants should send a letter of application, a current curriculum vitae, a statement of research interests, a statement of teaching experience and interest, and arrange to have sent three letters of recommendation, with at least one discussing the candidate's teaching experience, to the Analysis Search Committee, Department of Mathematics, University of Wyoming, Laramie, WY 82071-3036. Review of completed applications will begin February 1, 2002. The University of Wyoming is an AA/EEO Employer.

UNIVERSITY OF WYOMING
Department of Mathematics
Head Search

The Department of Mathematics at the University of Wyoming invites applications and nominations for the position of department head. The appointment will be at the rank of professor and will be effective August 1, 2002. Minimum qualifications are: an earned doctorate with a strong record of research in mathematics and exemplary teaching that would warrant tenure at UW. Preference will be given to individuals with research interests close to those represented in the department and with an established record of leadership. Undergraduate advising and outreach teaching may be required.

UW is a Carnegie classified extensive doctoral research university with approximately 11,000 students. The department offers the B.S., M.S., and Ph.D. degrees in mathematics and a master's of science degree in teaching. For additional details, visit the department's Web page at http://math.uwyo.edu/.

Review of completed applications will begin on January 15, 2002. Nominations and informal inquiries are encouraged; e-mail should be directed to bshader@uwyo.edu. Applicants should submit a letter explaining their interest in the position, a separate statement that describes their approach to the responsibilities of a department head, a vita, and arrange for four letters of reference to be sent to: Head Search Committee, Department of Mathematics, University of Wyoming, Laramie, WY 82071-3036. UW is an AA/EEO Employer. This is a revision of the ad that appeared in the November *Notices*.

CANADA

QUEEN'S UNIVERSITY AT KINGSTON
Department of Mathematics and Statistics

The Department of Mathematics and Statistics invites applications for a renewable tenure-track appointment at the assistant professor level to begin July 2002. The successful applicant will be expected to demonstrate potential for outstanding scholarship and research and show evidence of a commitment to excellence in teaching. Salary will be commensurate with qualifications and experience.

Candidates should have a Ph.D. in pure or applied mathematics, statistics, or a related area and will have begun an active research program. Candidates with some teaching experience are preferred.

Interested candidates should arrange for a curriculum vita; a description of research interests; up to five publications or preprints; a statement on teaching or a teaching dossier; and at least four letters of reference, one of which should comment on the candidate's teaching, to be sent to the address below by December 31, 2001. Applications will be considered until the position is filled.

James A. Mingo, Associate Head
Department of Mathematics
and Statistics
Queen's University
Kingston, Ontario K7L 3N6, Canada
fax: 613-533-2964
http://www.mast.queensu.ca/
e-mail: position@mast.queensu.ca

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents; however, all applications are wel-

come. Queen's University is committed to employment equity and welcomes applications from all qualified women and men, including visible minorities, aboriginal people, persons with disabilities, gay men and lesbians.

SIMON FRASER UNIVERSITY
Vancouver, British Columbia
Department of Mathematics
Faculty Appointment in Mathematics

The Department of Mathematics of Simon Fraser University has two positions in mathematics to be filled over the next two years. One position will start September 1, 2002, the second a year later. Applicants will be expected to have completed a Ph.D. degree at the time of appointment and to have demonstrated a strong teaching and research potential. The appointments will be made at the level of assistant professor. The department seeks to enhance its current strengths in combinatorics, computer algebra, modern analysis, and number theory.

The first hiring priority is combinatorial optimization. The second priority is a candidate with expertise in algebra or algebraic geometry. Candidates who can support the department's strengths will be preferred. Exceptional applicants in all areas of pure mathematics will be considered.

Applications, including a curriculum vitae and descriptive statements on research plans and teaching activities, should be sent by 10 January 2002 to:

Search Committee
Department of Mathematics
Simon Fraser University
Burnaby, BC V5A 1S6
Canada
e-mail: mcs@sfu.ca

Please arrange for letters of reference to be sent, in confidence, from three referees. We thank all applicants in advance; only those short-listed will be contacted. These positions are subject to final budgetary approval.

Further information on the department and the university can be found at http://www.math.sfu.ca/mast_home.html.

Simon Fraser University is committed to the principle of equity in employment and offers equal employment opportunities to all qualified applicants. In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents.

UNIVERSITY OF ALBERTA
Department of Mathematical and Statistical Sciences
Classical Analysis

The Department of Mathematical and Statistical Sciences, University of Alberta, invites applications for a tenure-track position in classical analysis. The appointment will be at the assistant professor level and will commence on or before July 1, 2002. We are looking for a person with a Ph.D., a strong record/outstanding potential for research, excellent communication and teaching skills, and leadership potential. The successful candidate must have a commitment to undergraduate and graduate education. Preferences will be given to an individual whose research interests promote contact with other university researchers and/or industry. We are particularly interested in areas of approximation theory, classical Fourier analysis, applied harmonic analysis, real analysis, and related inequalities and function spaces. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. If suitable Canadian citizens and permanent residents cannot be found, other individuals will be considered.

Applications should include a curriculum vitae, a research plan, and teaching dossier. Candidates should arrange for at least three confidential letters of reference to be sent to: Anthony To-Ming Lau, Chair, Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton, Alberta, Canada, T6G 2G1. The closing date for applications is January 15, 2002. For more information about the department and our university, please see our Web page, http://www.math.ualberta.ca/.

The records arising from this competition will be managed in accordance with provisions of the Alberta Freedom of Information and Protection of Privacy Act (FOIPP). The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

UNIVERSITY OF ALBERTA
Department of Mathematical and Statistical Sciences
Faculty Lecturer

The Department of Mathematical and Statistical Sciences, University of Alberta, invites applications for the position of Faculty Lecturer. This is a two-year position, with the possibility of reappointment, and will commence on or before July 1, 2002. The duties normally consist of teaching three undergraduate courses in statistics and/or mathematics in each fall and winter term, and two courses in intersession. Preference will be given to applicants with experience in teaching Statistics. Requirements are a Ph.D. or M.Sc. in statistics, mathematics, or a related discipline, and experience in teaching undergraduate courses in statistics and/or mathematics. in accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. If suitable Canadian citizens and permanent residents cannot be found, other individuals will be considered.

Applications should include a curriculum vitae, a teaching profile outlining experience and/or interests, and the names of three references. Applications should be sent to: Anthony To-Ming Lau, Chair, Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton, Alberta, Canada, T6G 2G1. The closing date for applications is February 1, 2002. For more information about the department and our university, please see our Web page, http://www.math.ualberta.ca/.

The records arising from this competition will be managed in accordance with provisions of the Alberta Freedom of Information and Protection of Privacy Act (FOIPP). The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and aboriginal persons.

UNIVERSITY OF ALBERTA
Department of Mathematical and Statistical Sciences
Geometry (G 2002)

The Department of Mathematical and Statistical Sciences, University of Alberta, invites applications for a tenure-track position in Geometry. The appointment will be at the assistant professor level and will commence on or before July 1, 2002. Only candidates with excellent communication and teaching skills, outstanding research and leadership potential as well as expertise in algebraic, arithmetic or differential geometry will be considered. This position requires a Ph.D. in mathematics. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. If suitable Canadian citizens and permanent residents cannot be found, other individuals will be considered.

Applications should include a curriculum vitae (including a list of publications), a research plan, and teaching dossier. Candidates should arrange for at least three confidential letters of reference to be sent to: Anthony To-Ming Lau, Chair, Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton, Alberta, Canada, T6G 2G1. The closing date for applications is January 15, 2002. For more information about the department and our university, please see our Web page, http://www.math.ualberta.ca/.

The records arising from this competition will be managed in accordance with provisions of the Alberta Freedom of Information and Protection of Privacy Act (FOIPP). The University of Alberta hires on

the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and aboriginal persons.

INDIA

HARISH-CHANDRA RESEARCH INSTITUTE
Chhatnag Road, Jhusi, Allahabad-211 019 (India)

The Harish-Chandra Research Institute conducts basic research in theoretical physics (astrophysics, condensed matter, high energy phenomenology and string theory) and in mathematics (algebra, algebraic geometry, analysis, combinatorics, differential geometry, discontinuous groups, number theory, Riemann surfaces and representation theory). Applications are invited for postdoctoral fellowships up to two years and for permanent faculty positions. Some interinstitutional and interdisciplinary joint appointments are also possible.

We are also looking for a person with expertise and interest in UNIX systems administration who is willing to divide his/her time between research in mathematics or physics and systems management.

Library and computing facilities at the HRI are excellent, and there is generous support for research-related travel. The campus is within two kilometers of a beautiful confluence-point of Ganga and Yamuna, has residential facilities, a sports complex, and a swimming pool. For more information see our website, `http://www.mri.ernet.in/`.

Interested applicants may forward their résumé by e-mail to `director@mri.ernet.in` or by post to the director. Details regarding salary scales and other benefits can be obtained from the registrar, HRI, e-mail: `registrar@mri.ernet.in`.

PORTUGAL

INSTITUTO SUPERIOR TÉCNICO
Center for Mathematical Analysis, Geometry, and Dynamical Systems
Departamento de Matemática
Instituto Superior Técnico
Av. Rovisco Pais
1049-001 Lisboa, Portugal

Postdoctoral Positions: The Center for Mathematical Analysis, Geometry, and Dynamical Systems of the Department of Mathematics of Instituto Superior Técnico, Lisbon, Portugal, invites applications for postdoctoral positions for research in mathematics. Positions are for one year, with the possibility of extension for a second year upon mutual agreement. Selected candidates will be able to take up their position between September 1, 2002, and January 1, 2003.

Applicants should have a Ph.D. in mathematics obtained after December 31, 1999. They must show very strong research promise in one of the areas in which the mathematics faculty of the center is currently active. There are no teaching duties associated with these positions.

Applicants should send a curriculum vitae; reprints, preprints, and/or dissertation abstract; description of research project (of no more than 1,000 words); and three letters of reference directly to the director at the above address.

To insure full consideration, complete application packages should be received by January 15, 2002. Additional information about the center and the positions is available at `http://www.math.ist.utl.pt/cam/`.

SINGAPORE

NATIONAL UNIVERSITY OF SINGAPORE
Department of Mathematics

The Department of Mathematics at NUS invites applications for several tenure-track and visiting positions in 2002. We will consider outstanding researchers in any field of pure and applied mathematics, particularly those in the areas of financial mathematics, scientific computing, optimization and operations research, as well as in computational biology, mathematical modeling, approximation and simulations.

Application materials should be sent to:
Search Committee
Department of Mathematics
National University of Singapore
2 Science Drive 2, Singapore 117543
Republic of Singapore
fax: +65 779 5452

and should include: (1) an American Mathematical Society Standard Cover Sheet; (2) a detailed CV including publications list; (3) a statement of research accomplishments and plan; (4) at least three letters of recommendation, including one which indicates the candidate's effectiveness and commitment in teaching. Inquiries may be sent via e-mail to `search@math.nus.edu.sg`.

Review of applications will begin December 15, 2001, and will continue until positions are filled. For further information about the department, please see `http://www.math.nus.edu.sg/`.

TAIWAN

NATIONAL CHIAO TUNG UNIVERSITY
Department of Applied Mathematics

Applications are invited for assistant, associate, or full professor positions beginning fall 2002. All areas of pure and applied mathematics will be considered. The successful applicant should hold the Ph.D. degree in mathematics or a related field (earned by August 2002) and demonstrate strong research potential. The language of instruction is Mandarin, but in exceptional cases non-Mandarin speakers with excellent research records will be considered.

Applicants must send a letter of application, a curriculum vitae, a summary of research plans, and three letters of recommendation to:
Hiring Committee
Department of Applied Mathematics
National Chiao Tung University
Hsinchu 300, Taiwan

For full consideration the application should be received by February 15, 2002.

The department is one of the leading mathematics centers in Taiwan, featuring 25 faculty members in the areas of combinatorics, differential equations, differential geometry, dynamical systems, financial mathematics, functional analysis, Lie theory, numerical analysis, operator theory, probability theory. Visit the department's home page at `http://www.math.nctu.edu.tw/` for more information.

The National Chiao Tung University is an Equal Oppurtunity Employer and does not discriminate on the basis of race, color, religion, national origin, sex, age, or disability.

NATIONAL CHUNG CHENG UNIVERSITY
Department of Mathematics
Regular or Visiting Positions

The Department of Mathematics invites applications for regular or visiting positions at either the level of assistant professor or above effective August 1, 2002. Applications are invited in all areas of mathematics. **Differential geometry, partial differential equations, and statistics** are among the priorities. A Ph.D. degree is required. Applicants should send a complete curriculum vitae, three letters of reference, transcripts (if necessary), and a professional statement describing their philosophy about both teaching and research. Applications received by February 15, 2002, will be given full consideration. Send all materials to: C. J. Sung, Chair, Department of Mathematics, National Chung Cheng University, Ming-Hsiung, Chia-Yi, Taiwan, R.O.C. 62117. Additional department information is available on our website, `http://www.math.ccu.edu.tw/`; fax: 886-5-272-0497; e-mail: `director@math.ccu.edu.tw` or `cjsung@math.ccu.edu.tw`.

TURKEY

KOÇ UNIVERSITY
Mathematics Department

Applications and nominations are invited for faculty positions in mathematics. Ap-

pointment will be effective June 1, 2002, or September 1, 2002. Successful candidates are expected to have a strong research and publication record in mathematics. Koç University is a private institution, the language of instruction is English, and the compensation package is competitive. Letter and vita should be sent to:

Ali Mostafazadeh
Mathematics Department
Koç Universit
Rumelifeneri Yolu,
80910 Istanbul, Turkey
e-mail: amostafazadeh@ku.edu.tr
phone: (90-212) 338-1462
fax: (90-212) 338-1559
http://www.ku.edu.tr/

PUBLICATIONS WANTED

MATHEMATICS BOOKS PURCHASED

Pure & appl. adv. & research level, any age, usable cond. Reprints OK. One box to whole libraries sought. Contact: Collier Brown or Ryan Thomas @ **Powell's Technical Bks.**, Portland, OR. Call 800-225-6911, fax 503-228-0505, or e-mail ryan.thomas@powells.com.

www.african-j-math.org

AFRICAN JOURNAL OF MATHEMATICS

PHILOSOPHY OF THE JOURNAL

The African Journal of Mathematics *(AJM) is an international journal for mathematical research of highest rank. It offers a forum for publishing mathematical research with some emphasis on the contributions of African mathematicians and the rich connections between African universities and those of other continents. Papers in all areas of mathematics will be considered.*

INFORMATION FOR AUTHORS

When submitting manuscripts, the AJM requires the following:

- The work must not have been published before.
- It must not be under consideration elsewhere.
- If the manuscript is accepted for publication, the author must transfer the copyright to the publisher.
- The manuscript will not be published elsewhere in any language without the consent of the copyright holder.

MANUSCRIPT SUBMISSION

Manuscripts (sent in triplicate) should be addressed to the Editor-in-Chief, to the Managing Editors, or to any member of the Editorial Committee. Authors must also provide the Latex source file on a floppy disk (IBM or Apple format) or send it by electronic mail. Submission of a manuscript will be understood to mean that the paper is not being considered for publication elsewhere. The manuscript must be written in English or French. Incoming papers are acknowledged immediately. In order to avoid a large backlog, the AJM strongly encourages authors to restrict the length of their papers to no more than 20 pages. Longer papers will be accepted only in exceptional cases. Authors will be notified of the editor's publishing decision once the refereeing process has been completed. Twenty reprints of published papers will be sent to the submitting author free of charge. Additional reprints may be ordered from the publisher.

Figures should be sent as fair copy on paper, whenever possible scaled to about 200%, or as an EPS-file (Encapsulated PostScript). All figures, tables, etc., should be numbered and the appropriate space reserved in the text with the insertion point clearly indicated.

SUBSCRIPTION INFORMATION

The African Journal of Mathematics publishes one volume per year with two issues of 200 pages each (DM 240 or U.S. $120 per volume). Subscription rate is U.S. $220 for libraries and institutions and U.S. $40 for individuals. To subscribe, contact: Toka Diagana, Ph.D., Dept. of Mathematics, Howard University, 2441 6th Street, NW, Washington, DC, 20059, USA; phone: 1-202-806-7123; email: tdiagana@howard.edu.

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Silvio Levy, Editor

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Emilio Bujalance, Antonio F. Costa, and Ernesto Martínez, Editors

London Mathematical Society Lecture Note Series 287
0-521-00350-4, Paperback, $35.95

Surveys in Combinatorics, 2001
J.W.P. Hirschfeld, Editor

London Mathematical Society Lecture Note Series 288
0-521-00270-2, Paperback, $39.95

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- Asymptotics of Semiclassical Soliton Ensembles: Rigorous Justification of the WKB Approximation, *Peter D. Miller*
- Braid Group Actions and Tensor Products, *Vyjayanthi Chari*
- Cyclomorphy, *Dan Voiculescu*
- Estimates for Nonsingular Multiplicative Character Sums, *Nicholas M. Katz*
- Estimates for Parametric Elliptic Integrands, *Tobias H. Colding and William P. Minicozzi II*
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- Motivic Cohomology Groups are Isomorphic to Higher Chow Groups in any Characteristic, *Vladimir Voevodsky*
- On Convergence of Moments for Random Young Tableaux and a Random Growth Model, *Harold Widom*
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Robert J. Zimmer, J. P. May, Spencer J. Bloch, Carlos Kenig, Norman R. Lebovitz, and Benson Farb, editors

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New from de Gruyter Mathematics

Chaos and Chance

Arno Berger

2001. x + 245 pages.
ISBN 3-11-016991-6. Cloth US $49.95.
ISBN 3-11-016990-8. Paper US $29.95
(de Gruyter Textbook)

With emphasis on *stochastic aspects of deterministic systems* this short book introduces the reader to the basic facts and some special topics of applied ergodic theory. It addresses graduates from various disciplines, i.e. mathematicians, physicists, electrical and mechanical engineers. Based upon a sound (but non-technical) mathematical introduction, a number of typical examples from applications (mostly from mechanics) are thoroughly discussed. By studying both probabilistic and deterministic features of dynamical systems, the reader will develop what might be considered a unified view on *chaos* and *chance* as two sides of the same thing. (Though already familiar to Poincaré, this point of view has not been taken wider notice of until the 1970s.)

Modular Representation Theory of Finite Groups

Proceedings of a Symposium held at the University of Virginia, Charlottesville May 8-15, 1998

Michael J. Collins, Brian J. Parshall and Leonard L. Scott, editors

2001. xii + 262 pages.
ISBN 3-11-016367-5. Cloth US $99.95
(de Gruyter Proceedings)

This book is an outgrowth of a Research Symposium on the Modular Representation Theory of Finite Groups, held at the University of Virginia in May 1998. The main themes of this symposium were representations of groups of Lie type in nondefining (or cross) characteristic, and recent developments in block theory.

Series of lectures were given by M. Geck, A. Kleshchev and R. Rouquier, and their brief was to present material at the leading edge of research but accessible to graduate students working in the field. The first three articles are substantial expansions of their lectures, and each provides a complete account of a significant area of the subject together with an extensive bibliography. The remaining articles are based on some of the other lectures given at the symposium; some again are full surveys of the topic covered while others are short, but complete, research articles.

The opportunity has been taken to produce a book of enduring value so that this is not a conference proceedings in the conventional sense. Material has been updated so that this book, through its own content and in its extensive bibliographies, will serve as an invaluable resource for all those working in the area, whether established researchers or graduate students who wish to gain a general knowledge of the subject starting from a single source.

Aspects of Complexity

Minicourses in Algorithmics, Complexity, and Computational Algebra, Mathematics Workshop, Kaikoura, January 7-15, 2000

Rod Downey and Denis Hirschfeld, editors

2001. vii + 172 pages.
ISBN 3-11-016810-3. Cloth US $89.95
(de Gruyter Series in Logic and Its Applications 4)

The book contains eight detailed expositions of the lectures given at the Kaikoura 2000 Workshop on Computability, Complexity, and Computational Algebra. Topics covered include basic models and questions of complexity theory, the Blum-Shub-Smale model of computation, probability theory applied to algorithmics (randomized alogrithms), parametric complexity, Kolmogorov complexity of finite strings, computational group theory, counting problems, and canonical models of ZFC providing a solution to continuum hypothesis. The text addresses students in computer science or mathematics, and professionals in these areas who seek a complete, but gentle introduction to a wide range of techniques, concepts, and research horizons in the area of computational complexity in a broad sense.

Complex Analysis and Geometry

Jeff McNeal, editor

2001. viii + 191 pages.
ISBN 3-11-016809-X. Cloth US $99.95
(Ohio State University Mathematical Research Institute Publications 9)

This volume is the proceedings of a conference held at Ohio State University in May of 1999. Over sixty mathematicians from around the world participated in this conference and principal lectures were given by some of the most distinguished experts in the field. The proceedings volume contains fully refereed research articles from some of the principal speakers. including: Salah Baouendi (UCSD), David Barrett (Univ. Michigan), Bo Berndtsson (Goteborg), David Cadtlin (Purdue Univ.), Micheal Christ (Berkeley), John D'Angelo (Univ. Illinois), Xiaojun Huang (Rutgers). J.J. Kohn (Princeton), Y.-T. Siu (Harvard), and Emil Straube (Texas A & M).

Among the topics discussed are: global regularity and non-regularity of the $\overline{\partial}$ Heumann problem, convergence of formal power series, weighted estimates for $\overline{\partial}$, reflection principles in several variables, and moduli spaces for Levi flat hypersurfaces.

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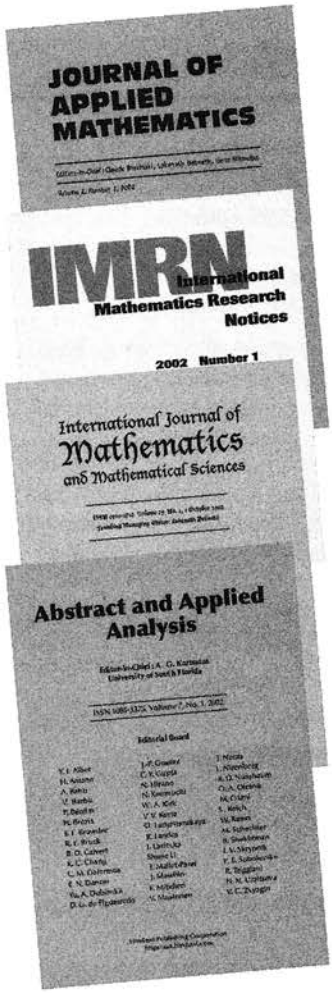

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Subscription Information (ISSN 0161-1712, 2002, volumes 29–32, 48 issues): $595.00 (print and electronic), $476.00 (electronic only). Journal's web site: http://ijmms.hindawi.com.

International Mathematics Research Notices

Managing Editor: Morris Weisfeld

Aims & Scope: IMRN provides very fast publication of research articles of high current interest in all areas of mathematics. Articles are judged by their contribution to advancing the state of the science of mathematics. Issues are published as frequently as necessary.

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Journal of Applied Mathematics

Editors-in-Chief: C. Brezinski (Université des Sciences et Technologies de Lille), L. Debnath (University of Central Florida), H. Nijmeijer (Eindhoven University of Technology)

Aims & Scope: JAM is devoted to the publication of original research papers and review articles in all areas of applied, computational, and industrial mathematics.

Subscription Information (ISSN 1110-757X, 2002, volume 2, 4+ issues): $295.00 (print and electronic), $236.00 (electronic only). Journal's web site: http://jam.hindawi.com.

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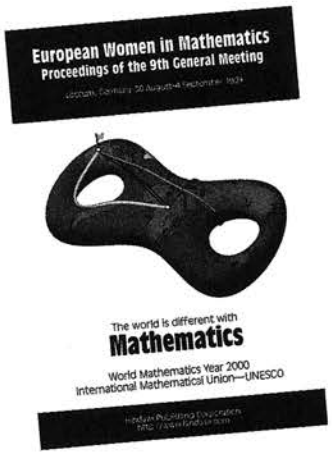

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TeachMap Workshops

COMAP is pleased to announce a series of TeachMap workshops, funded by the National Science Foundation (NSF).

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The first workshops will focus on how to use technological applications to enhance student learning. Participants will:

- Develop strategies for solving ATE-type applications problems
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April, 2002 (dates TBD)
Prior to the National Council of Teachers of Mathematics Annual Meeting in Las Vegas, NV

Further information and applications are available at COMAP's web site at: **www.comap.com/teachmap.**

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Meetings & Conferences of the AMS

IMPORTANT INFORMATION REGARDING MEETINGS PROGRAMS: AMS Sectional Meeting programs do not appear in the print version of the *Notices*. However, comprehensive and continually updated meeting and program information with links to the abstract for each talk can be found on the AMS website. See `http://www.ams.org/meetings/`. Programs and abstracts will continue to be displayed on the AMS website in the Meetings and Conferences section until about three weeks after the meeting is over. Final programs for Sectional Meetings will be archived on the AMS website in an electronic issue of the *Notices* as noted below for each meeting.

Irvine, California

University of California Irvine

November 10–11, 2001

Meeting #972

Western Section
Associate secretary: Bernard Russo
Announcement issue of *Notices*: September 2001
Program first available on AMS website: September 27, 2001
Program issue of electronic *Notices*: December 2001
Issue of *Abstracts*: Volume 22, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses

William Duke, University of California Los Angeles, *Recent directions in automorphic forms and analytic number theory.*

Grigory Mikhalkin, University of Utah, *Amoebas of algebraic varieties.*

Gigliola Staffilani, Brown University and Stanford University, *Dispersive equations and almost conservation laws.*

Jonathan Weitsman, University of California Santa Cruz, *The topology of Hamiltonian loop group spaces.*

Special Sessions

Dynamical Systems of Billiard Type, **Marek Rychlik**, University of Arizona, and **Andrew Torok**, University of Houston.

Extremal Metrics and Moduli Spaces, **Steven Bradlow**, University of Illinois, Urbana-Champaign, **Claude LeBrun**, State University of New York, Stony Brook, and **Yat Sun Poon**, University of California Riverside.

Groups and Covering Spaces in Algebraic Geometry, **Michael Fried**, University of California Irvine, and **Helmut Voelklein**, University of Florida.

Harmonic Analyses and Partial Differential Equations, **Gustavo Ponce**, University of California Santa Barbara, and **Gigliola Staffilani**, Brown University and Stanford University.

Harmonic Analysis and Complex Analysis, **Xiaojun Huang**, Rutgers University, and **Song-Ying Li**, University of California Irvine.

Operator Spaces, Operator Algebras, and Applications, **Marius Junge**, University of Illinois, Urbana-Champaign, and **Timur Oikhberg**, University of Texas and University of California Irvine.

Partial Differential Equations and Applications, **Edriss S. Titi**, University of California Irvine.

Quantum Topology, **Louis Kauffman**, University of Illinois at Chicago, **Jozef Przytycki**, George Washington University, and **Fernando Souza**, University of Waterloo.

Random and Deterministic Schrödinger Operators, **Svetlana Jitomirskaya** and **Abel Klein**, University of California Irvine.

Symplectic Geometry, **Jonathan Weitsman**, University of California Santa Cruz.

Topology of Algebraic Varieties, **Eriko Hironaka**, Florida State University, and **Grigory Mikhalkin**, University of Utah.

San Diego, California

San Diego Convention Center

January 6–9, 2002

Meeting #973

Joint Mathematics Meetings, including the 108th Annual Meeting of the AMS, 85th Meeting of the Mathematical Association of America (MAA), with minisymposia and other special events contributed by the Society for Industrial

and Applied Mathematics (SIAM); the annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM); and the winter meeting of the Association for Symbolic Logic (ASL).
Associate secretary: John L. Bryant
Announcement issue of *Notices*: October 2001
Program first available on AMS website: November 1, 2001
Program issue of electronic *Notices*: January 2002
Issue of *Abstracts*: Volume 23, Issue 1

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired
For summaries of papers to MAA organizers: To be announced

AMS-MAA Program Updates

Highlights from the 2000 CBMS Survey of the Mathematical Sciences, Sunday, 2:15 p.m. to 3:05 p.m.

The **AMS-MAA Government Speaker** on Tuesday, 4:20 p.m. to 5:05 p.m. is **James R. Schatz**, National Security Agency, title to be announced.

AMS Program Updates

The title of the **Gibbs Lecture** to be given by **Sir Michael Berry** at 8:30 on Sunday night is *Making light of mathematics.*

New Directions, Tuesday, 9:45 a.m. to 10:45 a.m. This panel of National Science Foundation (NSF) Institute directors and the Division of Mathematical Sciences (DMS) director will describe the new NSERC-NSF Conference Center at Banff, Canada (Banff International Research Station in the Mathematical Sciences) as well as the new initiatives taken by the NSF Institutes and by the DMS. Sponsored by the Committee on Meetings and Conferences.

The **Committee on Education** will sponsor a presentation on Wednesday, 8:30 a.m. to 10:00 p.m. by **Lee V. Stiff**, President, National Council of Teachers of Mathematics.

MAA Program Updates

JOMA Authors Present, Monday, 9:00 a.m.–10:30 a.m., organized by **David Smith**, Duke University and **Lang Moore**, MAA and Duke University. After an introduction by the editor of the Journal of Online Mathematics and Its Applications (JOMA), authors who have published in JOMA will talk about their materials and their work in general. Authors include **David Smith**, Duke University, **Tom Leathrum**, Jacksonville State University, and **John Kiltinen**, Northern Michigan University.

The Global Classroom: Live E-Learning over the Web, Tuesday, 9:00 a.m.–10:30 a.m., organized by **Marcelle Bessman**, Jacksonville University and **Douglas A. Quinney**, Keele University, UK. The Global Classroom is a "classroom without walls" that supports interaction between students and a "visiting" scholar and among students all gathered in a "classroom" on a virtual campus that resides on a server. It supports synchronous, collaborative use of common software packages including Mathematica, Maple and various commonly used software packages, such as word processors and spreadsheets via the Web. Control of a software package opened on one machine can be passed to a person at another machine in another room or even another geographic location. This campus supports audio connectivity in a cooperative learning environment. Sessions can be recorded for review of the session by students or for study by students who missed the session. We will describe the Global Classroom project and demonstrate the interconnectivity and collaboration over the Internet. In addition, participants will learn how to develop their own online teaching material.

How to Successfully Publish a Textbook, Wednesday, 1:00 pm–2:30 p.m. organized by **Michael R. Lennie**, San Diego, CA. Michael Lennie will cover the essential of how to write a winning proposal and contract essentials. He will cover the tricks of the trade describing how to present your textbook in its best possible light in the proposal. You'll learn techniques for selling your acquisitions editor with a clear description of the text, its features, and ancillaries. **Michael Sullivan**, Lemont, Il, will describe how to assure a successful review process and discuss the similar yet distinct pre-contract review, developmental review, and post-publication review from the unique position of the mathematics author. **Robert Christophererson**, American River College, will discuss the discipline of writing a textbook and what you must know about the publication process. He will explain why setting up a "writing studio", preparing the outline, style guides, and tracking logs are critical elements to creation of a successful manuscript. He will discuss research and writing, production of manuscript and art, and the publishing process, including developmental editing, book design, and marketing. Each presentation will be followed by questions and answers and will include handouts.

SIGMAA on Research in Undergraduate Mathematics Education presentation on Tuesday, features a talk by **Ed Dubinsky**, Cincinnati, OH, on *How can mathematical concepts be learned? Synthesizing APOS Theory and mathematical formalism to get one possible answer*, from 5:00 p.m. to 5:45 p.m.

Other Organizations Updates

Summer Program for Women in Mathematics (SPWM) Reunion, Monday, 2:00 p.m. to 4:00 p.m., organized by **Murli M. Gupta** and **E. Arthur Robinson Jr.**, George Washington University. SPWM program participants will be asked to describe their experiences.

Social Events Updates

Association of Christians in the Mathematical Sciences will host an ecumenical Christian service on Sunday, 7:00 a.m. to 7:45 a.m.

Mathematical Sciences Institutes Reception, Sunday, 5:30 p.m. to 7:30 p.m., CRM, CIMACS, the Fields Institute, IMA, IPAM, MSRI, and PIMS invite you to a reception where you can talk to their representatives, and learn about their current and future programs and activities (or reminisce about their past ones). The participating institutes are Centre de Recherches Mathématiques (Montréal), the Center for Discrete Mathematics and Theoretical Computer Science

(New Jersey), the Fields Institute (Toronto), the Institute for Mathematics and Its Applications (Minneapolis), the Institute for Pure and Applied Mathematics at UCLA (Los Angeles), the Mathematical Sciences Research Institute (Berkeley), and the Pacific Institute for the Mathematical Sciences (Vancouver).

Two-Year College Reception, Monday 5:45 p.m. to 7:00 p.m., sponsored by Addison Wesley Longman.

University of Wisconsin-Madison Department of Mathematics Reception, Monday, 6:00 p.m. to 7:30 p.m.

Knitting Circle, Monday, 8:15 p.m. to 9:45 p.m. Network with other mathematicians to discuss the mathematics involved in certain fiber arts. Bring along your current project.

Mathematical Reviews Reception, Tuesday, 6:00 p.m. to 7:00 p.m. All friends of Mathematical Reviews (MR) are invited to join reviewers and MR editors and staff (past and present) for a reception in honor of all the efforts that go into the creation and publication of the Mathematical Reviews Database. Refreshments will be served.

Association of Gay, Lesbian, Bisexual, and Transgendered Mathematicians Reception, Tuesday, 5:00 p.m. to 6:30 p.m.

University of Illinois at Urbana-Champaign Department of Mathematics Reception, Tuesday, 5:00 p.m. to 7:00 p.m.

Ann Arbor, Michigan

University of Michigan

March 1–3, 2002

Meeting #974

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: January 2002
Program first available on AMS website: January 17, 2002
Program issue of electronic *Notices*: May 2002
Issue of *Abstracts*: Volume 23, Issue 2

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: November 13, 2001
For abstracts: January 9, 2002

Invited Addresses

Lazlo Babai, University of Chicago, *Title to be announced.*

Netts Katz, Washington University, *Title to be announced.*

Alan Reid, University of Texas at Austin, *Title to be announced.*

Lihe Wang, University of Iowa, *Title to be announced.*

Special Sessions

Algebraic Combinatorics (Code: AMS SS H1), **Patricia Hersh**, University of Michigan, Ann Arbor, and **Brian D. Taylor**, Wayne State University.

Algebraic Topology (Code: AMS SS F1), **Robert Bruner**, Wayne State University, and **Igor Kriz**, University of Michigan, Ann Arbor.

Biological Applications of Dynamical Systems (Code: AMS SS J1), **J. M. Cushing**, University of Arizona, **Shandelle M. Henson**, Andrews University, and **Anna M. Spagnuolo**, Oakland University.

Commutative Algebra (Code: AMS SS D1), **Florian Enescu** and **Anurag K. Singh**, University of Utah, and **Karen E. Smith**, University of Michigan, Ann Arbor.

Differential Geometry (Code: AMS SS K1), **Lizhen Ji**, **Krishnan Shankar**, and **Ralf Spatzier**, University of Michigan, Ann Arbor.

Hyperbolic Manifolds and Discrete Groups (Code: AMS SS E1), **Richard D. Canary**, University of Michigan, Ann Arbor, and **Alan W. Reid**, University of Texas at Austin.

Integrable Systems and Poisson Geometry (Code: AMS SS C1), **Anthony Block**, University of Michigan, **Philip Foth**, University of Arizona, and **Michael Gekhtman**, University of Notre Dame.

Mapping Class Groups and Geometric Theory of Teichmüller Spaces (Code: AMS SS P1), **Benson Farb**, University of Chicago, **Nikolai Ivanov**, Michigan State University, and **Howard Masur**, University of Illinois at Chicago.

Mathematical Models in Medicine and the Life Sciences (Code: AMS SS M1), **Patrick Nelson**, University of Michigan, Ann Arbor.

Moduli Spaces (Code: AMS SS G1), **Angela Gibney**, University of Michigan, Ann Arbor.

Numerical Analysis and Applications of Partial Differential Equations (Code: AMS SS L1), **Joan Remski** and **Jennifer Zhao**, University of Michigan, Dearborn.

Partial Differential Equations (Code: AMS SS N1), **Qing Han**, University of Notre Dame, and **Lihe Wang**, University of Iowa.

Quantum Topology in Dimension Three (Code: AMS SS A1), **Charles Frohman**, University of Iowa, and **Joanna Kania-Bartoszynska**, Boise State University.

Topics in Geometric Function Theory (Code: AMS SS B1), **David A. Herron**, University of Cincinnati, **Nageswari Shanmugalingam**, University of Texas, and **Jeremy T. Tyson**, SUNY at Stony Brook.

Atlanta, Georgia

Georgia Institute of Technology

March 8–10, 2002

Meeting #975

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: January 2002
Program first available on AMS website: January 31, 2002
Program issue of electronic *Notices*: May 2002
Issue of *Abstracts*: Volume 23, Issue 2

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: November 27, 2001
For abstracts: January 22, 2002
For summaries of papers to MAA organizers: To be announced

AMS Invited Addresses

Nigel J. Kalton, University of Missouri, Columbia, *Title to be announced.*

James G. Oxley, Louisiana State University, *Title to be announced.*

AMS Special Sessions

Banach Spaces and Their Applications (Code: AMS SS B1), **Peter G. Casazza** and **N. J. Kalton**, University of Missouri-Columbia.

Combinatorics and Graph Theory (Code: AMS SS A1), **John M. Harris**, Furman University.

Frames, Wavelets, and Operator Theory (Code: AMS SS K1), **Christopher E. Heil** and **Yang Wany**, Georgia Institute of Technology.

Graphs and Matroids (Code: AMS SS H1), **James G. Oxley** and **Bogdan Oporowski**, Louisiana State University.

Harmonic Analysis (Code: AMS SS E1), **Gerd Mockenhaupt** and **Michael T. Lacy**, Georgia Institute of Technology, and **Akos Magyar**, University of Georgia.

Low Dimensional Topology (Code: AMS SS C1), **Wolfgang H. Heil**, Florida State University, and **Jose Carlos Gómez-Larrañaga**, CIMAT, Mexico.

Numerical Linear Algebra and Its Applications (Code: AMS SS J1), **Michele Benzi**, Emory University, **Steven B. Damelin**, Georgia Southern University, and **James Nagy**, Emory University.

Quantum Structures (Code: AMS SS D1), **Alexander G. Wilce**, Juniata College, **Richard J. Greechie**, Louisiana Technical University, and **Franklin E. Schroeck**, Florida Atlantic University.

Technology and Distance Learning (Code: AMS SS F1), **Tom Morley**, Georgia Institute of Technology, and **Martha Abel**, Georgia Southern University.

Three Bridges from "Applied" to "Mathematics" (Code: AMS SS G1), **Peter Mucha**, **John A. Pelesko**, **John E. McCuan**, and **Guillermo H. Goldsztein**, Georgia Institute of Technology.

Montréal, Quebec, Canada

Centre de Recherches Mathématiques, Université de Montréal

May 3–5, 2002

Meeting #976

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: March 2002
Program first available on AMS website: March 21, 2002
Program issue of electronic *Notices*: July 2002
Issue of *Abstracts*: Volume 23, Issue 3

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: January 15, 2002
For abstracts: March 12, 2002

Invited Addresses

Nicholas M. Ercolani, University of Arizona, *Title to be announced.*

Lars Hesselholt, Massachusetts Institute of Technology, *Title to be announced.*

Niky Kamran, McGill University, *Title to be announced.*

Rafael de la Llave, University of Texas at Austin, *Title to be announced.*

Special Sessions

Combinatorial Hopf Algebras (Code: AMS SS C1), **Marcelo Aguiar**, Texas A&M University, and **François Bergeron** and **Christophe Reutenauer**, Université du Québec á Montréal.

Combinatorial and Geometric Group Theory (Code: AMS SS A1), **Olga G. Kharlampovich**, McGill University, **Alexei Myasnikov** and **Vladimir Shpilrain**, City College, New York, and **Daniel Wise**, McGill University.

Commutative Algebra and Algebraic Geometry (Code: AMS SS G1), **Irena Peeva**, Cornell University, and **Hema Srinivasan**, University of Missouri-Columbia.

Curvature and Topology (Code: AMS SS E1), **Regina Rotman**, Courant Institute, New York University, and **Christina Sormani**, Lehman College, CUNY.

Function Spaces in Harmonic Analysis and PDEs (Code: AMS SS D1), **Galia D. Dafni** and **Jie Xiao**, Concordia University.

Potential Theory (Code: AMS SS B1), **Paul M. Gauthier**, Université de Montréal, **K. Gowri Sankaran**, McGill University, and **David H. Singman**, George Mason University.

Shape Theory in Dynamics (Code: AMS SS F1), **Alex Clark**, University of North Texas, and **Krystyna M. Kuperberg**, Auburn University.

Spectral Geometry (Code: AMS SS H1), **Dmitry Jakobson**, McGill University, and **Yiannis Petridis**, McGill University and Centre de Recherches Mathématiques.

Pisa, Italy

June 12–16, 2002

Meeting #977

First Joint International Meeting between the AMS and the Unione Matematica Italiana.
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced
Program first available on AMS website: Not applicable
Program issue of electronic *Notices*: Not applicable
Issue of *Abstracts*: Not applicable

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses

Luigi Ambrosio, Scuola Normale Superiore, *Title to be announced.*

Luis A. Caffarelli, University of Texas at Austin, *Title to be announced.*

Claudio Canuto, Politecnico di Torino, *Title to be announced.*

L. Craig Evans, University of California Berkeley, *Title to be announced.*

Giovanni Gallavotti, University of Rome I, *Title to be announced.*

Sergio Klainerman, Princeton University, *Title to be announced.*

Rahul V. Pandharipande, California Institute of Technology, *Title to be announced.*

Claudio Procesi, University of Rome, *Title to be announced.*

Special Sessions

Advances in Complex, Contact and Symplectic Geometry, **Paolo De Bartolomeis**, University of Florence, **Yakov Eliashberg**, Stanford University, **Gang Tian**, MIT, and **Giuseppe Tomassini**, Scuola Normale Superiore, Pisa.

Advances in Differential Geometry of PDEs and Applications, **Valentin Lychagin**, University of Heights, Newark, and **Agostino Prastaro**, University of Rome, La Sapienza.

Algebraic Logic and Universal Algebra, **Paolo Aglianó**, Universitá di Siena, **Keith A. Kearnes**, University of Colorado, **Franco Montagna**, Universitá di Siena, **Don Pigozzi**, Iowa State University, and **Aldo Ursini**, Universitá di Siena.

Algebraic Vector Bundles, **Vincenzo Ancona**, University of Florence, **Mohan Kumar**, Washington University, **Giorgio Maria Ottaviani**, University of Florence, **Christopher Peterson**, Colorado State University, and **Prabhakar Rao**, University of Missouri.

Analytic Aspects of Convex Geometry, **Stefano Campi**, University of Modena, **Richard Gardner**, Western Washington University, **Erwin Lutwak**, Polytechnic University Brooklyn, and **Alijosa Volcic**, University of Trieste.

Classification Theory and Topology of Algebraic Varieties, **Fabrizio Catanese**, University of Goettingen, **János Kollár**, Princeton University, and **Shing-Tung Yau**, Harvard University.

Commutative Algebra and the Geometry of Projective Varieties, **Ciro Ciliberto**, University of Rome II, **Anthony Geramita**, University of Genoa, **Rick Miranda**, Colorado State University, and **Ferruccio Orecchia**, University of Naples.

Commutative Algebra: Hilbert Functions, Homological Methods and Combinatorial Aspects, **Aldo Conca**, University of Genoa, **Anna Guerrieri**, University of L'Aquila, **Claudia Polini**, University of Oregon, and **Bernd Ulrich**, Michigan State University.

Commutative Rings and Integer-Valued Polynomials, **Stefania Gabelli**, University of Rome III, and **Thomas G. Lucas**, University of North Carolina, Charlotte.

Complex, Contact and Quaternionic Geometry, **David E. Blair**, Michigan State University, and **Stefano Marchiafava**, University of Rome, La Sapienza.

Contemporary Developments in Partial Differential Equations and in the Calculus of Variations, **Irene Fonseca**, Carnegie Mellon University, and **Paolo Marcellini**, University of Florence.

Didattica della Dimostrazione, **Ferdinando Arzarello**, University of Turin, **Guershon Harel**, Purdue University, and **Vinicio Villani**, University of Pisa.

Dynamical Systems, **Antonio Giorgilli**, University of Milano-Bicocca, **Stefano Marmi**, Scuola Normale Superiore, Pisa, and **John Norman Mather**, Princeton University.

Elliptic Partial Differential Equations, **Angelo Alvino**, University of Naples, **Luis Caffarelli**, University of Texas, **Giorgio Talenti**, University of Florence, and **Vladimir Oliker**, Emory University.

Equazioni di Evoluzione Nonlineari, **Alberto Tesei**, University of Rome, La Sapienza.

Free Boundary Problems, **Ricardo Horacio Nochetto**, College Park, Maryland, and **Augusto Visintin**, University of Trento.

Geometric Properties of Solutions to PDEs, **Donatella Danielli**, Johns Hopkins University, and **Sandro Salsa**, Politecnico di Milano.

Harmonic Analysis, **Fulvio Ricci**, Scuola Normale Superiore, Pisa, and **Elias M. Stein**, Princeton University.

Higher Dimensional Algebra, **John Baez**, University of California Riverside, and **Giuseppe Rosolini**, University of Genoa.

History of Mathematics, **Piers Bursil-Hall**, Cambridge University, **Enrico Giusti**, University of Florence, and **James J. Tattersall**, Providence College.

Hyperbolic Equations, **Sergiu Klainerman**, Princeton University, and **Sergio Spagnolo**, University of Pisa.

Hyperbolic Systems of Conservation Laws, **Alberto Bressan**, SISSA, Trieste, and **Shi Jin**, University of Wisconsin.

Inverse Boundary Problems and Applications, **Giovanni Alessandrini**, University of Trieste, and **Gunther Uhlmann**, University of Washington.

Jump Processes in Option Pricing Theory, **Claudio Albanese**, University of Toronto, and **Marco Isopi**, University of Bari.

Kolmogorov Equations, **Giuseppe Da Prato**, Scuola Normale Superiore, Pisa, and **Nicolai V. Krylov**, University of Minnesota.

Logarithmic De Rham Cohomology and Dwork Cohomology, **Alan Adolphson**, Oklahoma State University, Stillwater, **Francesco Baldassarri**, University of Padua, **Arthur Ogus**, University of California Berkeley, and **Steven Sperber**, University of Minnesota, Minneapolis.

Mathematical Problems in Soft Matter Modelling, **Eugene C. Gartland**, Kent State University, and **Epifanio Virga**, University of Pavia.

Mathematical Problems in Transport Theory, **Carlo Cercignani**, Politecnico di Milano, and **Irene Gamba**, University of Texas.

Mathematical Schools: Italy and the United States at the Turn of the Twentieth Century, **Umberto Bottazzini**, University of Palermo, and **Karen Hunger Parshall**, University of Virginia.

Mathematics in Polymer Science, **Antonio Fasano**, University of Florence, and **Kumbakonam R. Rajagopal**, Texas A&M University.

Microlocal Analysis and Applications to PDE, **Daniele Del Santo**, University of Trieste, **M. K. Venkatesha Murthy**, University of Pisa, and **Daniel Tataru**, Northwestern University.

Nonlinear Analysis, **Antonio Ambrosetti**, SISSA, Trieste, **Vieri Benci**, University of Pisa, **Haim Brezis**, Rutgers University, and **Paul Rabinowitz**, University of Wisconsin.

Nonlinear Elliptic and Parabolic Equations and Systems, **Gary Lieberman**, Iowa State University, and **Antonio Maugeri**, University of Catania.

Nonstandard Methods and Applications in Mathematics, **Alessandro Berarducci**, University of Pisa, **Nigel Cutland**, University of Hull, **Mauro Di Nasso**, University of Pisa, and **David Ross**, University of Hawaii.

Operator Algebras, **Sergio Doplicher**, University of Rome, La Sapienza, and **Edward George Effros**, University of California Los Angeles.

Optimization and Control, **Roberto Triggiani**, University of Virginia, and **Tullio Zolezzi**, University of Genoa.

Partial Differential Equations of Mixed Elliptic - Hyperbolic Type and Applications, **Daniela Lupo**, Politecnico di Milano, **Cathleen S. Morawetz**, Courant Institute, and **Kevin R. Payne**, University of Milan.

Periodic Solutions of Differential and Difference Equations, **Massimo Furi**, University of Florence, and **Mario Umberto Martelli**, Claremont McKenna College.

Poisson Geometry and Integrable Systems, **Franco Magri**, University of Milan, and **Ping Xu**, Pennsylvania State University.

Quantum Cohomology and Moduli Spaces, **Angelo Vistoli**, University of Bologna, and **Aaron Bertram**, University of Utah.

Scaling Limits and Homogenization Problems in Physics and Applied Sciences, **Mario Pulvirenti**, University of Rome, and **George Papanicolaou**, Stanford University.

Semigroups of Operators and Applications, **Francesco Altomare**, University of Bari, and **Frank Neubrander**, Louisiana State University.

Semigroups, Automata and Formal Languages, **Alessandra Cherubini**, Politecnico di Milano, and **John Meakin**, University of Nebraska-Lincoln.

Simulation via Quantum Computation, **Thomas L. Clarke**, University of Central Florida, Orlando, and **Massimo Pica Ciamarra**, University of Naples.

Some Mathematics around Composites, **Robert V. Kohn**, Courant Institute, NYU, and **Vincenzo Nesi**, University of Rome, La Sapienza.

Structured Matrix Analysis with Applications, **Dario Andrea Bini**, University of Pisa, and **Thomas Kailath**, Stanford University.

The Topology of 3-Manifolds, **Ricardo Benedetti** and **Carlo Petronio**, University of Pisa, **Dale Rolfsen**, University of British Columbia, Vancouver, and **Jeffrey Weeks**, Canton, New York.

Variational Analysis and Applications, **Franco Giannessi**, University of Pisa, **Boris S. Mordukhovich**, Wayne State University, Detroit, **Biagio Ricceri**, University of Catania, and **R. Tyrrell Rockafellar**, University of Washington.

Viscosity Methods in PDEs and Applications, **Piermarco Cannarsa**, University of Rome II, **Italo Capuzzo Dolcetta**, University of Rome, La Sapienza, and **Panagiotis Souganidis**, University of Texas at Austin.

White Noise Theory and Quantum Probability, **Luigi Accardi**, University of Rome, Tor Vergata, and **Hui-Hsiung Kuo**, Louisiana State University.

Portland, Oregon

Portland State University

June 20–22, 2002

Meeting #978

Western Section
Associate secretary: Bernard Russo
Announcement issue of *Notices*: April 2002

Program first available on AMS website: May 9, 2002
Program issue of electronic *Notices*: August 2002
Issue of *Abstracts*: Volume 23, Issue 2

Deadlines

For organizers: November 20, 2001
For consideration of contributed papers in Special Sessions: March 5, 2002
For abstracts: April 30, 2002

Special Sessions

Algebraic Geometry and Combinatorics (Code: AMS SS B1), **Eric Babson** and **Rekha Thomas**, University of Washington, and **Sergey Yuzvinsky**, University of Oregon.

Qualitative Properties and Applications of Functional Equations (Code: AMS SS A1), **Theodore A. Burton**, Southern Illinois University.

The Quintic Equation: Algebra and Geometry (Code: AMS SS C1), **Jerry Shurman**, Reed College, and **Scott Crass**, California State University, Long Beach.

Boston, Massachusetts

Northeastern University

October 5–6, 2002

Meeting #979

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: August 2002
Program first available on AMS website: August 22, 2002
Program issue of electronic *Notices*: December 2002
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: March 6, 2002
For consideration of contributed papers in Special Sessions: June 18, 2002
For abstracts: August 13, 2002

Invited Addresses

Lou P. van den Dries, University of Illinois, Urbana-Champaign, *Title to be announced.*

Diane Henderson, Pennsylvania State University, *Title to be announced.*

Christopher K. King, Northeastern University, *Title to be announced.*

Xiaobo Liu, University of Notre Dame, *Title to be announced.*

Madison, Wisconsin

University of Wisconsin-Madison

October 12–13, 2002

Meeting #980

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: August 2002
Program first available on AMS website: August 29, 2002
Program issue of electronic *Notices*: December 2002
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: March 12, 2002
For consideration of contributed papers in Special Sessions: June 25, 2002
For abstracts: August 20, 2002

Invited Addresses

Lawrence Ein, University of Illinois at Chicago, *Title to be announced.*

Eleny Ionel, University of Wisconsin, *Title to be announced.*

Mikhail Safonov, University of Minnesota, *Title to be announced.*

John Sullivan, University of Illinois, Urbana-Champaign, *Title to be announced.*

Special Sessions

Arithmetic Algebraic Geometry (Code: AMS SS A1), **Ken Ono** and **Tonghai Yang**, University of Wisconsin-Madison.

Arrangements of Hyperplanes (Code: AMS SS E1), **Daniel C. Cohen**, Louisiana State University, **Peter Orlik**, University of Wisconsin-Madison, and **Anne Shepler**, University of California Santa Cruz.

Biological Computation and Learning in Intelligent Systems (Code: AMS SS S1), **Shun-ichi Amari**, RIKEN, **Amir Assadi**, University of Wisconsin-Madison, and **Tomaso Poggio**, MIT.

Combinatorics and Special Functions (Code: AMS SS T1), **Richard Askey** and **Paul Terwilliger**, University of Wisconsin-Madison.

Dynamical Systems (Code: AMS SS P1), **Sergey Bolotin** and **Paul Rabinowitz**, University of Wisconsin-Madison.

Effectiveness Questions in Model Theory (Code: AMS SS J1), **Charles McCoy**, **Reed Solomon**, and **Patrick Speissegger**, University of Wisconsin-Madison.

Geometric Methods in Differential Equations (Code: AMS SS H1), **Gloria Mari Beffa**, University of Wisconsin-Madison, and **Peter Olver**, University of Minnesota.

Geophysical Waves and Turbulence (Code: AMS SS M1), **Paul Milewski**, **Leslie Smith**, and **Fabian Waleffe**, University of Wisconsin-Madison.

Group Cohomology and Homotopy Theory (Code: AMS SS G1), **Alejandro Adem**, University of Wisconsin-Madison, and **Jesper Grodal**, Institute for Advanced Study.

Harmonic Analysis (Code: AMS SS C1), **Alex Ionescu** and **Andreas Seeger**, University of Wisconsin-Madison.

Hyperbolic Differential Equations and Kinetic Theory (Code: AMS SS K1), **Shi Jin**, **Marshall Slemrod**, and **Athanassios Tzavaras**, University of Wisconsin-Madison.

Lie Algebras and Related Topics (Code: AMS SS N1), **Georgia Benkart** and **Arun Ram**, University of Wisconsin-Madison.

Multiresolution Analysis and Data Presentation (Code: AMS SS F1), **Amos Ron**, University of Wisconsin-Madison.

Partial Differential Equations and Geometry (Code: AMS SS D1), **Sigurd Angenent** and **Mikhail Feldman**, University of Wisconsin-Madison.

Probability (Code: AMS SS R1), **David Griffeath**, University of Wisconsin-Madison, and **Timo Seppalainen**, Iowa State University.

Ring Theory and Related Topics (Code: AMS SS L1), **Don Passman**, University of Wisconsin-Madison.

Several Complex Variables (Code: AMS SS B1), **Pat Ahern**, **Xianghong Gong**, **Alex Nagel**, and **Jean-Pierre Rosay**, University of Wisconsin-Madison.

Salt Lake City, Utah

University of Utah

October 26–27, 2002

Meeting #981

Western Section
Associate secretary: Bernard Russo
Announcement issue of *Notices*: September 2002
Program first available on AMS website: September 16, 2002
Program issue of electronic *Notices*: January 2003
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: March 26, 2002
For consideration of contributed papers in Special Sessions: July 10, 2002
For abstracts: September 4, 2002

Orlando, Florida

University of Central Florida

November 9–10, 2002

Meeting #982

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: September 2002
Program first available on AMS website: September 26, 2002
Program issue of electronic *Notices*: January 2003
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: April 10, 2002
For consideration of contributed papers in Special Sessions: July 23, 2002
For abstracts: September 17, 2002

Baltimore, Maryland

Baltimore Convention Center

January 15–18, 2003

Joint Mathematics Meetings, including the 109th Annual Meeting of the AMS, 86th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 15, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Baton Rouge, Louisiana

Louisiana State University

March 14–16, 2003

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: August 14, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Bloomington, Indiana

Indiana University

April 4–6, 2003

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: September 4, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Seville, Spain

June 18–21, 2003

First Joint International Meeting between the AMS and the Real Sociedad Matematica Española (RSME).
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: May 15, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Binghamton, New York

SUNY-Binghamton

October 10–12, 2003

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: March 10, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Phoenix, Arizona

Phoenix Civic Plaza

January 7–10, 2004

Associate secretary: Bernard Russo
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 2, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Athens, Ohio

Ohio University

March 26–27, 2004

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: August 26, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Atlanta, Georgia

Atlanta Marriott Marquis and Hyatt Regency Atlanta

January 5–8, 2005

Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 5, 2004
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

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Reviews

Meetings and Conferences of the AMS

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The Meetings and Conferences section of the *Notices* gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. **Information in this issue may be dated. Up-to-date meeting and conference information** at www.ams.org/meetings/.

Meetings:

Important Information regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 87 in the January 2001 issue of the *Notices* for general information regarding participation in AMS meetings and conferences.

Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of LaTeX is necessary to submit an electronic form, although those who use LaTeX may submit abstracts with such 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; 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 Meetings & Conferences Department, AMS, P.O. Box 6887, Providence, RI 02940. There is a $20 processing fee for each paper abstract. There is no charge for electronic abstracts. 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.)

February 14–19, 2002: Annual Meeting of the American Association for the Advancement of Science (AAAS), Boston, MA.

May 20–25, 2002: 6th International Conference on Clifford Algebras and Their Applications to Mathematical Physics, Cookeville, TN.

June 3–8, 2002: Abel Bicentennial Conference 2002, University of Oslo, Norway.

June 7–August 1, 2002: Joint Summer Research Conferences in the Mathematical Sciences, Mount Holyoke College, South Hadley, MA. See pages 1289-1291, this issue, for details.

San Diego Joint Meetings Advance Registration/Housing Form

Name _____
(please write name as you would like it to appear on your badge)

Mailing Address _____

_____

Telephone _____ Fax _____

Email Address _____
(Acknowledgment of this registration will be sent to the email address given here, unless you check this box: *Send by US Mail* ☐)

Badge Information: Affiliation for badge _____

Nonmathematician guest badge name _____
(please note charge below)

Membership
✓ all that apply

AMS	☐
ASA	☐
ASL	☐
AWM	☐
CMS	☐
MAA	☐
NAM	☐
SIAM	☐
YMN	☐

☐ **I DO NOT want my program and badge to be mailed to me on 12/14/01.**

Registration Fees

Joint Meetings	**by Dec 10**	**at mtg**	**Subtotal**
☐ Member AMS, ASL, CMS, MAA, SIAM	$185	$241	
☐ Nonmember	$287	$373	
☐ Graduate Student	$ 35	$ 45	
☐ Undergraduate Student	$ 20	$ 26	
☐ High School Student	$ 2	$ 5	
☐ Unemployed	$ 35	$ 45	
☐ Temporarily Employed	$145	$166	
☐ Developing Countries Special Rate	$ 35	$ 45	
☐ Emeritus Member of AMS or MAA	$ 35	$ 45	
☐ High School Teacher	$ 35	$ 45	
☐ Librarian	$ 35	$ 45	
☐ Nonmathematician Guest	$ 5	$ 5	

$_____

AMS Short Course: *Symbolic Dynamics & its Applications (1/4–1/5)*

☐ Member of AMS or MAA	$ 80	$100	
☐ Nonmember	$110	$130	
☐ Student, Unemployed, Emeritus	$ 35	$ 50	

$_____

MAA Short Course: *A Sampler of Applications of Graph Theory (1/4–1/5)*

☐ Member of MAA	$125	$140	
☐ Nonmember	$175	$190	
☐ Student, Unemployed, Emeritus	$ 50	$ 60	

$_____

MAA Minicourses (see listing in text)
I would like to attend: ☐ One Minicourse ☐ Two Minicourses
Please enroll me in MAA Minicourse(s) #_____ and/or #_____
In order of preference, my alternatives are: #_____ and/or #_____
(no onsite registration for Minicourses 1 & 2)
Prices: $90 for Minicourses #1-8 and $60 for Minicourses #9-16

$_____

Employment Center
Applicant résumé forms and employer job listing forms will be on e-MATH and in *Notices* in September and October.

Employer—First Table ☐ Regular ☐ Self-scheduled	$210	$300
Employer— Each Additional Table ☐ Regular ☐ Self-scheduled	$ 60	$100
☐ Employer—Posting Only	$ 50	N/A
☐ Applicant (all services)	$ 40	$ 75
☐ Applicant (Winter List & Message Ctr only)	$ 20	$ 20

$_____

Events with Tickets

MER Banquet	$47	#____Regular	#____Veg
NAM Banquet	$47	#____Regular	#____Veg
AMS Banquet	$47	#____Regular	#____Veg

$_____

Other Events (no charge)
☐ Graduate Student Reception (1/6)

Total for Registrations and Events $_____

Payment

Registration & Event Total (total from other column) $_____

Hotel Deposit (only if paying by check) $_____

Total Amount To Be Paid **$**_____

(Note: A $5 processing fee will be charged for each returned check or invalid credit card. Debit cards are not accepted.)

Method of Payment
☐ Check. Make checks payable to the AMS. Checks drawn on foreign banks must be in equivalent foreign currency at current exchange rates.
☐ Credit Card. VISA, MasterCard, AMEX, Discover (no others accepted)

Card number: _____

Exp. date: _____ Zipcode of credit card billing address: _____

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Name on card: _____

☐ Purchase order #_____ (please enclose copy)

Registration for the Joint Meetings is not required for the Short Courses, but it is required for the Minicourses and the Employment Center.

Other Information

Mathematical Reviews field of interest # _____

How did you hear about this meeting? Check one:
☐ Colleague(s) ☐ *Notices* ☐ Focus ☐ Internet

☐ I am a mathematics department chair.

☐ **Please do not include my name on any promotional mailing list.**

☐ Please ✓ this box if you have a disability requiring special services.

Mail to:

Mathematics Meetings Service Bureau (MMSB)
P. O. Box 6887
Providence, RI 02940-6887
Fax: 401-455-4004
Questions/changes call: 401-455-4143 or 1-800-321-4267 x4143; mmsb@ams.org

Deadlines

For room lottery and/or résumés/job descriptions printed in the *Winter Lists*, return this form by:	**Oct. 26, 2001**
For housing reservations, badges/programs mailed:	**Nov. 7, 2001**
For housing changes/cancellations through MMSB:	**Dec. 6, 2001**
For advance registration for the Joint Meetings, Employment Center, Short Courses, MAA Minicourses, & Tickets:	**Dec. 10, 2001**
For 50% refund on banquets, cancel by:	**Dec. 21, 2001***
For 50% refund on advance registration, Minicourses & Short Courses, cancel by:	**Jan. 2, 2002***

***no refunds after this date**

San Diego Joint Meetings Hotel Reservations

To ensure accurate assignments, please rank hotels in order of preference by writing 1, 2, 3, etc., in the column on the left and by circling the requested room type and rate. If the rate or the hotel requested is no longer available, you will be assigned a room at a ranked or unranked hotel at a comparable rate. Participants are urged to call the hotels directly for details on suite configurations, sizes, and availability; however, suite reservations can only be made through the MMSB to receive the convention rates listed. Reservations at the following hotels must be made through the MMSB to receive the convention rates listed. All rates are subject to a 10.5% sales tax and a California commerce fee of $0.13. Rates at hotels may be subject to an energy surcharge. Participants are not obligated to pay an energy surcharge and may use their own discretion in this decision.

Guarantee requirements: First night deposit by check (add to payment on reverse of form) or a credit card guarantee.

☐ Deposit enclosed ☐ Hold with my credit card Card Number _____ Exp. Date _____ Signature _____

Date and Time of Arrival _____ **Date and Time of Departure** _____

Name of Other Room Occupant _____ **Arrival Date** _____ **Departure Date** _____ **Child (give age(s)** _____

Order of choice	Hotel	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites Starting rates
	San Diego Marriott Hotel & Marina (headquarters)								
	Bay view	$176	$176	$176	$196	(king & cot) $196	$216	N/A	$650
	City view	$156	$156	$156	$176	(king & cot) $176	$196	N/A	$650
	Student	$128	$128	$128	$148	(king & cot) $148	$168	N/A	N/A
	Embassy Suites (Regular Suites)	$148	$148	$148	$168	N/A	$188	N/A	N/A
	Bay view (Suites)	$168	$168	$168	$188	N/A	$208	N/A	N/A
	Student (Suites)	$138	$138	$138	$158	N/A	$178	N/A	N/A
	Wyndham San Diego at Emerald Plaza (Regular Rooms)	$147	$147	$147	$167	(king & cot) $187	$187	N/A	$550
	Student	$137	$137	$137	$157	(king & cot) $177	$177	N/A	N/A
	Horton Grand (Regular Rooms-most rooms have one bed)	$145	$145	$145	N/A	N/A	N/A	N/A	$259
	Student	$135	$135	$135	N/A	N/A	N/A	N/A	N/A
	Bristol San Diego (Regular Rooms)	$140	$140	$140	$150	(king & cot) $160	$160	N/A	N/A
	Student	$130	$130	$130	$140	(king & cot) $150	$150	N/A	N/A
	Westin Horton Plaza (Regular Rooms)	$139	$149	$149	$169	$194	$189	$214	$500
	Holiday Inn on the Bay (Regular Rooms)	$138	$148	$148	$163	$178	$178	$193	N/A
	Bay view	$158	$168	$168	$183	$198	$198	$213	$250
	Clarion Bay View (Regular Rooms)	$138	$138	$138	$158	(king & cot) $158	$178	N/A	$209
	Student	$128	$128	$128	$148	(king & cot) $148	$168	N/A	N/A
	Best Western Bayside (Regular rooms)	$119	$119	$119	$129	$141	$129	$141	N/A
	Student	$109	$109	$109	$119	$131	$119	$131	N/A
	Quality Inn & Suites Harbor View	$109	$119	$119	$129	$144	$139	$154	N/A
	Comfort Inn	$91	$91	$91	$91	$106	$91	$106	N/A

Special Housing Requests:.

☐ I have disabilities as defined by the ADA that require a sleeping room that is accessible to the physically challenged. My needs are: _____

☐ Other requests: _____

☐ If you are a member of a hotel frequent-travel club and would like to receive appropriate credit, please include the hotel chain and card number here: _____

If you are not making a reservation, please check off one of the following:

☐ I plan to make a reservation at a later date.

☐ I will be making my own reservations at a hotel not listed. Name of hotel: _____

☐ I live in the area or will be staying privately with family or friends.

☐ I plan to share a room with _____, who is making the reservations.

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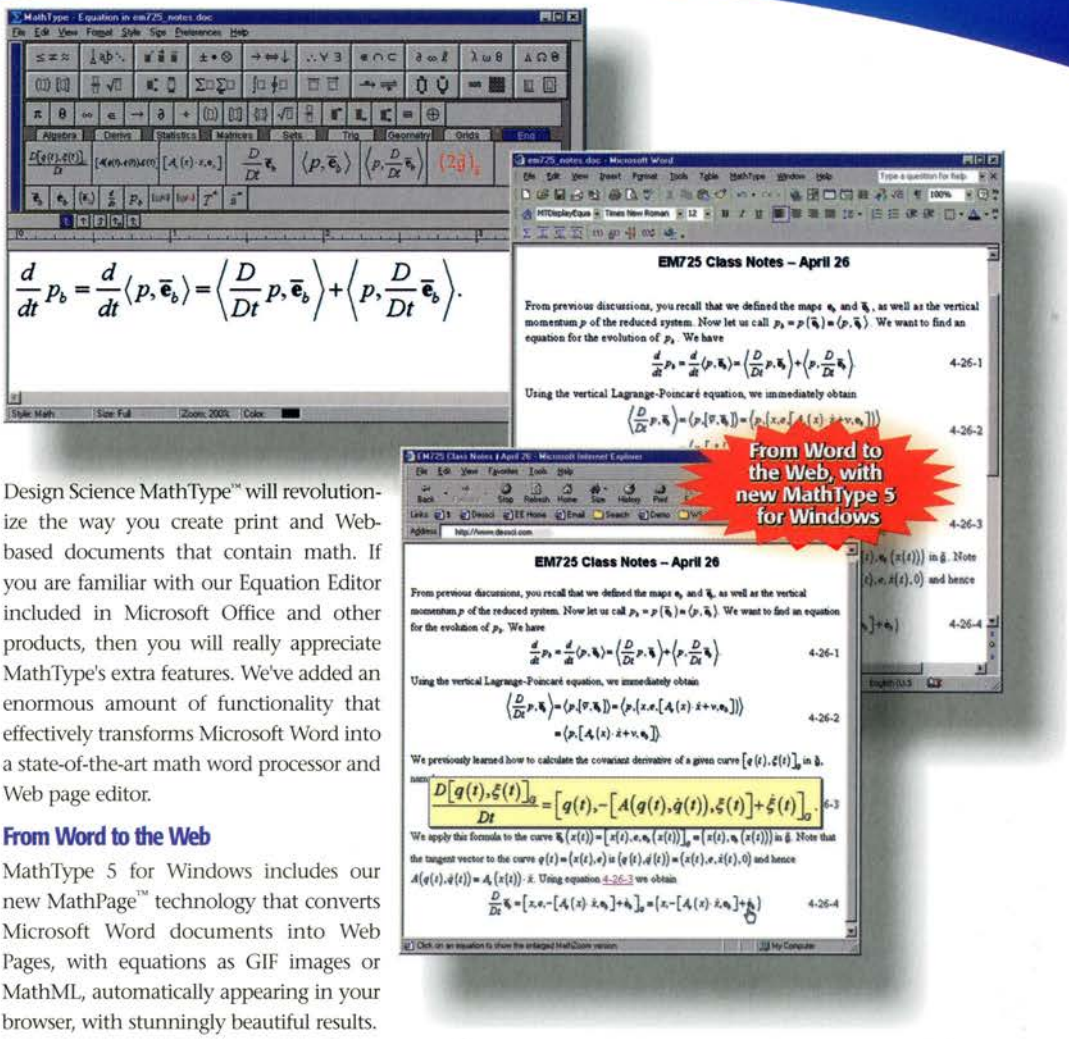

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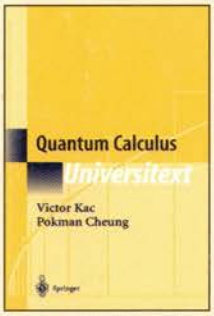

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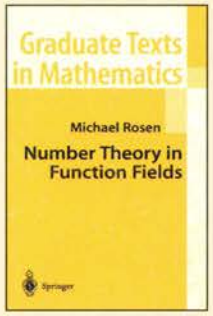

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