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Paulo D. Cordaro, IME-LISP, Sao Paulo, Brazil, and Howard Jacobowitz, Rutgers University, Camden, NJ, Editors

This collection of papers by outstanding contributors in analysis, partial differential equations, and several complex variables is dedicated to Professor François Treves in honor of his 65th birthday. There are five important survey articles covering analytic singularities, holomorphically non-degenerate algebraic hypersurfaces, analyticity of CR mappings, removable singularities of vector fields, and local solvability for systems of vector fields. The other papers are original research contributions on topics such as Káhn-Gordon and Dirac equations, Toeplitz operators, elliptic structures, complexification of Lie groups, pseudo-differential operators, nonlinear equations, CR and Mizohata structures, analytic hypoellipticity, overdetermined systems, and group invariant convex hypersurfaces.

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Sandee N. Bhatt, Bell Communications Research, Morristown, NJ, Editor

This volume is the result of the Third DIMACS Implementation Challenges held as part of the 1993–1994 Special Year on Parallel Algorithms. The Implementation Challenges was formulated in order to provide a forum for a concerted effort to study effective algorithms for combinatorial problems, and to investigate opportunities for massive speedups on parallel computers. The challenge included two problem areas for research study: tree searching algorithms, used in game search and combinatorial optimization, for example, and algorithms for sparse graphs.

Participants at sites in the U.S. and Europe undertook projects from November 1993 through October 1994. The workshop was held at DIMACS in November 1994. Participants were encouraged to share test results, to rework their implementations considering feedback at the workshop, and to submit a final report for the proceedings.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 30; 1997; 162 pages; Hardcover; ISBN 0-8218-0457-2; List $45; Individual member $37; Order code DIMACS/30NT74
Feature Article

An Interview with Vladimir Arnol'd

S.H. Lui

V. I. Arnol'd discusses his early mathematical training, mathematics in the Soviet Union, and different cultures in mathematics.

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From the AMS

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The State of the Union and Mathematics

In his State of the Union message delivered on February 4, 1997, President Clinton stated:

"...my No. 1 priority as president for the next four years is to ensure that Americans have the best education in the world."

In order to achieve this, he proposed spending 51 billion dollars next year as “an unprecedented commitment to these goals.” He then proposed a “Call to Action for American Education” based on ten principles.

In my roles as mathematician, educator, father of school children, taxpayer, and social commentator I applaud the president for setting education so high on his priority list. I seriously question the efficacy of many of his principles.

The first stated principle is a call for a “national crusade for education standards.” The mathematics community was among the first to propose standards, as reflected in the National Council for Teachers of Mathematics (NCTM) standards promulgated in 1989. These standards have been adopted by many schools, including the one which my sons attend. Those who have read the many opinions in these Notices will note the various reactions these standards have elicited within the mathematical community. My own experience is that the schools, and in particular textbook writers and teachers, are not able to implement these standards because they do not have the mathematical maturity required to understand the reasons for inclusion of many of the recommendations, they do not know how to communicate them to students, and they do not know what roles the various standards play in the “big picture” of mathematics and the world.

The NCTM standards call for mention of non-Euclidean geometry in high school mathematics. How many high school geometry textbooks mention this subject? How many teachers include this in their curriculum? Why is it included at all? My point is not to question whether the inclusion is justified, but rather to illustrate the difficulty in implementing standards within the current context of pre-K–12 mathematics education.

Equally difficult is how one changes undergraduate education in our many colleges and universities so that future teachers will be able to teach "up to the standards" that are being proposed. Just this one example suggests a "sea change" in how we educate future teachers. There are many more that come to mind.

President Clinton’s second principle calls for getting the best teachers by budgeting funds to enable 100,000 more teachers to attain certification as master teachers. This principle is to be applauded, especially in view of the criticism leveled in the paragraphs above.

President Clinton’s eighth principle proposes “HOPE” scholarships, two years of a $1,500 tax credit for college tuition, and a tax deduction of up to $10,000 a year for all tuition after high school. Pundits have already questioned how these credits will affect grades, noting that in places where tax credits are tied to grades, grade inflation has already taken place. I question how this principle jibes with those principles that recommend improved standards, which imply, in my mind, stricter standards for passing courses and increased demands on the performance of students, especially those who plan to become teachers.

Finally, the president proposes connecting every classroom to the Internet by the year 2000. I believe the costs involved are not justified by a corresponding improvement in the quality of education. The time wasted in the classroom by students waiting for a Web connection to a site that will not yield quality information would be better spent reading today’s textbooks, poor as they are. What is really needed is released time for the teachers, who can search the Web at their leisure, download the information desired, and then present it to the students in an orderly manner.

In conclusion, I believe that the 51 billion dollars could be better spent than in most of the programs President Clinton proposes.

—Robert Fossum

Editor’s Note: The views expressed in editorials are those of the author alone and should not be construed as the opinion or policy of the editorial board or of the American Mathematical Society.
Averting Tenure Pogrom

Steven Krantz's editorial (Notices, January 1997, p. 4) is an eloquent summary of a pro-tenure position. While the essence of his argument is impressive, we believe that the community of university scholars can and should be much more pro-active in identifying and implementing practical measures to strengthen its support base. All good reasons for it notwithstanding, tenure as a social institution is almost certainly bound to yield to the powerful anti-tenure forces unless the university community is ready to make the necessary adjustments to avert the impending pogrom in academia. The problem transcends national boundaries. The recent anti-tenure rhetoric coming from different sources (e.g., some articles in the American, Canadian, and British press) have much in common.

Talking on social roles of tenured academia, Krantz says, "If we leave it to General Motors and Microsoft to carry out these functions, then civilization as we know it is in jeopardy." So far, so good, but the reality is that such a pronouncement requires a serious backup in real actions in order to be truly convincing. We have to face the unpleasant fact that the way the present trend is developing, too many people “out there” are tending to think that, yes, General Motors and Microsoft will do it better.

Not pretending to offer all the answers and strategies, we would like to mention two aspects where we believe academia has some serious homework to do. The first is the unjustifiably high level of inter- and intradisciplinary competition within the science community. The competition for research grants long ago passed all reasonable limits needed for healthy stimulation and turned into a ferocious rat race and Darwinian fight for survival. Publicly acclaimed cases of research misconduct, misuse of anonymous peer review, and patent court battles between rivalling groups also do not seem to show signs of receding. Is this the best way to impress the outside public with the impeccable quality of our value system? How likely is it to invoke a broad social sympathy to our cause?

The second aspect where urgent correction is long overdue is a highly regretful, if not shameful, split between the “tenure elite” and our non-tenured science brethren (we assume a gender inclusivity, of course). While it is natural for any meritorious system (including tenure) to keep some junior members in a candidate status for some period, the present realm is such that much of this populous (part-timers, postdocs, “soft-money” research assistants, etc.) are getting progressively more and more marginalized. Often they face exploitive high job stress, low security, meager pay, and poor benefits. This group is largely (but not exclusively) fed by the Ph.D. overproduction which was recently well documented in many areas of science, including some letters in Notices. The most recent mass emergence is the category of “eternal postdocs”, and soon the first wave of them will approach retirement age (often without pension). The problem is unlikely to be solved in a single stroke, but at least on the side of Ph.D. (over)production, much of the responsibility is ours.

About the Cover
Dewdrops on a Spider Web. We weave these fine webs to arrest the flight of things passing through, but it does become weighty, particularly during inclement times. Photograph by Darrell Gulin for Tony Stone Images.
Correcting the above flaws is neither easy nor entertaining. But without this hard and long-term job of reevaluation and adjustment, the emergence of McTenure (perhaps in several breeds) seems just the next natural evolutionary step.

Alexander Berezin
Irene Berezin
McMaster University

(Received January 13, 1997)

Request for Information
The family of Dr. Okee Jekeri has lost contact with him and would like to reestablish it. Okee Jekeri was born in Uganda in 1934, earned degrees in mathematics in England and Germany, was a lecturer at Makerere University in Uganda, left Uganda fearing political persecution, and, when last heard from, was at a university somewhere in the United States. It would be greatly appreciated if anyone with information about Okee Jekeri would contact his nephew, Kilama George, through me.

James E. Ward
Makerere University

(Received January 17, 1997)

On Mathematics and Social Responsibility
I was quite glad to see Susan Landau's editorial on "Mathematicians and Social Responsibility"; these issues deserve all the discussion that they can get, and I agree with her examples of areas in which mathematicians have a particular social responsibility. However, the article seemed to sidestep many of the issues raised in its opening paragraphs and was disingenuous with its claims that, unlike other scientists, it's not clear how questions of social responsibility apply to us. On the contrary, these questions apply to mathematicians in exactly the same ways that they apply to other scientists.

While many mathematicians do work in abstract areas with no direct application to the real world, this hardly sets us apart from physicists, who frequently investigate aspects of the physical world far removed from everyday experience, such as what the universe looked like in the first fractions of a second after the big bang. And, just as many scientists work in areas that clearly raise questions of social responsibility, so do many mathematicians. Many of us, myself included, accept funding or have in the past accepted funding from military sources. Many of us work for government agencies such as the NSA. Our government's military agencies and other agencies dealing with foreign affairs and operations have had a huge effect on the lives of Americans and an even huger effect on the lives of people living in other countries, whether we are invading those countries or protecting them from invasion, working to overthrow their governments (possibly democratic, possibly not) or working to prevent their governments from being overthrown (ditto), giving economic support to help other countries or forcing them to adopt economic measures that hurt their own citizens. Wherever you fall on these issues, they all raise questions of social responsibility, and by associating ourselves with the agencies involved, we are implicated in their actions.

Furthermore, newspapers constantly run articles about moral issues involving mathematicians. For example, over the last few years there have been many articles about encryption, debating whether it is a good thing (because it protects our privacy) or a bad thing (because it prevents the government from catching crooks). This is a moral issue; it would not have arisen without mathematicians. Or to come up with an example more directly relevant to Pugwash, the U.S. Government is the only government in the world right now that wants to continue to be able to test nuclear weapons, mainly by simulating them on computers, and our insistence on being able to maintain a nuclear arsenal this way is the main stumbling block to disarming nuclear weapons and preventing further proliferation. Not only are there mathematicians working directly on simulating nuclear weapons in this way, but doing so would be impossible without the centuries of mathematical tradition that lie behind us, even though such applications would have been inconceivable to many of the mathematicians making up that tradition.

We cannot simply absolve ourselves of responsibility because our current research doesn't seem to have anything to do with the real world: we are all part of a tradition that will lead to further opportunities to do good or bad in ways that are unimaginable to us currently, and as such we all have a responsibility as mathematicians to work for the good and work against the bad.

David Carlton
Massachusetts Institute of Technology

(Received January 17, 1997)

On the Work of E. Cartan on Real Simple Lie Algebras
In [2], A. J. Coleman asserts that E. Cartan had obtained in [1] which, by the way, is [38] in his Collected Papers, not [39], not only a classification of real forms of complex simple Lie algebras, but also of their Cartan subalgebras, a fact he had never seen referred to in the literature. I was asked to comment on this assertion, and it was later suggested that I write to the Notices about it, whence this letter.

First, let me dispose of a very minor point. By classification of Cartan subalgebras, we mean nowadays up to inner automorphisms. The distinction between inner and outer automorphisms does not seem to me to occur in E. Cartan's work before 1927, so that it would have been a classification up to automorphisms. However, had he obtained one, this would be minor quibbling, but I do not believe he had, even implicitly. Let me explain why.

By index of a nondegenerate quadratic form on ℝ^n, Cartan means the number of positive squares minus the number of negative squares, once the form is diagonalized. Let g be a complex simple Lie algebra, h a Cartan subalgebra of g, and r its rank. The character δ of a real form g of g over which is the index of its Killing form. Given
a Cartan subalgebra \( h \) of \( g \). Cartan denotes by \( \delta_0 \) the index of the restriction of the Killing form of \( g \) to \( h \). It may depend on \( h \), of course. The integers \( \delta \) and \( \delta_0 \) play a fundamental role in [1]. It turns out that “in general” (see below) the index characterizes the real form, up to isomorphisms, and this dictates Cartan’s strategy. He starts from a real form \( h \) of \( h_\text{C} \) and tries to construct, by analyzing the constants of structure and the restrictions of roots to \( h \), a real form \( g \) having \( h \) as a Cartan subalgebra. This gives him a certain number of possibilities for \( \delta \) and \( \delta_0 \). Furthermore, early in his discussion, he divides the possibilities into two categories for some types of \( g_\text{C} \)’s. Then, within one category, he proves that two real forms \( g, g' \) with the same \( \delta \) are isomorphic. To this end he first shows that \( g \) and \( g' \) contain Cartan subalgebras \( h, h' \) with the same \( \delta_0 \). If \( \delta = r \) (split form; he says normal form), he may try \( \delta_0 = r \) (split Cartan subalgebra). If he finds \( h, h' \) with \( \delta_0 = -r \) (compact Cartan subalgebras), he often uses these; this would of course be the only possibility if \( \delta = \dim g \) (compact form). Then the argument consists in establishing an isomorphism of \( g \) onto \( g' \), bringing \( h \) onto \( h' \). This is indeed a conjugacy assertion in a given \( g \) for Cartan subalgebras with the chosen \( \delta_0 \), but it is only a first step towards a classification. As a second one along those lines it would be necessary, given \( g \), to find all possible values of \( \delta_0 \). As far as I can see, Cartan does not do it, nor does he seem interested. There would then be the problem of the conjugacy of Cartan subalgebras with a given \( \delta_0 \). If they were conjugate, one might hope that some generalization of Cartan’s procedure might prove it, but this is not always true. Since \( \delta_0 \) is the only invariant of \( h \) considered in the paper, this rules out a priori the possibility for this paper to contain such a classification. There is indeed only one conjugacy class if \( \delta_0 = r, -r \), as Cartan shows in many cases, but even for those he does not make a general statement.

To conclude, I note that Cartan’s tables give a quantitative meaning to the above “in general”: \( g_\text{C} \) may have two nonisomorphic real forms with the same character only if it is of type \( A_r, r = m^2 - 3 \) \((r > 1, \text{ odd})\), or \( D_r, r = m^2 \), where \( m \) is a positive integer.

In order not to lengthen this letter, I shall not discuss the other assertions of [2] about Killing and Cartan, though they seem to me somewhat misleading and inaccurate.

References

Armand Borel
Institute for Advanced Study
(Received January 31, 1997)

Editor’s Note: The classification in question was first accomplished by Bertram Kostant in two papers submitted (by Saunders Mac Lane) to the Proceedings of the National Academy of Science. The first was published [On the conjugacy of real Cartan subalgebras I, Proc. Nat. Acad. Sci. U.A. 41 (1955), 967-970], but the editors objected to the elaborate tables in the second, which nevertheless was widely circulated among those with an interest in the area. About four years later a list was published by M. Sugiura [Conjugacy classes of Cartan subalgebras in real semi-simple Lie algebras, J. Math. Soc. Japan 19 (1959), 374-434], who, upon subsequently seeing Kostant’s second paper confirmed to him that the lists were identical.

Cartan Knew Almost Everything!
Armand Borel is perfectly correct. I used the word “classification” in a loose way. I am glad that my error has elicited from him a careful exegesis of Elie Cartan’s 1914 paper. Hopefully this will encourage others to study one of the crucial documents in the history of Lie Algebras. Never before have I seen it discussed in any detail.

As far as I am aware, Bertram Kostant was the first person to classify the conjugacy classes of Cartan subalgebras of the real semisimple Lie algebras.

Cartan’s paper is long and tedious. When I struggled with it I was already acquainted with the papers of Kostant and Sugiura. I was amazed by how many “Cartan subalgebras” were listed. During many years, Cartan referred to these as “the group \( y \)”. For example, in the case of the Exceptional simple LA of rank 4, Kostant and Sugiura found that among its three real forms there are 11 conjugate classes of \( y \). All of these appear in Cartan’s lists. Similarly, for the normal form of the Exceptional algebra of rank 7, all 10 types of \( y \) appear.

Borel is correct in stating that at no point does Cartan say that he is trying to find possible classes of \( y \). His single-minded purpose was to classify the “continuous real simple groups”. He does this and, for instance, notes—a result often ascribed to Weyl—that for each complex simple LA there is a unique compact real form. In so doing, in order to be on firm ground, he found it necessary to distinguish various \( y \). Like Monsieur Jourdain who was amazed to discover that he had been speaking “prose” all his life without realizing it, so Cartan found many inequivalent classes of Cartan subalgebras without noticing he had done so. Of course, he was too modest to ever attach his name to an object which had been defined and deployed effectively by Killing some years before he began the study of Lie algebras!

Ten years later when classifying homogeneous spaces he manifests much detailed knowledge of the various classes of \( y \) in the real Lie algebras making many references to his 1914 paper. The more I read him the more amazed I became of his detailed intuitive grasp of everything about Lie groups.

A. John Coleman
Queen’s University
(Received February 6, 1997)
An Interview with Vladimir Arnol’d

by S. H. Lui

Utilius scandalum nasci permittur quam veritas relinquatur.
(One should speak the truth even at risk of provoking a scandal.)

—Decretalium V of Pope Gregory IX, 1227-1241

Vladimir Arnol’d is currently professor of mathematics at both the Steklov Mathematical Institute, Moscow, and Ceremade, Université de Paris-Dauphine. Professor Arnol’d obtained his Ph.D. from the Moscow State University in 1961. He has made fundamental contributions in dynamical systems, singularity theory, stability theory, topology, algebraic geometry, magneto-hydrodynamics, partial differential equations, and other areas. Professor Arnol’d has won numerous honors and awards, including the Lenin Prize, the Crafoord Prize, and the Harvey Prize.

This interview took place on November 11, 1995. The following articles may be of interest to the reader:


Lui: Please tell us a little bit about your early education. Were you already interested in mathematics as a child?

Arnol’d: The Russian mathematical tradition goes back to the old merchant problems. Very young children start thinking about such problems even before they have any knowledge of numbers. Children five to six years old like them very much and are able to solve them, but they may be too difficult for university graduates, who are spoiled by formal mathematical training. A typical example is:

You take a spoon of wine from a barrel of wine, and you put it into your cup of tea. Then you return a spoon of the (nonuniform!) mixture of tea from your cup to the barrel. Now you have some foreign substance (wine) in the cup and some foreign substance (tea) in the barrel. Which is larger: the quantity of wine in the cup or the quantity of tea in the barrel at the end of your manipulations?

Slightly older children, knowing the first few numbers, like the following problem. Jane and John wish to buy a children’s book. However, Jane needs seven more cents to buy the book, while John needs one more cent. They decide to buy only one book together but discover that they

S. H. Lui is an assistant professor at the Hong Kong University of Science and Technology. His e-mail address is shlui@uxmail.ust.hk.

This article previously appeared in the February 1996 issue of the Hong Kong Mathematics Society Newsletter.

Editor’s Note: As this article went to press, V. I. Arnol’d submitted an update on the interview, based on subsequent correspondence and events. It was received too late to be included in the article.
Many Russian families have the tradition of giving hundreds of such problems to their children, and mine was no exception. The first real mathematical experience I had was when our schoolteacher I. V. Morozkin gave us the following problem: Two old women started at sunrise and each walked at a constant velocity. One went from A to B and the other from B to A. They met at noon and, continuing with no stop, arrived respectively at B at 4 p.m. and at A at 9 p.m. At what time was the sunrise on this day?

I spent a whole day thinking on this oldie, and the solution (based on what is now called scaling arguments, dimensional analysis, or toric variety theory, depending on your taste) came as a revelation. The feeling of discovery that I had then (1949) was exactly the same as in all the subsequent much more serious problems—be it the discovery of the relation between algebraic geometry of real plane curves and four-dimensional topology (1970) or between singularities of caustics and of wave fronts and simple Lie algebra and Coxeter groups (1972). It is the greed to experience such a wonderful feeling more and more times that was, and still is, my main motivation in mathematics.

Lub: What was it like studying at Moscow State University? Can you tell us something about the professors (Petrovskii, Kolmogorov, Pontriagin, Rokhlin,...)?

Arnol’d: The atmosphere of the Mechmat (Moscow State University Mechanics and Mathematics Faculty) in the fifties when I was a student is described in detail in the book *Golden Years of Moscow Mathematics*, edited by S. Zdravkovska and P. L. Duren and published jointly by the AMS and LMS in 1993. It contains reminiscences of many people. In particular, my article was on A. N. Kolmogorov, who was my supervisor.

The constellation of great mathematicians in the same department when I was studying at the Mechmat was really exceptional, and I have never seen anything like it at any other place. Kolmogorov, Gelfand, Petrovskii, Pontriagin, P. Novikov, Markov, Gelfond, Lusternik, Khinchin, and P. S. Alexandrov were teaching students like Marlin, Sinai, S. Novikov, V. M. Alexeev, Anosov, A. A. Kirillov, and me.

All these mathematicians were so different! It was almost impossible to understand Kolmogorov’s lectures, but they were full of ideas and were really rewarding! I recall his explanation of his theory of the size of the minimal cube into which you can embed every graph having $N$ vertices (balls of fixed size), each connected with at most $K$ others by wires of fixed thickness. He explained that when $N$ is very large (while $K$ is fixed), the diameter of the cube grows like $\sqrt{N}$ by the following argument: the grey matter (the body of the neurons) is on the surface of the human brain, while the white matter (the connections) fills the interior part. Since the brain is embedded into the head as economically as possible, a sufficiently complicated brain of $N$ neurons can only be embedded in a cube of size $\sqrt{N}$ (while a trivial brain, like that of a worm, needs only the size $\sqrt{N}$).

Kolmogorov’s work on what is now called KAM theory of Hamiltonian systems was a by-product of compulsory exercises that he gave to all second-year undergraduate students. One of the problems was the study of some nontrivial completely integrable systems (like the motion of a heavy particle along the surface of a horizontal torus of revolution). No computers were available then! He observed that the motion in all such classical examples was quasiperiodic and tried to find examples of more complicated motion ("mixing", or in today’s language, "chaos") in the case of nonintegrable perturbed systems.

His attempts were unsuccessful. The problem which motivated his study is still open—no one has been able to find an invariant torus carrying mixing flows in generically perturbed systems. However, the by-products of this investigation are far more important than the initial technical problem on mixing. They include the discovery of the persistent nonresonant tori, the "accelerated convergence" method and the related implicit function theorems in function spaces, the proof of stability of motion in many Hamiltonian systems (e.g., gyroscopes and planetary orbits), and the proof of the existence of magnetic surfaces in the Tokamak geometry, which is used in the study of plasma containment for controlled thermonuclear fusion.

That consequences of an investigation are more important than the original question is a general phenomenon. The initial goal of Christopher Columbus was to find a new way to India. The discovery of the New World was just a by-product.

Pontriagin was already very weak when I was a student at Mechmat, but he was perhaps the best of the lecturers. He had just turned from topology to control theory, and his personality had also changed a lot. He later explained his reasons for switching to applied mathematics and his antisemitic ideas in his autobiography published in the *Russian Mathematical Surveys*. When he submitted this paper to the Editorial Board, the KGB representative suggested that the article should not be published as it was because of its extreme openness. I would prefer to see the original text published—what you now find is rather softened. Some people claim that
his antisemitism might be simply a manifesta-
tion of his fear that some part of his blood might 
be Jewish and that this might be discovered.

However, Pontriagin was not always like this! 
During the war his best student, V. A. Rokhlin, 
was wounded and imprisoned by the Germans.
Later, Rokhlin was liberated by the Americans, 
returned to Russia, and continued to serve in the 
Russian army, which was still fighting. One day, 
while he was transporting a captured German of-

cicer to his superior, he met a drunk KGB offi-
cer, who wanted to shoot the German officer im-
mediately. Rokhlin objected. Fortunately, Rokhlin 
was saved by his superior, who immediately 
sent him to a different regiment. However, in the 
end Rokhlin was, as were all the Russians who 
were saved from the German camps by the Al-
lies, sent to the gulag (Russian concentration 
camp) in the north of Russia.

Some months later, someone who was liber-
ated from this camp came to Moscow and told 
Pontriagin that Rokhlin was still alive but dying 
from starvation in the camp. Pontriagin, with the 
help of Kolmogorov, Alexandrov, and others, 
\[\text{second letter to Beria, and Rokhlin finally was} \]
\[\text{able to return to Moscow.} \]
\[\text{Rokhlin had no right to } \text{propiska } \text{in Moscow} \]
\[\text{since returning from the gulag. [Propiska is Russ}-
\text{ian, meaning the right to live in a specified area—}
\text{one is not free to live elsewhere. Propiska is ap}-
\text{plied to everybody!} \]
Pontriagin was completely 
blind and had a right to hire a personal secre-
tary at the Moscow Steklov Institute. 
He was brave enough to give this position to Rokhlin, 
who later became one of the leading Soviet math-
ematicians in topology and dynamical systems. 
Rokhlin had a lot of influence on the younger 
generation of mathematicians (like S. Novikov, 
Sinaï, Anosov, and me) and later created a very 
important mathematical school at St. Peters-
burg. Some of his illustrious students include 
Vershik, Gromov, Eliashberg, Viro, Shustin, Tu-
raev, and Kharlamov. I met him in the sixties 
when he held a seminar in Moscow. He came to 
Moscow from one hundred miles away, where his 
propiska allowed him to live.

Rokhlin was of Jewish origin and survived 
the German prisoner camp by pretending to be 
a Muslim. Indeed, he was born in Baku, Azer-
bajjan. It was really dangerous for Pontriagin to 
help him and to approach Beria. Pontriagin 
preserved his high opinion of Rokhlin even after he 
became an active antisemite. My personal rela-
tion with Pontriagin was rather good. He invited 
me to his house and to his seminar and showed 
genuine interest in my work, especially on sin-
gularity theory. This was partially due to our 
common interests in differential topology and 
control and game theory. The main reason, how-
ever, was that he wanted to say something 
against me at an international meeting. Pon-
triagin was then the Russian representative in 
the International Mathematical Union (IMU) and 
\[\text{had done a lot to prevent any vote for dissident} \]
\[\text{Russians. (I was blacklisted because I, along with} \]
\[\text{99 other mathematicians, had signed a letter} \]
\[\text{protesting the imprisonment of a perfectly} \]
\[\text{healthy Soviet mathematician in a psychiatric} \]
\[\text{hospital. This was the standard method of elimi}-
\text{nating dissidents.) The IMU had always been very} \]
\[\text{political, and he succeeded. In his reminiscences} \]
\[\text{Pontriagin revealed that quite a few of the IMU} \]
\[\text{officers shared his cannibalistic views. I hope we} \]
\[\text{shall know their names. Curiously enough, I am} \]
\[\text{now in his former position, representing Russia} \]
\[\text{in the IMU.} \]

Petrovskii, who was then the rector of the 
university, usually met Rokhlin in the elevator 
just before the seminar. I think it was danger-
ous for him to be seen in the company of Rokhlin. 
Petrovskii was no longer active in mathematics. 
However, he was extremely important for the 
Moscow mathematical community, always try-
ing to support genuine mathematicians in dif-
ficult fights with the Communist Party.

His mathematical taste was rather classical, 
\[\text{based on the Italian school of algebraic geome}-
\text{try more than the set-theoretic conceptions. Sir} \]
\[\text{Michael Atiyah once told me that he was always} \]
\[\text{delighted by the way Petrovskii dealt with alge}-
\text{braic geometry in his works on PDEs. One of} \]
\[\text{these, the paper on the lacunas of hyperbolic} \]
\[\text{PDEs, was later rewritten by Atiyah, Bott, and} \]
\[\text{Gårding in modern terminology in two long pa}-
\text{pers in Acta Mathematica. It is a far-reaching gen}-
\text{eralization of the well-known fact of the im}-
\text{possibility of acoustic communication in the} \]
\[\text{even-dimensional spaces (for instance, in the} \]
\[\text{"plane" world), while in our three-dimensional} \]
\[\text{world we communicate easily. It is interesting} \]
\[\text{that in this paper, Petrovskii proved that the} \]
\[\text{cohomology classes of the complement of an al}-
\text{gebraic variety are representable by rational dif}-
f
\[\text{ferential forms—a result which is usually at}-
\text{tributed to Grothendieck.} \]

\[\text{The works of Petrovskii (1933 and 1938) on} \]
\[\text{real algebraic geometry (related to the 16th} \]
\[\text{Hilbert problem on the shape of real plane al}-
\text{gebraic curves) started an important branch of} \]
\[\text{modern mathematics—the topology of real al}-
\text{gebraic varieties. Results of this theory (for ex-}
of the degrees of the equations) are very useful in many branches of mathematics, including complexity theory. For instance, they were used by Khovanskii in his fewnomial theory, by Smale in his study of the “real P-NP” problem, and so on. In the West these results are usually attributed to Thom and to Milnor (1965), while the papers by Petrovskii and his student Oleinik, published in the forties, contained better estimates (and were, by the way, quoted by Thom and by Milnor). This is, however, a very standard situation—it is too easy to omit quoting Russian fundamental papers in the modern world of the job hunters.

Petrovskii had never been a party member. This was unknown to most Communists. He was highly influential, partially because of his personal relation to his former students, who had attained very high positions in the Soviet hierarchical system. Petrovskii was made a member of the Presidium of the Supreme Soviet, which was the “collective president” of the Soviet Union. He died at the door of the Party Central Committee building in Moscow of a heart attack after a long fight at a meeting for the support of fundamental science. His last words were “I won.”

After his death the party and the KGB worked for twenty years to destroy the mathematical center at Mechmat created by him. They had stopped the appointment of talented people to the faculty, and they have by now almost succeeded in killing the center.

Lui: Can you tell us your philosophy of teaching undergraduates and of supervising graduate students and how many you have had in Russia and France?

Arnold: The number of Ph.D. theses defended under my supervision is something like forty. I cannot give the exact number for several reasons. In the “stagnation” period, I was not allowed to supervise foreign graduate students at Moscow University because I was not a party member. They still were studying with me, but the official supervisor was some friendly party member who also got paid for it. Some graduate students had other supervisors but wrote their theses on topics discussed in my seminars and were practically my students. Three examples are S. M. Gusein-Zade, Yu. Iliashenko, and A. I. Neishtadt. At present, I am working with two undergraduates and three graduates in Moscow and with four graduates in Paris. Two or three more are supposed to start in January.

I learn a lot from my students, especially undergraduates. I never assign a thesis topic to my students. This is like assigning them a spouse. I merely show them what is known and unknown.

My Moscow seminar, working even when I am abroad, consists of about thirty mathematicians, mostly my former graduate students, but there are always others. The seminar has existed for about thirty years, and among the participants in different years were Ya. Sinai, V. Alexeev, S. Novikov, M. Kontsevich, A. Goncharov, D. B. Fuchs, G. Tjurina, A. Tjurin...

Life in Moscow is so difficult that most students have to earn their living independently of their scientific work. Some, for instance, start their own businesses. The rate of crime is so high, however, that in starting a business, one risks being killed. One of my graduate students in Moscow, who has just finished his thesis but has not defended it, disappeared a few weeks ago. We have doubts about whether he is alive or not.

Lui: Do you have any mathematical heroes?

Arnold: I would mention Barrow, Newton (who was, however, a very unpleasant person—see my book Huygens and Barrow, Newton and Hooke published by Birkhäuser, 1990), Riemann, Poincaré, Minkowski, Weyl, Kolmogorov, Whitney, Thom, Smale, and Milnor. One-half of the mathematics I know comes from the book of F. Klein Lectures on the Development of Mathematics in the 19th Century. I have also learned a lot from many mathematicians like Gelfand, Rokhlin, S. Novikov, P. Deligne, Fuchs, and from my own students like Khovanskii, Nekhoroshev, Varchenko, Zakaljukin, Vassiliev, Givental, Goryunov, O. Scherbak, Chekanov, and Kazarian.

I am deeply indebted to Thom, whose singularity seminar at the Institut des Hautes Études Scientifiques, which I frequented throughout the year 1965, profoundly changed my mathematical universe. I was always delighted by the way in which Thom discussed mathematics, using sentences obviously having no strict logical meaning at all. While I was never able to completely free myself from the straitjacket of logic, I was forever poisoned by the dream of the irresponsible mathematical speculation with no exact meaning. “One can always find imbeciles to prove theorems” was, according to Thom’s students, his principle.

Milnor’s talks at Leningrad in 1961 on the differential structures on the sphere made such a profound impression on my supervisor, Kolmogorov, that he suggested that I put this in my graduate curriculum. This forced me to study differential topology from Novikov, Fuchs, and Rokhlin. This came in handy because, a year later, I was on the jury for Novikov’s thesis defense on the differential structures on the products of spheres.

Smale was one of the first foreign mathematicians I met when he came to Moscow in
Lui: Do you notice any differences in the way people from different cultures do mathematics?

Arnold: I was unaware of these differences for many years, but they do exist. A few years ago, I was participating in an International Science Foundation (ISF) meeting in Washington, D.C. This organization distributes grants to Russian scientists. One American participant suggested support for some Russian mathematician because “he is working in a good American style.” I was puzzled and asked for an explanation. “Well,” the American answered, “it means that he is traveling a lot to present all his latest results at all our conferences and is personally known to all experts in the field.” My opinion is that ISF should better support those who are working in the good Russian style, which is to sit at home working hard to prove fundamental theorems which will remain the cornerstones of mathematics forever!

Russian salaries are (and were) so small, that if someone is doing mathematics, it means that for him it is the goal and not a means to earn money. It is still possible to attain a high reputation in the Western mathematical community by simply rewriting (or modernizing) classical Russian achievements and ideas unknown to the West.

The Russian attitude toward knowledge, science, and mathematics always conforms to the old traditions of the Russian intelligentsiya. This word does not exist in other languages, since no other country has a similar caste of scholars, medical doctors, artists, teachers, etc., who find more reward from their contributions to society than from personal or monetary gains.

My friend Vershik recently tried to obtain an American visa in Paris. “What is your salary in St. Petersburg?” asked the staff at the American consulate. After hearing his honest reply, the staff asked, “Do you wish to persuade us that you intend to return to St. Petersburg at such a salary?” Vershik answered, “Of course. Money is not all!” The staff was so shocked that Vershik was given the visa immediately.

I was applying for a visa a week earlier, and they put me on a waiting list for three weeks. Their reasoning was that my papers must be checked in Washington since I am a “donkey”. I asked for an explanation. “Well,” they replied, “we have such names for every crime: dog, cat, tiger, camel, and so on.” They showed me the list, and “donkey” is a pseudonym for a Russian scientist.

One other characteristic of the Russian mathematical tradition is the tendency to regard all of mathematics as one living organism. In the West it is quite possible to be an expert in mathematics modulo 5, knowing nothing about mathematics modulo 7. One’s breadth is regarded as negative in the West to the same extent as one’s narrowness is regarded as unacceptable in Russia.

The French mathematical school was brilliant for several centuries, up to the penetrating works of Leray, H. Cartan, Serre, Thom, and Cerf. The Bourbakiists claimed that all the great mathematicians were, using the words of Dirichlet, replacing blind calculations by clear ideas. The Bourbaki manifesto containing these words was translated into Russian as “all clear ideas were replaced by blind calculations.” The editor of the translation was Kolmogorov. His French was excellent. I was shocked to find such a mistake in the translation and discussed it with Kolmogorov. His answer was: I had not realized that something was wrong in the translation since the translator described the Bourbaki style much better than the Bourbakiists did. Unfortunately, Poincaré left no school in France.

A typical example of the French narrow-mindedness is the recent discussion at the Academy of Sciences. Gromov was a foreign associate for many years, but he recently chose the French nationality and hence could no longer remain a foreign associate. The problem was to transfer him to be an ordinary fellow of the Academy. The French mathematicians, however, were opposed to this, saying that “those places are for the really French people!” In my opinion, all the “really French” candidates were incomparably below the level of Gromov, who is one of the world’s leading mathematicians. In the end, Gromov is still not a fellow.

To teach in France is very difficult because of the formalized Bourbaki training the students have. For example, at a written examination in dynamical systems for fourth-year students at Paris-Dauphine, one problem was to find the limit of the solution of a system of Hamiltonian equations on the phase plane starting with some given initial point when time goes to infinity. The idea was to choose the initial point on a separatrix of a saddle, with the limit being the saddle point.

Preparing the examination problem, I made an arithmetical error, and the phase curve (the energy-level curve containing the initial point) was a closed oval instead of the separatrix. The students discovered this and concluded that there exists a finite time $T$ at which the solution returns to the initial point. Using the unicity theorem, they were able to deduce that for any integer $n$ the value of the solution at time $nT$ is still the initial point. Then came the conclusion: since the limit at infinite time coincides with the limit for any subsequence of times going to infinity, the limit is equal to the initial point! This
solution was invented independently by several good students sitting at different places in the examination hall. In all this reasoning, there are no logical mistakes. It is a correct deduction which one may also generate by a computer. It is apparent that the authors understood nothing. It is awful to think what kind of pressure the Bourbakists put on (evidently nonsilly) students to reduce them to formal machines! This kind of formalized education is completely useless for any practical problem and even dangerous, leading to Chernobyl-type events. Unfortunately, this plague of formal deduction is propagating in many countries, and the future of the mathematics infected by it is rather bleak.

The United States has a different danger. No Russian professor is able to solve correctly the problem they give in the Graduate Record Examination, the official entrance examination for graduate studies: find the closest pair to (angle, degree) among the pairs: (time, hour), (area, square inch), and (milk, quart). Every American immediately solves it correctly. The official explanation for the correct response (area, square inch) is: one degree is the minimal measure of angle, one square inch is the minimal measure of area, while an hour contains minutes and a quart contains two pints. I always wondered how it is possible for so many Americans to overcome such difficulties and become great mathematicians. One physicist in New York who solved the problem successfully told me that he had the correct model of the degree of stupidity of the authors of such problems.

H. Whitney told me that the problem (intended for fourteen-year-old American school children) of whether 120% of the number 80 is a number greater than, smaller than, or equal to 80 was correctly solved (in a nationwide test) by 30% of the students. People making the test thought that 30% of the school children understood percentages. Whitney explained to me, however, that the number of those who really understood was negligible with respect to the whole sample. Since there were three possible answers, the statistical prediction for a correct random choice was 33%, with a 5% uncertainty.

Recently, even the National Academy of Sciences decided that scientific education in America should be enhanced. What they propose is to eliminate from the curriculum unnecessary scientific facts too difficult for American children and replace them by really fundamental, basic knowledge, such as all objects have properties and all organisms have nature! (See Nature 372:5606 December 8, 1994.) Undoubtedly, they will go far with this! Two years ago, I read in USA Today that American parents have formed a list of really necessary knowledge for children in each age category. At ten they have to know that water has two phases, and at fifteen that the moon has phases and rotates around the earth. In Russia we still teach children in primary school that water has three phases, but the new Americanized culture will undoubtedly win in the near future. There are, however, some remarkable advantages in the free American system, where a high school student may take, say, a course on the history of jazz instead of algebra.

A few months before his death, Whitney, who was still very active at the Institute for Advanced Study in Princeton, told me the story of his mathematical studies. He was an undergraduate in violin at Yale, and after the second year he was sent to one of the best centers in Europe for music. Unfortunately, I have forgotten which city it was, but in any case it was not far from the Alps, since he already was a mountain climber. There, a student had to pass an exam in a subject different from his own studies. Whitney asked his fellow students which subject was the most fashionable then, and they told him quantum mechanics. After his first class in quantum mechanics, Whitney approached the famous lecturer (Pauli? Schrödinger? Sommerfeld?) with the following words: "Dear Professor, it seems to me that something is wrong with your lectures. I'm the best student from Yale, and still I am unable to understand a word in your lecture." The lecturer, after being informed that Whitney was studying music, answered quite politely, "This is because you need some background, such as calculus and linear algebra." "Well," Whitney replied, "I hope these are not so brand new as your subject and someone has already written textbooks on these subjects." The lecturer agreed and mentioned the titles of some textbooks. (If someone knows about this story, I would like to know the name of the city, lecturer, and titles.) "In three weeks," Whitney continued, "I was understanding his lectures, and at the end of the semester I switched from music to mathematics."

Kolmogorov also started as a nonmathematician—he was studying history. His first paper, written when he was seventeen, was reported at a seminar given by Bakhruhin at Moscow University. Kolmogorov came to some conclusion based on an analysis of medieval tax records in Novgorod. After his talk, Kolmogorov asked Bakhruhin whether he agreed with the conclusions. "Young man," the professor said, "in history, we need at least five proofs for any conclusion." Next day, Kolmogorov switched to mathematics. The paper was rediscovered in his archive after his death and is now published and approved by the historians.

Lui: Any comments on the relation between pure and applied mathematics?
Fiske Society Charter Members Inducted

Outgoing AMS president Cathleen S. Morawetz presents AMS treasurer Franklin P. Peterson with a token recognizing his support for and membership in the Thomas S. Fiske Society.

Thirteen individuals are now Fiske Society members, five of whom were recognized at the Joint Mathematics Meetings in San Diego in January.

Thomas S. Fiske founded the American Mathematical Society in 1888. In 1996 the AMS launched the Thomas S. Fiske Society to recognize those who have included the Society in their estate plans.

For further information on the Fiske Society or on how you can make a gift to support mathematics while saving taxes and receiving an enhanced income, contact Tim Goggins at 401-455-4110 (direct) or 800-321-4267 or tjg@ams.org. or see the Development home page at www.ams.org/development/.

—Tim Goggins,
AMS Development Officer

Arnol'd: According to Louis Pasteur, there exist no applied sciences—what do exist are the APPLICATIONS of sciences. The common opinion of both pure mathematicians and theoretical physicists on the applied mathematics community is that it consists of weak thinkers unable to produce something scientifically important and of those who are more interested in money than in mathematics. I do not think that this characteristic is fully deserved by the applied mathematics community. See my article “Apology of applied mathematics” in Russian Mathematical Surveys, 1996. It summarizes my talk at the opening of the Hamburg International Congress of Industrial and Applied Mathematics, July 1995. I think that the difference between pure and applied mathematics is social rather than scientific. A pure mathematician is paid for making mathematical discoveries. An applied mathematician is paid for the solution of given problems.

When Columbus set sail, he was like an applied mathematician, paid for the search of the solution of a concrete problem: find a way to India. His discovery of the New World was similar to the work of a pure mathematician. I do not think that the discoveries of Galileo (who was immediately exploiting them in a businesslike American style) are less important than, say, those of the pure philosopher Pascal. The real danger is not the applied mafia itself, but the divorce between pure mathematics and the sciences created by the (I would say criminal) formalization of mathematics and of mathematical education. The axiomatical-deductive Hilbert-Bourbaki style of exposition of mathematics, dominant in the first half of this century, is now fortunately giving place to the unifying trends of the Poincaré style geometrical mathematics, combining deep theoretical insight with real-world applications.

By the way, I read in a recent American book that geometry is the art of making no mistakes in long calculations. I think that this is an underestimation of geometry.

Our brain has two halves: one is responsible for the multiplication of polynomials and languages, and the other half is responsible for orientation of figures in space and all the things important in real life. Mathematics is geometry when you have to use both halves. See, for instance, “The geometry of formulae” by A. G. Khovanskii in the Soviet Sci. Rev. Sect. C: Math. Phys. Rev. V4 (1984).
A Wealth of Potential but an Uncertain Future: Today's Mathematics Departments

What does the future hold for today's mathematics departments? The Notices asked three prominent department chairs to explore this question, and their thoughts appear below. Many of the issues raised here are being examined by the AMS Task Force on Excellence in Mathematical Scholarship, chaired by Morton Lowengrub of Indiana University. The Task Force is planning to release its report this fall.

John B. Conway

We are in a period of change in the profession. Change that is fundamental and permanent. With the metamorphosis of the world economy and, in particular, the shifting of the United States's position in the world economy, changes are occurring in every sector of life. In recent years entire industries have faded to a shadow of their former glory, and American citizens no longer view continued increases of their families' fortunes as a given. In that atmosphere no one, including academia and mathematics, can expect to be spared fundamental shifts.

Compounding these problems is the electronic explosion. We have to believe that computers are going to continue getting smaller and faster. How long will it be before we have a 200 MHz computer with 32 Mb of RAM that slips into a shirt pocket? When that happens many disciplines that presently require their students to take mathematics courses may begin to reconsider such a requirement. If what they want is that their students learn how to execute certain algorithms, I don't see why they should keep sending them to us.

The nature of the mathematics department ten years from now depends on how the mathematical community responds to this change. If you can predict that response, you can see what departments will be like. How the profession reacts to advancing technology, the coming of posttenure review, the assessment of effectiveness in the academic world, and the competition for mathematical talent will determine whether mathematics departments prosper or follow a path to the arcane.

The one force of change that we have any control over is technology. Of course we cannot control the technology itself, but we can decide whether to meet it as friend or foe. We have to embrace technology. I don't mean just tolerate it; embrace it and celebrate it! Let's face it. In our low-level courses we have been teaching students how to execute algorithms. We avoided the pain of trying to convey concepts and the meaning of mathematics to the great unwashed. This approach found its way into grade and high schools. (How did the teachers learn their mathematics?) Now calculators and computers can do those algorithms.

The professional mathematics community must adapt and learn how to best incorporate technology into instruction. With the existence of powerful, inexpensive computers, I see mathematics departments rethinking their entire curriculum. At least I hope they do. Otherwise we are out of business and will be replaced by buildings on the edge of campus that are filled with

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computers loaded with self-paced instructional software that leads the student through the steps of pushing appropriate buttons.

There is a dramatic upside to this. I think that proper incorporation of technology in teaching mathematics and an emphasis on teaching concepts and understanding implies smaller classes and the need for teachers with greater understanding of the subject. This might counteract some of the drive toward larger classes and more nondoctoral instructors.

It also means that mathematics departments must begin to act as their own ambassadors, sending diplomatic missions to their client departments. We have to understand what mathematics the other departments want their students to learn and start offering it to them. We should also try to persuade them that a greater understanding of the concepts is to their benefit. (This is not as difficult as you may think.) The alternative is that they will try to do it themselves. With technology, that may be more of a threat than ever.

One casualty of increasing accountability will be tenure as we know it. In ten years just about every state university will have a system of post-tenure review in place. I am not sure of the form, and in fact there will probably be wide variation in the practice. Some will have a very mild form: problem faculty will be identified by the department head, and measures will be taken to correct the problem. If there is no improvement, the faculty member will be dismissed. Others will have five-year periodic reviews of all faculty. The review may be something like a promotion review, and some universities may waste everybody's time by writing for outside letters. Of course no academician will ever write a letter that will justify dismissal of a tenured faculty member, especially with most states having laws that make such letters accessible to the public.

Frankly, I'll be happy with posttenure review. Tenure is a great institution for protecting freedom of thought and expression. But unless there is a workable process for removing tenure, it is a guarantee of lifelong employment. As such it is indefensible. I have personally known mathematics professors who have spent a considerable portion of a semester lecturing on Norse sagas, have not shown up for their class, have cancelled classes after the Thanksgiving break, or have spent considerable lecture time staring at and mumbling to the chalkboard. Such people do not deserve our respect or the protection of tenure. Most would reform at the mere hint of review.

In the future, most graduate programs will be more specialized. The top ten or twenty programs will barely change at all, but the rest will begin to focus on a small number of well-defined research areas. To be a mathematician you need to know mathematics from several different areas, but most departments cannot afford to have heavy representation in all the areas. As a result they will pool their resources and focus on building research groups in four or so parts of mathematics, while hiring just enough faculty in other areas to maintain a diverse graduate curriculum. The core areas will offer their courses every year, and the others will be offered every other year.

External funding for individual research will decrease even further. The National Science Foundation (NSF) is tending toward funding more group research activities than individual grants. There appears to be widening support for institutes, conferences, and infrastructure. With increasing numbers of mathematicians significantly using computers in their research, however, there will be an increase in NSF support for equipment.

As a partial compensation, more mathematics departments will become involved in fundraising. It will be difficult, almost impossible, to convince donors that their contributions should go toward subsidizing faculty to do research during the summer. About the only form of research support that will attract private contributions is a conference or an annual lecture with a well-defined purpose, such as the annual undergraduate or graduate honors lecture. Donors are far more likely to contribute to scholarships.

More mathematics departments will be involved with mathematics education and teacher training. There is a problem with education, though I don't think it is as big as some are trying to convince us it is, and the public believes that those who are capable should try to fix it. This is one of the reasons they support us. I think this is a good development. The more involved the best mathematical minds become with education, the more the profession will profit.

Is the future bright or dreary? Neither. It is uncertain. That is the way the future always is. What happens is a dynamic process. We will have the opportunity to make substantial input, but we cannot determine the outcome. The only certainty is that the profession has the ability to influence the future—as much as any force that is driving change.

William Rundell

"The future ain't what it used to be," may be the most pragmatic prediction, given the historical
failures of our prophets, mathematical ones included. Yet the political winds of recent years have left little untouched, and it is impossible not to look ahead. Few can doubt that academic science, including mathematics, is going through a period of rapid change, and it is all too tempting to dwell on the negative side effects: diminished government support and greater accountability to a public that is almost completely ignorant of science, never mind scientific research.

The current trend is to predict the future of mathematics departments on the basis of resolving current difficulties. This negative approach is destined to lead to poor predictions, for our task is less to foresee than to enable; society invariably rewards those who have the ability and willingness to address current needs, and fiscal reductions are unlikely to be uniform. We should expect to see an increased emphasis on, and respect for, those areas that directly impact "public interest"—for example, the biological, medical, social, and information sciences. No discipline that wishes to prosper can fail to address the fundamental problems of the age. The intellectual problems of the future, as in the past, will involve deep mathematical questions. In this regard our discipline and mathematicians who treat these rapidly changing times as fundamental contributions.

We cannot argue solely on the grounds that mathematics is critical to society and therefore academic mathematics departments should be supported at some predetermined level. The pragmatists will counter that if we are so important and all-embracing, then why do we seem to attract so few students at both the undergraduate and graduate level (compared to, say, chemistry and computer science)? Even these small numbers face uncertain employment prospects. This is despite the fact that our talent pool, as measured by factors such as standard test scores, is always amongst the highest in the university. The pragmatists may be perplexed by the dichotomies of the situation but not persuaded to invest resources. One has to look no further than our colleagues in departments of English to see that society’s perception of a discipline’s importance does not translate into funds for its practitioners.

How do these generalities translate into actual changes within mathematics departments? To be viewed as a key player in a research university, mathematics departments simply must have visible accomplishments. Although the prognosis is that mathematics departments cannot expect to have high levels of external funding and graduate enrollments, this is exactly what we need if we are to be taken seriously. Along with expansion must come significant diversification. The focus of many, if not most, of the Ph.D. granting departments must be redirected away from producing professors at similar institutions. This shift will require an acceleration of the already evident trend to reclaim the boundaries of the discipline. It must not be viewed as merely an attempt to produce more "sophisticated engineers", but rather a way to produce deeply trained mathematicians with significant knowledge of an application area. This could mean a number theorist moving into computer security, a differential geometer into crystallography, or a probabilist going into business analysis. The real change here, already started, is the realization by existing research faculty that the burden of these changes rests with them.

To be competitive we are going to have to offer students stipends comparable to salaries in the disciplines in which they will eventually work, which means the stipends will almost certainly have to be higher than they are now. We also must shorten the time to Ph.D. if we are to present an attractive alternative. How can we reconcile the clarion calls for more breadth, a significant outside area, and retention of research depth with probably the same amount of teaching requirements and a shorter time frame? Breadth must be interpreted as "not single focus". The traditional requirement of considerable knowledge of analysis, algebra, and geometry will no longer be relevant for all but a small proportion of graduates. Let me stress this is not a call for relinquishing the core of the discipline, but simply a return to the style of Newton, Gauss, and von Neumann.

Many smaller programs will be able to flourish by concentrating on excellence in a single topic. Some of the present larger programs will be forced to shrink dramatically. The public who pay for the system and are our real clients and the employers who hire our students will ultimately determine which departments will prosper. A formal accreditation system, especially one that ignores market forces, is almost certainly doomed to failure.

At most large research universities undergraduate mathematics majors represent about one percent of the degrees awarded (the percentage is higher at private and liberal arts institutions). A department that teaches less than ten percent of its credit hours to its own majors is also going to be vulnerable to competitive pressure. As engineering enrollments decline, are we surprised that engineering departments, with a surplus of faculty, are trying to ensure that their majors take as few courses outside their department as possible? Engineering today, the College of Business tomorrow?
This one issue—the small number of undergraduate mathematics majors—has received relatively scant attention. It should be a priority within the mathematics community to considerably expand the number of students specializing in the discipline—again by offering more broadly based programs in addition to the traditional core. The advantages are numerous. First some obvious ones; an expanded base for graduate programs and the political reality that in a formula-funded institution majors translate into resources. Second, it is a known fact that alumni tend to favor the institution and department where they received their undergraduate education, and this is true whether it is with private funds or those of their employers that they influence—funds we will need to replace those we are currently losing. Third, and most critical, mathematical training is important to society’s needs, and we should be more evangelical about this fact.

Our influence with the high schools is, despite the recent rhetoric, always going to be remote. Change at the graduate level will be limited by the quality of the undergraduate pool. Therefore, it makes a great deal of sense to concentrate on the undergraduate program, where we have a large captive audience. The quality undergraduate institutions have known all this for years, yet it seems to be neglected at the large research universities. The cost of an expanded undergraduate major is far cheaper than a comparable expansion at the graduate level and would require very few additional resources.

It almost goes without saying that we need to pay careful attention to undergraduate instruction. Not only must we have, but we must be seen to have, an intellectually solid curriculum that is meaningful to the future careers of the students we teach. We also need to ensure that it is presented with enthusiasm. There has been considerable and much needed reform in calculus designed for science and engineers, but a lot less in calculus for liberal arts and business students, though change is equally necessary here.

However, there are pitfalls. Small projects combining enthusiastic instructors giving dedicated attention to hand-picked, talented students almost never scale up and have little relevance at large institutions. Introduction of computing technology is essential, but it is easy to allow form to replace substance. These issues must be tackled by mainstream faculty and with average students in mind. This is critically important to our future, and we need to be playing our first team lest the spin doctors, who will always be with us, get to substitute simple illusions for complicated truths.

These things mean new demands on faculty, who will not only have to take an expanded interest in research and curriculum matters but have to deal with a more diverse public. Mathematics departments have long been a refuge for the highly focused and socially noninteractive individual. They always will be, but there will be fewer such havens.

B. A. Taylor

The basic role of the university in our society—creating, disseminating, and preserving knowledge—will not change significantly in the foreseeable future, and the mathematics departments of large universities will not change dramatically either. In my optimistic scenario, good mathematics programs will bring success.

The balance between teaching, research, and service roles of faculty is evolving and will continue to do so. Faculty will become more involved with teaching, curriculum development, and administrative tasks. The importance of research and scholarship will remain very strong, but, except in very rare cases, it will not be sufficient in itself to justify promotion or other rewards for merit. Our mission will remain the same—to do high-quality research and effective teaching within a sound curricular framework, but we will be held more accountable, both individually and as departments, for the learning of our students.

There is an increasing need for mathematically educated citizens. Besides being a beautiful field, mathematics is a gateway discipline for science, engineering, and almost any technical field. This is true at all levels, from K–12 through graduate, and it is a tremendous advantage. We can keep jobs within mathematics departments if we are successful at providing appropriate curriculum and effective teaching and at paying attention to the career paths of our students. As technology increases in importance throughout our economy, the significance of our contributions can increase correspondingly if we give students the knowledge and learning skills they need to succeed in technology-based careers. It needs to be widely understood and accepted that mathematics is important to the success of students with a variety of career interests.

The recent National Science Foundation report Shaping the Future points out (p. 6) that our educational system has produced a large supply of world-class scientists and at the same time done a poor job in science and mathematics education for most of the public. Thus I think we are doing

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many educational tasks quite well, and we must be careful to maintain these strengths, such as our graduate and honors programs. In addition, I do not think mathematicians have focused entirely on the top students. During the thirty years I have worked as a mathematics faculty member, it seems to me that mathematics faculty have always been changing the curriculum, trying to do a better job for more students. At the undergraduate level we have an ongoing commitment to curriculum and pedagogy reform. For example, the learning of mathematics needs to be integrated with the use of computers and calculators to do mathematics. We are already making progress on this important task.

In the face of declining research support, one defense of small and expensive graduate and honors programs lies in meeting our responsibilities to students at all levels. The bulk of our teaching will remain at the freshman-sophomore level (over 80 percent of the enrollment in my department), where the majority of the students are from other disciplines. We must collaborate with client disciplines to produce appropriate curricula for this level, with the interests of their students as the primary objective. In a time of competition for scarce resources, isolation from other departments would be disastrous.

At the junior-senior level, we would better fill our role in the university and society by increasing the number of mathematics majors. To do this will require efforts in two directions. First, in freshman-sophomore courses, we need to do a better job of explaining what mathematics majors do. Do most students understand that there are career paths for mathematics majors other than teaching? Through the efforts of the professional societies, there is now a lot of career information available. But do faculty have the information, and do they pass it on in their classes? Second, we need to know how our majors fare in the job market and the kinds of careers they take up. In my department, about 10 percent of undergraduate majors go on to graduate programs in mathematics, 30 percent go to graduate programs in other fields, and 60 percent get jobs in industry. Thus, very few of our students end up with jobs labeled "mathematician". Nevertheless, feedback from alumni and employers who recruit mathematics majors shows that they value the hallmarks of a mathematics major—problem-solving skills, clear thinking, and the ability to deal with abstract concepts. We have found that alumni are cooperative, even enthusiastic, about advising current students and giving feedback on what courses were important for them. Alumni support is an underutilized resource that departments should tap.

There is an increased competition within my university for scarce resources. Michigan is adopting the Value-Centered/Resource-Centered management accounting system, and such systems are increasingly popular nationwide. At its worst, this is a system where senior administrators let the accounting drive the decision making. It leads to individual units wanting to teach their own mathematics courses, their own computing courses, their own English courses, etc. In this environment, we will have a tough time regardless of the quality of our work. We need to work with administrators to ensure that decisions are driven by academic values, although restrained by the realities of limited resources.

I think the single word that best describes the pressures departments and faculty will feel in future years is accountability. Government funding agencies at all levels will demand that our teaching and research fill a societal role. Evaluation of departments by legislators, funding agencies, prospective students with tuition dollars, and consequently university administrators will be done through evaluations of the success of our students and our research. Advances in information technology are making it much easier for administrators to pull out quantitative measures of workload and efficiency and to ask prickly questions: How much tuition revenue is generated by this department? How many students does this faculty member teach? What are the rankings on student course evaluations? The best way to prepare for this environment is for faculty and administration to agree upon clearly defined goals and priorities and procedures for measuring success.

If we do not step up to define these, they are likely to be imposed externally. But if we do so and if we show people the value of mathematics in education, we will be able to count on the support of people inside and outside of our universities.
The National Council of Teachers of Mathematics (NCTM) has begun an effort to revise the mathematics education standards that it published over the last several years. The goal of the project is to combine the three standards documents into one, reaffirm their central message, and revisit the specifics in light of reactions and experiences that have accumulated since the standards were first published.

The first NCTM standards document, *Curriculum and Evaluation Standards for School Mathematics*, appeared in 1989. This document had a large influence not only on many mathematics teachers across the country but also on other academic disciplines, such as history and the sciences, which later sought to produce their own standards. The NCTM published *Professional Standards for Teaching Mathematics* in 1991 and *Assessment Standards for School Mathematics* in 1994. In April 1996 the NCTM launched the four-year project called Standards 2000 to update, refine, and revise the Standards.

The NCTM Standards do not comprise a curriculum or even a curricular framework. Rather, they set forth a general philosophy and approach for effective teaching of mathematics and suggestions for the content of mathematics courses. As with most such documents, the Standards have been both praised and criticized. Many K-12 teachers expressed enthusiasm for the Standards not only as providing a way to improve students' understanding of mathematics but also as an expression of their professional expertise and responsibilities. Many college and university mathematicians also approved of the Standards; indeed, the Standards have much in common with some of the calculus reform projects developed by mathematicians. On the other hand, some mathematicians have criticized certain aspects of the Standards. (For examples of views on both sides, see the "Forum" section of this issue of the *Notices*.) The generality of the Standards has led to a variety of interpretations of what constitutes a Standards-based curriculum. Certain mathematics curricula claiming to be based on the Standards have come in for heavy criticism, leading some to conclude that the Standards themselves are flawed.

The central tenets of the NCTM Standards—emphasis on understanding over rote memorization, getting students to be active learners, a focus on problem solving, etc.—will remain central in the revision. However, the revision will also take into account advances in technology and "lessons learned" from experimental curricula and calculus reform. In addition, the active discussions over the past decade about what students should learn and which skills are important will inform the revision. Thus the revised Standards are expected to include a reexamination of curricula, new and perhaps extended illustrative examples of content and pedagogy, and an updated look at the possibilities of technology. The NCTM believes that combining the existing three Standards documents into one will provide a better and more coherent vision for mathematics education reform. Mindful of the broad impact of the original Standards and of the many groups who feel they have a stake in them, the NCTM has constructed the Standards 2000 process in such a way as to include
a wide range of views in formulating the new version.

Standards 2000 is overseen by the Commission on the Future of the Standards, appointed by NCTM president Gail Burrill (a list of the Commission members accompanies this article). In addition, there is a network of linked groups working on different aspects of the project. The Writing Groups, which will have responsibility for the actual writing of the revised document, are organized around four grade-level clusters. The chair of the Writing Groups is Joan Ferrini-Mundy of the University of New Hampshire, who is currently executive director of the Mathematical Sciences Education Board of the National Research Council. The leaders of the Writing Groups are: Jeane M. Joyner, Department of Public Instruction, North Carolina (grades pre-K-2); Barbara Reys, University of Missouri-Columbia (grades 3-5); Ed Silver, University of Pittsburgh (grades 6-8); and Alan Schoenfeld, University of California, Berkeley (grades 9-12).

The Association Review Groups (ARGs) consist of members of organizations having an interest in improving mathematics education and providing a way for these organizations to contribute to the project. The ARG for the AMS is chaired by Roger Howe of Yale University; the ARG for the MAA is chaired by Kenneth Ross of the University of Oregon. There are also ARGs for the American Statistical Association, the American Mathematical Association of Two-Year Colleges, and other groups.

The present plan calls for the formation of five Topical Advisory Resource Panels of four or five individuals having expertise in key areas: (1) equity issues; (2) technology; (3) research in mathematics learning; (4) special populations (including special education, gifted and talented, and bilingual students); and (5) applications, business, and industry. The panels will identify resources useful to the Writing Groups and also read drafts of the new document. The Electronic Format Group will work closely with the Writing Groups to develop electronic means for presenting drafts of the Standards as well as the final version of the document.

A draft is expected to be released in the fall of 1998, with the final version available in the year 2000. The NCTM welcomes input by individuals for Standards 2000. The NCTM Web site, http://www.nctm.org/, has a list of 7 questions about the Standards which were developed by the Commission in the fall of 1996 as well as other information about the project. Individuals may respond to the questions directly at the Web site. Comments may also be sent to the e-mail address futureweb@nctm.org.

—Allyn Jackson
A very uncharacteristic event for Russia of the mid-90s occurred on September 25, 1996. In an impressive opening ceremony, the city of Moscow granted a 49-year lease of a building, located in the city's historic center, recently repaired, beautifully redecorated, and equipped at its own expense, to a small unpublicized independent educational organization called MCCME. This abbreviation stands for the Moscow Center for Continuous Mathematical Education, a nonprofit organization created only two years ago at the initiative of N. N. Konstantinov and the Independent University of Moscow. The president of its Board of Trustees is Vladimir Arnol'd, and its main activities are related to mathematical contests, advanced math curricula for high schools, and teacher training. The MCCME also serves as the organizational backbone of the Independent University of Moscow (IUM), and the new building is where the Higher Mathematics College of the IUM now holds its classes.

How could this possibly happen today in Russia, with the economy in shambles, with state support for fundamental research practically nonexistent? These questions were on the lips of numerous mathematicians present at the dedication. There was a large turnout—it seems the entire Moscow mathematical beau monde was there: the independent research mathematicians constituting the teaching staff of the IUM; the young, self-denying math educators engaged in the activities of the MCCME; as well as top establishment mathematicians formerly of the Soviet scientific nomenclatura, including the president of the Russian Academy of Science, Yuri Osipov, and the rector of Moscow State University, Victor Sadovnichii.

At the building's main entrance the traditional ribbon cutting was performed by V. I. Arnol'd and Alexandr Ilyich Muzikantski, prefect of the Central District of Moscow, the latter replacing Mayor Yuri Luzhkov in absentia. Then the guests moved on to the conference hall, where the dedication ceremony was held. Again, uncharacteristically, the speeches were brief, informal, and lively, with Arnol'd drawing laughs from the audience in his comments on the cost efficiency of supporting mathematics as com-

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pared to physics: mathematicians produce as much, he said (meaning published papers), as physicists do, but at one fiftieth of the price. V. Sadovnichii gave a speech very supportive of the IUM, dispelling rumors about alleged conflicts between Moscow State University and the IUM. Other speakers included A. I. Muzikantski, Yuli Ilyashenko (the dean of the IUM math college), P. Arnoux (the French cultural attaché), and Yu. Osipov. A congratulatory message from AMS president Cathleen Morawetz was read. The official part was concluded with the award of a dozen Mayor's honor stipends to Math Olympiad winners and meritorious IUM undergraduates. Then the guests dispersed to visit exhibits of MCCME and IUM activities and for coffee and champagne. All this took place in a very festive atmosphere, hope and optimism mingling with nostalgia and disbelief as mathematicians of all ages and views discussed the prospects of the IUM and Moscow mathematics in general.

Of course this "minor miracle", as some of the speakers at the dedication ceremony described it, was not due to pure chance. It was master-minded by N. Konstantinov, Yu. Ilyashenko, A. Shen, and I. Yashchenko (the executive director of MCCME) and would not have occurred without the benevolent support of A. I. Muzikantski, an enlightened politician, formerly a math major at Moscow University.

So now the IUM Higher Mathematics College continues to function in its splendid new locale. On the bright side, efforts of numerous enthusiasts of informal math teaching and contests grouped around the MCCME continue supplying the IUM with well-prepared and motivated freshmen students. The present crop of graduate students is absolutely first rate. But many of the problems remain. The main ones are the absence of regular sources of income and the IUM's inability to ensure draft exemption for the students. Concerning the former, the IUM is not state supported and charges no tuition (in fact, it pays all students some scholarship money, tiny amounts by Western standards, but still...), and so balancing its (albeit very small) budget remains a difficult exercise. As to the draft, recent changes in legislation have ruined all hopes of organizing the Russian equivalent of the ROTC program in the framework of another university, which means that male IUM students must matriculate at another (state-sponsored) institution to avoid the draft (and thus carry a double workload). This will change by the year 2000, provided Yeltsin makes good on his promise to do away with the draft altogether.

And provided the IUM will last that much longer. Will it? One of the most assiduous IUM lecturers answered this question by saying, "I'm an optimist. I would say it's a toss-up."
The Pacific Institute for the Mathematical Sciences (Plms), founded by five universities in western Canada, began its operations late last year. Plms is committed to enhancing the mathematical sciences through support for basic research and its applications and to forging meaningful connections between mathematical scientists, the larger scientific community, and the general public. As a result, we expect to see a heightened awareness of the importance of the mathematical sciences in all areas of Canadian society, especially among users of the mathematical sciences in business and industry, educators, governmental agencies, and lay people.

The founding institutions, from the Canadian provinces of Alberta and British Columbia, are the Universities of Alberta, British Columbia, Calgary, Victoria, and Simon Fraser University. Local sources within the five universities are providing initial funding while additional funds are pending from the National Sciences and Engineering Research Council of Canada and sources within the two provincial governments. While a search for director proceeds, Nassif Ghoussoub is serving as interim director, working with an International Scientific Review Panel composed of David Boyd, Richard Ewing, Ronald Graham, Wolfgang Hoefer, John Kalbfleisch, Richard Karp, Alistair Lachlan, Bernard Matkowsky, Robert Moody, Nicholas Pippenger, Gordon Slade, and Gang Tian.

The Westernmost Node of the National Network for Collaboration in the Mathematical Sciences

The Pacific Institute is an integral part of the National Network for Collaboration in the Mathematical Sciences (NNCMS), the result of an unprecedented effort to bring together all components of the mathematical sciences community in Canada. Reflecting a new vision for the Canadian mathematical sciences, the National Network aims to restructure the way in which mathematical scientists relate to both the scientific community and society at large. Simply put, the National Network will provide an overarching national organization to coordinate and prioritize the efforts of mathematical scientists and to encourage the use of the mathematical sciences in other sectors. This means stimulating research in the mathematical sciences through the three Canadian research centers (The Fields Institute, le Centre de Recherches Mathematiques, and the Pacific Institute), investing in the mathematical sciences infrastructure and the training of personnel, and using new communication technologies to bring together scientific expertise in the face of geographic distance.

Within the National Network, several features give the Pacific Institute a role complementary to the two older Canadian mathematics insti-
Institutes. First, Plms is organized as a “distributed” institute. This means that there will be no permanent physical home for Plms; instead, all members of the founding universities will equally contribute to and share in the resources of the Institute. To some degree, this will be achieved through the use of new communications technologies. For instance, Plms is running a Distinguished Lectureship on High Performance Computing, sponsored jointly with the Western University Research Consortium (WurcNet), and a colloquium series, both of which are distributed to the five founding universities by videoconferencing technology. Examples of recent talks include Don Ludwig speaking on “Statistics and Public Policy” and Jack Dongarra on “Recent Work in Parallel Algorithms for Linear Algebra”. Plms is also working in partnership with the Tele-Learning Research Network to adapt the “Virtual University” technology to enable more effective collaboration across long distances.

Another unique feature is that efforts will concentrate on short, intensive programs rather than the more traditional thematic programs devoted to the study of a single topic, thus providing Plms the flexibility to react to rapidly developing areas and to represent the mathematical sciences in all their diversity.

A Mission of Stimulating Research
The Pacific Institute will provide support for a broad range of research in the mathematical sciences. Indeed, the academic members of Plms come from many departments, including mathematics, statistics, computer science, physics, electrical engineering, and geophysics. The research activities of the Institute are loosely grouped into six folders—Innovations in the Mathematical Sciences, the Physical and Life Sciences, Computing, the Social Sciences, the Resource Sector, and Technology—which reflect the diversity of mathematical investigation encouraged by Plms. Also illustrating this commitment are the programs of the Institute’s opening meetings held in Calgary and Victoria: Kathy Heinrich, the president of the Canadian Mathematical Society, on “Plms and Mathematics Communication”, Richard Karp on “Combinatorial Optimization as a Tool for Molecular Biology”, Donald Saari on “The Chaotic Complexity of Economics and the Social Sciences”, David Brillinger on “Studying the Tracks of Elephant Seals”, Kamal K. Botros on “The Role of Mathematics in Gas Transmission and Chemical Manufacturing Industries”, and William R. Pulleyblank on “Mathematics, Computing and Industry”.

Close Ties to Pacific Rim Countries
Taking advantage of its geographic location, Plms will bring together mathematical scientists throughout the Pacific Rim. To mention a few examples, Plms is jointly sponsoring and planning the Pacific Rim Conference on Mathematics to be held in Hong Kong in December 1997. Plms will also host the Pacific Rim Geometric Analysis Conference, this being the first time the conference will be held in North America. The 4x3 Canada-China initiative, in which Plms plays a major role, provides a structure for closer working relationships between Canadian academics at the universities of British Columbia, Montreal, Toronto, and McGill University and their Chinese counterparts at Beijing University, Nankai University, and Tsinghua University. Within North America, Plms is now a sponsor of the Pacific Northwest Workshop on Mathematical Biology, bringing together American and Canadian mathematical biologists.

Training Highly Qualified Mathematical Scientists
The Pacific Institute aims to nurture young mathematical talent through a variety of programs. Postdoctoral Fellowships for outstanding young researchers have been created, some with matching funds from partners in business, industry, and government. Current proposals call for fellowships in probability theory, biodiversity, forestry, fish-stock management, mathematical chemistry, and imaging. To attract and train the best students, Plms is establishing Graduate Student Fellowships, Graduate Summer Schools, and a Graduate Student Internship Program designed to place students in a research-oriented industrial setting for a portion of their studies.

Closer Relationships with Business and Industrial Partners
Plms has designed and is implementing a number of industrial programs to facilitate university-industrial interaction. One of these is a modified version of the “Oxford Study Group”, providing the means for an academic to visit industry and organize subsequent workshops for both industrial and academic participants. In the same vein, Plms will have an industrial coordinator to develop an Industrial Resource Base to help match university researchers with industrial colleagues and create several Industrial Certification Programs.

An important part of this strategy depends on developing industrial partners. Expressions of support have been received from and partnerships are developing with MacDonald-Dettwiler Associates, Hughes Aircraft, Powertech Corporation, IBM-Canada, and MacMillan Bloedel. These efforts are being coordinated with various
Free Probability Theory

Dan-Virgil Voiculescu,
University of California, Berkeley

Free probability theory is a highly noncommutative probability theory, with independence based on free products instead of tensor products. The theory models random matrices in the large $N$ limit and operator algebra free products. It has led to a surge of new results on the von Neumann algebras of free groups.

This is a volume of papers from a workshop on Random Matrices and Operator Algebra Free Products, held at The Fields Institute for Research in the Mathematical Sciences in March 1995. Over the last few years, there has been much progress on the operator algebra and noncommutative probability sides of the subject. New links with the physics of masterfields and the combinatorics of noncrossing partitions have emerged. Moreover there is a growing free entropy theory.

The idea of this workshop was to bring together people working in all these directions and from an even broader free products area where future developments might lead.

Fields Institute Communications, Volume 12; 1997; 312 pages; Hardcover; ISBN 0-8218-0675-0; List $79; Individual member $61; order code FIC/12NA

Hommage à
P. A. Meyer et J. Neveu

This tribute to Paul André Meyer and Jacques Neveu displays their wide influence on modern probability theory by gathering nineteen original research papers, drawn from a large range of topics: potential theory, classical stochastic processes and their laws, non-commutative probability, estimates of heat kernels, entropy, ergodic theory, phase transition, stochastic models in financial markets, and excursion theory.

Titles in this series are published by the Société Mathématique de France and distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Astérisque, Number 236; 1996; 308 pages; Softcover; List $68; Individual member $61; order code AST/236NA

governmental liaison agencies such as the Alberta Research Council, the British Columbia Advanced Systems Institute, and the British Columbia Science Council.

Mathematics Education and Communication

Plms is developing several initiatives to coordinate meaningful connections with educators and deepen public awareness of the mathematical sciences. As an example, Plms is establishing a summer institute to bring together elementary school teachers with university educators to increase communication between the two groups. Other projects, such as the successful Math in the Malls and various high school outreach programs, will take current mathematical science to the general public. In cooperation with E-GEMS (Electronic Games for Education in Math and Science), Plms is developing an innovative partnership with Shaw Cable to provide the means for high school students to create commercial video productions featuring mathematical concepts to be shown on local cable television. This project is designed to be particularly appealing to young women and involve them in the expression of mathematical ideas. In many of these programs, Plms will be working in cooperation with the provincial ministries of education.

A Plms Integrated Network

Finally, the Plms Integrated Network is developing as a regional node of the National Computer Network for Mathematical Research, a significant investment in the physical infrastructure of the mathematical sciences. By providing fast, high-bandwidth connections between the five founding universities, the Integrated Network will facilitate more effective communication between physically separated researchers. Furthermore, with its access to high-performance computing through its partnership with WurcNet, Plms is helping to advance the mathematical content of high-performance computing.

For more information about the Pacific Institute, its programs or its aims, please consult the Plms Web page at http://www.pims.math.ca/ or write to pims@pims.math.ca.
The Mathematical Association of America and the Association for Women in Mathematics awarded a number of prizes at the Joint Mathematics Meetings in San Diego in January 1997.

The MAA Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics is MAA's most prestigious award. First given in 1990, this award is the successor to the MAA's Award for Distinguished Service to Mathematics, established in 1962, and is made possible by the late Dr. Hu and his wife, Yueh-Gin Gung. Though a geologist and not a mathematician, Dr. Hu had strong feelings about the importance of mathematics to all human endeavors. The 1997 recipient of this award is Deborah Tepper Haimo, who served as MAA president during 1991-1992.

The MAA Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics honor teachers who have been widely recognized as extraordinarily successful and whose teaching effectiveness has been shown to have had influence beyond their own institutions. Haimo Awards were presented to Carl C. Cowen Jr., of Purdue University, Carl Pomerance of the University of Georgia, and T. Christine Stevens of St. Louis University.

The MAA Chauvenet Prize for expository writing is given for an outstanding expository article on a mathematical topic by an MAA member. The recipient for 1997 is Thomas Hawkins of Boston University for his article "The birth of Lie's theory of groups", Mathematical Intelligencer 16 (1994), 6-17.

Certificates of Meritorious Service are presented for service to the MAA at the national level or for service to an MAA section. The awardees for 1997 are: Florida Section: Ernest R. Ross Jr., of St. Petersburg Junior College, Clearwater campus; Michigan Section: Don R. Lick, Eastern Michigan University; Northeastern Section: Frank P. Battles and Laura L. Kelleher, Massachusetts Maritime Academy; Rocky Mountain Section: William C. Ramaley, Fort Lewis College; Texas Section: Glen E. Mattingly, Sam Houston State University.

The Louise Hay Award for Contributions to Mathematics Education was established by the AWM in 1990. The purpose of the award is to recognize outstanding achievements in any area of mathematics education, to be interpreted in the broadest sense. The award honors the memory of Louise Hay, who was the head of the Department of Mathematics, Statistics, and Computer Science at the University of Illinois at Chicago. The 1997 recipient of the Hay Award is Marilyn Burns of Marilyn Burns Educational Associates. Burns has written books, developed curricula, and created workshops and videos aimed at improving mathematics instruction in grade school.

—Allyn Jackson
## Backlog of Mathematics Research Journals

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<tr>
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**Backlog.** Information on the backlog of papers for research journals, primarily those published in North America, is reported to the Providence office by those editorial boards which elect to participate. The figures are an estimate of the number of printed pages which have been accepted, but are in excess of the number required to maintain copy editing and printing schedules.

**Observed Waiting Time.** The quartiles give a measure of normal dispersion. They do not include extremes which may be misleading. Waiting times are measured in months from receipt of manuscript in final form to publication of the issue. When a paper is revised, the waiting time between an editor's receipt of the final revision and its publication may be much shorter than is the case otherwise, so these figures are low to that extent.

The observations are made from the latest issue published, before the deadline for this issue of Notices; from journals that have actually been received by a subscriber in the Providence, Rhode Island area; in some cases this may be two months later than publication abroad. If the latest issue was a festschrift or conference proceedings, or for some other reason was obviously not typical, we use the next previous issue if available. "NA" stands for "not available", usually meaning that the libraries we tried do not subscribe.
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NR means no response received.
NA means not available or not applicable.
* The wide variation shown for this journal is not a typographical error.
** From date accepted.
*** Date of receipt of manuscript not given in this journal.
† From date of meeting at which the paper was communicated.
The 1989 Curriculum and Evaluation Standards of the National Council of Teachers of Mathematics have become the centerpiece of most efforts to reform school mathematics. Indeed they have come to be seen by other disciplines as a model for "standards"-based national curricula. Happily, an increasing number of research mathematicians have become interested in the problems of school mathematics. Some of these people have been strong supporters of the NCTM Standards, others vocal critics. The following two articles present both sides. While important for what they say, these articles are published foremost to stimulate further discussion about school mathematics among AMS members. NCTM is undertaking a review of the Standards and has encouraged and actively engaged input from the research mathematics community. (Please see "NCTM Updating Standards Documents" on page 444 of this issue of the Notices.)

The NCTM Standards: Helping Shape a Mathematically Literate Society

Jack Price

We educators must continually ask ourselves, "Are the skills we provide our students those that they will be using in their jobs and in their adult lives?" Hopefully the answer is a resounding yes; if not, then we are not living up to our obligation as educators.

The harsh reality we faced in mathematics education in the 1970s was that we were not doing enough. School mathematics programs did not adequately challenge the mathematically talented, and they did not adequately entice the mathematically disinterested. As educators we did not show students the real-life applications of mathematics and therefore did not answer the question on many students' minds, "When will I ever use this stuff?"

The need to change was both evident and well documented. Publications like Agenda for Action (1980) and A Nation at Risk (1983) charged that in order for students to achieve mathematics had to be placed in a familiar context and that change had to be a well-thought-out process sustained over time.

The National Council of Teachers of Mathematics recognized this need and put in motion plans to develop a focused, coherent approach to mathematics education in schools that sets high standards of achievement for every student. NCTM's Curriculum and Evaluation Standards for School Mathematics (1989), Professional Standards for Teaching Mathematics (1991), and Assessment Standards for School Mathematics (1995) present guidelines that can be used to shape such a mathematics curriculum in every school, in every state.

The effort to develop the NCTM Standards was a broad-based, concerted effort articulated over time. Many of those with an interest in mathematics education—teachers, researchers, mathematicians, parent groups, and business and political leaders—shared in the development process.

The underlying philosophy driving the NCTM Standards is the belief that all students can—and must—learn mathematics. Two complementary philosophies guided the development of the NCTM Standards: an educational philosophy on the need to change, and a conceptual philosophy to articulate the individual standards.

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The Need to Change

Changes in the world necessitate changes in the way we prepare our students to be successful. These changes have a profound impact on the way we evaluate the mathematics education we provide our students and determine the education we believe our students need to succeed in the twenty-first century.

Changes in the need for mathematics, in mathematics and its uses, in the role of technology both in today’s society and in the future, in society, in what we know about how students learn, and in international competitiveness necessitate a change in mathematics education.

Changes in the Need for Mathematics

Each recent generation has needed more mathematics than the previous generation, with no exception for today’s students. Problem solving and reasoning skills rank high on employers’ lists of skills, as do competence in higher levels of mathematics such as algebra, probability, and statistics. Similarly, we cannot open a newspaper or make an informed decision about a candidate for election without seeing mathematics in many forms. Citizens need to be more mathematically literate to participate fully in society.

Changes in Mathematics and Its Uses

In the past quarter century we have seen the development of new branches of mathematics and an unprecedented increase in the types and variety of problems requiring mathematical applications. Some of the credit must be given to the development of computers and the subsequent development of computer applications. For example, with technology, two high school students in Connecticut have discovered a new way to carry out a Fibonacci sequence. And we have also seen such complex theorems as Fermat’s Last Theorem being proved.

Changes in the Role of Technology

What mathematics is important, as well as how mathematics is done, has been affected by technology. Without mathematics there would be no computers; yet computers extend the reach and power of mathematics. It is now possible to execute almost all of the algorithmic techniques taught from kindergarten through the first two years of college on hand-held calculators. The impact of technology—calculators and computers—is so profound that all aspects of school mathematics had to be revisited.

Changes in Society

When today’s children enter the workforce, they will find that most jobs require greater mathematical skills than in the past. At the same time, white males—once the base of U.S. mathematically trained workers—will represent a significantly smaller portion of new workers. These changes forced us to rethink our approach to mathematics education and how diverse audiences can be successful.

Changes in What We Know about How Students Learn

We have increasing evidence that most students learn best when ideas are introduced in context—a known, real-world situation, problem, or structure into which the mathematics falls. Against this background, students can begin to think abstractly and see the value of proof. A mathematically literate person knows much more than a series of techniques acquired through repetitive drill.

Changes in International Competitiveness

International studies have shown that U.S. students are not high achievers in mathematics. Although international data are useful, they often lead to international rankings, with inadequate consideration given to the varying social contexts and educational practices in which schooling takes place. Still, the information we are able to garner from international studies—of both education and business practices—provides us with much needed information to prepare our students to compete in the global marketplace.

Although these six components helped form the foundation supporting the need to change mathematics education, they did not provide answers to the question, What do we change?

What Do We Change

The process of changing school mathematics is far reaching and time consuming, encompassing all aspects of mathematics education—content, teaching, and assessment. Although the NCTM Standards were released in three separate documents, the message forms a cohesive whole. To improve learning, teaching must improve; and to improve content, assessment must improve.

The changes in educational practices recommended in the NCTM Standards include:

- In curriculum, a shift toward a more extensive study of mathematical ideas and concepts and their uses in today’s world.
- In learning, a shift toward more active student involvement with mathematics, including mathematical problems that relate to their world, and the use of a variety of mathematical tools for solving these problems.
- In teaching, a shift toward creating classrooms that are stimulating learning environments in which all students have the opportunity to reach their full mathematical potential.
In assessment practices, a shift toward student evaluations that are continuous and based on many sources of evidence.

Each set of Standards is built around five curricular goals for students: become a mathematical problem solver, learn to communicate mathematically, learn to reason mathematically, learn to value mathematics, and become confident in one’s own ability.

One look at any of the NCTM Standards documents and you will see the interrelation between the mathematics content, teaching, and assessment, as well as opportunities to reach the five curricular goals. For example, the NCTM Assessment Standards for School Mathematics contends that assessments are learning opportunities as well as opportunities for students to demonstrate what they know and can do. Specifically, the document contends that assessment that enhances mathematics learning becomes a routine part of ongoing classroom activity rather than an interruption. It does not simply mark the end of a learning cycle; it is an integral part of instruction that encourages and supports further learning. To a visitor entering a classroom, instruction and assessment might be indistinguishable.

The Assessment Standards also acknowledge that teachers must have high expectations for themselves as well as for all students, provide for different learning styles, and encourage the active involvement of all students in learning mathematics. Assessment must give each student, including those with special needs or talents, the opportunity to demonstrate his or her understanding in a variety of ways. Results of the assessment must be used to ensure that each student is given not only the opportunity but also the necessary support to reach the highest possible levels of achievement.

The NCTM Standards are guidelines to help shape the mathematics curriculum—they are not a national mandate. Recognizing the need for autonomy among the states, the Standards enable each state, textbook company, and test publisher to interpret the recommendations and develop appropriate curricula. They are meant to stimulate policymakers, parents, teachers, administrators, and local communities and school boards to improve mathematics programs at all levels.

The question is no longer what needs to change, nor is it how do we change. The recommendations noted in the NCTM Standards reflect the changes that must take place in mathematics education if we are to ensure that our students know—and understand—the mathematics they do.

It is time to move forward, time to raise the standards of mathematics education.

Next Steps to Ensuring Mathematics Excellence for All

We have two choices: either submit to the problem or take responsibility for fixing it. As a mathematics educator, I am committed to improving mathematics education. We have existence proofs that point the way.

Indications that positive change is taking place in mathematics classrooms nationwide are now available. Where NCTM recommendations are being systematically implemented, the achievement data are encouraging.

The Third International Mathematics and Science Study (TIMSS) is a wonderful opportunity for all of us to learn, to refine our approach to improving the mathematics education provided to all students. What is unique about the TIMSS data is the abundance of information that will be available. For example, videotapes of classroom instruction in Japan, Germany, and the United States will be released in the near future, offering us opportunities to understand better the teaching and learning that is taking place in the classroom. Preliminary reports note that "it seems clear that Japanese teachers, on average, come closer to implementing the spirit of current ideas advanced by American reformers than do American teachers."

The findings illustrate what mathematics teachers have been saying for years—that an intellectual, coherent, focused approach to mathematics education, addressing content, teaching practices, and assessment is needed to ensure our students' success.

We must provide all of our students with the skills needed to be competitive on a global scale. Yet we can neither mimic the education system of one country nor provide a national curriculum that fails to capitalize on the diversity in our society and on the states' responsibility for education. Improving mathematics education is a multiyear journey that demands continual rethinking. Just as our country is predicated on constant improvement, so must our education system be.

As we move forward in our efforts to improve the mathematics we provide to all students, we must view the NCTM Standards as the means to raise our student achievement. And we must all work together toward the common goal of mathematics excellence for all students.

Resources


Commentary on Assessment Standards for School Mathematics

George E. Andrews

Everyone recognizes that mathematics education is in some difficulty in the USA. In one way or another, with more or less evidence, many of us feel that standards have fallen. Obviously assessment is not working well currently. Something must be done to ensure that our students learn more before they are assessed as passing.

There are numerous assessment problems that could be addressed, so let me base my commentary on three of the most obvious.

Grade Inflation

In a recent study carried out at the University of California at San Diego, R. Betts and S. Boedeker made a careful study of the relationship between learning and grade inflation. Their central conclusion is: "Students who attend schools with more lax grading standards learn less during the school year than do students at schools with more stringent grading standards, even after controlling for a wide variety of measures of family background and school resources." [1]

Yet according to the College Board, the past decade has witnessed substantial increases in the number of As given in high school, with corresponding decreases in lower letter grades. It might (and undoubtedly will) be argued that grade inflation is a problem of evaluation, not of assessment, surely a distinction without a difference. Grades, whatever their merits, are perceived by students and public alike as substantial rewards or punishment for academic work. Given this perception, they will have enormous impact on any assessment process, and this impact merits serious consideration in any discussion of assessment.

Homework

The Economist of May 6, 1995, ran an article summarizing various studies on homework:

Timothy Keith of the University of Iowa and several colleagues find that homework's power to influence success ranks second only to ability, and ahead of race and family background. "Graded homework," Mr. Walberg and his colleagues (at the University of Illinois-Chicago) found, "produces an effect...three times larger than social class."

One of the most careful comparisons, by Chuansheng Chen and Harold Stevenson of the University of Michigan, found that eleven-year-olds in Taiwan do twice as much homework as do their counterparts in Japan, who in turn do twice as much as American fifth-graders. [2]

Of course, those anxious to contradict the obvious will say that the recent TIMSS (Third International Mathematics and Science Study) shows that the Chen-Stevenson report is wrong. This faulty view is based on the TIMSS assertion that lack of homework is not a problem:

It found that American math and science teachers assign much more than teachers in Germany or Japan. Eighty-six percent of American teachers surveyed in the study said they assigned homework three to five times a week. In Japan, 21 percent of teachers said they did, yet their students rank much higher in an overall assessment of math and science skills. Most Japanese eighth-graders do, however, attend after-school classes in math for a few hours each week to prepare for high-school entrance exams, the study notes. [3]

Obviously the number of assignments is hardly a measure of how much work is done outside of class. Are the assignments all collected? Are they corrected? How much do they count for the class grade? Is anyone seriously suggesting

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that our students work nearly enough on studies outside of class?

Clearly the homework question is a difficult one. How can homework best be utilized in the assessment process? Homework is done outside the supervision of the teacher. How much should it count towards a grade, given this lack of supervision? How can a teacher use assessment incentives to encourage more and better homework?

The Role of Calculators in Assessment

I have been unable to unearth controlled studies on the effects of technology in assessment. To illustrate some of the problems, I shall rely on four vignettes.

The NCTM Assessment Standards uses many vignettes to illustrate its points. There is, however, an important difference between my vignettes and those used by NCTM. My stories actually happened. The NCTM notes that "Except for those identified as adapted from research, the vignettes are fictional illustrations and, although drawn from experience, are not factual accounts." My stories are too ridiculous to make credible fiction.

Vignette 1. The scene is an oral, one-on-one exam being given to a nonmath major in a freshman course at a Big Ten university.

Professor: Please give me an example of a sequence decreasing geometrically.

Student: 1/3, 1/6, 1/9, 1/12...

Professor: Actually the rate of decrease must be much faster. Suppose that we start with 1/3. Then, for example, to form each new term we might divide by 3. What is 1/3 divided by 3?

Student: I don't know! I don't have my calculator.

Professor: "Really, you don't need a calculator to figure this out. Dividing 1/3 by 3 is the same as multiplying 1/3 times 1/3. What is 1/3 times 1/3?"

Student (after a long pause): Two sixths?

Vignette 2. Five students are preparing a psychology lab report in a major East Coast state university.

Student A: What is the average of .12 and .12?
Student A pulls out his sophisticated graphics calculator and enters .12 + .12/2. The calculator responds .18.

Student A: The average of .12 and .12 is .18. Three other students write this down.

Student B: Wait a minute! The average of .12 and .12 is obviously .12.

Student A: That's what I thought, but my calculator says it's .18.

Student B asks to use the calculator. He enters (.12 + .12)/2. The calculator responds .12.

Seeing this, the other four are immediately convinced that the average of .12 and .12 is .12.

Vignette 3. The scene is a professor's office in a major East Coast state university. The professor is talking with a student from an elementary statistics class.

Student: I can't get the right answer to Problem 10. The book says it is 0.5.

Professor: What answer did you get?

Student: 1/2.

Professor: (Unprintable).

Student pulls calculator from his bag and enters 1/2. The calculator responds .5.

Student: Wow, I got it after all.

Vignette 4. The scene is a large, elementary physics-for-engineers lecture in the flagship state university in a large state.

Instructor: How many of you know what 968 divided by 10 is without using a calculator?

Fewer than 10 percent knew the answer.

In subsequent discussion with one of these students, the instructor found that the student could calculate 1000/2 by hand but not 1000/10.

It would be a terrible misreading of these stories to infer that today's students are just stupid. Rather, many are ignorant due to a misunderstanding which involves heavy use of calculators. So with this introduction I would hope that even the most skeptical reader will at least concede that the issues raised above merit some consideration as assessment issues.

And how does NCTM Assessment Standards for School Mathematics address these problems?

Concerning grade inflation they have NOTHING to say. I would argue that this is one of the most important problems we face today. Yet NOTHING is said by the NCTM. Well, not exactly. The Standards wishes to shift assessment practice "TOWARD assessing students' full mathematical power (and) AWAY FROM assessing only students' knowledge of specific facts and isolated skills." [4] What does this imply? The impression I get from the Standards is that students should know a lot and that the main fault of current assessment is its failure to sample the vast array of student skills. Is this your view of what has happened to the students in your classes? It is obvious that university students who have no grasp of basic arithmetic have been given a high school diploma under false pretenses.

Concerning homework, the NCTM Assessment Standards has ALMOST NOTHING to say. The word homework never appears, even though guidance on the role of homework in the assessment process would be welcomed by countless math teachers, including me. They do once refer to "work at home".
A threat to the validity of inferences comes from potential bias in the evidence. New forms of assessment, such as portfolios or extended projects, may create new sources of bias. Extended projects may allow students to complete some of the work at home [God forbid! (GEA)], with the result that differences in home resources (including assistance from the parents [No! No! Not the parents! Anything but the parents! (GEA)]) may bias the results. [5]

This quote highlights one of the problems with the NCTM Assessment Standards. This is obviously a document written by people who truly desire a more decent and equitable society. Time after time we are warned that bias may creep into assessment.

“Another source of potential bias lies in assessment activities that rely on students’ ability to use the English language to communicate mathematical knowledge.” [6]

“How is the role of students’ background and experiences recognized in judging their responses to the assessment?” [7]

“Assessments have too often ignored differences in students’ experience, physical condition, gender, and ethnic, cultural, and social backgrounds in an effort to be fair.” [8]

Now, there is nothing wrong with each of these three statements per se, but admitting their validity does not ensure greater equity in mathematics achievement, a goal clearly desired by all. Indeed, excessive attention to these statements at the expense of proven indices for achieving the desired equity may have negative implications on both equity and high standards. Note, for example, this further excerpt from The Economist article:

Indeed, homework turns out to be a powerful educational leveler—and it levels upwards. Studying British grammar school boys, Michael Holmes and Paul Croll, both British researchers, found that working-class children benefited more from homework than did their wealthier schoolmates. Working-class boys who spent an hour or more at night on homework achieved just as much as middle-class boys who did the same—whereas among low-homework boys, class differences were pronounced. [2]

Thus an emphasis on homework and standards increased equity as an indirect result.

In all the NCTM vignettes with group learning, peanut-eating elephants, postal-rate histories, areas of salt marshes, and the appropriate use of dynamic geometry software, one nagging question continues to plague the reader: What is the path of least resistance through all this stuff?

Will all students participating in groups with appropriate software work like little beavers to achieve “mathematical power”? Or will a number realize that if they sort of get the idea, then the group can carry them to a passing grade, especially if they have Energizer batteries in their calculators?

If students know they can pass with little effort, if they know they can cry “Bias!” when homework is assigned, then some, perhaps many, will work the system to their advantage.

Of course something bad like this will never happen provided all teachers are the highly motivated, single-minded dynamos that populate the admitted fiction of the NCTM Assessment Standards. Unfortunately, out in the real world a variety of educationists “leaders” leave many math teachers uncertain of what is really important in math education. Out of this confusion emerge many students who are poorly educated in arithmetic, algebra, and trigonometry.

It is impossible in this commentary to cover the multitude of sins in this book; fortunately, there are numerous teachers and school boards who will just ignore it.

Recently I had a long conversation with an eleven-year-old boy who goes to our local elementary school. I was then in the process of writing this commentary, and when the subject of arithmetic came up, I decided to ask a few questions. “What’s 8 × 7?” “56,” he responded immediately. “What’s 11 × 12?” “132,” he responded almost immediately. “That’s easy because the middle digit is the sum of the outer two when you multiply by 11.” “OK, what’s 8 × 12?” There was a pause. “96,” he said eventually. “I didn’t know it, but I did know 3 × 12 and 5 × 12, so I added 36 to 60.” He has obviously learned some “specific facts” from his teacher. Will all these specific facts prevent him from achieving mathematical power?

Mathematics is almost tactile: it is like playing the piano. You can’t do it holistically. If you can’t play a scale, it is highly unlikely that you can play “The Moonlight Sonata” (highly unlikely, not impossible). Of course, you can always put a CD of Rubinstein into a CD player, and if you are a big enough fool, you can believe that you are playing the piano with some technological assistance. If anyone really believes that a typical student can become mathematically powerful while remaining arithmetically, algebraically, and trigonometrically ignorant, then he has an obligation to provide some compelling evidence before this hypothesis becomes an un-
intended consequence of efforts to implement national recommendations.

Reviewing the NCTM Assessment Standards left me with the depressing feeling that they can only add to the deplorable mathematical ignorance that we struggle against daily. Does anyone have any evidence that allows a different conclusion?

References

Response of George Andrews

OK, class! Our assessment activity for the day is the following quiz on Jack Price's essay, The NCTM Standards: Helping Shape a Mathematically Literate Society.

1. How many times does the word "change" (singular or plural) occur in Price's piece?
   a. 5
   b. 23
   c. 432
   d. 11317.6
   Answer: b

2. Which century is it that has so badly frightened us into all this change?
   a. the 12th
   b. the 16th
   c. the 19th
   d. the 21st
   Answer: d

3. Price clearly identifies the culprits in our current educational turmoil with the following sentence: "Preliminary reports note that it seems clear that Japanese teachers, on average, come closer to implementing the spirit of current ideas advanced by American reformers than do American _________." The word that belongs in the blank is:
   a. educationists
   b. celebrities
   c. capitalists
   d. teachers
   Answer: d

4. In his next sentence, Price clearly identifies the heroes in our current educational turmoil with the following assertion: "The findings illustrate what mathematics ________ have been saying for years—that an intellectual, coherent, focused approach to mathematics education, addressing content, teaching practices, and assessment is needed to ensure our students' success." The word that belongs in the blank is:
   a. educationists
   b. celebrities
   c. capitalists
   d. teachers
   Answer: d

5. Price tells us that "improving mathematics education" is:
   a. an impossible job
   b. a lucrative business
   c. an ongoing process
   d. a multiyear journey
   Answer: d

6. What is demanded by the multiyear journey mentioned in Question 5?
   a. a car
   b. funding
   c. a calendar & map
   d. continual rethinking
   Answer: d

7. What does a mathematically literate person know?
   a. 17th century algebra
   b. 15th century arithmetic
   c. geometry from ancient Greece
   d. much more than a series of techniques acquired through repetitive drill
   Answer: d

8. What do international data often lead to?
   a. a clear understanding of what the NCTM has already done for us
   b. funding
   c. the smoking gun
   d. international rankings
   Answer: d

9. Do international rankings often give inadequate consideration to the varying social contexts and educational practices in which schooling takes place?
   a. yes
   Answer: a

10. According to Price, almost all algorithmic techniques taught from kindergarten through the first two years of college have been ________ by hand-held calculators. The word or phrase that belongs in the blank is:
Response of Jack Price

Mathematics education is currently suffering under a burden of what John Gardner called "unloving critics" and "uncritical lovers". There is a huge chasm between these two groups—nostalgic and reactionary on the one hand and well meaning but overreactive on the other. In the meantime, most of us are trying our best to keep a balance.

We all have the same goal: to heighten the mathematics achievement of U.S. students. But it is time to do more than just point out the problem; we must take responsibility for fixing it.

Although I agree with Dr. Andrews on both the counterproductive impact of grade inflation and the importance of homework, I do not agree with his inference that current reform efforts dilute grades and homework. Clearly, if we are to improve mathematics education, then we must focus on what is most important: high student achievement in high-quality mathematics.

The Standards emphasize high expectations and high standards for teacher and student alike without specific recommendations for homework, grades, or any one part of the educational enterprise. Would it help if these issues were dealt with overtly? Undoubtedly. However, their omission from the Assessment Standards hardly invalidates the document. The Standards provide a philosophy to guide decision making.

Although I share Dr. Andrews' discouragement at the actions noted in his vignettes, I take exception to his remarks that "many [students] are ignorant due to a miseducation which involves heavy use of calculators." We all hope that there will be few such stories in the future, but I cannot help but notice that each vignette involves a college-aged student whose education predates widespread implementation of a Standards-based mathematics education. His choice of vignettes validates the need to change an education process that has failed our students.

We have seen a shift from longhand to typewriters to word processors. Just as the word processor has not replaced our ability to compose, calculators and computers have not replaced our ability to think—quite the opposite. The appropriate use of technology enables us to reach higher levels of achievement. Miseducation is the culprit, not technology. And it is miseducation that the Standards address.

So, in response to Dr. Andrews's "nagging question", I would like to point out that since the dawn of time, there have been those who choose the path of least resistance. As educators we are compelled to do what we can to encourage every student to reach his or her full potential. Will we succeed with each student? Probably not. Have we, in the past, succeeded with every student? Clearly not. We have ample evidence that what we have done in the past does not work. Today we have a growing number of skilled professionals who can effect change, and we have the technology and curriculum materials needed to support their efforts. It is time to stop complaining that the cup is half empty and time to start working together to make the cup full.

Count the number you got right, and get out your calculators. Multiply the number you got right by 2. Add 200. Divide the result by 2. Finally subtract the number you got right. The result is your grade for the quiz. Happy? Me too!
Free Probability Theory
Dan-Virgil Voiculescu, University of California, Berkeley Editor
Free probability theory is a highly noncommutative probability theory, with independence based on free products instead of tensor products. The theory models random matrices in the large N limit and operator algebra free products. It has led to a surge of new results on the von Neumann algebras of free groups.

This is a volume of papers from a workshop on Random Matrices and Operator Algebra Free Products, held at The Fields Institute for Research in the Mathematical Sciences in March 1995. Over the last few years, there has been much progress on the operator algebra and noncommutative probability sides of the subject. New links with the physics of masterfields and the combinatorics of noncrossing partitions have emerged. Moreover there is a growing free entropy theory. The idea of this workshop was to bring together people working in all these directions and from an even broader free products area where future developments might lead.

Fields Institute Communications, Volume 12; 1997; 312 pages; Hardcover; ISBN 0-8218-0675-0; List $79; Individual member $47; order code FIC/12R74

Operator Algebras and Their Applications
Peter A. Fillmore, Dalhousie University, Halifax, NS, Canada, and James A. Mingo, Queen's University, Kingston, ON, Canada, Editors
The study of operator algebras, which grew out of von Neumann's work in the 1920s and the 1930s on modelling quantum mechanics, has undergone years of tremendous growth and vitality. This growth has resulted in significant applications in other areas—both within and outside mathematics. The field was a natural candidate for a 1994-1995 program year in Operator Algebras and Applications held at The Fields Institute for Research in the Mathematical Sciences.

This volume contains a selection of papers that arose from the seminars and workshops of the program. Topics covered include the classification of amenable C*-algebras, the Baum-Connes conjecture, E0 semigroups, subfactors, E-theory, quasicrystals, and the solution to a long-standing problem in operator theory: Can almost commuting self-adjoint matrices be approximated by commuting self-adjoint matrices?

Fields Institute Communications, Volume 13; 1997; 323 pages; Hardcover; ISBN 0-8218-0322-3; List $79; Individual member $47; order code FIC/13R74

Recent Developments in Optimization Theory and Nonlinear Analysis
Yair Censor, University of Haifa, and Simeon Reich, The Technion—Israel Institute of Technology, Haifa, Editors
This volume contains the refereed proceedings of the special session on Optimization and Nonlinear Analysis held at the Joint American Mathematical Society-Israel Mathematical Union Meeting which took place at the Hebrew University of Jerusalem in May 1995. Most of the papers in this book originated from the lectures delivered at this special session. In addition, some participants who didn’t present lectures and invited speakers who were unable to attend contributed their work.

The fields of optimization theory and nonlinear analysis continue to be very active. This book presents not only the wide spectrum and diversity of the results, but also their manifold connections to other areas, such as differential equations, functional analysis, operator theory, calculus of variations, numerical analysis, and mathematical programming.

In reading this book one encounters papers that deal, for example, with convex, quasiconvex and generalized convex functions, fixed and periodic problems, fractional-linear transformations, moduli of convexity, monotone operators, Morse lemmas, Navier-Stokes equations, nonexpansive maps, nonsmooth analysis, numerical stability, products of projections, steepest descent, the Leray-Schauder degree, turnpike property, and variational inequalities.

Contemporary Mathematics, Volume 204; 1997; 278 pages; Softcover; ISBN 0-8218-0515-0; List $49; Individual member $29; Order code CONM/204RT4

Solitons, Geometry, and Topology: On the Crossroad
V. M. Buchstaber, Moscow State University, Russia, and S. P. Novikov, University of Maryland, College Park, Editors
This collection contains articles reflecting the most recent activity in topology and mathematical physics presented at the Novikov Seminar held in Moscow. Papers in the volume are devoted to problems in geometry, topology, and mathematical physics, including applications of topology to physical problems. Such a combination is a long-standing tradition of the seminar, which originated in 1965.

American Mathematical Society Translations—Series 2, Volume 179; 1997; 219 pages; Hardcover; ISBN 0-8218-0666-1; List $89; Individual member $55; order code TRANS2/179RT4

Special Functions, q-Series and Related Topics
Mourad E. H. Ismail, University of South Florida, Tampa, David R. Masson, University of Toronto, ON, Canada, and Mizan Rahman, Carleton University, Ottawa, ON, Canada, Editors
This book contains contributions from the proceedings at The Fields Institute workshop on Special Functions, q-Series and Related Topics that was held in June 1995. The articles cover areas from quantum groups and their representations, multivariate special functions, q-series, and symbolic algebra techniques as well as the traditional areas of single-variable special functions. The book contains both pure and applied topics and reflects recent trends of research in the various areas of special functions.

Fields Institute Communications, Volume 14; 1997; 277 pages; Hardcover; ISBN 0-8218-0523-X; List $49; Individual member $29; Order code FIC/14R74

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Mathematics People

1997 Bergman Prize Awarded

David E. Barrett and Michael Christ have been named awardees of the Stefan Bergman Trust for 1997. The trust, established in 1988, recognizes mathematical accomplishments in the areas of research in which Stefan Bergman worked.

The previous beneficiaries of the trust are: David W. Catlin (1989), Steven Bell and Ewa Ligocka (1991), Charles Fefferman (1992), Yum Tong Siu (1993), Jon Erik Fornaess (1994), and Harold P. Boas and Emil J. Straube (1995). On the selection committee for the 1997 award were Frederick Gehring, J. J. Kohn (chair), and Yum Tong Siu.

David E. Barrett

Citation
Barrett's work is characterized by highly original and deep insight. Of the many important contributions that David Barrett has made to the theory of several complex variables, the following two represent unexpected developments which settled crucial natural problems and initiated new directions of research.

The first is Barrett's construction of a domain in $C^2$ with real analytic boundary with the property that there exists a $C^\infty$ function of compact support whose Bergman projection is unbounded (see Irregularity of the projection on a smooth bounded domain in $C^2$, Ann. of Math. (2) 119 (1984), no. 2, 431–436). This result plays an important role in the study of the Bergman projection operator. There are numerous results concerning the regularity of this projection, but all the research prior to Barrett's result was restricted to pseudoconvex domains, and it was not known whether or not the condition of pseudoconvexity is an essential assumption.

The second is Barrett's discovery that on the Diederich-Fornaess worm domain the Bergman projection does not preserve the Sobolev $H^s$ spaces for large $s$ (see Behavior of the Bergman projection on the Diederich-Fornaess worm, Acta Math. 168 (1992), no. 1–2, 1–10). This result was completely unexpected, and it led to the remarkable proof of irregularity on such domains obtained by Michael Christ.

Biography
David E. Barrett was born May 13, 1955, in Rochester, New York. He received his A.B. degree in mathematics from Oberlin College in 1977 and his S.M. and Ph.D. degrees in mathematics from the University of Chicago in 1978 and 1982, respectively, the latter under the direction of Raghavan Narasimhan. He was an instructor (1982–84) and assistant professor (1984–87) at Princeton University. He became an associate professor at the University of Michigan in 1987 and was promoted to full professor in 1993. He was a National Science Foundation Postdoctoral Fellow from 1982 to 1984 and an Alfred P. Sloan Foundation Fellow from 1985 to 1988. He has held visiting positions at the Institut Mittag-Leffler, the Université de Paris-Sud, the Institut des Hautes Études Scientifiques, and the Mathematical Sciences Research Institute.

Michael Christ

Citation
Michael Christ has made major contributions to a number of fields, mainly harmonic analysis, partial differential equations, and several complex variables. Among his results in several complex variables we cite the following striking contributions.
In his paper *Embedding compact three-dimensional CR manifolds of type* $C^n$, Ann. Math. (2) 129 (1989), no. 1, 195–213, Christ develops a highly original method to prove a natural and fundamental result. In a series of papers he has studied analyticity for operators associated with $\partial_b$ (see for example Remarks on the breakdown of analyticity for $\partial_b$ and Szego kernels, Harmonic Analysis (Sendai 1990), pp. 61–78, ICM-90 Satellite Conference Proceedings, Springer, Tokyo, 1991). Finally we cite his remarkable result, which is a true "tour-de-force", that global regularity does not hold on the Diederich-Fornaess worm domain; see *Global* $C^\omega$ *irregularity of the* $\partial$-Neumann problem on worm domains, J. Amer. Math. Soc. 9 (1996), no. 4, 1171–1185.

**Biography**

Michael Christ attended Nicolet High School in Milwaukee, Wisconsin, and earned his B.S. at Harvey Mudd College in 1977. He received his Ph.D. in 1982 with a dissertation written under the direction of A. P. Calderon at the University of Chicago, where he also studied under W. Beckner, R. Ffferman, R. W. Jones, and R. Narasimhan. He was an instructor (1982) and later assistant professor (1984) at Princeton University. In 1986 he was appointed associate professor at the University of California, Los Angeles, and in 1988 advanced to the rank of professor. In 1996 he was appointed professor at the University of California, Berkeley. Christ was a visitor at the Institut des Hautes Etudes Scientifiques during the 1989–90 academic year, was Professeur Invite at the Universite de Paris VI in the winter of 1993, and was a research professor at the Mathematical Sciences Research Institute in 1995–96. He was a National Science Foundation Postdoctoral Fellow (1982–84), an Alfred P. Sloan Foundation Fellow (1986), and a Presidential Young Investigator (1986–91). He was an invited speaker at the International Congress of Mathematicians in Kyoto in 1990.

**About the Prize**

The Bergman Prize honors the memory of Stefan Bergman, best known for his research in several complex variables, as well as the Bergman projection and the Bergman kernel function, which bear his name. A native of Poland, he taught at Stanford University for many years and died in 1977 at the age of 82. He was an AMS member for thirty-five years. When his wife died, the terms of her will stipulated that funds should go toward a special prize in her husband's honor.

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

—Allyn Jackson
Groups and Computation

Larry Finkelstein, Northeastern University, Boston, MA, and William M. Kantor, University of Oregon, Eugene

The workshop "Groups and Computations" took place at the Center for Discrete Mathematics and Theoretical Computer Science (DIMACS) at Rutgers University in June 1995. This and an earlier workshop (see Groups and Computation, Finkelstein and Kantor, © 1993, American Mathematical Society) held in October 1991 was aimed at merging theory and practice within the broad area of computation with groups. The primary goal of the previous workshop was to foster a dialogue between researchers studying the computational complexity of group algorithms and those engaged in the development of practical software. It was expected that this would lead to a deeper understanding of the mathematical issues underlying group computation and that this understanding would lead, in turn, to faster algorithms. Comments and subsequent work indicated that this goal had been achieved beyond expectations. The second workshop was designed to reinforce the progress in these directions.

The scientific program consisted of invited lectures and research announcements, as well as informal discussions and software demonstrations. The eight extended talks discussed randomization, permutation groups, matrix groups, software systems, fast Fourier transforms and their applications to signal processing and data analysis, computations with finitely presented groups, and implementation and complexity questions. As in the previous workshop, speakers ranged from established researchers to graduate students.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 26; 1997; 382 pages; Hardcover; ISBN 0-8218-0516-9; List $79; Individual member $47; order code DIMACS/28NA

Spectral Graph Theory

Fan R. K. Chung, University of Pennsylvania, Philadelphia

This monograph is an intertwined tale of eigenvalues and their use in unlocking a thousand secrets about graphs. The stories will be told—how the spectrum reveals fundamental properties of a graph, how spectral graph theory links the discrete universe to the continuous one through geometric, analytic and algebraic techniques, and how, through eigenvalues, theory and applications in communications and computer science come together in symbolic harmony.

— from the Preface

Beautifully written and elegantly presented, this book is based on 10 lectures given at the CBMS workshop on spectral graph theory in June 1994 at Fresno State University. Chung's well-written exposition can be likened to a conversation with a good teacher—one who not only gives you the facts, but tells you what is really going on, why it is worth doing, and how it is related to familiar ideas in other areas. The monograph is accessible to the nonexpert who is interested in reading about this evolving area of mathematics.

CBMS Regional Conference Series in Mathematics, Number 92; 1997; 267 pages; Softcover; ISBN 0-8218-0315-8; List $25; All individuals $20; order code CBMS/92NA

Fulbright Scholar Awards Competition

The competition for 1998-1999 awards for Fulbright Scholarships for U.S. faculty and professionals opened March 1, 1997. These scholarships provide opportunities for lecturing or advanced research in over 135 countries. Awards range from two months to a full academic year, and many assignments are flexible to the needs of the grantee.

The basic eligibility requirements for a Fulbright senior scholar award are U.S. citizenship and a Ph.D. or comparable professional qualifications. For lecturing awards, university or college teaching experience is expected. Foreign language skills are needed for some countries, but most lecturing assignments are in English. The deadline for lecturing or research grants for 1998-1999 is August 1, 1997. Other deadlines are in place for special programs: distinguished Fulbright chairs in Western Europe and Canada (May 1), and Fulbright seminars for international education and academic administrators (November 1).

Funding for the Fulbright Program is provided by the United States Information Agency, on behalf of the U.S. government, and by cooperating governments and host institutions abroad.

For further information and application materials, contact the USIA Fulbright Senior Scholar Program, Council for International Exchange of Scholars, 3007 Tilden Street, NW, Suite 5M, Box GNEWS, Washington, DC 20008-3009; telephone 202-686-7877; World Wide Web http://www.cies.org. Requests for mailing of application materials only may be sent by e-mail to cies1@ciesnet.cies.org.
NSF Proposes New Review Criteria for Grant Proposals

The National Science Foundation (NSF) has issued a proposal to change its merit review criteria and has asked the science community for feedback. A National Science Board and NSF staff task force proposes eliminating the existing four criteria and replacing them with two criteria. The task force also recommends subquestions or "contextual elements" for each criterion to guide but not limit reviewers. Here are the proposed criteria:

1. What is the intellectual merit and quality of the proposed activity? The following are suggested questions to consider in assessing how well the proposal meets the criterion: What is the likelihood that the project will significantly advance the knowledge base within and/or across different fields? Does the proposed activity suggest and explore new lines of inquiry? To what degree does the proposer's documented expertise and record of achievement increase the probability of success? Is the project conceptually well designed? Is the plan for organizing and managing the project credible and well conceived? And is there sufficient access to resources?

2. What are the broader impacts of the proposed activity? The following are suggested questions to consider in assessing how well the proposal meets the criterion: How well does the activity advance discovery and understanding while concurrently promoting teaching, training, and learning? Will it create/enhance facilities, instrumentation, information bases, networks, partnerships, and/or other infrastructure? How well does the activity broaden the diversity of participants? Does the activity enhance scientific and technological literacy? And what is the potential impact on meeting societal needs?

At a briefing NSF director Neal Lane stressed that a) the contextual elements are noninclusive; that is, there may be other considerations for specific proposals; b) reviewers should address only those contextual elements that they consider relevant to the proposal at hand and they feel qualified to evaluate; and c) there is no universal or predetermined weighting of the two criteria—weighting would depend on the nature of the proposed activity. Lane also said that the current system is "not broken," but that the existing criteria are out of date, do not easily encompass nonresearch activities, do not align well with NSF's current strategic plan, and are not always well understood by reviewers, who sometimes ignore them. He also said that he does not anticipate that the proposed criteria will change the NSF's current portfolio nor are they designed to do so. He emphasized that the excellence of people and ideas will continue to be paramount in determining which projects are funded.

The NSF is seeking comment from the community and has put the task force's report and proposal on the NSF Web site http://www.nsf.gov/od/lpa/meritrev.htm, along with an automatic feedback form. Comments can also be sent to meritrev@nsf.gov. The National Science Board will review the task force recommendations and comments received from the community in the spring.

—from JPBMElectronic News
ICMI Study on History

The International Commission on Mathematical Instruction (ICMI) is conducting an ICMI Study on The Role of the History of Mathematics in the Teaching and Learning of Mathematics. This study is led by an International Program Committee (IPC) of ten members, of whom Florence Fasanelli of the Mathematical Association of America is the U.S. representative.

The IPC has prepared a Discussion Document in which key issues related to the study are identified, presented, and discussed in a preliminary manner. The document has identified the major questions the study will address. These questions and others will be discussed in more detail at an invited study conference, to be held in France in the spring of 1998. Individuals will also conduct related research activities during the next two years. It is planned that a book will be published in late 1999 in the ICMI Study series, based on contributions to and outcomes of the conference and research activities.

The IPC for the study invites members of the mathematical community to propose or submit contributions on specific questions, problems or issues stimulated by the Discussion Document no later than June 1, 1997. These contributions will be regarded as input to the planning of the study conference. The entire Discussion Document is appearing in L'Enseignement Mathematique, the official organ of ICMI. But because the IPC wants to make it accessible to as many people as possible, it will also be available electronically through the MAA World Wide Web site, MAA-On­line, whose URL is http://www.maa.org. If you cannot access the Web, you may receive a copy by contacting Florence Fasanelli, Mathematical Association of America, 1529 18th St. N.W., Washington, DC 20036; fax: 202-453-5450; e-mail: ffasanel@maa.org.

—Victor Katz,
University of the District of Columbia

Special Issue of the Journal of Symbolic Computation

The Journal of Symbolic Computation (JSC) invites submissions for a special issue on Differential Equations and Differential Algebra. Papers should contribute to the mathematical foundation for symbolic computation algorithms in these areas.

Guidelines for submittal of JSC manuscripts and the JSC style files can be found at the URL http://www.cis.udel.edu/~caviness/jsc.html. Manuscripts may be submitted electronically to one of the two guest editors who will handle the preparation of this special issue.


Call for Nominations for Popov Prize

The second Vasil A. Popov Prize will be awarded at the Ninth Texas International Conference on Approximation Theory, to be held in January 1998. The prize has been established in memory of Vasil A. Popov and his contributions to approximation theory and related areas of mathematics.

The prize is awarded every three years for outstanding research contributions in fields related to Popov's work. Albert Cohen was the first recipient of the prize, awarded in 1995. Eligibility for the prize is restricted to mathematicians who did not have their terminal degrees on June 1, 1991. The winner of the prize will be asked to deliver a plenary lecture at the Texas conference.

The selection committee for the Popov Prize consists of: Charles Chui, Ronald A. DeVore, Paul Nevai, Allan Pinkus, Pencho Petrushev, and Edward Saff. Nominations should include a brief description of the research related to the nomination. Other supporting material may also be submitted. Nominations should be sent to the chair of the selection committee: Ronald A. DeVore, Department of Mathematics, University of South Carolina, Columbia, SC 29208. The closing date for nominations is June 1, 1997.

—Announcement of the Popov Prize Selection Committee

New Website for JPBM’s Congressional Action Network

Information on the Joint Policy Board for Mathematics (JPBM) Congressional Action Network and selected items from JPBM’s Congressional Action Kit can now be found on the Web, courtesy of The Math Forum Website maintained at Swarthmore College, http://forum.swarthmore.edu/social/jpbmcan. The Congressional Action Network was established by JPBM to facilitate communications between mathematical scientists and their legislators. Participants are offered tips and resources for conveying the value and impact of the mathematical sciences and the national importance of federal support for research and education. The Congressional Action Kit is also available via regular mail. To join the network, send your e-mail address to jpbm@math.umd.edu; include your postal address if you would like the kit mailed to you.

—JPBM electronic news
Call for Nominations for Schafer Prize

The Executive Committee of the Association for Women in Mathematics (AWM) calls for nominations for the Alice T. Schafer Mathematics Prize, to be awarded to an undergraduate woman for excellence in mathematics. All members of the mathematical community are invited to submit nominations for the prize. The nominee may be at any level in her undergraduate career. A nominee must either be a U.S. citizen or have a school address in the USA. The prize will be awarded at the Joint Prize Session at the Joint Mathematics Meetings in Baltimore, Maryland, January 1998.

The Schafer Prize was established in 1990 by the Executive Committee of the AWM and is named for former AWM president and one of its founding members, Alice T. Schafer, who has contributed a great deal to women in mathematics throughout her career.

A letter of nomination should include, but not be limited to, an evaluation of the nominee based on the following criteria: 1) quality of performance in advanced mathematics courses and special programs, 2) demonstration of real interest in mathematics, 3) ability for independent work in mathematics, and 4) performance in mathematical competitions at the local or national level, if any. Supporting materials (e.g., reports from summer work using mathematics, copies of talks given in student chapters, transcripts, etc.) should be enclosed with the nomination.

Send five complete copies of nominations for this award to: The Alice T. Schafer Award Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, Maryland 20742-2461. Nominations via e-mail or fax are not acceptable.

For further information contact the AWM by telephone at 301-405-7892 or by e-mail at awm@math.umd.edu. The nomination deadline is September 15, 1997.

— from AWM Announcement
Add this Cover Sheet to all of your Academic Job Applications

How to use this form

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

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

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

Mathematics Departments in Bachelor's, Master's and Doctorate granting institutions have been contacted and are expecting to receive the form from each applicant, along with any other application materials they require. Obviously, not all departments will utilize the cover form information in the same manner. Please direct all general questions and comments about the form to:

emp-info@ams.org

or call the Professional Programs and Services Department, AMS, at 800-321-4267 extension 4105.

JCEO Recommendations for Professional Standards in Hiring Practices

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

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

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

**AMS STANDARD COVER SHEET**

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*Indicate the mathematical subject area(s) in which you have done research using the 1991 Mathematics Subject Classification printed on the back of this form. If listing more than one number, list first the one number which best describes your current primary interest.*

**Primary Interest**  

**Secondary Interests** optional

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

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

University or Company

Position Title Dates

Indicate the position for which you are applying and position posting code, if applicable

If unsuccessful for this position, would you like to be considered for a temporary position?  

☐ Yes  ☐ No  

If yes, please check the appropriate boxes.

☐ Postdoctoral Position  ☐ 2+ Year Position  ☐ 1 Year Position

List the names, affiliations, and e-mail addresses of up to four individuals who will provide letters of recommendation if asked. Mark the box provided for each individual whom you have already asked to send a letter.

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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.

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Upcoming Deadlines
April 7, August 11, 1997: Short-Term Project Development NRC Grants for Central/Eastern Europe Collabora-

Where to Find It
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Mathematics Research Institutes Contact Information: The Fields Institute, The Geometry Center, Institute for Advanced Study (IAS), Institute for Mathematics and its Applications (IMA), Mathematical Sciences Research Institute (MSRI), Center for Discrete Mathematics and Theoretical Computer Science (DIMACS), Centre de Recherches Mathématiques (CRM)
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NSF, program officers in math education
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Fermat's Last Theorem: Unlocking the Secret of an Ancient Mathematical Problem
Amir D. Aczel, Bentley College, Waltham, MA

... Aczel sets out the whole story clearly and concisely ... there's a surprising amount of drama ... [Wiles' proof] employs a staggering range of abstract devices, which Mr. Aczel is an able hand at explaining ... [Mathematics] operates very close to religion ... Maybe that is the final justification for the quest Mr. Aczel chronicles so well ...

---The Wall Street Journal

Maps the strange, beautiful byways of modern mathematical thought
---Publishers Weekly

Perhaps I could best describe my experience of doing mathematics in terms of entering a dark mansion. You go into the first room and it's dark, completely dark. You stumble around, bumping into the furniture. Gradually, you learn where each piece of furniture is. And finally, after six months or so, you find the light switch and turn it on. Suddenly, it's all illuminated and you can see exactly where you were. Then you enter the next dark room ...

---Professor Andrew Wiles describing his seven-year quest for the "mathematicians' Holy Grail"

Wiles spent seven years working on his solution and another year fine-tuning it. He was obsessed with finding a solution that had eluded mathematicians for centuries.

In this book, Aczel celebrates Wiles' achievement. He explains complex mathematical developments and relates previously untold stories of the personalities, emotions, and motivations associated with a theorem that spans mathematical history.

In preparing this book, Aczel spent 18 months studying the mathematics that lay between Fermat's margin note and Wiles' solution. Aczel's investigation and references are presented in clear terms and are fully accessible to a general audience. Key points are elucidated with real-life analogies and simple line drawings. Published by Four Wall Eight Windows.

1997; 147 pages; Hardcover; ISBN 1-56858-077-0; List $18; Individual members $14; order code FERMATNA

Geometry and Nature
Hanna Nencka, University of Madeira, Portugal, and Jean-Pierre Bourguignon, IHES, Bures-sur-Yvette, France

This volume is the outgrowth of a conference devoted to William K. Clifford entitled, "New Trends in Geometrical and Topological Methods", which was held at the University of Madeira in July and August 1995. The aim of the conference was to bring together active workers in fields linked to Clifford's work and to foster the exchange of ideas between mathematicians and theoretical physicists. Divided into 6 one-day sessions, each session was devoted to a specific aspect of Clifford's work.

Contemporary Mathematics, Volume 203; 1997; 296 pages; Softcover; ISBN 0-8218-0607-6; List $65; Individual member $39; order code CONM/203NA

Proceedings of the Norbert Wiener Centenary Congress, 1994
V. Mandrekar, Michigan State University, East Lansing, and P. R. Masani, University of Pittsburgh, PA

One of the great mathematicians of this century, Norbert Wiener was a universal thinker of colossal proportions. This book contains the proceedings of the Norbert Wiener Centenary Congress held at Michigan State University on November 27-December 2, 1994. The aim of the Congress was to reveal the depth and strong coherence of thought that runs through Wiener's legacy, and to exhibit its continuation in ongoing research.

Proceedings of Symposia in Applied Mathematics, Volume 52; 1997; approximately 600 pages; Hardcover; ISBN 0-8218-0482-9; List $99; Individual member $59; order code PSAPM/52NA
This journal is devoted to research in representation theory. It is committed to maintaining a high standard for exposition and mathematical content.

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Mathematics Calendar

April 1997

*3-4 DIMACS/PMMB/MBBC Workshop on DNA Topology II, DIMACS, CoRE Building, Rutgers University, Piscataway, New Jersey.
**Sponsors:** DIMACS, PMMB (The Program on Mathematics and Molecular Biology based at Berkeley), MBBC (The Center for Molecular Biophysics and Biophysical Chemistry at Rutgers).

**Organizers and Contacts:** W. Olson, olson@rutchem.rutgers.edu, B. Coleman, bcoleman@stokes.rutgers.edu, T. Schlick, schlick@nyu.edu, I. Tobias, tobias@rutchem.rutgers.edu. Tel: 908-445-3993.

**Local Arrangements:** P. Pravato, DIMACS Center, pravato@dimacs.rutgers.edu, 908-445-5929.

**WWW Information:** http://dimacs.rutgers.edu/Workshops/index.html.

**Short Description:** This workshop will focus attention on the energetics and dynamics of supercoiled and knotted DNA as well as the effects of protein activity-binding and primary base sequence on DNA structure and topology. The workshop is designed to reach a very diverse audience consisting of roughly a 50:50 mix of biologists-biochemists and mathematicians-biophysicists.

*6-11 Eighth Copper Mountain Conference on Multigrid Methods, Copper Mountain, Colorado.

**Information:** For information such as registration, author instructions, and lodging arrangements (including a lodging bulletin board), please access http://amath.colorado.edu:80/appm//faculty/copper/. You may also contact by e-mail at cs97@boulder.colorado.edu.

*8-10, 1997 Concentration Year 1997 on Mathematical Problems in Fluid Dynamics: Workshop on Kinetic Approximation of Conservation Laws, Instituto per le Applicazioni del Calcolo "M. Picone", Rome, Italy.

**Information:** A short series of lectures will be given by B. Perthame (Univ. Paris 6). Other speakers will be Y. Brenier (ENS Paris), H. Chen (EXA Corporation), G. Toscani (Univ. Favia), T. Tzavaras (Madison). This workshop is a part of a concentration year organized at Instituto per le Applicazioni del Calcolo in Rome, with the support of the SIMAI, around four one-week workshops on specific topics: kinetic approximation of conservation laws (April 8-10; local org.: R. Natalini (natalini@iac.rm.cnr.it)), flows within phase-change (May; local org.: D. Mansutti (mansutti@iac.rm.cnr.it)),orio
ticy dynamics and turbulence (July 3-8; local org.: S. Succi (succi@iac.rm.cnr.it)), mathematical problems in bio-fluid dynamics (October; local org.: G. Pontrelli (pontr@iac.rm.cnr.it)). There is financial support given by SIMAI for selected young researchers. Please contact us for more information about applications. Organizing Committee: M. Bertsch, P. Marcati, R. Natalini, R. Piva, M. Pulvirenti, S. Succi.

**Scientific Secretariat:** R. Abbondanza, IAC, Viale del Policlinico 137, 00161, Rome (Italy); tel.: 39-6-88470276; fax: 39-6-4404306; e-mail: abbondanza@iac.rm.cnr.it.


**Organizers:** R. Alexander, alex@iastate.edu, 515-294-7579; and F. Keinert, keinert@iastate.edu, 515-294-5223.

**Information:** Via WWW at http://www.math.iastate.edu/MidwestNA_Day/, or by e-mail to naday@iastate.edu.

**Deadline:** For submitting a 20-minute contributed talk, send a title and abstract by March 17, 1997.

*12-13 Pacific Northwest Geometry Seminar (spring meeting), University of British Columbia, Vancouver, BC, Canada.

**Information:** For details, visit the http://...
14–16 Bring Your Own Code Workshop on the Parallel Solution of PDEs, Cornell Theory Center, Cornell University, Ithaca, New York.

Sponsors: Cornell Theory Center, Institute for Computer Applications in Science & Engineering, Argonne National Laboratory.

Focus: A workshop designed for computational engineers and scientists with an interest in distributed computation for large-scale problems in partial differential equations. The workshop will introduce participants to PETSc, the Portable, Extensible Toolkit for Scientific Computation. It will consist of a day of presentations by PETSc developers and users and two days of "hands-on" coaching to port codes brought by participants to parallel machines.

Information: For additional information, including registration form, visit: http://www.ccornell.edu/Eda/Workshops/PDE.97.Apr/index.html or contact A. Levy, Conference Assistant, Cornell Theory Center; tel: 607-254-8686; e-mail: alevy@ccornell.edu.

18–19 DIMACS Workshop on Economics, Game Theory, and the Internet, DIMACS Center, Rutgers University, Piscataway, New Jersey, 08855-1179.

Sponsors: Organized by The Center for Discrete Mathematics and Theoretical Computer Science (DIMACS) and in cooperation with the Department of Economics at Rutgers University at New Brunswick.

Organizers: E. Friedman, Dept. of Economics, Rutgers Univ., friedman@fas-econ.rutgers.edu; R. McLean, Dept. of Economics, Rutgers Univ.; S. Shenker, Xerox PARC, shenker@parc.xerox.com.


Local Arrangements: P. Pravato, DIMACS Center, pravato@dimacs.rutgers.edu, 908-445-5929.

WWW Information: http://dimacs.rutgers.edu/Workshops/index.html.

Short Description: The Internet poses many interesting challenges for theoretical economics and game theory. The highly asynchronous interactions and large degree of anonymity inherent in the Internet require that many traditional game theoretic notions of equilibrium, learning, and mechanism design need to be re-examined in this context.


Information: This conference will likely receive some N.S.F. funding as part of the Northwestern Emphasis Year. The organizing committee (E. Friedlander, D. Grayson, and R. Jardine) expects to distribute much of this very limited funding to graduate students and mathematicians early in their careers. For further information about funding, please write to E. Friedlander (eric@math.nwu.edu); for information about hotels, etc., please write to M. Rubin (melanie@math.nwu.edu).


Sponsors: DIMACS.

Organizers and Contacts: D.-Z. Du, dzdu@cs.unm.edu, F. Pardalos, pardalos@ufl.edu.

Distinguished Speaker: S. Arora.

Local Arrangements: S. Babu, Princeton Univ., barb@cs.princeton.edu, 609-609-1771.

WWW Information: http://dimacs.rutgers.edu/Workshops/index.html.

Short Description: The workshop will focus on combinatorial, algorithmic, and application aspects of these problems, with special interest in efficient approximation algorithms and their computational performance.

May 1997

5–11 Fields Institute Workshop on Geometry and Complexity, The Fields Institute, Toronto, Ontario, Canada.

Purpose: This workshop will be a synergetic meeting intended to bring together researchers interested in various algorithmic and constructive aspects of geometry, topology, geometric group theory, and related subjects.

Organizers: A. Khovanskii (Univ. of Toronto), A. Nabutovsky (Univ. of Toronto).

Information: This workshop is part of the January–June 1997 program on Singularity Theory and Geometry at The Fields Institute. Visit http://www.fields.utoronto.ca for more information, or e-mail: complex@fields.utoronto.ca for registration information.

16–17 Third Mississippi State Conference on Differential Equations and Computational Simulations, Mississippi State, University, Mississippi.

Organizers: Department of Mathematics and Statistics and NSF Engineering Research Center, Mississippi State Univ.


Principal Speakers: W. Allegretto (Univ. of Alberta, Canada), J. L. Bona (Univ. of Texas), D. de Figueiredo (Univ. of Campinas, Brazil), S. Godunov (Sabolev Institute of Mathematics, Russia), A. Jameson (Princeton Univ.), J. Mawhin (Univ. of Louvain, Belgium), S. Os­her (Univ. of California), K. Schmitt (Univ. of Utah), J. Shang (Wright Patterson Air Force Base).

Forum: This is an interdisciplinary conference involving theoretical and applied developments in differential equations and computational simulations. In addition to the nine principal lectures, there will be sessions of contributed talks.

Abstracts: Abstracts for contributed papers should be submitted electronically no later than March 11, 1997, to the program chairman, J. Zhu, jzhu@math.msstate.edu.

Information: For further information on the conference organization, program, and submission of abstracts, visit the conference home page at http://www.msstate.edu/Dept/Math/conf.html or contact the organizers: R. Shivaji, Dept. of Mathematics & Statistics, Mississippi State, MS 39762; shivaji@math.msstate.edu; tel: 601-325-3414; fax: 601-325-0005; R. Soni, NSF Engineering Research Center, Mississippi State, MS 39762; basoni@er.es.msstate.edu; tel: 601-325-8278; fax: 601-325-7692.

17–18 Sixth Southern California Geometric Analysis Seminar, Mathematics Department, University of Irvine, Irvine, California.


Support: Some support is available for graduate students and postdocs. The SCGAS particularly encourages the participation of women and members of underrepresented groups.

Information: Contact R. Wentworth, Department of Mathematics, California Institute of Technology, 1200 E. California Blvd., Pasadena, CA 91125-7875; rpared@math.caltech.edu; fax: 714-824-7993; WWW home page: http://www.math.caltech.edu/SCGAS.html.


Topics: Differential equations and dynamical systems.

Program: Short courses on mathematical epidemiology by C. Castillo-Chaves (Cornell Univ.), flow on porous media by R. Showalter (Univ. of Texas), and physical background of the nonlinear diffusion equation by M. Ibanes (Univ. de los Andes). The rest of the program will consist of invited talks and twenty-minute contributed talks.

Abstracts: Abstracts for contributed talks should be sent to aru@usu.ve by March 15, 1997.

Information: For further information write to D. Rueda at Universidad del Zulia, Maracaibo, Venezuela.
26–June 1 Positive Solutions of Elliptic and Parabolic Differential Equations, Technion-Israel Institute of Technology, Haifa, Israel.  
Organizing Committee: V. Lin, M. Marcus, Y. Pinchover, R. Pinsky.  
Invited Speakers: S. Agron (Hebrew Univ.), A. Ancona (Orsay), C. Bardelli (Basel), M. Ben-Artzi (Hebrew Univ.), H. Berestycki (Paris VI), X. Cabre (Paris VI), I. Chavel (CUNY), C. V. Coffman (Carnegie-Mellon), M. Cranston (Rochester), E. B. Davies (King’s College, London), S. Gindikin (Rutgers), E. Hsu (Northwestern), V. Kaimanovich (Rennes), S. Kamin (Tel Aviv), Y. Kifer (Hebrew Univ.), Y. Li (Rutgers), S. Molchanov (Charlotte, North Carolina), N. Nadirashvili (ETH), L. A. Peletier (Leiden), M. Solomyak (Weizmann Institute), M. Shubin (Northeastern), J. Spruck (John Hopkins), D. Stroock (MIT), L. Veron (Tours).  
Information: For further information and registration form, contact Y. Pinchover, Department of Mathematics, Technion-Israel Institute of Technology, 32000 Haifa, Israel; e-mail: pincho@techunix.technion.ac.il; fax: 972 4 832 4654.  
Contact: J. Propp, prop@math.mit.edu.  
Local Arrangements: P. Pravato, DIMACS Center, pravato@dimacs.rutgers.edu, tel: 908-445-5929.  
Sponsors: Nayanova University, Samara State University, Russian Academy of Natural Sciences, International Federation of Nonlinear Analysis.  
Information and Submissions: V. Sobolev (organizer) or He. Gorelova (seminar coordinator), e-mail: modeling@ssu.samara.emnet.ru; Nayanova University, Molodogvardeiskaya 196, Samara, 443001, Russia.  
Registration Fee: 250 ECU. Financial support for young researchers from the European Union. All prospective participants are encouraged to apply for partial support.
These details have already been circulated to those on the conference e-mailing list, but there have been problems with outdated e-mail addresses that have caused many messages to be bounced.

Organizers: V.A. Dougalis (Athens, Greece), A. S. Fokas (London, United Kingdom).
Main Speakers: J. L. Bona (Austin, U.S.A.), D. Crighton (Cambridge, United Kingdom), A. Its (Purdue, U.S.A.), J.-C. Saut (Paris-Sud, France), V. E. Zakharov (Moscow, Russia).
Registration Fee: 250 ECU. Financial support for young researchers from the European Union. All prospective participants are encouraged to apply for partial support.
Information and Applications: S. Papadopoulos, Dept. of Mathematics, University of Crete Heraklion, Crete, Greece; fax-nr.: 81-234516; e-mail: souzana@math.uoch.gr.

30-July 5 Modern Group Analysis VII Lie Groups and Contemporary Symmetry Analysis, Sophus Lie Conference Center, Norderjorkeid, Norway.
Topics: The main topics of the conference will include: Classical heritage and historical aspects of Lie group analysis, invariant and partially invariant solutions of differential equations, applications in fluid dynamics, symmetries in mathematical physics and physical chemistry; geometric and group theoretic analysis of initial value problems, applications in mathematics of finance and in industrial problems, approximate groups, perturbation methods and deformations of Lie algebras, group analysis of integro-differential and finite-difference equations, nonlocal, conditional and other generalized symmetries, computational aspects. The conference will also highlight educational aspects, and therefore will include an educational workshop consisting of mini-seminars dedicated to several selected topics and arranged by participants.
Call for Papers: A one-page abstract (suitable for direct photo-reproduction) for presentation at the conference is invited. The presentation is expected to be 30 minutes in length, including a 5-minute discussion. The deadline for the abstract is March 1, 1997. The abstract may be e-mailed (T\TeX or \LaTeX file) to the chairman of the organizing committee (E. Straume, eldars@matstat.unit.no) with copy to the chairman of the scientific committee (N. H. Ibragimov, nhi@gauss.cam.wits.ac.za). Notification of acceptance will be given by April 1, 1997. Copies of all accepted abstracts will be distributed at the conference.
Information: Organizing committee: Sophus Lie Conference Center, Departement of Mathematical Sciences, NTNU, Trondheim, N-7055 Dragvoll, Norway, fax: +47 73 59 10 38; tel: +47 73 59 66 83; e-mail: eldars@matstat.unit.no.

July 1997

7-11 16th British Combinatorial Conference, Queen Mary and Westfield College, University of London, England.
Information: Further information and a registration form can be obtained from the local organizers: R. A. Bailey, P. J. Cameron, L. H. Soicher, and S. Wilkinson, School of Mathematical Sciences, Queen Mary and Westfield College, Mile End Road, London E1 4NS; e-mail: gccg@qmw.ac.uk; fax: 44-181-981-9587; Web: http://www.maths.qmw.ac.uk/~jpc/bcc16.html.

7-23 XXVIIIth Probability Summer School, Saint-Flour, (Cantal), France.
Invited Speakers: J. Bertoin, Université Paris VI, "Processus de Lévy"; F. Martinelli, Université dell’Aquila (Italy), “Glauber Dynamics for Lattice Spin Models of Statistical Mechanics”; Y. Peres, Hebrew University, Jerusalem, "Probability on trees".
Information: F. Bernard, Université Blaise Pascal, Mathématiques Appliquées, F63177 Aubière Cedex; tel. 04.73.40.70.52 or 04.73.40.70.50; fax 04.73/04.70.64; e-mail: bernard@cfm.univ-bpclermont.fr.

14-25 Complex Analysis and Applications, Stefan Banach International Mathematical Center, Warsaw, Poland.
Organizing committee: E. Chirka (Moscow), A.-M. Chollet (Lille), R. Dwilewicz (Warsaw), H. Jacobowitz (Camden), J. Siciak (Cracow).
Scope: The aim of the conference is to present the latest achievements in complex analysis (on a broad sense) with applications to different areas of mathematics, for instance, algebraic geometry, partial differential equations, analytic number theory, etc.
Location: The Banach Center is an international mathematical center located in downtown Warsaw. It is affiliated with the Institute of Mathematics of the Polish Academy of Sciences and organizes semesters, conferences, and workshops devoted to different areas of mathematics. More about the Banach Center can be found at the address: http://www.impan.gov.pl/BC.
Funding: A limited amount of funding will be available to cover living expenses in Warsaw. Some of these funds are reserved for graduate students.
Contact: To participate in the conference, or for further information, please contact R. Dwilewicz, preferably via e-mail, at e-mail: rd@impan.gov.pl or write to him at Stefan Banach International Mathematical Center, Conference Complex Analysis and Applications, ul. Mokotowska 25, P.O. Box 137, 00-950 Warsaw, Poland; tel.: (48 22) 628-0192; fax: (48 22) 622-5750.

August 1997

1-4 MAA Mathfest, Renaissance Atlanta Hotel, Atlanta, Georgia.
Program: Invited lectures, contributed paper sessions, student contributed paper sessions, mini-courses, short course exhibits and book sale.
Information: For additional information about the 1997 MAA Mathfest, go to MAA Online at http://www.maa.org.

20-22 The 2nd International Conference on the Practice and Theory of Automated Timetabling (PATAT’97), University of Toronto, Canada.
Themes: The themes of the conference include (but are not limited to): complexity issues; distributed timetabling systems; experiences; implementations; commercial packages; interactive vs. batch timetabling; relationship with other scheduling problems; techniques, including: constraint logic programming, genetic algorithms, graph colouring, expert systems, knowledge-based systems, operational research, simulated annealing, tabu-search.
Information: For more information, contact: E. K. Burke, Dept. of Computer Science, Univ. of Nottingham, University Park, Nottingham NG7 2RD, UK; e-mail: ekb@cs.nott.ac.uk.

22-26 Justification and Enrollment Problems in Education Involving Mathematics or Physics, Roskilde University, Denmark.
Purpose: Mathematics and physics play an objectively significant role in a large number of educational subjects and study programs in various areas, not only as subjects in their own right, but even more perhaps as essential components in other subjects and fields of study. Yet in many places in the world pupils and students have considerable difficulties in finding mathematics and physics subjectively relevant and in coming to grips with their study. Similarly, in many countries students, to an increasing extent, are opting away from tertiary studies in which mathematics or physics form a key component. The main purpose of the conference is to elucidate and analyze the problems with respect to these aspects and to do so from a variety of different perspectives, such as educational sector and level, geography, and culture.
Information: To receive the first announcement, which is due by early January 1997, please contact the conference secretariat by e-mail: klm@cf.nuc.dk or fax: +45-46755065; conference secretariat: K. Larsen, IMU/MA, Roskilde University, P.O. Box 260, DK-4000 Roskilde, Denmark.

25-29 Analysis and Logic, University of Mons-Hainaut, Mons, Belgium.
Organizers: Teams of analysis and of mathematical logic of the University of Mons-Hainaut and team of analysis of the University of Paris VI.
Location: University of Mons-Hainaut (Belgium).
Subject: Geometry of Banach spaces, nonstandard analysis, Ramsey theory, descriptive set theory, and their interactions.
Program: The program will include three mini-courses and ten plenary lectures.
September 1997

* September-November Dynamical Systems and Pattern Formation. The Lorentz Center, Leiden University, Leiden, The Netherlands.

Program: The program will involve a visitor program, a series of international workshops, graduate courses, and seminars. Groups active in dynamical systems, operator theory, and pattern formation in Amsterdam, Delft, Groningen, Leiden, and Utrecht will be involved in organizing different workshops.

Organizing Committee: L.A. Peletier (Leiden) and S.M. Verduyn Lunel (Amsterdam).

Workshops: Finite dimensional dynamical systems (week 40); Multi-bump solutions (week 41); Dynamics of differential equations with delay (week 42); Operators and dynamical systems (week 43); Interactions in space: Improving the mean field approximation (week 44); Interfaces and parabolic regularization (week 46).

Kloosterman Lecture Series: During the fall semester J.K. Hale of Georgia Institute of Technology will be Kloosterman Professor at Leiden University. He will give a graduate course entitled Diffusivity and Dynamics.

Fellowships: There is a limited number of fellowships available. Applications should be submitted before April 15, 1997, to: Lorentz Center, attn: Professor G. van Dijk, director, Leiden University, P.O. Box 9512, 2300 KA Leiden, The Netherlands.

Sponsors: Financial support for the program is provided by a SWON 'Centraal Jaarhem', the Lorentz Center, NWO and the research schools Thomas Stieltjes Institute for Mathematics and the Mathematical Research Institute.

Information: For further information please contact the organizers at e-mail: peletier@wi.leidenuniv.nl,iotoreiandaalvredijn@wi.uva.nl.

* 1-6 3rd International Conference on Geometry, Varna, Bulgaria.

Information: G. Stanilov, University of Sofia, Faculty of Mathematics and Informatics, Blvd. James Bourcher 5, 1164 Sofia, Bulgaria, e-mail: stanilov@math.uni-sofiia.bg.

* 7-14 35th International Symposium on Functional Equations, Graz-Mariatrost, Austria.

Scientific Committee: W. Benz (Hamburg), R. Ger (Katowice), J. Rätz (Bern), L. Reich (Graz).

Local Organizers: D. Cronau, J. Schwaiger, L. Reich (University of Graz).

Information: Participation is by invitation only. Those who wish to be invited should write to one of the local organizers (Institut für Mathematik, Universität Graz, Heinrichstrasse 36, A-8010 Graz; e-mail: lfs@funigraz.ac.at).

* 8-10 Optimal Discrete Structures and Algorithms - ODSA'97, Rostock, Germany.

Topics: Emphasis is on the interactions between several aspects of discrete mathematics, mathematical optimization, and theoretical computer science.


Contributed Lectures: If you plan to give a contributed talk (25 min), please prepare an abstract no longer than one page. Please do not forget to include the title of your talk on the registration form. The final deadline for the submission of abstracts is June 15. Please send a hard copy of the abstract to the address below and, if possible, also send a TeX-version of your abstract by e-mail.

Registration: Registration deadline is June 15. The registration fee for participants is DM 100. Students pay a reduced price of DM 50, and for accompanying persons the fee is DM 40. The registration fee covers the cost of conference materials (not including the special issue of Discrete Applied Mathematics) as well as admission to social events (boat excursion, organ recital).

Information: For further information, please contact the organizers at e-mail: peletier@wi.leidenuniv.nl, iotoreiandaalvredijn@wi.uva.nl.

Information: A. Flanagin, Peer Review Congress, 515 N. State Street, Chicago, Illinois 60610, USA; tel +312-464-2342; fax +312-464-5824; e-mail: jana-peer@ama-assn.org. For more information, visit the Peer Review Congress Web site at http://www.ama-assn.org/peer/.

* 22-26 Complex Analysis and Geometry in honor of Pierre Lelong on his 85th birthday, University Pierre et Marie Curie, Paris VI, France.

Organizers: Complex analysis team of the Mathematical Institute of University Pierre et Marie Curie Paris VI and European Network Analyse Complexe et Géométrie Analytique.


Invited Speakers: E. Bedford (Univ. of Indiana), J.-P. Demailly (Univ. of Grenoble), K. Diederich (Univ. of Wuppertal), J. Duval (Univ. of Toulouse), C. Kiselman (Univ. of Upsala), L. Lempert (Purdue Univ.), B. Shiffman (Johns Hopkins Univ.), N. Sibony (Univ. of Paris XI), J. Siciak (Univ. of Krakow), Y.-T. Siu (Harvard Univ.).

Information: e-mail: conf.complex.analysis@math.jussieu.fr.

* 4-8 AMS Western Sectional Meeting (Joint with MAA), University of California-Davis, CA.

Information: For more information, please contact W. Drady, wsd@ams.org.

November 1997

* 17-21 International Congress on Biomedical Peer Review and Global Communications, Prague Atrium Hotel, Prague, Czech Republic.

Information: A. Flanagin, Peer Review Congress, 515 N. State Street, Chicago, Illinois 60610, USA; tel +312-464-2342; fax +312-464-5824; e-mail: jana-peer@ama-assn.org. For more information, visit the Peer Review Congress Web site at http://www.ama-assn.org/peer/.

* 19-21 Mal'tsev Meeting, Novosibirsk, Russia.

Organizers: The Mal'tsev Meeting is organized by the Siberian Foundation for Mathematics Calendar
Algebra and Logic together with the Institute of Mathematics (Siberian Branch of the Russian Academy of Sciences) and the Research Institute for Mathematical and Informational Basis of Education (Novosibirsk State University).

Program: The conference will take place at the Institute of Mathematics. Reports from all fields of algebra and mathematical logic are invited. The program includes one-hour and half-hour lectures as well as sectional talks. Preliminary list of sections: group theory, ring theory, model theory, and universal algebra, computability theory.

Abstracts: Abstracts of talks (in English) files by e-mail or hard copies should be sent to the secretary. The deadline is May 1, 1997.

Information: D. Evgeniechich Pal'chunov, Russia, 630090, Novosibirsk, Universitetskaya prosp. 4, Institute of Mathematics SB RAS; tel: +7(383)-295-68-50; fax: +7(383)-237-06-52; e-mail: palch@math.nsc.ru.

January 1998

19-23 First Pacific Rim Conference on Mathematics, City University of Hong Kong, Hong Kong.

Objectives: This conference is to provide a forum for mathematical scientists to present their latest research on various areas, and aims to bring senior scientists and young researchers together for personal interaction and dialogue.

Session Topics: Analytic number theory, applied analysis, calculus of variations, combinatorics, computational complexity, geometric analysis, optimization, PDEs - pulse dynamics, probability.

Speakers: Plenary Speakers and Invited Speakers will be featured in these sessions, along with contributed papers. Plenary speakers: M. Blum (City University of Hong Kong), K. Burdzy (Univ. of Washington), F. Chung (Univ. of Pennsylvania), J. Friedlander (Univ. of Toronto), M. Giaquinta (Univ. of Pisa), P. L. Lions (Université de Paris-Dauphine), M. Mimura (Univ. of Tokyo), M. Wright (Bell Laboratories), S.-T. Yau (Harvard University).

Call for Papers: Titles and abstracts of contributed papers must be received by July 31, 1997. The abstracts should be typed in LATEX files, not to exceed one page, and sent to F. Cucker by e-mail or on a floppy disk.

Information: F. Cucker, Dept. of Math., City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong; e-mail: main@cityu.edu.hk; fax: (852)2788-8361.

February 1998

2-4 33 Years of Groebner Bases, RISC-Linz, Hagenberg, Austria.

Program: The institute RISC-Linz of the Johannes Kepler Universität in Linz, Austria, sponsors the conference.

Since the invention of Groebner bases by Buchberger in 1965, this new method in polynomial ideal theory and algebraic elimination theory has become one of the standard methods in computer algebra. There exists by now a considerable amount of theoretical work on Groebner bases, every major computer algebra system has an implementation of Groebner bases, and the field of applications ranges from algebraic geometry and computer aided geometric design to chemical structure analysis. The aim of the conference is to assess the state of the art in the theory and practice of Groebner bases. In addition to the regular program of the conference there will be a software exhibition.

Workshop Topics: Theoretical development of the algebraic theory of Groebner bases, numerical aspects of the computation and use of Groebner bases, applications of Groebner bases in science and engineering, implementations and issues of software design in connection with Groebner bases.


Information: Authors are invited to submit papers of about 12 pages to the Secretary of the Conference: Secretary of the Internat. Conf. on Groebner Bases, Johannes Kepler Universitat, A-4040 Linz, Austria, phone: +43 7326 3231 39; fax: +43 7326 3231 30; e-mail: gb-conf@risc.uni-linz.ac.at. Preferably submissions should be sent by e-mail. Paper submissions must be sent in triplicate. Submission must be written in LATEX. For further information, see http://www.risc.uni-linz.ac.at/conference/DB/G8Conf.html.

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.

April 1998

* 12-13 Central Sectional Meeting, DePaul University, Chicago, IL.

Information: For more information, please contact W. Drady, wad@ams.org.

October 1998

* 24-25 AMS Eastern Sectional Meeting, Pennsylvania State University, State College, PA.

Information: For more information, please contact R. Cascella, rgc@ams.org.

November 1998

* 14-15 AMS Western Sectional Meeting, University of Arizona, Tucson, AZ.

Information: For more information, please contact W. Drady, wad@ams.org.

April 1999

* 10-11 AMS Western Sectional Meeting, University of Nevada, Las Vegas, NV.

Information: For more information, please contact W. Drady, wad@ams.org.

* 24-25 AMS Eastern Sectional Meeting, State University of New York, Buffalo, NY.

Information: For more information, please contact R. Cascella, rgc@ams.org.
New Publications Offered by the AMS

General Interest

Séminaire Bourbaki, Volume 1994/95

This volume contains fifteen survey lectures on topics of current interest: two lectures on operator algebras; two on algebraic groups; one on affine Hecke algebras and one on the algebraic geometry of affine space; one lecture on abelian varieties over number fields; one on invariants of 3-dimensional manifolds; one on Verlinde’s formula and one on mirror symmetry; one lecture on the index of differential operators; one on the 2-Neumann problem and one on the Cauchy problem for PDEs.

This volume also contains two lectures on Wiles’ proof of the fact that semi-stable elliptic curves over $Q$ are modular, which implies Fermat’s last theorem.

Titles in this series are published by the Société Mathématique de France and distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Contents:
- M. Derridj, La sous-ellipticité pour le problème 2-Neumann dans un domaine pseudoconvexe de $C^n$ [d’après D. Catlin]
- M. Duflo, Opérateurs transversalement elliptiques et formes différentielles équivariantes [d’après N. Berline et M. Vergne]
- J.-L. Loday, La renaissance des opérades
- W. Soergel, Conjectures de Lusztig; C. Sorger, La formule de Verlinde; J.-B. Bost, Périodes et isogénies des variétés abéliennes sur les corps de nombres [d’après D. Masser et G. Wüstholz]
- J. Golin, Le problème de Cauchy pour des EDP semi-linéaires périodiques en variables d’espace [d’après Bourgain]
- I. G. MacDonald, Affine Hecke algebra and orthogonal polynomials
- O. Mathieu, Le modèle des chemins [d’après P. Littelmann]
- P. Vogel, Les invariants récents des variétés de dimension 3
- V. Jones, Fusion en algèbres de von Neumann et groupes de lacets [d’après A. Wassermann]
- M. Kontsevich, Mirror symmetry in dimension 3
- H. Kraft, Challenging problems on affine n-space
- J.-P. Serre, Travaux de Wiles (et Taylor,...), partie I
- J. Oesterlé, Travaux de Wiles (et Taylor,...), partie II

Astérisque, Number 237

Logic & Foundations

Descriptive Complexity and Finite Models

Neil Immerman, University of Massachusetts, Amherst, MA, and Phokion G. Kolaitis, University of California, Santa Cruz, CA, Editors

We hope that this small volume will suggest directions of synergy and contact for future researchers to build upon, creating connections and making discoveries that will help explain some of the many mysteries of computation.

—from the Preface

Finite model theory can be succinctly described as the study of logics on finite structures. It is an area of research existing between mathematical logic and computer science. This area has been developing through continuous interaction with computational complexity, database theory, and combinatorics.

The volume presents articles by leading researchers who delivered talks at the "Workshop on Finite Models and Descriptive Complexity" at Princeton in January 1996 during a DIMACS sponsored Special Year on Logic and Algorithms. Each article is self-contained and provides a valuable introduction to the featured research areas connected with finite model theory.

This text will also be of interest to those working in discrete mathematics and combinatorics.

Contents:
- R. Fagin, Easier ways to win logical games
- B. Courcelle, On the expression of graph properties in some fragments of monadic second-order logic
- H. Straubing, Finite models, automata, and circuit complexity
- V. Vianu, Databases and finite-model theory
- M. Y. Vardi, Why is modal logic so robustly
decidable?: E. A. Emerson, Model checking and the mu-calculus; T. Pitassi, Algebraic propositional proof systems.

**DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 31**


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**The SPIN Verification System**

Jean-Charles Grégoire, INRS-Telecommunications, Montreal, PQ, Canada, Gerard J. Holzmann and Doron A. Peled, Lucent Technologies, Murray Hill, NJ, Editors

What is SPIN? SPIN is a general tool for the specification and formal verification of software for distributed systems. It has been used to detect design errors in a wide range of applications, such as abstract distributed algorithms, data communications protocols, operating systems code, and telephone switching code. The verifier can check for basic correctness properties, such as absence of deadlock and race conditions, logical completeness, or unwarranted assumptions about the relative speeds of processes. It can also check for more subtle system dependent correctness properties expressed in the syntax of Linear-Time Temporal Logic (LTL). The tool translates LTL formulae automatically into automata representations, which can be used in an efficient on-the-fly verifications procedure.

This DIMACS volume presents the papers contributed to the second international workshop that was held on the SPIN verification system at Rutgers University in August 1996. The workshop covers theoretical and foundational studies of formal verification, empirical studies of the effectiveness of different types of algorithms, significant practical applications of the SPIN verifier, and discussions of extensions and revisions of the basic code.

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


DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 32

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**Algebra & Algebraic Geometry**

Robert Steinberg, Collected Papers

Robert Steinberg, University of California, Los Angeles, CA

This volume is a collection of published papers by Robert Steinberg. It contains all of his published papers on group theory, including those on "special representations" (now called Steinberg representations), tensor products of representations, finite reflection groups, regular elements of algebraic groups, Galois cohomology, universal extensions, etc. At the end of the book, there is a section called "Comments on the Papers". The comments by Steinberg contain minor corrections and clarifications and explain how ideas and results have evolved and been used since they first appeared.

Contents: A geometric approach to the representations of the full linear group over a Galois field; The representations of GL(3, q), GL(4, q), PGL(3, q), and PGL(4, q); Prime power representations of finite linear groups; Prime power representations of finite linear groups. II; On the number of sides of a Petrie polygon; Eigenvalues of the unitary part of a matrix; Finite reflection groups; Variations on a theme of Chevalley; The simplicity of certain groups; Automorphisms of finite linear groups; Invariants of finite reflection groups; Automorphisms of classical Lie algebras; A general Clebsch-Gordan theorem; Generators for simple groups; A closure property of sets of vectors; Complete sets of representations of algebras; Générateurs, relations et revêtements de groupes algébriques; Representations of algebraic groups; Differential equations invariant under finite reflection groups; Regular elements of semisimple algebraic groups; On the Galois cohomology of linear algebraic groups; Classes of elements of semisimple algebraic groups; Algebraic groups and finite groups; Conjugacy classes; Abstract homomorphisms of simple algebraic groups; Torsion in reductive groups; On a theorem of Pittie; On the desingularization of the unipotent variety; On theorems of Lie-Kolchin, Borel, and Lang; Conjugacy in semisimple algebraic groups; Kleinian singularities and unipotent elements; Generators, relations, and coverings of algebraic groups. II; Finite subgroups of SU_2, Dynkin diagrams and affine Coxeter elements; Some consequences of the elementary relations of SL_n; Tensor product theorems; On Dickson's theorem on invariants; An occurrence of the Robinson-Schensted correspondence; Parabolic subgroups with Abelian unipotent radical; Nagata's example; Endomorphisms of linear algebraic groups.

Collected Works, Volume 7


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**New Publications Offered by the AMS**

April 1997, Notices of the AMS 483
Analysis

**Approximation Theory and Function Series**

P. Vértesi, L. Leindler, and F. Móricz, Hungarian Academy of Sciences, Budapest, Hungary, Sz. Révész, J. Szabados, and V. Totik, Jozsef Attila University, Bolyai Institute, Szeged, Hungary, Editors

This Volume contains 22 selected papers (including five survey works) from the more than one hundred lectures held on the International Conference on Approximation Theory and Function Series dedicated to Karoly Tandori on his 75th birthday.

The main topics covered by the Conference were function series, Fourier analysis, interpolation, approximation in abstract spaces and inequalities.

The 5 survey papers written by J. Korevaar, D. Leviatan, D. S. Lubinsky, G. Mastroianni and S. M. Nikolskii give a fair overview on the new developments in approximation of functions.

Bolyai Society Mathematical Studies is published by János Bolyai Mathematical Society, and distributed worldwide, except in Eastern and Western Europe, by the AMS.

**Contents:**

**Invited papers.** J. Korevaar, Fekete extreme points and related problems; D. Leviatan, Shape preserving approximation by polynomials and splines; D. S. Lubinsky, Jackson and Bernstein theorems for exponential weights; G. Mastroianni, Boundedness of Lagrange operator in some functional spaces. A survey; S. M. Nikolskii, Approximation on the manifolds given by trigonometric polynomials; Contributed papers. V. A. Andrienko, Approximation by rectangular partial sums; M. Bagota, On the order of magnitude of double Fourier transforms; M. Diethelm, Definite quadrature formulae for Cauchy principal value integrals; S. Ehrich and G. Mastroianni, On generalized Stieltjes polynomials and Lagrange interpolation; K.-J. Förster, Comparison theorems for the variance of quadrature formulas; K. F. Papp, Lebesgue integrability for multiple trigonometric series; I. Horová, Gegenbauer polynomials, optimal kernels and Stancu operators; A. Kivinukk, Subordination in Fourier approximation by generalized Rogosinski means and its applications; Zh.-K. Li, Approximation of the Jacobi-Weyl class of functions by the partial sums of Jacobi expansions; E. Malkowsky, Linear operators in certain BK spaces; F. Móricz, The maximal Féjer operator on the spaces $H^1$ and $L^1$; F. Pintér and P. Neival, Schur functions and orthogonal polynomials on the unit circle; F. Schipp and L. Szil, Approximation on $H^1$-norm; A. M. Stokolos, On differentiation of integrals with respect to bases of convex sets; B. Underhill and A. K. Varma, On a convergent (0, 1, 3, 4) interpolation process; F. Weisz, Hardy spaces and Cesáro means of two-dimensional Fourier series.

Bolyai Society Mathematical Studies, Volume 5


**An Introduction to Infinite Ergodic Theory**

Jon Aaronson, Tel Aviv University, Israel

Infinite ergodic theory is the study of measure preserving transformations of infinite measure spaces. The book focuses on properties specific to infinite measure preserving transformations.

The work begins with an introduction to basic nonsingular ergodic theory, including recurrence behavior, existence of invariant measures, ergodic theorems, and spectral theory. A wide range of possible "ergodic behavior" is catalogued in the third chapter mainly according to the yardsticks of intrinsic normalizing constants, laws of large numbers, and return sequences. The rest of the book consists of illustrations of these phenomena, including Markov maps, inner functions, and cocycles and skew products. One chapter presents a start on the classification theory.

**Contents:**

Non singular transformations; General ergodic and spectral theorems; Transformations with infinite invariant measures; Markov maps; Recurrent events and similarity of Markov chains; Inner functions; Hyperbolic geodesic flows; Cocycles and skew products; Bibliography; Index.

**Mathematical Surveys and Monographs**


**Geometry & Topology**

**Topology with Applications**

Á. Császár, Rolando Eotvos University, Budapest, Hungary, Editor

This volume contains 35 papers presented at the Seventh Colloquium on Topology, organized by the J. Bolyai Mathematical Society at Szekszard (Hungary), August 23-27, 1993.

The papers touch various branches of general, algebraic and differential topology: topological categories, various topological structures, such as merotopic spaces, filter spaces, uniform and quasi-uniform spaces, relation spaces, cardinal invariants, group topologies, nonstandard methods, frames, extensions, hypertopologies, metrization, homotopies, essential mappings, continuous approximations, topological manifolds, Atiyah-Hirzebruch theorem, etc.

Besides, papers containing new results, there are some expository papers, e.g. from P.J. Collins, D. Dikranjan, P.J. Eccles, H.-P.A. Kunzi. All papers in the volume have been refereed.

Bolyai Society Mathematical Studies is published by János Bolyai Mathematical Society, and distributed worldwide, except in Eastern and Western Europe, by the AMS.
Contents: P. Andrzejewski, The equivariant Siebenmann boundary theorem for semi-free actions; M. Bogdán, i-categories, free groups, fundamental groupoids; Z. Čerin, Homotopy groups for $C^*$-algebras; P. Cherenack, Smooth homotopy; M. M. Clementino, On connectedness and disconnectedness; A. E. McCluskey and S. D. McCartan, Minimality with respect to $T_{5A}$ and $T_{SP}$; P. J. Collins, Acyclic monotone normality, well ordered $(F)$ spaces and Borges normality; J. Deák, Extending a family of merotopies in a screen space; D. Kikrnan, On the poset of precompact group topologies; D. Doitchinov, Some reflections on quasi-uniform frames; A. G. Dragalin, Complete Heyting and Boolean algebras over a partial ordering. Constructive approaches; P. J. Eccles, Characteristic numbers of immersions and self-intersection manifolds; P. Fletcher, A. Gryzlov, On some theorems of the theory of cardinal invariants and partition calculus; R. Hajduk, A new approach to Atiyah-Hirzebruch theorem; R. W. Hansell, Lebesgue's theorem on Baire class 1 functions; H. H. Hung, Metrization theorems, uniform and non-uniform; I. Juhász and Z. Szentmiklóssy, Spaces with no smaller normal or compact topologies; Z. Károly, Remarks on essential mappings onto surfaces; P. Krason, Some remarks on the category of unstable modules modulo its nilpotents; H.-P. A. Künnzi, Nonsymmetric topology; M. M. Marjanović, Sketch of a morphology based on topological ideas; E. Molnár, Non-geometric good orbitfolds; S. De Neymet and R. Jiménez, $G$-overlays; Sz. Plewik, Hypertopologies can generalize dimensional types; H. Poppe, On locally defined topological notions; H. Render, Topologies on the non-standard model; D. Repovš and P. V. Semenov, On continuous approximations; J. Schröder, $k$-extension-coveredness and $k$-completions; D. Shakhmatov, J. Pelant, and S. Watson, A universal complete metric Abelian group of a given weight; J. Šlapal, An exponential superconstruct of the construct of finitely generated topological spaces; D. Stavrova, Upper bounds for the cardinality of topological spaces with a selected subset; A. Száz, Neighbourhood relations.

Bolyai Society Mathematical Studies, Volume 4

Individual member $41, List $69, Institutional member $55, Order code BSMS/4N.

New Journal

Journal of the Ramanujan Mathematical Society

V. Kumar Murty, University of Toronto, ON, Canada, Kapil Paranjape, Institute of Mathematical Sciences, Madras, India, R. Parimala, Tata Institute of Fundamental Research, Bombay, India, Dipendra Prasad, Mehta Research Institute, Allahabad, India, and V. S. Sunder, Institute of Mathematical Sciences, Madras, India, Editors

In 1997, the Journal of the Ramanujan Mathematical Society takes on a new look. With a freshly constituted Editorial Board containing some of the best young mathematicians from India, the journal is sure to be of significant interest to a wide spectrum of the mathematical public. The journal is dedicated to publishing high-quality original papers in all areas of mathematics. One volume of two numbers is published each year. Backlog will be kept to a minimum so as to ensure timely publication.

Distributed worldwide by the AMS (outside of India). ISSN 0970-1249, 1997 Subscription: All Individuals $25, List $90, Order code 97JRMSN
These textbooks from the AMS have proven to be ideal classroom choices for many mathematics courses. Faculty from several universities have reviewed these selections and have chosen them for their undergraduate and graduate level courses.

**Analysis**
Elliott H. Lieb, *Princeton University, NJ*, and Michael Loss, *Georgia Institute of Technology, Atlanta*


**C*-Algebras by Example**
Kenneth R. Davidson, *University of Waterloo, ON, Canada*

*Fields Institute Monographs, Volume 6, 1996, ISBN 0-8218-0599-1, 309 pages (hardcover), List $59, All AMS members $47.* To order, please specify FIM/6NP

**Groups and Symmetry: A Guide to Discovering Mathematics**
David W. Farmer, *Bucknell University, Lewisburg, PA*

... on the basis of this book it is possible to tailor a good course for high school students to really discover mathematics ... for anyone who is working with high school students in an advanced level the book is really recommended.

---*Zentralblatt für Mathematik*


**An Invitation to Arithmetic Geometry**
Dino Lorenzini, *University of Georgia, Athens*


**Knots and Surfaces: A Guide to Discovering Mathematics**
David W. Farmer, *Bucknell University, Lewisburg, PA*, and Theodore B. Stanford, *University of Nevada, Reno*

The book is perfectly suited to a course for non-science majors in need of fulfilling a math requirement. All the sections have worked well at sparking student interest and convincing them that math is much more interesting than mere number-crunching and graphing.

---*William Bloch, Wheaton College*


**Representations of Finite and Compact Groups**
Barry Simon, *California Institute of Technology, Pasadena*

... contains a very good explanation of representation theory of finite and compact groups and can be recommended to everyone for learning or teaching representation theory ...

---*Zentralblatt für Mathematik*

*Graduate Studies in Mathematics, Volume 10, 1996, ISBN 0-8218-0453-7, 266 pages (hardcover), List $35, All AMS members $27.* To order, please specify GSM/10NP

**Spectral Graph Theory**
Fan R. K. Chung, *University of Pennsylvania, Philadelphia*


**Techniques of Problem Solving**
Steven G. Krantz, *Washington University, St. Louis, MO*


**Vertex Algebras for Beginners**
Victor Kac, *Massachusetts Institute of Technology, Cambridge*

*University Lecture Series, Volume 10, 1997, ISBN 0-8218-0643-2, 141 pages (softcover), List $25, All AMS members $20.* To order, please specify ULECT/10NP

**Also of Interest** ...

**How to Teach Mathematics: a personal perspective**
Steven G. Krantz, *Washington University, St. Louis, MO*


**On Being a Department Head, a Personal View**
John B. Conway, *University of Tennessee, Knoxville*


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INdiana

University of Notre Dame
Department of Mathematics
Notre Dame, IN 46556

The Department of Mathematics of the University of Notre Dame invites applications for several visiting positions to begin in the fall of 1997. These are one-year positions with the possibility for renewal for an additional year. They carry a teaching load of two courses per semester. The department is particularly interested in applicants in fields compatible with its interests: algebra, algebraic geometry, complex analysis, partial differential equations, differential geometry, logic, algebraic topology, and several areas of applied mathematics. Salaries are competitive. The evaluation of candidates will begin on March 1, but late and/or incomplete applications will be considered. To apply, send a curriculum vitae along with a letter of application and a completed AMS Standard Cover Sheet to: Alexander J. Hahn, Chair, at the above address. Please arrange for three letters of recommendation to be sent to the same location. These letters should address the applicant’s research accomplishments and at the same time supply evidence that the applicant has the ability to communicate effectively in the classroom. Notre Dame is an Equal Opportunity Employer. Women and minorities are urged to apply.

New York

Polytechnic University
Department of Applied Mathematics and Physics
Positions in Mathematics

The Department of Applied Mathematics and Physics invites applications for a position of assistant professor of mathematics beginning fall 1997. All areas of specialization will be considered, with preference for partial differential equations, geometric inequalities, and applied mathematics. A record of teaching and research excellence is essential. Additional positions, at the non-tenure-track level, may also be available. All positions are subject to availability of resources and administrative approval. Candidates should send a CV along with at least three letters of recommendation and a standard cover page to:

Hiring Committee
Room 3052
Department of Applied Mathematics and Physics
Polytechnic University
6 MetroTech Center
Brooklyn, NY 11201-2990

Polytechnic University is situated in the heart of MetroTech, a thriving center for technology and finance across the East River from Wall Street. The student body draws from the diverse communities of the Greater New York City region and the world.

Polytechnic is an E/O/AA Employer and encourages applications from women and minorities.

North Carolina

Technical Editor-Print/Online
ISA is a 49,000-member nonprofit educational organization for measurement and control professionals located in Research Triangle Park, NC. ISA is a respected publisher of magazines, books, and consensus standards and a sponsor of technical conferences.

ISA seeks an editor for Motion Control magazine (audience is design engineers in the motion control industry). Strong technical/scientific background plus excellent writing skills are required. Web authoring experience is a plus.

Please send resume with salary history in confidence to: Human Resources, ISA, 67 Alexander Drive, P.O. Box 12277, Research Triangle Park, NC 27709. Fax 919-990-9263; e-mail: staffing@isa.org.

Ohio

Assistant Professor in Mathematics

The Mathematics Department invites applications for a tenure-track position at the assistant professor level starting in September 1997. Candidates must have a Ph.D. in the mathematical sciences or mathematics education (completed by the...
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A.M. Meirmanov • V.V. Pukhnachov • S.I. Shmarev

1997. xiii + 311 pages. Cloth $148.95
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J. R. Quine, Florida State University, Tallahassee, and Peter Sarnak, Princeton University, NJ, Editors

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Singularities and Complex Geometry
Qi-keng Lu, Shantou University, Guangdong, China, Stephen S.-T. Yau and Anatoly Libgober, University of Illinois at Chicago, Editors

This book presents the proceedings of the joint U.S.-China Seminar on Singularity and Complex Geometry held at the Institute of Mathematics of the Chinese Academy, Beijing, in June 1994. This was the first gathering of Chinese and American mathematicians working in these fields (several Japanese mathematicians also took part). The volume covers a wide range of problems in areas such as CR-manifolds, value distribution theory of holomorphic curves, topology of the complements of algebraic plane curves with singularities, and arrangements, topology of isolated singularities, gauge theory on resolutions of simple singularities, and residues of foliations. The articles give accounts of research in these fast developing areas. Much of the material appears here for the first time in print.

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Solitons, Geometry, and Topology: On the Crossroad
V. M. Buchstaber, Moscow State University, Russia, and S. P. Novikov, University of Maryland, College Park, Editors

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American Mathematical Society Translations—Series 2, Volume 179; 1997; 189 pages; Hardcover; ISBN 0-8218-0666-1; List $49; Individual member $39; order code TRANS2/179NA

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Jean-Pierre Otal, Ecole Normale Superieure de Lyon, France

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Membership Categories

Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

For ordinary members whose annual professional income is below $45,000, the dues are $93; for those whose annual professional income is $45,000 or more, the dues are $124.

The CMS cooperative rate applies to ordinary members of the AMS who are also members of the Canadian Mathematical Society and reside outside of the U.S. For members whose annual professional income is $45,000 or less, the dues are $79; for those whose annual professional income is above $45,000, the dues are $105.

For a joint family membership, one member pays ordinary dues, based on his or her income; the other pays ordinary dues based on his or her income, less $20. (Only the member paying full dues will receive the Notices and the Bulletin as a privilege of membership, but both members will be accorded all other privileges of membership.) Minimum dues for contributing members are $186.

For either students or unemployed individuals, dues are $31, and annual verification is required.

The annual dues for reciprocity members who reside outside the U.S. and Canada are $62. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement, and annual verification is required. Reciprocity members who reside in the U.S. or Canada must pay ordinary member dues ($93 or $124). The annual dues for category-S members, those who reside in developing countries, are $16. Members can choose only one privilege journal. Please indicate your choice below.

Members can purchase a multi-year membership by prepaying their current dues rate for either two, three, four or five years. This option is not available to category-S, unemployed, or student members.

1997 Dues Schedule (January through December)

Ordinary member .................................................. $93 $124
CMS Cooperative rate ............................................. $78 $105
Joint family member (full rate) ................................. $93 $124
Joint family member (reduced rate) ......................... $73 $104
Contributing member (minimum $186) ............... $186

Student member (please verify) ............................... $31
Unemployed member (please verify) ......................... $31
Reciprocity member (please verify) ......................... $62 $93 $124
Category-S member .................................................. $16
Multi-year membership ......................... $ for years

1 Student Verification (sign below)
I am a full-time student at ........................................... currently working toward a degree.

2 Unemployed Verification (sign below) I am currently unemployed and actively seeking employment.

3 Reciprocity Membership Verification (sign below) I am currently a member of the society indicated on the right and am therefore eligible for reciprocity membership.

Signature

☐ send NOTICES ☐ send BULLETIN

Reciprocating Societies

☐ Allahabad Mathematical Society
☐ Asociacion Matematica Espanola
☐ Australian Mathematical Society
☐ Azerbaijan Mathematical Society
☐ Berliner Mathematische Gesellschaft e.V.
☐ Calcutta Mathematical Society
☐ Croatian Mathematical Society
☐ Cyprus Mathematical Society
☐ Dansk Mathematisk Forening
☐ Deutsche Mathematiker-Vereinigung e.V.
☐ Edinburgh Mathematical Society
☐ Egyptian Mathematical Society
☐ Gesellschaft für Angewandte Mathematik und Mechanik
☐ Glasgow Mathematical Association
☐ Hellenic Mathematical Society
☐ Indian Mathematical Society
☐ Iranian Mathematical Society
☐ Irish Mathematical Society
☐ Istanbuls Staatliches Stiftung
☐ Israel Mathematical Union
☐ Janos Bolyai Mathematical Society
☐ Korean Mathematical Society
☐ London Mathematical Society
☐ Malaysian Mathematical Society
☐ Mathematical Society of Japan
☐ Mathematical Society of the Philippines
☐ Mathematical Society of the Republic of China
☐ Mongolian Mathematical Society
☐ Nepal Mathematical Society
☐ New Zealand Mathematical Society
☐ Nigerian Mathematical Society
☐ Norsk Matematisk Forening
☐ Österreichische Mathematische Gesellschaft
☐ Palestine Society for Mathematical Sciences
☐ Polskie Towarzystwo Matematyczne
☐ Punjab Mathematical Society
☐ Romanian Mathematical Society
☐ Real Sociedad Matematica Espanola
☐ Saudi Association for Mathematical Sciences
☐ Sociedad Colombiana de Matematica
☐ Sociedad de Matematica de Chile
☐ Sociedad Matematica de la Republica Dominicana
☐ Sociedad Matematica Mexicana
☐ Sociedade Brasileira de Matematica
☐ Societe de Mathematiques et Industrielles
☐ Societe Mathematique de Belgique
☐ Societe Mathematique de France
☐ Societe Mathematique Suisse
☐ Society of Astronomers of the Philippines
☐ South African Mathematical Society
☐ Southeast Asian Mathematical Society
☐ Suomen Matemaattinen Yhdistys
☐ Svenska Matematikersamfundet
☐ Union Mathematika, Argentina
☐ Union of Bulgarian Mathematicians
☐ Union of Czech Mathematicians and Physicists
☐ Union of Slovak Mathematicians and Physicists
☐ Unione Matematica Italiana
☐ Vijnana Parishad of India
☐ Wiskundig Genootschap
Members of the Society who move or change positions are urged to notify the Providence Office as soon as possible. Journal mailing lists must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

Besides mailing addresses for members, the Society's records contain information about members' positions and their employers (for publication in the Combined Membership List). In addition, the AMS maintains records of members' honors, awards, and information on Society service.

When changing their addresses, members are urged to cooperate by supplying the requested information. The Society's records are of value only to the extent that they are current and accurate.

If your address has changed or will change within the next two or three months, please fill out this form, supply any other information appropriate for the AMS records, and mail it to:

Customer Services
AMS
P.O. Box 6248
Providence, RI 02940

or send the information on the form by e-mail to:

amsmem@math.ams.org or
cust-serv@math.ams.org

Name __________________________

Customer code __________________

Change effective as of ____________

Old mailing address

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New mailing address

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New position _____________________

If mailing address is not that of your employer, please supply the following informations:

New employer _____________________

Location of employer (city, state, zip code, country)

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Telephone number _________________

e-mail __________________________

Recent honors and awards

________________________________

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Membership and Customer Services
AMERICAN MATHEMATICAL SOCIETY
P. O. Box 6248
Providence, RI 02940-9943
Techniques of Problem Solving

Steven G. Krantz, Washington University, St. Louis, MO

The purpose of this book is to teach the basic principles of problem solving, including both mathematical and non-mathematical problems. This book will help students to...

- translate verbal discussions into analytical data.
- learn problem-solving methods for attacking collections of analytical questions or data.
- build a personal arsenal of problem-solving techniques and solutions.
- become "armed problem solvers", ready to do battle with a variety of puzzles in different areas of life.

1996; 465 pages; Softcover; ISBN 0-8218-0619-X; List $29; All AMS members $23; Order code TP5NA

What’s Happening in the Mathematical Sciences, 1995–1996

Barry Cipra

... stylish format ... largely accessible to laymen ... This publication is one of the snappier examples of a growing genre from scientific societies seeking to increase public understanding of their work and its societal value.

—Science & Government Report

Beautifully produced and marvelously written, What’s Happening in the Mathematical Sciences, 1995–1996 contains 10 articles on recent developments in the field. In an engaging, reader-friendly style, Barry Cipra explores topics ranging from Fermat’s Last Theorem to Computational Fluid Dynamics. The volumes in this series highlight the many roles mathematics plays in the modern world.

This volume includes articles on:
- a new mathematical method that’s taking Wall Street by storm
- “Ultra-parallel” supercomputing with DNA
- how a mathematician found the famous flaw in the Pentium chip.

Unique in kind, and lively in style, What’s Happening in the Mathematical Sciences, 1995–1996 is a delight to read and a valuable source of information.

What's Happening in the Mathematical Sciences, Volume 3; 1996; 111 pages; Softcover; ISBN 0-8218-0385-7; List $12; Order code HAPPENING/3NA

The Way I Remember It

Walter Rudin, University of Wisconsin, Madison

Walter Rudin’s memoirs should prove to be a delightful read specifically to mathematicians, but also to historians who are interested in learning about his colorful history and ancestry. As those who are familiar with Rudin’s writing will recognize, he brings to this book the same care, depth, and originality that is the hallmark of his work.

Co-published with the London Mathematical Society. Members of the LMS may order directly from the AMS at the LMS member price. The LMS is registered with the Charity Commissioners.

History of Mathematics, Volume 12; 1996; 191 pages; Hardcover; ISBN 0-8218-0633-5; List $29; All AMS members $23; Order code HMATH/12NA

Groups and Symmetry: A Guide to Discovering Mathematics

David W. Farmer, Bucknell University, Lewisburg, PA

Knots and Surfaces: A Guide to Discovering Mathematics

David W. Farmer, Bucknell University, Lewisburg, PA, and Theodore B. Stanford, University of Nevada, Reno

The book is perfectly suited to a course for non-science majors in need of fulfilling a math requirement. All the sections have worked well and sparking student interest and convincing them that math is much more interesting than mere number-crunching and graphing.

—William Bloch, Wheaton College

In most mathematics textbooks, the most exciting part of mathematics—the process of invention and discovery—is completely hidden from the reader. The aim of Groups and Symmetry and Knots and Surfaces is to change all that. By means of a series of carefully selected tasks, these books lead readers to discover some real mathematics. There are no formulas to memorize; no procedures to follow. The books are guides: their job is to start you in the right direction and to bring you back if you stray too far. Discovery is left to you.

Mathematical World, Volume 5 (Farmer); 1996; 102 pages; Softcover; ISBN 0-8218-0450-2; List $19; All AMS members $16; Order code MAWRDL/5NA

Mathematical World, Volume 6 (Stanford); 1996; 101 pages; Softcover; ISBN 0-8218-0451-4; List $19; All AMS members $15; Order code MAWRDL/6NA

How to Teach Mathematics: a personal perspective

Steven G. Krantz, Mathematical Sciences Research Institute, Berkeley, CA

... an original contribution to the educational literature on teaching mathematics at the post-secondary level. The book itself is an explicit proof of the author’s claim "teaching can be rewarding, useful, and fun."

—Zentralblatt für Mathematik

This unique book presents simple mathematical models of various aspects of sports, with applications to sports training and competitions. Requiring only a background in precalculus, it would be suitable for a textbook for courses in mathematical modeling and operations research at the high school or college level. Coaches and those who participate in sports will find it interesting as well. The lively writing style and wide range of topics make this book especially appealing.

Mathematical World, Volume 3; 1994; 152 pages; Softcover; ISBN 0-8218-9500-1; List $19; All AMS members $16; Order code MAWRDL/3NA

Mathematics and Sports

L. E. Sadovskii and A. L. Sadovskii

... a nice survey of applications of mathematics in sporting events.

—Mathematical Reviews

Treatment is concise and insightful.

—Zentralblatt für Mathematik

AMS 1996; 16 pages; Softcover; ISBN 0-8218-0197-X; List $29; All AMS members $23; Order code TP5NA

All prices subject to change. Charges for delivery are $3.00 per order. For air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from: American Mathematical Society, P. O. Box 598, Providence, RI 02940-0598. For credit card orders, fax (401) 384-2020 or call toll free 800-321-4AMS (4267) in the U.S. and Canada, (401) 455-4000 worldwide. Or place your order through the AMS bookstore at http://www.ams.org/bookstore/. Residents of Canada, please include 7% GST.
Meetings & Conferences of the AMS

College Park, Maryland

University of Maryland, College Park
April 12-13, 1997

Meeting #920
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: February 1997
Program issue of Notices: April 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Registration and Meeting Information
Registration will take place in the rotunda on the main level of the Mathematics Building from 8:00 a.m. to noon and from 1:00 p.m. to 4:00 p.m. on Saturday, April 12, and from 8:00 a.m. to noon on Sunday, April 13. Registration fees (payable on site only): $30/AMS members; $45/nonmembers; and $10/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express. Sessions also take place in the Mathematics Building; invited lectures will be held in the Physics Building.
Corvallis, Oregon
Oregon State University
April 19–20, 1997

Meeting #921
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: February 1997
Program issue of Notices: April 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Registration and Meeting Information
Registration will take place in Room 108 of the Math Learning Center located in Kidder Hall from 7:30 a.m. to noon and from 1:00 p.m. to 5:00 p.m. on Saturday, April 19, and from 8:00 a.m. to noon on Sunday, April 20. Registration fees (payable on site only): $30/AMS members; $45/nonmembers; and $10/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express. Lectures will take place in Gilfillan Auditorium and the Social Sciences Building.

Detroit, Michigan
Wayne State University
May 2–4, 1997

Meeting #922
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: March 1997
Program issue of Notices: May 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses
Harold P. Boas, Texas A&M University, The football player and the infinite series.
Carlos E. Kenig, University of Chicago, Harmonic measure of locally flat domains.
Ernest E. Shult, Kansas State University, Geometric hyperplanes of classical geometries of Lie type.
Alexander L. Volberg, Michigan State University, Singular integrals and multivariate stochastic processes: New problems and methods.

Special Sessions
Algebraic Combinatorics, Devadatta M. Kulkarni, Oakland University.
Algebraic Topology, Robert R. Bruner and David Handel, Wayne State University.
Analysis and Geometry, Carlos E. Kenig, University of Chicago, and Tatiana Toro, University of Washington.
C*-Algebras, Jerry Kaminker, Indiana University-Purdue University at Indianapolis, and Claude L. Schochet, Wayne State University.
Groups and Geometries, Daniel E. Frohardt and Kay Magaard, Wayne State University, and Robert L. Griess Jr., University of Michigan.
Optimization and Variational Analysis, Boris S. Mordukhovich, Wayne State University, and Jay S. Treiman and Qiji Zhu, Western Michigan University.
Partial Differential Equations: Theories, Applications and Numerical Approaches, Frank J. Massey III and Jennifer Zhao, University of Michigan-Dearborn, and Daoqi Yang, Wayne State University.
Recent Advances in Noncommutative Ring Theory, Peter Malcolmson and Frank Okoh, Wayne State University.
Representation Theory of Finite Groups and Related Topics, David Howard Gluck, Wayne State University.

Stochastic Processes in Finance and Control, Raoul LePage, Michigan State University, and Bert M. Schreiber, Wayne State University.

VOA's Monstrous Moonshine and Related Topics, Chongying Dong, University of California, Santa Cruz, and Robert L. Griess Jr., University of Michigan.

Wavelets and Applications, Gregory F. Bachelis and Tsche-Chien Sun, Wayne State University, and Grant Gerhart, Tardec, Tacoma, U.S. Army.

Pretoria, Republic of South Africa
University of Pretoria
June 26-28, 1997

Meeting #923

Associate secretary: Susan J. Friedlander
Announcement issue of Notices: March 1997
Program issue of Notices: June/July 1997
Issue of Abstracts: None

Special Sessions

Algebraic K-Theory, Eric M. Friedlander, Northwestern University, eric@math.nwu.edu; and Aderemi O. Kuku, ICTP, Trieste, Italy, kuku@ictp.trieste.it.

Commutative Algebra and Algebraic Geometry, James W. Brewer, Florida Atlantic University, jim@kafka.ac. fau.edu; Barry Green, University of Stellenbosch, South Africa; and Sylvia Margaret Wiegand, University of Nebraska, Lincoln, sweigand@unlinfo.unl.edu.

Dynamical Systems and Ergodic Theory, Harvey B. Keynes, University of Minnesota, keynes@math.umn.edu; Michael Sears, University of Witwatersrand, South Africa, 036mis@cosmos.wits.ac.za; and Lionel Slammert, University of Western Cape, South Africa, lslammert@math.uwc.ac.za.

Finite Groups and Representation Theory, Jamshid Moori, University of Natal, South Africa, moori@math.unp.ac.za; and Kenechukwu Kenneth Nwabueze, Mathematical Sciences Research Institute, nwabueze@mrsi.org.

Fluid Dynamics, Susan J. Friedlander, University of Illinois at Chicago, susan@math.nwu.edu; Andrew Gilbert, University of Exeter, United Kingdom, adg@maths.exeter.ac.uk; and David Mason, University of Witwatersrand, South Africa, dpmason@gauss.cam.wits.ac.za.

Geometry, Topology and Physics, Steven B. Bradlow, University of Illinois-Urbana, bradlow@uiuc.edu; George Ellis, University of Cape Town, South Africa, ellis@maths.uct.ac.za; Nigel J. Hitchin, University of Cambridge, England, n.hitchin@pmms.cam.ac.za; and Joao Rodrigues, University of Witwatersrand, South Africa, joao@physnet.phys.wits.ac.za.

Invariant Subspaces and Collections of Operators, Peter Rosenthal, University of Toronto, rosent@math.toronto.edu; and Graeme Philip West, University of Witwatersrand, South Africa, 036weg@cosmos.wits.ac.za.

Logic, Algebra, and Formal Aspects of Computer Science, Valentin Goranko, Rand Afrikaans University, Johannesburg, South Africa; Peter Jipsen, University of Cape Town, South Africa, pjipsen@maths.uct.ac.za; Ralph McKenzie, Vanderbilt University, mckenzie@math.vanderbilt.edu; and James Raftery, University of Natal, South Africa, raftery@ph.und.ac.za.

Non-commutative Algebra, Carlton J. Maxson, Texas A & M University, cjmaxson@math.tamu.edu; and Leon Van Wyk, University of Stellenbosch, South Africa, lvw@maties.sun.ac.za.

Number Theory, Arnold Knopfmacher, University of Witwatersrand, South Africa, arnoldk#gauss.cam.wits.ac.za; and Peter Sarnak, Princeton University, sarnak@math.princeton.edu. (See http://sunsite.wits.ac.za/nt/)

Numerical Analysis and Approximation Theory, Peter Graves-Morris, Bradford University, United Kingdom, p.r.graves-morris@bradford.ac.uk; Dirk P. Laurie, Potchefstroom University, South Africa, dirk@calvyn.puk.ac.za; Doron S. Lubinsky, University of Witwatersrand, South Africa, 036ds1@cosmos.wits.ac.za; and

Invited Addresses

Hyman Bass, Columbia University, Title to be announced.

Armand Borel, Institute for Advanced Study, Title to be announced.

Percy Deft, Courant Institute of Mathematical Sciences, New York University, Title to be announced.

G. F. R. Ellis, University of Cape Town, South Africa, Title to be announced.

David Epstein, University of Warwick, United Kingdom, Title to be announced.

W. Goddard, University of Natal, Durban, South Africa, Generalised colorings of graphs.

Doron Lubinsky, University of Witwatersrand, South Africa, A nonrandom walk from continued fractions to orthogonal polynomials.

Robert Mackay, University of Cambridge, United Kingdom, Title to be announced.

Peter Sarnak, Princeton University, Title to be announced.
Andre Weideman, Oregon State University, weideman@math.orst.edu.

**Operator Spaces and Related Structures**
David P. Blecher, University of Houston, dblecher@math.uh.edu; Allan M. Sinclair, University of Edinburgh, United Kingdom, allan@maths.ed.ac.uk; and Johan Swart, University of Pretoria, South Africa, jswart@scientia.up.ac.za.

**Operator Theory and Its Applications**
Joseph A. Ball, Virginia Polytechnic Institute & State University, ball@math.vt.edu; Ronald W. Cross, University of Cape Town, South Africa, cross@maths.uct.ac.za; Gilbert J. Groenewald, University of the Western Cape, South Africa; and Marinus A. Kaashoek, Vrije University, Amsterdam, Netherlands, kaash@cs.vu.nl.

**Partial Differential Equations**
Percy Alec Deift, deift@cims.nyu.edu; and Jalal Shatah, Courant Institute, New York University, shatah@cims.nyu.edu.

**Ramsey Theory and Set Theory**
William Fouche, University of Pretoria, South Africa, wlfouche@scientia.up.ac.za; Pieter Maritz, University of Stellenbosch, South Africa, pm@maths.sun.ac.za; and Marion Scheepers, Boise State University, marion@cantor.idbsu.edu.

**Secondary and Postsecondary Curriculum Reform**
Johann Engelbrecht, University of Pretoria, South Africa, jengelbr@scientia.up.ac.za; Deborah Hughes Hallet, Harvard University, dbh@math.harvard.edu; and Harvey B. Keynes, University of Minnesota, keynes@math.umn.edu.

For contributed papers contact joint@math.up.ac.za.

**Accommodations**
Accommodation and transportation arrangements have been made with a number of hotels in Pretoria. Information will be sent to people who indicate that they are interested (joint@math.up.ac.za). Transportation between the hotels and the campus as well as transportation between the airport and the hotels will be arranged. Arrangements have been made with the following hotels for special conference rates. The current exchange rate is US$1.00 = R4.70. Participants should make their own arrangements directly with the hotel of their choice. Reservations must be made before May 23 to qualify for the special rates.

**Holiday Inn Crown Plaza**, 794 Beatrix Street, P.O. Box 40694, Arcadia, 0007 Pretoria (tel: 27 12 3411571; fax: 27 12 447534); R300.00 single and R175.00 double. Contact Kaylene Collier and indicate reference number 665/30.

**Hotel 224**, Schoenman Street, P.O. Box 55405, Arcadia, 0007 Pretoria (tel: 27 12 445281; fax: 27 12 443603); R150.00 single (includes English breakfast) and R95.00 double (includes English breakfast). Contact Annemari Lourens.

**Health**
Individuals should check with their own physician or hospital travel clinic for recommendations regarding any vaccines or inoculations that may be required.

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**Local Information**
Detailed tourist information is available from the South Africa Tourism Board, 500 Fifth Avenue, New York, NY 10110-0002 (212-730-2929).

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**Montreal, Quebec, Canada**
**University of Montreal**
**September 26-28, 1997**

**Meeting #924**

**Eastern Section**
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

**Deadlines**
For organizers: Expired
For consideration of contributed papers in Special Sessions: May 1, 1997
For abstracts: June 26, 1997

**Invited Addresses**
Jacob E. Goodman, City University of New York, City College, *Title to be announced.*
Dieter Kotschick, University of Basel, *Title to be announced.*
Francois Lalonde, University of Quebec at Montreal, *Title to be announced.*
I. Moerdijk, University of Utrecht, Netherlands, *Title to be announced.*

**Special Sessions**

**Algebraic Methods in Statistics** (Code: AMS SS H1), Gerard G. Letac, Université Paul Sabatier, France.

**Category Theory and Its Applications** (Code: AMS SS E1), Michael Barr, McGill University, Ieke Moerdijk, University of Utrecht, Netherlands, and Myles Tierney, Rutgers University.

**Combinatorial Geometry** (Code: AMS SS C1), David Avis, McGill University, Jacob E. Goodman, City University of New York, City College, and Richard Pollack, Courant Institute, New York University.

**Commutative Algebra** (Code: AMS SS D1), Irena V. Peeva, Massachusetts Institute of Technology, and Hema Srinivasan, University of Missouri.

**Geometric Analysis and Spectral Theory** (Code: AMS SS I1), John Andrew Toth, McGill University.

**History of Mathematics** (Code: AMS SS J1), Israel Kleiner, York University, and James J. Tattersall, Providence College.
Meetings & Conferences

Invariant Theory (Code: AMS SS G1), Abraham Broer, University of Montreal, Yannis Y. Papageorgiou, C.R.M., University of Montreal, and David L. Wehlau, Royal Military College and Queen's University.

Number Theory and Arithmetic Geometry (Code: AMS SS F1), Henri Rene Darmon and Adrian Iovita, McGill University and CICMA, and Chantal David, Concordia University and CICMA.

Potential Theory (Code: AMS SS A1), Kohur Gowri Sankaran, McGill University, and David H. Singman, George Mason University.

Symplectic Geometry and Differential Topology (Code: AMS SS B1), Jacques C. Hurtubise and Lisa Claire Jeffrey, McGill University, and Francois Lalonde, University of Quebec at Montreal.

Claremont, California

Claremont Colleges

October 4, 1997

Meeting #925

Joint meeting with the Mathematical Association of America.

Western Section

Associate secretary: William A. Harris Jr.

Announcement issue of Notices: August 1997

Program issue of Notices: October 1997

Issue of Abstracts: To be announced

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: May 2, 1997

For abstracts: June 27, 1997

Atlanta, Georgia

Georgia Institute of Technology

October 10-12, 1997

Meeting #926

Southeastern Section

Associate secretary: Robert J. Daverman

Announcement issue of Notices: August 1997

Program issue of Notices: October 1997

Issue of Abstracts: To be announced

Invited Addresses

Irene Fonseca, Carnegie-Mellon University, Title to be announced.

Michael T. Lacey, Georgia Institute of Technology, Title to be announced.

Marek T. Rychlik, University of Arizona, Title to be announced.

J. Ernest Wilkins Jr., Clark Atlanta University, Title to be announced.

Special Sessions

Applications of Symbolic Computation to Differential Equations (Code: AMS SS N1), James Herod, Georgia Tech, and Maria Clara Nucci, University of Perugia, Italy.

Complex and Algebraic Dynamics and Applications (Code: AMS SS K1), Marek R. Rychlik, University of Arizona.

Computer Proofs in Set Theory and Logic (Code: AMS SS E1), Johan G. F. Belinfante, Georgia Institute of Technology.

Concrete Aspects of Real Polynomials (Code: AMS SS H1), Victoria Ann Powers, Emory University, and Bruce A. Reznick, University of Illinois, Champaign-Urbana.

Discrete Conformal Geometry (Code: AMS SS G1), Philip Lee Bowers, Florida State University.

Discrete and Combinatorial Geometry (Code: AMS SS L1), András Bezdek and Wlodzimierz Kuperberg, Auburn University.

Harmonic Analysis and Its Applications (Code: AMS SS D1), Michael Lacey, Georgia Institute of Technology.

Modern Banach Space Theory (Code: AMS SS C1), Stephen Dilworth and Maria K. Girardi, University of South Carolina.

Nonlinear Dynamics and Applications (Code: AMS SS I1), Wenxian Shen, Auburn University, and Yingfei Yi, Georgia Institute of Technology.

Recent Developments in PDEs, Calculus of Variations, and Applications to Problems in Materials Science (Code: AMS SS M1), Irene Fonseca, Carnegie Mellon University, Daniel Phillips, Purdue University, and Vladimir Sverak, University of Minnesota.

Second-Generation Wavelets (Code: AMS SS J1), Christopher E. Heil and Yang Wang, Georgia Institute of Technology.

Set-Theoretic Techniques in Topology and Analysis (Code: AMS SS A1), Gary F. Gruenhage and Piotr Koszmider, Auburn University.

Stochastic Inequalities and Their Applications (Code: AMS SS F1), Theodore P. Hill and Christian Houdré, Georgia Institute of Technology.

Milwaukee, Wisconsin
University of Wisconsin
October 24–26, 1997

Meeting #927
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: May 21, 1997
For abstracts: July 16, 1997

Invited Addresses
Spencer J. Bloch, University of Chicago, Title to be announced.
Henri Moscovici, Ohio State University, Title to be announced.
Wei Ming Ni, University of Minnesota, Title to be announced.
Andrei Suslin, Northwestern University, Title to be announced.

Special Sessions
Analysis with Wavelets (Code: AMS SS M1), Gilbert G. Walter, University of Wisconsin-Milwaukee, and Ahmed I. Zayed, University of Central Florida.
Applications of Model Theory to Analysis and Topology (Code: AMS SS Q1), Paul J. Bankston, Marquette University, and H. Jerome Keisler, University of Wisconsin.
Computability Theory (Code: AMS SS A1), Steffen Lempp, University of Wisconsin-Madison, and Robert I. Soare, University of Chicago.
Concentration Phenomena in Differential Equations (Code: AMS SS E1), Lia Bronsard, McMaster University, and Wei-Ming Ni, University of Minnesota.
Differential Geometry (Code: AMS SS N1), Hongyou Wu, Northern Illinois University.
Eigenvalue Problems for Differential Equations (Code: AMS SS K1), Paul A. Binding, University of Calgary, and Hans W. Volkmer, University of Wisconsin-Milwaukee.
Enveloping Algebras and Quantum Groups (Code: AMS SS J1), Ian M. Musson and Yi Ming Zou, University of Wisconsin-Milwaukee.
Geometric Topology and Geometric Group Theory (Code: AMS SS H1), Fredric Davis Ancel and Craig R. Guilbault, University of Wisconsin-Milwaukee.
Harmonic Analysis and Its Applications (Code: AMS SS F1), Lung-Kee Chen, Oregon State University, Dashan Fan, University of Wisconsin-Milwaukee, and Yi-Biao Pan, University of Pittsburgh.
Low Dimensional Dynamics (Code: AMS SS C1), Karen M. Brucks, University of Wisconsin-Milwaukee, and Beverly E. J. Diamond, University of Charleston.
Number Theory and Cryptography (Code: AMS SS D1), Eric Bach and Rene Peralta, University of Wisconsin-Milwaukee.
Operator Theory and Function Spaces (Code: AMS SS G1), Zeljko Cuckovic, University of Toledo.
Rings and Modules (Code: AMS SS I1), Karl Andrew Kosler and Shubhangi S. Stalder, University of Wisconsin Centers-Waukesha.
Semigroups and Their Applications (Code: AMS SS P1), Karl E. Byleen and Peter R. Jones, Marquette University.
Symplectic Topology and Quantum Cohomology (Code: AMS SS L1), Yong-Geun Oh, University of Wisconsin, and Yongbin Ruan, University of Utah.

Albuquerque, New Mexico
University of New Mexico
November 8–9, 1997

Meeting #928
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: September 1997
Program issue of Notices: November 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: June 12, 1997
For abstracts: August 7, 1997

Oaxaca, Mexico
Oaxaca, Mexico
December 4–7, 1997

Meeting #929
Third Joint Meeting of the American Mathematical Society and the Sociedad Mathematica Mexicana.
Associate secretary: Lesley M. Sibner
Meetings & Conferences

Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Baltimore, Maryland
Baltimore Convention Center
January 7–10, 1998

Meeting #930
Joint Mathematics Meetings, including the 104th Annual Meeting of the AMS, 81st Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).

Invited Addresses
Edward Witten, Institute for Advanced Study (AMS Josiah Willard Gibbs Lecture).

Louisville, Kentucky
University of Louisville
March 20–21, 1998

Meeting #931
Southeastern Section
Associate secretary: Robert J. Daverman

Invited Addresses
Richard M. Davitt, University of Louisville.

Manhattan, Kansas
Kansas State University
March 27–28, 1998

Meeting #932
Central Section
Associate secretary: Susan J. Friedlander

For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions
Banach Space Theory (Code: AMS SS F1), Patrick N. Dowling and Beata Randrianantoanina, Miami University, Ohio.
Boundary Value Problems for Differential Equations (Code: AMS SS J1), Paul W. Eloe, University of Dayton.
Combinatorics and Enumerative Geometry (Code: AMS SS A1), Kequan Ding, University of Illinois, Urbana-Champaign, and Chi Wang, University of Louisville.
Combinatorics and Graph Theory (Code: AMS SS B1), Andre E. Kezdy, Grzegorz Kubicki, and Jenoe Lehel, University of Louisville.
Discrete Mathematics, Classification Theory and Consensus (Code: AMS SS C1), Robert C. Powers, University of Louisville.
Fractal Geometry and Related Topics (Code: AMS SS D1), Ka-Sing Lau, University of Pittsburgh, and Weibin Zeng, University of Louisville.
Functional Equations and Inequalities (Code: AMS SS E1), Thomas Riedel and Prasanna Sahoo, University of Louisville.
Real Analysis (Code: AMS SS G1), Udayan B. Darji and Lee Larson, University of Louisville.
Semigroups, Algorithms, and Universal Algebra (Code: AMS SS H1), Ralph N. McKenzie, Vanderbilt University, and Steven Seif, University of Louisville.
Spectral Geometry (Code: AMS SS K1), Ruth Gornet, Texas Tech University, and Peter Anton Perry, University of Kentucky.
Spectral Theory, Mathematical Physics and Disordered Media (Code: AMS SS L1), Peter David Hislop, University of Kentucky, and Gunter H. Stolz, University of Alabama at Birmingham.
The Use of the History of Mathematics and Science in the University and School Classroom (Code: AMS SS M1), Richard M. Davitt, University of Louisville.
Deadlines
For organizers: June 26, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions

Philadelphia, Pennsylvania
Temple University
April 4-6, 1998

Meeting #933
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: July 2, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Tobias H. Colding, Courant Institute-New York University.
Martin Davis, University of California, Berkeley.
Ezra Getzler, Max Planck Institute and Northwestern University.
Yanyan Li, Rutgers University, New Brunswick.

Special Sessions
Harmonic Analysis and Its Applications to PDEs (Code: AMS SS G1), Cristian E. Gutiérrez, Temple University, and Guozhen Lu, Wright State University.
Heat Kernel Analysis on Lie Groups (Code: AMS SS H1), Leonard Gross, Cornell University, and Omar Hijab, Temple University.
Mathematical Pedagogy (Code: AMS SS I1), Orin N. Chein, Temple University.
Modular Identities and Q-Series in Number Theory (Code: AMS SS A1), Boris Datskovsky and Marvin I. Knopp, Temple University.

Davis, California
University of California
April 25–26, 1998

Meeting #934
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: July 24, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Chicago, Illinois
DePaul University-Chicago
September 12–13, 1998
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
Meetings & Conferences

Tucson, Arizona
University of Arizona-Tucson
November 14–15, 1998
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

San Antonio, Texas
San Antonio Convention Center
January 13–16, 1999
Joint Mathematics Meetings, including the 105th Annual Meeting of the AMS, 82nd Meeting of the Mathematical Association of America (MAA), and annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: October 1998
Program issue of Notices: January 1999
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Las Vegas, Nevada
University of Nevada-Las Vegas
April 10–11, 1999
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Washington, District of Columbia
Sheraton Washington Hotel and Omni Shoreham Hotel
January 19–22, 2000
Joint Mathematics Meetings, including the 106th Annual Meeting of the AMS, 83rd Meeting of the Mathematical Association of America (MAA), and annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
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

New Orleans, Louisiana
New Orleans Marriott and ITT Sheraton New Orleans Hotel
January 10–13, 2001
Joint Mathematics Meetings, including the 107th Annual Meeting of the AMS, 84th Meeting of the Mathematical Association of America (MAA), and annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
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
Presenters of Papers

Ams Invited Lecturer, *Special Session Speaker, *Graduate Student

College Park, Maryland; April 12-13, 1997

**Presenters of Papers**

**Numbers following the name indicate the speaker's position on the program.**

*AMS Invited Lecturer, *Special Session Speaker, *Graduate Student

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Program of the Sessions

College Park, Maryland, April 12–13, 1997

Saturday, April 12

Registration

7:30 AM – 4:00 PM
Rotunda, Mathematics Building

Special Session on Lie Groups and Automorphic Forms, I

8:00 AM – 10:50 AM
Room 0407, Mathematics Building

Organizers: Jian-shu Li, University of Maryland
Gordan Savin, University of Utah

8:00 AM
One K type representations. Preliminary report.
Dan M. Barbasch, Cornell University (920-22-175)

8:30 AM
Character sheaves and minimal representations over finite fields.
Karl E. Rumshihart, Stanford University (920-22-156)

9:00 AM
Periods of residual representations.
Dihua Jiang, Yale University (920-22-170)

9:30 AM
An integral transform and ladder representations of \(U(p,q)\). Preliminary report.
John D. Lorch, Wakefield University (920-22-104)

10:00 AM
Hecke algebras of symplectic groups over \(p\)-adic fields.
Julee Kim, Yale University (920-22-34)

10:30 AM
An exceptional dual pair correspondence.
Gordan Savin, University of Utah (920-22-30)

Special Session on Groupoids and their Applications, I

8:00 AM – 10:50 AM
Room 0106, Mathematics Building

Organizer: Alan T. Paterson, University of Mississippi

8:00 AM
The Brauer group of a locally compact groupoid.
Alexander Kumjian, University of Nevada, Paul S. Muhly, University of Iowa, Jean N. Renault, and Dana P. Williams*, Dartmouth College (920-46-95)

8:30 AM
Crossed products of graph \(C^*\)-algebras. Preliminary report.
David A. Pask*, The University of Newcastle, Australia, and Alex Kumjian, University of Nevada (920-46-19)

9:00 AM
Entropy estimates for some \(C^*\)-endomorphisms. Preliminary report.
Valentin Deaconu, University of Nevada (920-46-91)

9:30 AM
Duality for groupoids, I. Preliminary report.
Karla J. Oty*, SE Okla State Univ, and Arlan B. Ramsay, University of Colorado (920-22-82)

10:00 AM
Duality for groupoids, II. Preliminary report.
Arlan B. Ramsay*, Univ of Colorado, and Karla J. Oty, SE Okla St University (920-22-83)

10:30 AM
Automorphisms of Fredholm modules over transformation group \(C^*\)-algebras. Preliminary report.
Efton Park, Texas Christian University (920-46-22)

Special Session on Knot Theory and 3-Manifolds, I

8:00 AM – 10:50 AM
Room B0421, Mathematics Building

Organizers: Jozef H. Przytycki, George Washington University
Yongwu Rong, George Washington University

8:00 AM
The Conway polynomial, K-theory, and variations of the Pasc move. Preliminary report.
Fred Hickling, University of Central Arkansas (920-57-15)

8:30 AM
Finite index subgroups and knots.
Daniel S. Silver* and Susan G. Williams, University of South Alabama (920-57-224)

9:00 AM
Lattices and skein modules.
Charles D. Frohman*, Doug Bullock and Joanna Kania-Bartoszynska (920-57-132)

9:30 AM
Brauer representation and random walks on string links.
Xiao-Song Lin*, University of California, Riverside, Feng Tian, University of California, San Diego, and Zhongshan Wang, Indiana University (920-57-251)

The time limit for each contributed paper in the sessions is ten minutes. In the Special Sessions the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Papers flagged with a solid triangle (●) have been designated by the author as being of possible interest to undergraduate students.

Abstracts of papers presented in the sessions at this meeting will be found in Volume 18, Issue 2 of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings. The middle two digits, e.g., 897-20-1136, refer to the Mathematical Review subject classification assigned by the individual author. Groups of papers for each subject are listed chronologically in the Abstracts. The last one to four digits, e.g., 897-20-1136, refer to the receipt number of the abstract; abstracts are further sorted by the receipt number within each classification.
**Special Session on Numerical Solution of Differential Equations, I**

8:30 AM - 10:50 AM  Room 80425, Mathematics Building

Organizers: Ricardo H. Nochetto, University of Maryland
John E. Osborn, University of Maryland

- **8:30 AM**  
  
  Adaptive finite elements in 3D and the binary black hole initial data problem.
  
  **(19)**
  
  Douglas N. Arnold, Penn State (920-65-166)

- **9:00 AM**  
  
  Naive a posteriori estimates for nonlinear parabolic equations.
  
  **(20)**
  
  Bernardo Cockburn (920-65-254)

- **9:30 AM**  
  
  Preconditioning for the steady-state Navier-Stokes equations with low viscosity.
  
  **(21)**
  
  Howard C. Elman, University of Maryland (920-65-66)

- **10:00 AM**  
  
  Estimating the error of numerical solutions of nonlinear reaction-diffusion equations.
  
  **(22)**
  
  Donald J. Estep, Georgia Institute of Technology (920-65-191)

- **10:30 AM**  
  
  Preconditioning mixed and least squares finite element methods.
  
  **(23)**
  
  Douglas N. Arnold, Penn State University, Richard S. Falk*, Rutgers University, and Ragnar Winther, University of Oslo, Norway (920-65-195)

**Special Session on Harmonic Analysis and Applications, I**

8:30 AM - 10:50 AM  Room 8030, Mathematics Building

Organizers: Stephen D. Casey, American University
David F. Walnut, George Mason University

- **8:30 AM**  
  
  Solution of boundary value problems via sampling theory.
  
  **(24)**
  
  P. A. McCoy, U.S. Naval Academy (920-42-56)

- **9:00 AM**  
  
  Pseudodifferential operators with homogeneous symbols.
  
  **(25)**
  
  Loukas Grafakos, University of Missouri, and Rodolfo H. Torres*, University of Kansas (920-42-46)

- **9:30 AM**  
  
  Spectral criteria, SLLNS and a.s. convergence of singular averages for unitary groups.
  
  **(26)**
  
  C. Houdré, Georgia Institute of Technology (920-42-47)

- **10:00 AM**  
  
  Exacte iterative reconstruction algorithm for multivariate irregrady sampled functions in spline-like spaces: The $L_p$-Theory.
  
  **(27)**
  
  Akram Aldroubi*, NIH, and Hans Feichtinger, NUHAG, Vienna, Austria (920-43-211)

- **10:30 AM**  
  
  Multi-channel sampling for non-bandlimited functions: stability and performance.
  
  **(28)**
  
  Michael Unser, National Institutes of Health, Bethesda, MD (920-41-215)

**Special Session on Algorithms in Real Algebraic Geometry, I**

9:00 AM - 10:50 AM  Room 80101, Mathematics Building

Organizers: Richard Pollack, Courant Institute of Mathematical Sciences, New York University

**Special Session on Symplectic Geometry, Moduli Spaces and Integrable Systems, I**

9:00 AM - 10:50 AM  Room 80306, Mathematics Building

Organizers: Lisa Claire Jeffrey, McGill University and Institute for Advanced Study
Eyal Markman, University of Massachusetts, Amherst

- **9:00 AM**  
  
  Equivariant holomorphic Morse theory.
  
  **(33)**
  
  Siye Wu, Institute for Advanced Study (920-53-237)

- **9:30 AM**  
  
  Components of $\text{Hom}(\tau_1, PGL_2, R)$.
  
  **(34)**
  
  Eugene Z. Xia, University of Maryland at College Park (920-14-07)

- **10:00 AM**  
  
  A rigorous definition of fiberwise quantum cohomology and equivariant quantum cohomology.
  
  **(35)**
  
  Peng Lu, University of Minnesota (920-58-63)

- **10:30 AM**  
  
  Gromov invariants and symplectic dynamics.
  
  **(36)**
  
  Eleny Ionel*, MIT and MSRI, and Thomas H. Parker, Michigan State University (920-14-271)

**Special Session on Topological Dynamics, I**

9:00 AM - 10:50 AM  Room 80423, Mathematics Building

Organizers: Joseph Auslander, University of Maryland
Kenneth R. Berg, University of Maryland

- **9:00 AM**  
  
  Simplicial dynamical systems.
  
  **(37)**
  
  Ethan Akin, City College of New York (920-54-71)

- **9:30 AM**  
  
  Continuous extension of cocycles to the universal pointed flow.
  
  **(38)**
  
  Douglas P. Dokken, University of St Thomas (920-54-143)

- **10:00 AM**  
  
  The structural stability of topological cocycles.
  
  **(39)**
  
  Preliminary report.
  
  Kathleen Madden*, Lafayette College, and Nelson Markley, University of Maryland (920-99-134)

- **10:30 AM**  
  
  Transitivity in topological dynamics.
  
  **(40)**
  
  Annalisia Crannell, Franklin & Marshall College (920-54-37)

**Special Session on Automorphism Groups of Geometric Structures, I**

9:00 AM - 10:50 AM  Room 80201, Mathematics Building

Organizers: Alessandra Iozzi, University of Maryland
Garrett James Stuck, University of Maryland
Program of the Sessions - College Park, MD, Saturday, April 12 (cont'd.)

9:00AM - 10:50AM
Classification of group actions on hyperelliptic Riemann surfaces of genus \( g \geq 2 \).
Anthony Weaver, The Graduate School and University Center, CUNY (920-51-39)

9:30AM
Superrigid subgroups of solvable Lie groups.
Dave Witte, Oklahoma State University (920-22-58)

10:00AM
The decomposition of real projective \( n \)-manifolds and the classification of radiant affine 3-manifolds. Preliminary report.
Suhyoung Choi, Seoul National University, Korea (920-51-62)

10:30AM
The arithmetic-geometric invariants of symmetry.
Ravi S. Kulkarni, City University of New York, Queen's College (920-22-64)

Special Session on Partial Differential Equations, I

9:00AM - 10:50AM
Room 0302, Mathematics Building
Organizer: Jonathan Adam Poritz, University of Maryland

9:00AM
Harmonic functions on manifolds.

9:30AM
Symmetry and multiple eigenvalues for Laplacians.
Robert B. Lockhart, USNA (920-35-163)

10:00AM
Algebraic treatment of the Cauchy-Fueter and related systems.
Daniele Struppa, George Mason University (920-35-286)

10:30AM
Regular functions of biquaternionic variables and applications to mathematical physics.
Irene Marie Sabadini, Dipartimento di Matematica, Milano, Italy (920-35-289)

Special Session on Hyperbolic Equations, I

9:30AM - 10:50AM
Room 0411, Mathematics Building
Organizers: Manoussos Grillakis, University of Maryland
Matei Machedon, University of Maryland

9:00AM
Supersonic perturbed conic flow.
Zhenwen Geng, West Virginia University (920-35-285)

9:30AM
Uniqueness of generalized solutions to nonlinear wave equations. Preliminary report.
Yi Zhou, Institute for Advanced Study and Fudan University (920-35-234)

10:00AM
Daniel I. Tataru, Princeton University (920-35-72)

10:30AM
Instability of symmetric vortices in Ginzburg-Landau theory.
L. Almeida, B. Bethuel, and Y. Guo*, Princeton University and Brown University (920-35-204)

Invited Address

11:00AM - 11:50AM
Room 1412, Physics Building
Algorithms in real algebraic geometry.
Richard Pollack, Courant Institute, New York University (920-14-79)

Special Session on Algorithms in Real Algebraic Geometry, II

2:30PM - 4:20PM
Room 0101, Mathematics Building
Organizers: Richard Pollack, Courant Institute of Mathematical Sciences, New York University
Marie-Francoise Roy, University of Rennes I, France

2:30PM
Complexity of sign determination of remainder sequences.
Thomas Michael Lickteig, Institut fuer Informatik, Bonn, Germany, and Marie-Francoise Roy*, Universite de Rennes I, France (920-14-69)

3:00PM
Real root counting in near-quadratic time.
Preliminary report.
J. Maurice Rojas, MIT (920-14-45)

3:30PM
A numerical schubert calculus.
Birkett Huber, Department of Mathematics Texas A&M University, Frank Sottile*, Mathematical Sciences Research Institute and The University of Toronto, and Bernd Sturmfels, Department of Mathematics, University of California, Berkeley (920-14-202)

4:00PM
Algorithms for expressing forms as a sum of linear powers of forms. Preliminary report.
Bruce Reznick, University of Illinois at Urbana-Champaign (920-14-203)

Special Session on Symplectic Geometry, Moduli Spaces and Integrable Systems, II

2:30PM - 5:50PM
Room 0306, Mathematics Building
Organizers: Lisa Claire Jeffrey, McGill University and Institute for Advanced Study
Eyal Markman, University of Massachusetts, Amherst

2:30PM
Genus zero moduli space as “difference” of toric varieties.
Allen Knutson*, Brandeis University, and Jean-Claude Hausmann, University of Geneva (920-14-197)

3:00PM
Moduli spaces of flat bundles and matrix p-tuples. Preliminary report.
Philip A Foth, Penn State University (920-14-10)

3:30PM
Rationality of moduli spaces of vector bundles over smooth curves.
Hans U. Boden*, McMaster University, and Koji Yokogawa, Osaka University, Japan (920-14-23)

4:00PM
A symplectic approach to Verlinde factorization.
Eckhard Meinenken, Massachusetts Institute of Technology (920-53-145)

4:30PM
Symplectic geometry and fusion.
Chris Woodward, Harvard University (920-53-169)

5:00PM
The Verlinde algebra of a compact group. Preliminary report.
Sharad Agnihotri, University of Texas at Austin (920-14-168)
### Special Session on Lie Groups and Automorphic Forms, II

**2:30 PM - 4:50 PM**

**Room 0407, Mathematics Building**

**Organizers:** Jian-shu Li, University of Maryland

Gordan Savin, University of Utah

**2:30PM**

- **Special Session on Knot Theory and 3-Manifolds,**
  - *Preliminary report.*
  - *Jorgen Andersen, Aarhus University, Denmark, josef Kay, University of California, Davis, and Nicolai Reshetikhin, University of California, Berkeley (920-58-14)*

**3:00PM**

- **Gerstenhaber algebras and Lie algebroids,**
  - *Preliminary report.*
  - *Ping Xu, Pennsylvania State University (920-58-53)*

**3:30PM**

- **Groupoid actions and inverse semigroups,**
  - *Preliminary report.*
  - *John Quigg* and Nándor Sieben, Arizona State University (920-46-60)

### Special Session on Analysis of Spatial Stochastic Models

**2:30 PM - 5:15 PM**

**Room 0102, Mathematics Building**

**Organizers:**

A. M. Kagan, University of Maryland

Eric V. Slud, University of Maryland

**2:30PM**

- **Wavelet thresholding for non (necessarily) Gaussian noise,**
  - *C. Houdré, Georgia Institute of Technology (920-62-48)*

**3:10PM**

- **Spatial statistics and functional brain imaging,**
  - *Preliminary report.*
  - *Lawrence A. Shepp, Columbia University (920-62-255)*

**3:50PM**

- **Improving climate prediction using seasonal space-time models,**
  - *Xu-Feng Niu, Ian McKeague* and James Elsner, Florida State University (920-62-117)

**4:30PM**

- **Prediction in binary random fields,**
  - *Preliminary report.*
  - *Victor De Oliveira, University of Maryland (920-62-40)*

**5:00PM**

- **Questions and Discussion**

### Special Session on Topological Dynamics, II

**2:30 PM - 4:20 PM**

**Room R0423, Mathematics Building**

**Organizers:**

Joseph Auslander, University of Maryland

Kenneth R. Berg, University of Maryland

**2:30PM**

- **Graph substitutions,**
  - *Joseph P. Previte, University of Maryland (920-57-78)*

**3:00PM**

- **T, T^-1 is not standard,**
  - *Deborah W Heicklen, University of Maryland (920-28-122)*

**3:30PM**

- **A double return times theorem,**
  - *Preliminary report.*
  - *Idris Assani, University of North Carolina, Chapel Hill (920-28-108)*
Organizers: Alessandra Iozzi, University of Maryland
Garrett James Stuck, University of Maryland

2:30PM On the dynamics of pseudo-Anosov homeomorphisms on representation varieties of surface groups. Preliminary report.
Michael Kapovich (920-53-116)

3:00PM Growth rate of trajectories of flows on homogeneous spaces.
Dmitry Y. Kleinbock*, Institute for Advanced Study, and Gregory A. Margulis, Yale University (920-58-187)

3:30PM Geodesic foliations and Lorentz dynamics.
Abdelghani Zeghib, Ecole Normale Superieure de Lyon, Lyon, France (920-58-133)

4:00PM Curvature obstructions for compact Hermitian manifolds.
Luis Hernandez-Lamoneda, CIMAT, Guanajuato, Mexico (920-53-148)

4:30PM Topological superrigidity and applications.
Renato Feres*, Washington University, and Francois Labourie, Universite Paris-Sud, Orsay (920-58-158)

5:00PM Isometry groups of compact hyper-lorentz manifolds.
Brett A. Sovereign, University of Maryland College Park (920-53-29)

Special Session on Partial Differential Equations, II

2:30 PM - 5:20 PM Room 0302, Mathematics Building
Organizer: Jonathan Adam Poritz, University of Maryland

2:30PM A new framework for studying geometric interface evolution problems.
Sergio A. Alvarez*, Carnegie Mellon University, and Robert L. Pego, University of Maryland (920-35-127)

3:00PM Solvability of super-diffusive nonlinear parabolic problems.
Panagiota Daskalopoulos*, University of California, Irvine, and Manuel del Pino (920-53-283)

3:30PM Polynomial bound for the \( L^2 \) norms of solutions for Schr{"o}dinger equations.
Gigliola Staffilani, Stanford University (920-35-194)

4:00PM Regularizing effects for integrodifferential equations. Preliminary report.
Hans P. Engler, Georgetown University (920-45-196)

4:30PM The existence of discrete shock profiles for a class of monotonicity-preserving schemes for conservation laws.
Haitao Fan, Georgetown University (920-35-287)

5:00PM On the differential system governing flows in magnetic field with data in \( L^p \).
Fengxin Chen, Brigham Young University, and Ping Wang*, Penn State University (920-35-20)

Special Session on Numerical Solution of Differential Equations, II

2:30 PM - 4:50 PM Room 0425, Mathematics Building
Organizers: Ricardo H. Nochetto, University of Maryland
John E. Osborn, University of Maryland

2:30PM Numerical simulation and analysis of shear band formation.
Donald A. French, University of Cincinnati (920-65-292)

3:00PM Godunov-like schemes for general systems of conservation laws. Preliminary report.
Harland Glaz, University of Maryland, College Park (920-76-250)

3:30PM Anisotropic adaptation in finite elements.
Jonathan B. Goodman, Courant Institute, New York University (920-65-210)

4:00PM Optimal approximability of solutions of singularly perturbed differential equations.
R. Bruce Kellogg*, University of Maryland, College Park, and Martin Stynes, University College, Cork, Ireland (920-65-296)

4:30PM Quadrature-free implementation of discontinuous Galerkin method.
Chi-Wang Shu, Division of Applied Mathematics, Brown University (920-65-50)

Special Session on Harmonic Analysis and Applications, II

2:30 PM - 5:50 PM Room 0303, Mathematics Building
Organizers: Stephen D. Casey, American University
David F. Walnut, George Mason University

2:30PM A fundamental principle for hyperfunctions solutions of systems of infinite order differential equations.
Daniele Struppa, George Mason University (920-35-291)

3:00PM Perturbations of the \( n \)-dimensional Haar wavelet.
Richard A. Zalik, Auburn University (920-65-212)

4:00PM Time-frequency localization frames.
Joseph D. Lakey, New Mexico State University, Las Cruces (920-42-136)

4:30PM Spline type summability methods for sampling theory. Preliminary report.
W. R. Madych, University of Connecticut (920-42-248)

5:00PM Wiener's lemma and Gabor frames.
Karlheinz F. Gr{"o}chenig, University of Connecticut (920-42-284)

Special Session on Hyperbolic Equations, II

3:30 PM - 4:50 PM Room 0411, Mathematics Building
Organizers: Manoussos Grillakis, University of Maryland
Matei Machedon, University of Maryland
Sunday, April 13

Special Session on Topological Dynamics, IV
2:30 PM - 3:20 PM Room R0423, Mathematics Building
Organizers: Joseph Auslander, University of Maryland
Kenneth R. Berg, University of Maryland

A zero-one law for dynamical properties.
Jonathan King, Univ. of Florida, Gainesville (920-54-277)

Special Session on Lie Groups and Automorphic Forms, III
8:00 AM - 10:50 AM Room 0407, Mathematics Building
Organizers: Jian-shu Li, University of Maryland
Gordan Savin, University of Utah

8:00 AM
On the unitary dual of real semisimple Lie groups and the A(λ) modules. The regular case.
Susana Allicia Salamanca-Riba, New Mexico State University. Las Cruces, NM 88003 (920-22-151)

9:00 AM
A new proof of the duality theorem of Hecht, Milicić, Schmid and Wolf.
Dragan Milicić*, University of Utah, and Pavle Pandžić, Massachusetts Institute of Technology (920-22-247)

10:00 AM
Berezin transform on line bundles over Hermitian symmetric spaces. Preliminary report.
Genkai Zhang, University of Karlstad, Sweden (920-22-51)

Special Session on Groupoids and their Applications, III
8:00 AM - 10:50 AM Room 0106, Mathematics Building
Organizer: Alan T. Paterson, University of Mississippi

8:00 AM
Connes' index theorem for smooth groupoids.
Jerome Kaminker*, IUPUI, and Alan Paterson, University of Mississippi (920-46-54)

9:00 AM
Preliminary report.
Carla E. Farsi, Univ of Colorado, Boulder (920-46-109)

10:00 AM
Fell Bundles over Equivalence Relations. Preliminary report.
Igor Fulman, University of Iowa (920-47-52)

Special Session on Harmonic Analysis and Applications, III
8:00 AM - 10:50 AM Room 0303, Mathematics Building
Organizers: Stephen D. Casey, American University
David F. Walnut, George Mason University

8:00 AM
Schiffer problem and isoparametric hypersurfaces. Preliminary report.
Carlos A. Berenstein and Vladimir E. Shklover*, University of Maryland at College Park (920-35-112)

9:00 AM
Christopher M. Brislawn, Los Alamos National Laboratory (920-93-23)
Special Session on Symplectic Geometry, Moduli Spaces and Integrable Systems, III

8:30 AM - 10:50 AM  Room 0306, Mathematics Building
Organizers: Lisa Claire Jeffrey, McGill University and Institute for Advanced Study  
Eyal Markman, University of Massachusetts, Amherst

8:30 AM  (143) Langlands conjecture and geometric realization of Whittaker functions.  
Edward Frenkel, Harvard University (920-14-165)

9:00 AM  (144) Integrable systems and algebraic surfaces.  
Jacques C. Hurtubise, McGill University (920-58-113)

9:30 AM  (145) Prym integrable systems. Preliminary report.  
Jacques C. Hurtubise, McGill University, and Eyal Markman*, University of Massachusetts, Amherst (920-14-142)

10:00 AM  (146) Heisenberg action and the Hitchin system.  
Preliminary report.  
Bert van Geemen, Università di Torino, Italy, and Emma Previato*, Boston University (920-14-140)

10:30 AM  (147) Principal bundles on elliptic fibrations. Preliminary report.  
Ron Y. Donagi, On leave from: University of Pennsylvania (920-14-193)

Special Session on Numerical Solution of Differential Equations, III

8:30 AM - 10:20 AM  Room B0425, Mathematics Building
Organizers: Ricardo H. Nochetto, University of Maryland  
John E. Osborn, University of Maryland

8:30 AM  (148) Optimal hp convergence over partitioned domains.  
Preliminary report.  
Padmanabhan Seshaiyer and Manil Suri*, University of Maryland, Baltimore County (920-65-98)

9:00 AM  (149) Exact and computed solutions to constrained total variation minimization problems.  
Joel C. W. Rogers, Polytechnic University, and William G. Szymczak*, Naval Research Laboratory (920-65-182)

Tobias von Petersdorff, University of Maryland (920-65-293)

10:00 AM  (151) A monotone finite scheme for convection diffusion equations.  
Jinchao Xu, Pennsylvania State University (920-65-273)

Special Session on Algorithms in Real Algebraic Geometry, III

9:00 AM - 10:50 AM  Room 0101, Mathematics Building
Organizers: Richard Pollack, Courant Institute of Mathematical Sciences, New York University  
Marie-Francoise Roy, University of Rennes I, France

9:00 AM  (152) Nearly sharp parallel complexity bounds for testing arrangements and polyhedra.  
Dima Grigoriev, Penn State University (920-68-06)

9:30 AM  (153) VC-dimension and semi-algebraic sets.  
Hervé Brunniman, INRIA Sophia-Antipolis (920-68-152)

10:00 AM  (154) Adjunction inequality for real algebraic curves.  
Grisha Mikhalkin, MSRI, Berkeley (920-14-24)

10:30 AM  (155) Multiplicity of a zero of an analytic function on a trajectory of a vector field. Preliminary report.  
Andrei Gabrielov, Purdue University (920-14-95)

Special Session on Nonlinear Waves and Stability in Weakly Dissipative Systems, I

9:00 AM - 10:50 AM  Room 0107, Mathematics Building
Organizer: Robert L. Pego, University of Maryland

9:00 AM  (156) Invariant manifolds for a class of dispersive, Hamiltonian, partial differential equations.  
Preliminary report.  
Claude-Alain Pillet, Université de Genève, Switzerland, and Clarence E Wayne*, The Pennsylvania State University (920-35-96)

9:40 AM  (157) Time-dependent resonance theory.  
Avy Soffer, Rutgers University, New Brunswick, and Michael I. Weinstein*, University of Michigan, Ann Arbor (920-35-124)

10:20 AM  (158) Resonances, radiation damping and instability in Hamiltonian nonlinear wave equations.  
Avy Soffer*, Rutgers University, New Brunswick, and Michael I. Weinstein, University of Michigan, Ann Arbor (920-35-125)

Special Session on Topological Dynamics, III

9:00 AM - 10:50 AM  Room R0423, Mathematics Building
Organizers: Joseph Auslander, University of Maryland  
Kenneth R. Berg, University of Maryland

9:00 AM  (159) Flux across nonsmooth boundaries. Preliminary report.  
Jenny C. Harrison, Rockefeller University of New York and University of California, Berkeley (920-28-256)

9:30 AM  (160) Topological groups with trivial and nontrivial universal minimal flows.  
Vladimir Pestov, Victoria University (920-54-260)

10:00 AM  (161) The Bohr compactification of a group extension.  
Preliminary report.  
Hugo D. Junghenn*, The George Washington University, and Paul Milnes, University of Western Ontario (920-22-120)

Hsin Chu, Univ. of Maryland (920-34-272)
### Special Session on Automorphism Groups of Geometric Structures, III

**9:00 AM - 10:50 AM**  
**Room 0201, Mathematics Building**  
**Organizers:** Alessandra Iozzi, University of Maryland  
Garrett James Stuck, University of Maryland

- **9:00AM**  
  **(163)**  
  Superrigidity for isometric group actions on CAT(1) spaces.  
  - Yan Gao, Yale University (920-22-131)

- **9:30AM**  
  **(164)**  
  Rigidity and deformations for semisimple Lie group actions.  
  - Elie J. Benveniste, Stanford University (920-53-171)

- **10:00AM**  
  **(165)**  
  Isotopy of semisimple group actions on manifolds with geometric structure.  
  - John P. Szaro, University of Michigan (920-53-173)

- **10:30AM**  
  **(166)**  
  Cycles over Anosov actions and applications.  
  Preliminary report.  
  - Vio rel Nitica*, Indiana University, Bloomington, and Andrew Török, Princeton University (920-58-219)

### Special Session on Partial Differential Equations, III

**9:00 AM - 10:50 AM**  
**Room 0302, Mathematics Building**  
**Organizer:** Jonathan Adam Portz, University of Maryland

- **9:00AM**  
  **(167)**  
  Harmonic and quasi-harmonic maps. Preliminary report.  
  - Changyou Wang* and Fang Hua Lin (920-35-92)

- **9:30AM**  
  **(168)**  
  Painleve solutions from Yang-Mills instantons.  
  Preliminary report.  
  - Jan Segert, University of Missouri (920-53-157)

- **10:00AM**  
  **(169)**  
  Solution of the non-abelian monopole equation and relations between Donaldson and Seiberg-Witten invariants. Preliminary report.  
  - Paul M. N. Feehan, Harvard University (920-58-16)

- **10:30AM**  
  **(170)**  
  Combinatorial Bochner's method and Ricci curvature.  
  - Robin Forman, Rice University (920-35-288)

### Session on Contributed Papers

**9:30 AM - 10:55 AM**  
**Room 0310, Mathematics Building**

- **9:30AM**  
  **(171)**  
  Cohomological quantization modules for symplectic tori. Preliminary report.  
  - Scott Gregory Chastain* and Paul Lee Robinson, University of Florida (920-58-12)

- **9:45AM**  
  **(172)**  
  Supercuspidal representations of GL(n) distinguished by $U(n)$ and $O(n)$.  
  - Jeffrey L. Hakim* American University, and Zhengyu Mao, The Ohio State University (920-22-101)

- **10:00AM**  
  **(173)**  
  Decoding $D$-dimensional perfect maps. Preliminary report.  
  - Chungzhan Ozturk*, Eric Schnutz and Jonathan Nissanov, Drexel University (920-05-17)

- **10:15AM**  
  **(174)**  
  The trace on $SU(2,1)$ and special functions associated to complex hyperbolic 2-space.  
  - Hanna M. Sandler, American University (920-51-100)

- **10:30AM**  
  **(175)**  
  The argument principle for harmonic mappings on punctured domains. Preliminary report.  
  - John W Thompson, author (920-30-41)

- **10:45AM**  
  **(176)**  
  $P$-groups and canonical coordinates. Preliminary report.  
  - Boris S. Khots (920-22-235)

### Invited Address

**11:00 AM - 11:50 AM**  
**Room 1412, Physics Building**

- **(177)**  
  Unipotent representations attached to small nilpotent orbits.  
  - Jian-Shu Li, University of Maryland, College Park (920-22-102)

### Invited Address

**1:30 PM - 2:20 PM**  
**Room 1412, Physics Building**

- **(178)**  
  Merits and demerits of the orbit method.  
  - Alexandre Kirillov, University of Pennsylvania (920-00-04)

### Special Session on Algorithms in Real Algebraic Geometry, IV

**2:30 PM - 4:20 PM**  
**Room 0101, Mathematics Building**  
**Organizers:** Richard Pollack, Courant Institute of Mathematical Sciences, New York University  
Marie-Francoise Roy, University of Rennes I, France

- **2:30PM**  
  Systems of real quadratic equations.  
  - Alexander Barvinok, University of Michigan (920-14-88)

- **3:00PM**  
  On bounding the complexity of the connected components of semi-algebraic sets. Preliminary report.  
  - Saugata Basu*, Mathematical Sciences Research Institute, Berkeley, Richard Pollack, Courant Institute, New York University, and Marie-Francoise Roy, Institut Mathematique, Universite de Rennes, France (920-08-227)

- **3:30PM**  
  Cylindrical algebraic decomposition adapted to a set of equalities and global projection operators.  
  - Laureano Gonzalez-Vega* and Neila Gonzalez-Campos, Universidad de Cantabria, Spain (920-14-70)

- **4:00PM**  
  - Victoria Powers*, Emory University, and Claus Scheiderer, Universitat Regensburg (920-14-177)

### Special Session on Symplectic Geometry, Moduli Spaces and Integrable Systems, IV

**2:30 PM - 5:50 PM**  
**Room 0306, Mathematics Building**  
**Organizers:** Lisa Claire Jeffrey, McGill University and Institute for Advanced Study  
Eyal Markman, University of Massachusetts, Amherst

- **2:30PM**  
  Geometry of commuting differential operators.  
  - (183) Preliminary report.  
  - Motto Mulas, University of California, Davis (920-14-172)

- **3:00PM**  
  Topology of moduli spaces over a quadruply-punctured sphere. Preliminary report.  
  - William M. Goldman* and Robert L. Benedetto (920-57-181)

- **3:30PM**  
  On representation varieties of Artin groups, projective arrangements and the fundamental groups of smooth complex algebraic varieties.  
  - John J. Millson, University of Maryland (920-14-135)

- **4:00PM**  
  Fox calculus, symplectic geometry, and moduli spaces.  
  - Valentino Zocca, Universite' Paris XI, Orsay, France (920-53-31)
Program of the Sessions  - College Park, MD, Sunday, April 13 (cont'd.)

Special Session on Knot Theory and 3-Manifolds, IV

2:30 PM - 5:50 PM Room B0421, Mathematics Building

Organizers: Jozef H. Przytycki, George Washington University
Yongwu Rong, George Washington University

2:30PM Burau representation of string links.
(198) Xiao-song Lin, UC at Riverside, Feng Tian, UC at San Diego, and Zhenghan Wang*, Indiana University at Bloomington (920-57-294)

3:00PM A combinatorial description of knotted surfaces and their isotopies.
(199) J. Scott Carter, University of South Alabama, Joachim H. Rieger, Universidade de Sao Paulo, Instituto de Ciencias Matematicas de Sao Car, and Masahico Saito*, University of South Florida (920-57-21)

3:30PM Geometry and physics of knots.
(200) Andrzej Stasiak, Universite de Lausanne (920-57-220)

4:00PM Shadows of wave fronts and Arnold-Bennequin type invariants of fronts on surfaces. Preliminary report.
Vladimir V. Tchernov, University of California, Riverside (920-57-174)

4:30PM Some properties of the projections of knotted surfaces.
(202) J. Scott Carter*, University of South Alabama, Vera Cararra, Universidade de Sao Paulo, Brasil, and Masahico Saito, University of South Florida (920-57-28)

5:00PM Subgroup-separability of the figure-eight knot group.
Daniel T. Wise, UC Berkeley (920-57-188)

5:30PM Limits of hyperbolic 3-manifolds.
(204) Timothy D. Comar, St. Louis University (920-57-13)

Special Session on Nonlinear Waves and Stability in Weakly Dissipative Systems, II

2:30 PM - 4:20 PM Room 0107, Mathematics Building

Organizer: Robert L. Pego, University of Maryland

2:30PM Linear stability of solitary waves with large surface tension. Preliminary report.
Robert L. Pego, University of Maryland, College Park, and Robert L. Sachs*, George Mason University (920-35-184)

3:10PM Fourier splitting method for universal decay of nonlocally damped nonlinear waves.
Keith Promislow, Simon Fraser University (920-35-216)

3:50PM Weak travelling wave solutions of a perturbed Boussinesq system.
Yi A. Li, School of Mathematics, University of Minnesota (920-35-228)

Special Session on Automorphism Groups of Geometric Structures, IV

2:30 PM - 4:50 PM Room 0201, Mathematics Building

Organizers: Alessandra Iozzi, University of Maryland
Garrett James Stuck, University of Maryland

2:30PM Geometry of crooked planes.
(208) Todd A. Drumm*, Swarthmore College, and William M. Goldman, University of Maryland (920-51-201)

3:00PM Invariant measures and orbit closures on homogeneous spaces for actions of subgroups generated by unipotent elements.
Nimish A. Shah, Institute for Advanced Studies, Princeton and Tata Institute of (920-22-205)

3:30PM Topological equivalence of flows on solvmanifolds.
(210) Diego M. Benardete*, University of Hartford, and S. G. Dani, Tata Institute (920-58-214)

4:00PM Compact Clifford-Klein forms of homogeneous manifolds.
Toshiyuki Kobayashi, Mathematical Sciences, University of Tokyo (920-22-164)

4:30PM Local rigidity of higher rank lattice actions.
(212) Nantian Qian, Yale University (920-58-179)
Program of Sessions

Special Session on Partial Differential Equations, IV

2:30 PM - 4:20 PM  Room 0302, Mathematics Building
Organizer: Jonathan Adam Poritz, University of Maryland

2:30 PM  The 1/H flow and the Hawking-Penrose conjecture.
(213) Tom Ilmanen*, Northwestern University, and Gerhard Huisken, University of Tuebingen, Germany (920-35-75)

3:00 PM  Natural geometric structures for CMC and CSC moduli spaces.
(214) Rob Kusner, Institute for Advanced Study (920-53-81)

3:30 PM  Triunduloids: Embedded CMC surfaces with three ends. Preliminary report.
(215) John M. Sullivan, Univ of Minnesota (920-53-121)

4:00 PM  Mean curvature data and the shape of a surface.
(216) Georgi I. Kamberov, University of Massachusetts at Amherst (920-53-176)

Special Session on Harmonic Analysis and Applications, IV

2:30 PM - 5:50 PM  Room 0303, Mathematics Building
Organizers: Stephen D. Casey, American University
David F. Walnut, George Mason University

2:30 PM  Rearrangements of functions and integrability of the Fourier transform.
(217) Archil Gulisashvili, Ohio University (920-42-138)

3:00 PM  Focused Wideband maximum likelihood and spatial spectrum estimation.
(218) Brian M. Sadler, Army Research Laboratory (920-60-213)

3:30 PM  Parameter estimation for noisy polynomial phase signals.
(219) Ananthram Swami, Army Research Lab., Adelphi, Maryland (920-60-207)

4:00 PM  Number theoretic methods in period estimation from sparse noisy data.
(220) Stephen D. Casey, American University (920-42-147)

4:30 PM  Coping with complex boundaries.
(221) Jack F. Douglas (920-42-242)

5:00 PM  Generalized binomial expansion on complex matrix space.
(222) Hongming Ding, St. Louis University (920-43-190)

5:30 PM  Sampling on unions of lattices and applications.
(223) David F Walnut, George Mason University (920-42-154)

Lesley M. Silber
Associate Secretary
Brooklyn, New York
Presenters of Papers

Corvallis, Oregon; April 19-20, 1997

Numbers following the name indicate the speaker's position on the program.

• AMS Invited Lecturer, * Special Session Speaker, » Graduate Student
Program of the Sessions
Corvallis, Oregon, April 19-20, 1997

Saturday, April 19

Registration
7:30 AM - 5:00 PM Room 108, Kidder Hall, Mathematics Learning Center

Special Session on Geometric Mechanics, I
8:00 AM - 10:50 AM Room 106, Strand Agricultural Hall
Organizers: Judith M. Arms, University of Washington
John V. Leahy, University of Oregon

8:00 AM Minimal Legendrian tangles. Preliminary report.
Lisa M. Traynor, Bryn Mawr College (921-53-88)

8:25 AM Moduli spaces of stable polygons and symplectic structures on \( \mathbb{C} \), Preliminary report.
Yi Hu, University of California, Berkeley (921-57-144)

8:50 AM Cohomology of Jacobian algebras. Preliminary report.
Ann M. Ritten, University of Oregon (921-58-161)

9:15 AM Equivariant moment maps for Poisson Lie groups.
Lucas Hsu, University of Arizona (921-53-137)

9:40 AM Characteristic Lagrangians and local obstructions to global existence problems in differential geometry. Preliminary report.
Ian M. Anderson, Utah State University, and Mark E. Fels, University of Minnesota (921-58-112)

10:05 AM The multi-dimensional Darboux transformation.
Niky Kamran, McGill University (921-58-162)

10:30 AM Symmetries, conservation laws, and variational principles for vector field theories.
Ian M. Anderson, Utah State University, and Hu Pohjanpelto, Oregon State University (921-58-104)

Special Session on Geometric Methods in Mathematical Physics, I
8:00 AM - 10:50 AM Room 109, Strand Agricultural Hall
Organizer: Juha Pohjanpelto, Oregon State University

8:00 AM Some global properties of vacuum spacetimes with \( U(1) \times U(1) \) isometry.
James A. Isenberg, University of Oregon (921-83-171)

8:25 AM Differential invariants and moving frames.
Mark E. Fels and Peter J. Olver, University of Minnesota (921-58-86)

Lucas Hsu, University of Arizona (921-53-137)

9:15 AM Characteristic Lagrangians and local obstructions to global existence problems in differential geometry. Preliminary report.
Ian M. Anderson, Utah State University, and Mark E. Fels, University of Minnesota (921-58-112)

9:40 AM Direct construction of conservation laws from field equations.
Stephen C. Anco and George W. Bluman, University of British Columbia (921-58-162)

10:05 AM The multi-dimensional Darboux transformation.
Niky Kamran, McGill University (921-58-162)

10:30 AM Symmetries, conservation laws, and variational principles for vector field theories.
Ian M. Anderson, Utah State University, and Hu Pohjanpelto, Oregon State University (921-58-104)

Special Session on Actuarial and Financial Mathematics, I
8:30 AM - 10:45 AM Room 100, Social Science Building
Organizers: Donald Jones, Oregon State University
Enrique A. Thomann, Oregon State University
Edward C. Waymire, Oregon State University

The time limit for each contributed paper in the sessions is ten minutes. In the Special Sessions the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Papers flagged with a solid triangle (,) have been designated by the author as being of possible interest to undergraduate students.

Abstracts of papers presented at this meeting will be found in Volume 18, Issue 2 of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings. The middle two digits, e.g., 897-20-1136, refer to the Mathematical Reviews subject classification assigned by the individual author. Groups of papers for each subject are listed chronologically in the Abstracts. The last one to four digits, e.g., 897-20-1136, refer to the receipt number of the abstract; abstracts are further sorted by the receipt number within each classification.
Program of the Sessions - Corvallis, OR, Saturday, April 19 (cont’d.)

8:30AM - 10:30AM  Room 115, Social Science Building
Organizers: Richard A. Mollin, University of Calgary
Peter J. Shiue, University of Nevada, Las Vegas

8:30AM  Prime densities for linear recurrences. Preliminary report.
Peter Stevenhagen, Universiteit van Amsterdam, The Netherlands (921-11-12)

8:55AM  Bounds for frequencies of residues in second-order recurrences mod p^n.
Lawrence E. Somer, Catholic University of America (921-11-38)

9:20AM  Pseudoprimes, perfect numbers, and a problem of Lehmer.
Walter Carlip, Eliot T. Jacobson* and Lawrence Somer (921-11-127)

Walter Carlip* and Eliot Jacobson, Ohio University (921-11-128)

10:10AM  Some remarks on the distribution of second order linear recurrences.
John R. Burke, Gonzaga University (921-11-102)

Special Session on Octonions and Clifford Algebras, I

8:50AM - 10:45AM  Room 132, Strand Agricultural Hall
Organizers: Tevian Dray, Oregon State University
Corinne Manogue, Oregon State University

8:50AM  Matrix exponential via Clifford algebras.
Rafal F. Abłamowicz, Gannon University (921-16-92)

Susumu Okubo, University of Rochester (921-17-30)

9:50AM  Dirac operators, conformal transformations and classical harmonic analysis. Preliminary report.
John Ryan, University of Arkansas (921-30-37)

Corinne A. Manogue* and Tevian Dray, Oregon State University (921-17-81)

Special Session on Combinatorial Methods in Molecular Biology, I

9:00AM - 10:50AM  Room 104, Social Science Building
Organizers: Pavel Pevzner, University of Southern California

9:00AM  Quasi-Monte Carlo computations in Finance.
Richard E. Caflisch, UCLA (921-90-36)

Yuri Y Boykov, Carnegie Mellon University (921-90-151)

9:40AM  Catastrophe risk bonds. Preliminary report.
Hal Warren Pedersen, Georgia State University (921-90-159)

10:15AM  Applications of actuarial risk theory in the investment world.
Tony Zeppetella, Phoenix Home Life Mutual Insurance Company (921-90-175)

Special Session on Geometric Analysis, I

9:00AM - 10:50AM  Room 222, Strand Agricultural Hall
Organizers: Harold R. Parks, Oregon State University
Donald C. Solmon, Oregon State University

9:00AM  Boundary behavior of solutions of some elliptic boundary value problems near nonconvex corners. Preliminary report.
Zhiren Jin and Kirk E. Lancaster*, Wichita State University (921-35-87)

9:40AM  Volume comparison and nonnegative Ricci curvature outside a compact set.
Zhong-dong Liu, University of South Carolina (921-53-11)

Stephen J. Fromm* and David Jerison (921-35-21)

Special Session on Mathematical Issues in Physical Oceanography, I

9:00AM - 10:50AM  Room 108, Social Science Building
Organizer: Robert L. Higdon, Oregon State University

9:00AM  Hamilton’s principle asymptotics and weak solutions in geophysical fluid dynamics. Preliminary report.
Darryl D. Holm, Theoretical Division and Center for Nonlinear Studies, LANL, New Mexico (921-35-23)

9:30AM  Wave permeable boundary conditions for the simulation of continuously stratified flows. Preliminary report.
Dale R Durrant, Department of Atmospheric Sciences, University of Washington (921-65-63)

10:00AM  Low Froude number dynamics for stably stratified rotating flows with fixed or small Rossby numbers.
Pedro F. Embid, The University of New Mexico (921-86-116)

10:30AM  Modeling a solid boundary as a fluid of infinite viscosity.
Harry Gingold* and Dinesh Gera, West Virginia University (921-76-29)

Special Session on Operator Algebras, I

9:00AM - 10:50AM  Room 111, Strand Agricultural Hall
Organizers: Huaxin Lin, University of Oregon
Christopher Phillips, University of Oregon

9:00AM  Applications of Voiculescu’s free entropy.
Liming Ge, Massachusetts Institute of Technology (921-46-22)
Invited Address

11:00 AM - 11:50 AM Gilfillan Auditorium, Wilkinson Hall

(49) Transforming men into mice.
Pavel A. Pevzner, University of Southern California (921-05-136)

Invited Address

2:00 PM - 2:50 PM Gilfillan Auditorium, Wilkinson Hall

(50) Stabilization and dynamics of balance systems.
Jerrold E. Marsden, California Institute of Technology

(921-00-06)

Special Session on Actuarial and Financial Mathematics, II

3:00 PM - 6:15 PM Room 100, Social Science Building

Organizers: Donald Jones, Oregon State University
Enrique A. Thomann, Oregon State University
Edward C. Waymire, Oregon State University

3:00PM Generation and simulation of interest rate term structures. Preliminary report.
William J. Morokoff, UCLA and C.ATS Software (921-65-97)

3:35PM Volatility modeling and estimation of high-frequency data with Gaussian noise. Preliminary report.
Yue Fang, University of Oregon (921-62-99)

4:10PM Pricing perpetual American options with the geometric shifted Poisson process.
Frederic Michaud, Universite Laval (921-99-71)

4:45PM Calibration of interest rate models. Preliminary report.
Eduard Harabetian, University of Michigan (921-90-163)

Special Session on Algebraic and Elementary Number Theory, II

3:00 PM - 6:15 PM Room 115, Social Science Building

Organizers: Richard A. Mollin, University of Calgary
Peter J. Shiue, University of Nevada, Las Vegas

3:00PM Diophantine equations and ideals. Preliminary report.
Richard A. Mollin (921-11-142)

3:25PM Ramanujan’s class invariants.
(56) Bruce C. Berndt, University of Illinois at Urbana-Champaign (921-11-150)

3:50PM Some curves almost possessing rational points.
(57) Andrew Bremner, Arizona State University (921-11-143)

4:15PM Evaluations of multi-dimensional Euler/Zagier sums: A compendium of results for arbitrary depths.
Jonathan M. Borwein, CECM, Simon Fraser University (921-11-125)

4:40PM Some conjectures about base 2 pseudoprimes.
John Brillhart, University of Arizona (921-11-139)

5:05PM Composition of forms, ideals and continued fractions. Preliminary report.
Alfred J. van der Poorten, Macquarie University, Australia (921-11-14)

5:30PM Explicit primality criteria for \((p - 1)p^{n} - 1\).
(61) Hugh C. Williams, University of Manitoba (921-11-48)

5:55PM Imaginary octic fields of type \((2,2,2)\) with small class number.
Charles John Parry, Virginia Polytechnic Institute and State University (921-11-180)
**Program of the Sessions - Corvallis, OR, Saturday, April 19 (cont’d.)**

**Special Session on Octonions and Clifford Algebras, II**

3:00 PM - 5:25 PM  
Room 132, Strand Agricultural Hall  
Organizers: Tevian Dray, Oregon State University  
Corinne Manogue, Oregon State University

- **3:00PM**  
  Octonion X,Y-product: Groups and Clifford algebras.  
  (63)  
  Geoffrey Dixon (921-17-16)

- **3:30PM**  
  The Octonionic eigenvalue problem. Preliminary report.  
  (64)  
  Tevian Dray*, Dept of Mathematics, Oregon State University, and Corinne A. Manogue, Dept of Physics, Oregon State University (921-17-80)

- **4:00PM**  
  Should absolute metric signature matter in multivector theories? Preliminary report.  
  (65)  
  William M. Pezzaglia, Jr., Santa Clara University (921-58-130)

- **4:30PM**  
  On the symmetry principle in quaternionic analysis and applications. Preliminary report.  
  (66)  
  Vladislav V. Kravchenko and Michael V. Shapiro*, Instituto Politécnico Nacional, Mexico City, MEXICO (921-30-24)

- **5:00PM**  
  The fundamental theorem of geometric calculus via the generalized Riemann integral. Preliminary report.  
  (67)  
  Alan L. Macdonald, Luther College (921-28-53)

**Special Session on Combinatorial Methods in Molecular Biology, II**

3:00 PM - 4:50 PM  
Room 104, Social Science Building  
Organizers: Pavel Pevzner, University of Southern California  
Michael S. Waterman, University of Southern California

- **3:00PM**  
  Local rules for protein folding on a triangular lattice and generalized hydrophobicity in the HP model.  
  (68)  
  Richa Agarwala, National Institutes of Health, Serafim Batzoglou, Massachusetts Institute of Technology, Vlado Dančík*, University of Southern California, Scott E. Decatur, Massachusetts Institute of Technology, Martin Farach, Rutgers University, Sridhar Hannenhalli, University of Southern California, S. Muthukrishnan, Bell Laboratories, and Steven Skiena, SUNY Stony Brook (921-68-65)

- **3:40PM**  
  Evolution-based sequence matching.  
  (69)  
  Paul Cull*, Oregon State University, James L. Holloway and Jeffrey D. Cavener (921-99-107)

- **4:20PM**  
  A new method for a biological change-point problem: Dynamic programming detection of chimeric 16S rRNA artifacts.  
  (70)  
  George A. Komatsoulis* and Michael S. Waterman, University of Southern California (921-92-135)

**Special Session on Geometric Analysis, II**

3:00 PM - 5:30 PM  
Room 222, Strand Agricultural Hall  
Organizers: Harold R. Parks, Oregon State University  
Donald C. Solmon, Oregon State University

- **3:00PM**  
  Secondary characteristic currents.  
  (71)  
  John W Zweck, University of Nevada, Reno NV 89557 (921-58-41)

- **3:40PM**  
  The solution of the equichordal point Problem.  
  (72)  
  Marek R Rychlik, University of Arizona (921-39-138)

4:20PM  
Another unexpected appearance of the cycloid.  
(73)  
Preliminary report.  
Michael G Kerckhove, University of Richmond, and Gary R Lawlor*, Brigham Young University (921-49-84)

5:00PM  
Area-minimizing hypersurfaces with prescribed asymptotics at infinity.  
Claire C Chan, University of Utah (921-00-118)

**Special Session on Geometric Mechanics, II**

3:00 PM - 5:50 PM  
Room 106, Strand Agricultural Hall  
Organizers: Judith M. Arms, University of Washington  
John V. Leahy, University of Oregon

- **3:00PM**  
  A Lie algebraic generalization of the Mumford system, its symmetries and its multi-Hamiltonian structure. Preliminary report.  
  (75)  
  Pol Vanhaecke*, University of California, Davis, and Marco Pedroni, Universita di Genova, Italy (921-58-121)

- **3:25PM**  
  On quantizing \( T^*S^1 \).  
  (76)  
  Mark J. Gotay, University of Hawaii (921-81-62)

- **3:50PM**  
  Spin\(^q\) quantization. Preliminary report.  
  (77)  
  Ana Canas da Silva*, University of California, Berkeley and Instituto Superior Tecnico, Portugal, Yael Karshon, The Hebrew University of Jerusalem, Israel, and Susan Tolman, Princeton University (921-53-106)

- **4:15PM**  
  Some new results in the reduction of Hamiltonian systems with symmetry.  
  (78)  
  Juan-Pablo Ortega, University of California-Santa Cruz (921-70-56)

- **4:40PM**  
  On the stability of relative equilibria.  
  (79)  
  Eugene M. Lerman, University of Illinois at Urbana-Champaign (921-58-33)

- **5:05PM**  
  Symmetry reduction of variational bicomplexes and the principle of symmetric criticality.  
  (80)  
  Ian M. Anderson*, Utah State University, and Mark E. Fels, University of Minnesota (921-58-111)

- **5:30PM**  
  The mechanical connection and the complexified group action. Preliminary report.  
  (81)  
  Judith M. Arms, University of Washington (921-70-149)

**Special Session on Mathematical Issues in Physical Oceanography, II**

3:00 PM - 5:20 PM  
Room 108, Social Science Building  
Organizer: Robert L. Higdon, Oregon State University

- **3:00PM**  
  Justification of shallow water approximations to rigid lidflows with bottom topography.  
  (82)  
  Marcel Oliver, University of California, Irvine (921-35-134)

- **3:30PM**  
  Exploring the potential power of Sinc-Galerkin techniques in the numerical solution of physical oceanography problems. Preliminary report.  
  (83)  
  Donald F Winter*, University of Redlands, Kenneth L. Bowers and John Lund, Montana State University (921-65-148)

- **4:00PM**  
  Equations of motion for large-scale modelling.  
  (84)  
  Geoffrey K. Vallis, Esq., UCSC (921-76-152)

- **4:30PM**  
  On symmetric instabilities in ocean bottom boundary layers. Preliminary report.  
  (85)  
  John S. Allen, College of Oceanic & Atmospheric Sciences, Oregon State University (921-76-169)

- **5:00PM**  
  Globally well-posed shallow-water equations.  
  (86)  
  C. David Levermore, University of Arizona (921-76-170)
**Special Session on Operator Algebras, II**

3:00 PM - 5:50 PM  
Room 111, Strand Agricultural Hall

Organizers: Huaxin Lin, University of Oregon  
Christopher Phillips, University of Oregon

3:00 PM  
**Characteristic square of a factor and cocycle conjugacy of group actions.**  
Masamichi Takesaki, UCLA (921-46-160)

3:30 PM  
**New results in the theory of quantum dynamical semigroups.**  
William Arveson, University of California, Berkeley (921-46-176)

4:00 PM  
**Generalized solenoids and $C^*$-algebras.** Preliminary report.  
Valentin Deaconu, University of Nevada, Reno (921-46-179)

4:30 PM  
**Toeplitz algebras associated with endomorphisms.**  
Mahmood Khoshkam, University of Saskatchewan (921-46-28)

5:00 PM  
**Asymptotic range for cocycles of groupoid $C^*$-algebras.**  
Bellasario A. Ventura, California State University, San Bernardino (921-46-178)

5:30 PM  
Discussion

**Special Session on Singular Perturbations, Theory and Applications, II**

3:00 PM - 4:50 PM  
Room 211, Strand Agricultural Hall

Organizers: Leonid Viktorovich Kalachev, University of Montana  
Robert E. O'Malley, Jr., University of Washington

3:00 PM  
**Singular perturbation analysis of the solitary pulse solution for a model of spreading cortical depression.**  
Hideo Ikeda, Toyama University, Japan, and Robert M. Miura*, University of British Columbia (921-35-69)

3:30 PM  
**Metastability for a generalized Burgers equation with applications to propagating flame-fronts.**  
Xiaolin Sun and Michael J. Ward*, University of British Columbia (921-35-68)

4:00 PM  
**Asymptotic analysis of spike-type solutions.** Preliminary report.  
Leonid V. Kalachev, University of Montana (921-41-51)

4:30 PM  
**Internal layer structure of some parabolic problems.**  
Shagi-Di Shih, University of Wyoming (921-35-20)

**Special Session on Inverse Problems, II**

3:00 PM - 5:55 PM  
Room 226, Strand Agricultural Hall

Organizers: Adel Faridani, Oregon State University  
David V. Finch, Oregon State University

3:00 PM  
**An inverse problem in an infection-age-dependent model for the dynamics of HIV/AIDS: A preliminary result.** Preliminary report.  
Changmei Liu* and Carlos Castillo-Chavez, Cornell University (921-35-82)

3:30 PM  
**Recovering spatially-varying Lamé parameters from a traction experiment.**  
Steven J. Cox, Rice University, and Mark S. Gockenbach*, University of Michigan (921-35-90)

4:00 PM  
**Multisensor deconvolution and sampling.**  
David F Walnut, George Mason University (921-42-113)

4:30 PM  
**Phase space tomography in quantum mechanics.**  
M. C. Raymer, Department of Physics, University of Oregon, Eugene, OR 97403 (921-35-76)

5:00 PM  
**Inversion methods for obtaining seafloor parameters from partial spectral data.**  
Shixiao Wang* and Joyce R. McLaughlin, Department of Mathematical Sciences, Rensselaer Polytechnic Institute (921-35-146)

5:30 PM  
**The reconstruction of a first order differential operator from spectral data.** Preliminary report.  
Steven J. Cox, Rice University, and Roger A. Knobel*, University of Texas - Pan American (921-35-75)

**Special Session on Geometric Methods in Mathematical Physics, II**

4:15 PM - 6:15 PM  
Room 109, Strand Agricultural Hall

Organizer: Juha Pohjanpelto, Oregon State University

4:15 PM  
**Continuum solitons and matrix integrals.** Preliminary report.  
Motohico Mulase, University of California, Davis (921-58-124)

4:40 PM  
**Particle motion in classical field theories.** Preliminary report.  
David M. Stuart, IHES, Le Bois Marie, France (921-35-168)

5:05 PM  
**Oscillatory phenomena and complex dimensions of fractal strings, with applications to the critical zeros of the Riemann zeta-function.**  
Michel L. Lapidus, University of California, Riverside (921-58-172)

5:30 PM  
**Asymptotic conservation laws in classical field theory.**  
Charles Torre, Utah State University (921-83-174)

5:55 PM  
**Degenerate solutions of general relativity from 2-dimensional topological field theory.** Preliminary report.  
John C. Baez, University of California, Riverside (921-83-49)

**Sunday, April 20**

**Registration**

8:00 AM - NOON  
Room 108, Kidder Hall, Mathematics Learning Center

**Special Session on Geometric Methods in Mathematical Physics, III**

8:00 AM - 10:50 AM  
Room 109, Strand Agricultural Hall

Organizer: Juha Pohjanpelto, Oregon State University

8:00 AM  
**The braid group, periodic orbits, and the planar $N$-body problem.**  
Richard W. Montgomery, University of California, Santa Cruz (921-58-31)

8:25 AM  
**Group drift over the ergodic domains and attractors.** Preliminary report.  
Serge Preston, Portland State University, Portland, OR (921-70-122)

8:50 AM  
**Reduction by stages.** Preliminary report.  
Tudor S Ratiu, University of California, Santa Cruz (921-58-158)
Program of the Sessions – Corvallis, OR, Sunday, April 20 (cont'd.)

**Special Session on Operator Algebras, III**

8:00 AM – 10:50 AM  
Room 111, Strand Agricultural Hall  
Organizers: Huaxin Lin, University of Oregon  
Christopher Phillips, University of Oregon

- **8:00AM**  
  **Subfactors and partially commuting squares.**  
  Peter T. Akemann, University of California, Berkeley (921-46-125)

- **8:30AM**  
  **C*-algebra generated by orthogonal projections.**  
  Nikolai Vasilevski, Departamento de Matematicas, CINVESTAV del P.I.N., Mexico (921-46-18)

- **9:00AM**  
  **Computing K-theory contingencies to stable relations.** Preliminary report.  
  Terry A. Loring*, University of New Mexico, and Soren Eilers, University of Copenhagen (921-46-55)

- **9:30AM**  
  **Hilbert modules with involution.**  
  Nik Weaver, UCLA/Washington U (921-46-35)

- **10:00AM**  
  **Spectral invariance of stabilizations of dense subalgebras of C*-algebras.**  
  Larry B. Schweitzer (921-46-177)

10:30AM Discussion

**Special Session on Inverse Problems, III**

8:45 AM – 10:40 AM  
Room 226, Strand Agricultural Hall  
Organizers: Adel Faridani, Oregon State University  
David V. Finch, Oregon State University

- **8:45AM**  
  **On characterization of Dirichlet-to-Neumann maps for planar regions.**  
  David V. Ingerman, University of Washington (921-35-54)

- **9:15AM**  
  **On the null space in linearized anisotropic crosswell travel time tomography.**  
  Kenneth P. Bube*, University of Washington, and Mark A. Meadows, Chevron Petroleum Technology Company (921-86-98)

- **9:45AM**  
  **Spectra of periodic differential operators and photonic crystals.**  
  Peter Kuchment* and Leonid Kunyansky, Wichita State University (921-78-42)

10:15AM Discussion

**Special Session on Algebraic and Elementary Number Theory, III**

8:50 AM – 10:50 AM  
Room 115, Social Science Building  
Organizers: Richard A. Mollin, University of Calgary  
Peter J. Shiue, University of Nevada, Las Vegas

- **8:50AM**  
  **On an optimality property of Ramanujan sums.**  
  Gennady Bachman, University of Nevada at Las Vegas (921-11-17)

- **9:15AM**  
  **Some identities connecting partition functions to other number theoretic functions.**  
  Neville Robbins, San Francisco State University (921-11-64)

- **9:40AM**  
  **Cyclic indicator and partition functions.**  
  Leetsch C. Hsu, and Peter J.S. Shiue*, University of Nevada, Las Vegas (921-11-77)

10:05AM **Periods of sequences generated by two special mappings.** Preliminary report.  
  Wun-Seng Chou*, Academia Sinica, and Peter J.S. Shiue, University of Nevada, Las Vegas (921-11-139)

10:30AM Discussion

**Special Session on Octonions and Clifford Algebras, III**

8:50 AM – 10:45 AM  
Room 132, Strand Agricultural Hall  
Organizers: Tevian Dray, Oregon State University  
Corinne Manogue, Oregon State University

- **8:50AM**  
  **Duality, triality and the four-color theorem.** Preliminary report.  
  John C. Baez, University of California, Riverside (921-05-19)

- **9:20AM**  
  **The exceptions that prove the rule.** Preliminary report.  
  Anthony Sudbery, University of York, United Kingdom (921-17-129)

- **9:50AM**  
  **Octonions and exceptional structures.**  
  Frank D. Smith, Jr. (921-17-15)

- **10:20AM**  
  **Exceptional nonlinear superconformal and quasi superconformal algebras and their realizations.**  
  Murat Gunaydin, Penn State Physics, University Park (921-20-123)

**Special Session on Geometric Analysis, III**

9:00 AM – 10:50 AM  
Room 222, Strand Agricultural Hall  
Organizers: Harold R. Parks, Oregon State University  
Donald C. Solmon, Oregon State University

- **9:00AM**  
  **Approximation by spherical waves.**  
  Mark Agranovskii, Bar-Ilan University, Israel, Carlos A. Berenstein, University of Maryland, College Park, and Peter Kuchment*, Wichita State University (921-58-43)

- **9:40AM**  
  **Development of P-algebra Lie.** Preliminary report.  
  Boris S. Khots (921-22-164)

10:20AM Discussion

**Special Session on Singular Perturbations, Theory and Applications, III**

9:00 AM – 10:50 AM  
Room 211, Strand Agricultural Hall  
Organizers: Leonid Viktorovich Kalachev, University of Montana
Robert E. O'Malley, Jr., University of Washington

9:00AM More approximations for special functions.  
Harry Gingold, University of West Virginia (921-41-61)

9:30AM On the rate of convergence of Borel approximants.  
W. Balser, University of Ulm, Germany, D. A. Lutz*, San Diego State University, and R. Schaefke, University Louis Pasteur, France (921-41-72)

10:00AM Stokes multipliers of a generalized Weber equation with a large parameter.  
Tatsuhiko J. Tabara, Golden Gate University (921-34-173)

Alisher S. Abdullayev, National University, Sacramento (921-41-67)

Invited Address

11:00 AM - 11:50 AM Gilfillan Auditorium, Wilkinson Hall  
(137) Advances in the computation of area minimizing hypersurfaces.  
Harold R. Parks, Oregon State University (921-49-40)

Invited Address

2:00 PM - 2:50 PM Gilfillan Auditorium, Wilkinson Hall  
(138) Exponential asymptotics.  
Robert E. O'Malley, University of Washington (921-00-08)

Special Session on Octonions and Clifford Algebras, IV

3:00 PM - 5:00 PM Room 109, Strand Agricultural Hall  
Organizers: Tevian Dray, Oregon State University  
Corinne Manogue, Oregon State University

3:00PM Discussion

4:00PM Computer Demonstrations

Special Session on Operator Algebras, IV

3:00 PM - 4:50 PM Room 111, Strand Agricultural Hall  
Organizers: Huaxin Lin, University of Oregon  
Christopher Phillips, University of Oregon

3:00PM A non-commutative n-nomial formula. Preliminary report.  
Carla Emilia Farsi, University of Colorado (921-46-96)

3:30PM Rieffel's trace formula and theta functions. Preliminary report.  
Samuel G. Walters, University of Northern British Columbia (921-46-79)

4:00PM K-theory for translation algebras and its applications. Preliminary report.  
Guoliang Yu, University of Colorado, Boulder (921-19-34)

4:30PM Kirillov theory and transformation group C* algebras. Preliminary report.  
Jeffrey S Fox, University of Colorado, Boulder (921-22-147)

Special Session on Singular Perturbations, Theory and Applications, IV

3:00 PM - 4:50 PM Room 211, Strand Agricultural Hall  
Organizers: Leonid Viktorovich Kalachev, University of Montana  
Robert E. O'Malley Jr., University of Washington

3:00PM Weakly nonlinear waves for hyperbolic conservation laws with rapidly varying parameters.  
J. Kevorkian*, University of Washington, and D. L. Bosley, Harvey Mudd College (921-35-66)

3:30PM Singular perturbation methods for bursting systems.  
Mark Pernarowski, Montana State University (921-35-57)

4:00PM Asymptotics of the Eigenvalues of the rotating harmonic oscillator.  
Mark Dunster, San Diego State University (921-41-58)

4:30PM Asymptotic approximation for second order matrix differential equations.  
Uri Elias*, Technion, Israel Institute of Technology, and Harry Gingold, West Virginia University (921-34-13)

William A. Harris  
Associate Secretary  
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Call for Papers

MAA Mathfest, August 2-4, 1997 Atlanta, Georgia

Organizers solicit papers pertinent to their sessions. Note that the days scheduled for these sessions remain tentative.

Using Technology to Implement the Crossroads Standards in College Mathematics Courses. Saturday & Sunday afternoons.

Cheryl Stratton,* Learning Support Programs, Georgia State University, University Plaza, Atlanta, GA 30303-3083; (404) 651-3360; fax: (404) 651-4377; cstratton@gsu.edu.

Jean Bevis, Georgia State University

We invite presentations which focus on innovative ways to use technology in undergraduate mathematics courses; in particular, how these changes in delivery can support the AMATYC Standards and how the classroom can become a learning laboratory. Presentations should emphasize planning, implementation, and student performance. Participants wishing to extend their presentations beyond ten minutes should indicate so on their proposals. Submission of proposals via e-mail preferred.


Janet Heine Barnett,* Dept. of Math, University of Southern Colorado, 2200 Bonforte Blvd., Pueblo, CO 81001-4901; (719) 549-2540; fax: (719) 549-2732; jbarnett@metro.uscoloro.edu.

Janet G. Nichols, University of Southern Colorado Despite the reputation of liberal arts mathematics courses as "Math for Poets," such courses fulfill a standard graduation requirement and provide a final mathematical experience for numerous students who go on to important careers in non-technical fields. Recently a variety of philosophies concerning the quantitative and mathematical needs of these students have developed, along with new and often innovative methods of instruction and assessment. This session invites papers addressing these philosophies and instructional or assessment techniques being used to meet their goals.

History of Mathematics and Its Use in the Mathematics Classroom. Saturday & Sunday afternoons.

Charles B. Pierre,* Dept. of Math Sciences, Clark Atlanta University, P.O. Box 332, Atlanta, GA 30314; (404) 767-2119; fax: (404) 767-2119; cbpierre@prodigy.com.

Elinor Berger, Columbus College This session invites papers describing innovative ways of using the history of mathematics in the classroom. Investigative approaches, descriptions of ways to teach history of mathematics courses using both original and non-original sources, uses of the history of mathematics in accord with current changes in curricula, pedagogy, and the preparation of teachers of mathematics—or ideas inherent in the Standards—are all welcome.


Lawrence Husch,* Dept. of Math, University of Tennessee, Knoxville, TN 37996; (423) 974-4162; fax: (423) 974-6576; husch@math.utk.edu.

We are particularly interested in receiving reports from departments which have implemented calculus reform in a significant manner for a significant period of time and which have decided either that this is the way to teach calculus or that this is not the way to teach calculus. Reports on decisions based on experiences with either client departments and/or the training of mathematics majors are sought.


Mohammed H. Ahmadi,* Dept. of Math and Computer Science, University of Wisconsin-Whitewater, Whitewater, WI 53190; (414) 472-5175; fax: (414) 472-1372; ahmadim@uwvwax.uww.edu.

Tingxiu Wang, Oakton Community College Throughout our teaching careers, we often find new methods which are creative or interesting in teaching standard topics in undergraduate mathematics. This session invites papers which describe instructors’ outstanding or innovative ideas and their insights into teaching everyday materials in the first two years of undergraduate mathematics.


Cathy A. Godbois,* Dept. of Math, Harrisburg Area Community College, Lancaster Campus, 1008 New Holland Ave., Lancaster, PA 17601; (717) 293-6137; cagodboi@hacc01b.hacc.edu.

Eric Y. Leung, Harrisburg Area Community College As the trend toward the incorporation of modeling real and student collected data into the mathematics curriculum expands, issues regarding the amount of statistics required as a prerequisite and/or the statistics topics which must also be included in the course must be resolved. How much or how little statistical background is required or should be included? Papers describing different viewpoints and current practices are sought.

Submission Procedures for Contributed Papers After you have selected a session to which you wish to contribute a paper, forward the name(s) and address(es) of the author(s), and a one-page summary of your paper directly to the organizer (indicated above with an asterisk (*)). Include as much detailed information as possible within the one-page limitation. Your summary must reach the designated organizer by Monday, April 14, 1997. The organizer will acknowledge receipt of all summaries. You will receive notification from the organizer by April 28, 1997, whether your paper has been accepted. Please note that there will be no published abstracts for this meeting.

Sessions generally limit presentations to ten minutes, but selected participants may extend their contributions up to twenty minutes. Each session room contains an overhead projector and screen; blackboards will not be available. Persons needing additional equipment should contact, as soon as possible, but prior to May 1, 1997: Donovan H. Van Osdol, Dept. of Math, University of New Hampshire, Durham, NH 03824; dvanosdo@maa.org.
AMS-SIAM Summer Seminar in Applied Mathematics

Neuroengineering and Dynamical Systems in the Neurosciences

January 11–16, 1998
Arizona State University

The twenty-seventh AMS-SIAM Summer Seminar in Applied Mathematics will be held January 11–16, 1998. The seminar will be sponsored by the American Mathematical Society, Arizona State University, the Society for Industrial and Applied Mathematics, and others. It is anticipated that the seminar will be partially supported by grants from federal agencies. The proceedings will be published by the AMS in the Lectures in Applied Mathematics series.

The 1997 topic, *Neuroengineering and Dynamical Systems in the Neurosciences*, was selected by the 1995 AMS-SIAM Committee on Applied Mathematics, whose members included Shi-Nee Chow (Georgia Institute of Technology), James Demmel (chair) (University of California, Berkeley), Tai-Ping Liu (Stanford University), Juan Meza (Sandia National Labs), Dianne O'Leary (University of Maryland, College Park), and Tamar Schlick (NYU-Courant).

Members of the Organizing Committee for the Seminar

Steve Baer, Arizona State University
Roman Borisyuk, Pushchino, Russia
Humberto Carrillo, UNAM, Mexico
Robert Hecht-Nielsen, HNC, Inc.
Frank Hoppensteadt (chair), Arizona State University
Peter Killeen, Arizona State University
Jennie Si, Arizona State University
George Stelmach, Arizona State University

Program Goals

The scope of brain research has moved well beyond the confines of any one discipline. Major advances have been made toward better understanding of integrative aspects of the brain by medical and life scientists, engineers, and mathematicians. Mathematical, computer, and engineering sciences have played important roles in these studies up to now, and they will contribute significantly in the future.

This meeting will bring together workers from all of these disciplines into a common venue to promote the flow of information between disciplines, to establish new working relationships, and to expose participants to new ideas. The meeting is timely in helping to reduce barriers to cross-disciplinary work in understanding the brain. It is important to have meetings to bring together mathematical scientists with engineers, computer scientists, and medical/life scientists working to understand the organization and function of the brain. Particularly important are integrative models of parts of the brain, e.g., engineering of neuromechanical interfaces that can be used in prosthetics, analysis of information processing in neural networks, and general mathematical and engineering studies of large networks to guide and suggest experiments.

In addition, there is a need to increase communications between neurophysiologists and computational neuroscientists. Many computational models of the brain developed in the past have limited practical relevance because they do not integrate current biological knowledge into the computational structure. An important goal of this meeting is to initiate and facilitate such interfaces.

Program

Sunday: An intensive six-hour workshop will be organized to provide background on mathematical and engineering aspects of neurosciences for students, postdocs, and fac-
ulty on aspects of material to be presented during the following week. A partial list of speakers is included.

**Monday:** Neuroscience. Six one-hour lectures on neuroscience that have bearing on neuroengineering and dynamical systems. Speakers: O. Vinogradova (RUS), B. McNaughton (UA), R. Miller (UNZ), W. Singer (MPG Fra), R. Shapley (NYU), J. Bower (CalTech).

**Tuesday:** Neuroengineering. Six one-hour lectures on systems analysis of neural networks and interface devices and circuits for human-machine interfaces. Speakers: L. Sandberg (UT-Austin), K. Hornik (ASU), J. Si (ASU), A. Michel (Notre Dame), R. Hecht-Nielsen (HNC, Inc.).


**Friday:** Computer Sciences. Five one-hour lectures on computer science problems revolving around the brain. These include visualization, medical applications, industrial applications of methods from the neurosciences, and artificial neural networks. Speakers: E. Reimann (Good Samaritan Hospital), G. Farin (ASU), G. Strong (NSF), A. Rockwood (ASU), J. Schwartz (NYU-Courant).

A limited number of half-hour lectures will be presented throughout the week. Poster sessions will be presented each evening, Monday–Thursday.

All participants will be required to pay a registration fee of $50. Everyone interested in receiving an invitation to attend should submit the following information before May 1, 1997, to AMS-SIAM Summer Seminar Conference Coordinator, AMS Meetings and Conferences Department, P.O. Box 6887, Providence, RI 02940; or by e-mail to dls@ams.org. Please type or print the following:

1. Full name and mailing address.
2. Telephone and fax numbers (with area code) for office and home.
3. E-mail address if available.
4. Anticipated arrival and departure dates.
5. Your scientific background relevant to the topic of the seminar; please indicate if you are a student or if you received your Ph.D. on or after 7/1/91.
6. Financial assistance requested (please estimate cost of travel); indicate if support is not required and if interested in attending even if support is not offered.
7. Whether you would like to be included on a list of those desiring a roommate for the seminar. If yes, please indicate if you are male or female and list any other pertinent information (e.g., smoking/nonsmoking). A list of those requesting a shared room will be distributed with the letter of invitation to enable each participant to make separate arrangements.

Special encouragement is extended to advanced graduate students, postdoctoral investigators, and junior scientists to participate. Other participants who wish to apply for support funds should so indicate; however, funds available are very limited, and individuals who can obtain support from other sources are urged to do so.

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**Monotone Operators in Banach Space and Nonlinear Partial Differential Equations**

**R. E. Showalter, University of Texas, Austin**

The objectives of this monograph are to present some topics from the theory of monotone operators and nonlinear semigroup theory which are directly applicable to the existence and uniqueness theory of initial-boundary-value problems for partial differential equations and to construct such operators as realizations of those problems in appropriate function spaces. A highlight of this presentation is the large number and variety of examples introduced to illustrate the connection between the theory of nonlinear operators and partial differential equations. These include primarily semilinear or quasilinear equations of elliptic or of parabolic type, degenerate cases with change of type, related systems and variational inequalities, and spatial boundary conditions of the usual Dirichlet, Neumann, Robin or dynamic type.

The discussions of evolution equations include the usual initial-value problems as well as periodic or more general nonlinear constraints, history-value problems, those which may change type due to a possibly vanishing coefficient of the time derivative, and other implicit evolution equations or systems including hysteretic models. The scalar conservation law and semilinear wave equations are briefly mentioned, and hyperbolic systems arising from vibrations of plastic-elastic rods are developed. The origins of a representative sample of such problems is given in the Appendix.

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**Recent Developments in Optimization Theory and Nonlinear Analysis**

**Yair Censor, University of Haifa, Israel, and Simeon Reich, The Technion-Israel Institute of Technology, Haifa, Editors**

This volume contains the refereed proceedings of the special session on Optimization and Nonlinear Analysis held at the Joint American Mathematical Society-Israel Mathematical Union Meeting which took place at the Hebrew University of Jerusalem in May 1995. Most of the papers in this book originated from the lectures delivered at this special session. In addition, some participants who did not present lectures and invited speakers who were unable to attend contributed their work.

The fields of optimization theory and nonlinear analysis continue to be very active. This book presents not only the wide spectrum and diversity of the results, but also their manifold connections to other areas, such as differential equations, functional analysis, operator theory, calculus of variations, numerical analysis, and mathematical programming.

In reading this book one encounters papers that deal, for example, with convex, quasiconvex and generalized convex functions, fixed and periodic points, fractional-linear transformations, modules of convexity, monotone operators, Morse lemmas, Navier-Stokes equations, nonsmooth maps, nonsmooth analysis, numerical stability, products of projections, steepest descent, the Leray-Schauder degree, the turnpike property, and variational inequalities.

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**Mathematical Surveys and Monographs**

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Contemporary Mathematics, Volume 204; 1997; 278 pages; Softcover; ISBN 0-8218-6151-6; List US$49; Individual member US$29; order code CONM/204NA

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**All prices subject to change. Changes for delivery are $3.00 per order.**

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Meetings and Conferences of the AMS

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Southeastern Section: Robert J. Daverman, Department of Mathematics, University of Tennessee, Knoxville, TN 37996-1300; e-mail: g_daverman@ams.org; telephone: 423-974-6577.

The Meetings and Conferences section of the Notices gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. Up-to-date meeting and conference information is available on the World Wide Web via the Internet at URL http://www.ams.org/.

Meetings:

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Important Information Regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 183 in the January issue of the Notices for general information regarding participation in AMS meetings and conferences.

Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of TeX is necessary to submit an electronic form, although those who use plain TeX, AMS-TeX, LaTeX, or AMS-LaTeX may submit abstracts with TeX coding. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html or send mail to abs-submit@ams.org, typing help as the subject line, and descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed abstracts should be sent to abs-submit@ams.org, typing submission as the subject line. Questions about abstracts may be sent to abs-info@ams.org.

Paper abstract forms may be sent to Abstracts Coordinator, AMS, P.O. Box 6887, Providence, RI 02940. Note that all abstract deadlines are strictly enforced. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

Conferences:

See http://www.ams.org/meetings/ for the most up-to-date information on these conferences.

1997:

1998:
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1997 / APP. 350 PP. / HARDCOVER / $99.50
ISBN 0.387.98221.X

HARDCOVER / $29.95
ISBN 0.387.94916-X

New
HORST STÖCKER, Johann Wolfgang Goethe University, Germany

THE HANDBOOK OF MATHEMATICS AND COMPUTATIONAL SCIENCE

The Handbook of Mathematics and Computational Science puts equations, formulas, tables, illustrations, and explanations into one invaluable reference volume. This handbook of modern mathematics is fully up-to-date and includes almost a thousand pages of mathematical material. In addition to its broad coverage of topics in mathematics, it also includes new and expanded chapters on graphs and algebras, probability theory and mathematical statistics, fuzzy logic, neural networks, and the use of computers. This indispensable handbook will quickly become the standard reference for every mathematician and student.

1997 / APP. 950 PP., 545 ILLUS. HARDCOVER / $96.95
ISBN 0.387.94746.9

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CLAUSS müLLER, Aachen, Germany

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1997 / APP. 300 PP./ HARDCOVER / $49.95 (TENT.)
ISBN 0.387.94949.9
APPLIED MATHEMATICAL SCIENCES, VOLUME 122

New
BRUCE C. BerNDT, University of Illinois, Urbana

RAMANUJAN’S NOTESBOOKS

Part V

1997 / APP. 600 PP./ HARDCOVER / $97.95
ISBN 0.387.94944.0

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