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What Next after the Pisa Meeting?

Joint International Meetings are a relatively recent component of AMS activities. The first, held in Cambridge, England, took place in 1992. Since then there have been a dozen more, held on five continents—Africa, Asia, Australia, Europe, and North America. They exude the scientific aura of a large sectional meeting, with registrations varying between 300 and 700 participants, but usually include cultural components matched by few of the sectionals. Begun as an experiment, the now-mature program appears to be a fixture on the AMS scene, having recently received positive endorsements after extensive review by the AMS Committee on Meetings and Conferences, the committee charged with overseeing policy aspects of the Society's meetings program.

Event locations are determined haphazardly, as they depend on the interest and availability of willing partners. A host country must issue an invitation for cosponsoring a joint meeting. While specific dates and sites may be discussed among potential partners in advance, ultimately the guest must leave many such choices to the host, maintaining merely the decision of whether to accept the host's invitation. What strategic site planning does take place is informal. Someone might ask, "Wouldn't it be useful (fun, interesting) to have a joint meeting in Brazil?" Then someone else who knows a person who knows another person well connected on the other side might discreetly inquire through that chain about the existence and extent of reciprocal interest.

Meeting arrangements in North America are less haphazard. Relationships with North American neighbors of the United States are on a unique footing, since it is the American Mathematical Society, not the U.S. Mathematical Society. Standard sectional meetings occasionally have been held in Canada, and future ones are scheduled there, the next being planned for Montreal in May 2002. The relationship with Mexico has been described as "special" by the Committee on Meetings and Conferences. Without defining the term, the Committee encouraged a continued, regular program of joint meetings between the AMS and the Sociedad Matemática Mexicana (SMM). To date there have been five joint meetings with the SMM, all but one held in Mexico. A sixth is being planned for 2004, at a site to be announced somewhere in the U.S.

Just how these events run varies significantly. Conditions, practices, and expectations differ from place to place. Currently host countries are encouraged to take charge of logistical, cultural, and financial matters, making the timing of daily activities and registration fees, among other details, quite unpredictable, yet simultaneously offering unexpected cultural pleasures. Nevertheless, there are certain scientific constants. Invariably there are several plenary addresses, with speakers invited from the sponsoring societies, and there are Special Sessions, which most participants find to be the heart of the meeting. The international flavor is heightened when Special Sessions have coorganizers from both sponsoring societies, who invite a mix of speakers from the two sides. In some cases the set of Special Sessions is arranged strictly by invitation of a scientific program committee, which consists of representatives from each of the sponsoring societies; in other cases, a few Special Sessions are tied directly to the plenary addresses and the rest arise from proposals by volunteers.

The pace of the international meetings program continues to be measured. Current policy is to have at most one of these events per year, not counting the joint meetings with Mexico. Plans are in place for meetings in Pisa, Italy, during the summer of 2002 and in Seville, Spain, during 2003. Discussions are underway about possible meetings in India, Taiwan, and England. Meetings with Mexico, which have occurred every other year since 1993, will slow to one every three years, by mutual agreement with the SMM.

The primary program benefits are obvious. The meetings provide opportunities to exchange scientific ideas in an international setting and to make contacts for new collaborations and exchanges. Participants often appreciate having a professional purpose for visiting scientifically interesting international locations.

The AMS spends a modest amount (modest, but more than the average net expenditure for a sectional meeting) to help produce these events. It provides travel support for plenary speakers and a few AMS officials, and it pays a modest stipend to the host for those meetings held outside the U.S. Those costs are not offset by meeting income, since few meetings actually turn a profit. Ordinarily the host alone bears the risk of financial loss and reaps the rewards from any profits that do accrue, all calculated with the fixed AMS stipend in place.

Of course, no isolated instance of these international events impacts a large fraction of the Society. By my best guess, AMS members who have attended at least one of them number between 1,500 and 2,500. Attendees give the meetings high marks, both scientifically and culturally. Are those numbers and grades sufficient to justify the costs? Direct benefits are felt most keenly by participants, of course, but collateral benefits slowly percolate throughout the mathematical community. Undoubtedly the vibrancy of the global mathematical community, which certainly depends on many additional factors, is enhanced by the presence of this program. In the absence of any quantification—the AMS has no matrix in place for analysis of comparative cost-effectiveness—I like to believe that this low-cost program possesses a rich enough combination of such direct and collateral benefits to make it financially viable for a long time to come.

—Robert J. Daverman
AMS Secretary
Response to Wright and Boerner

In his letter about Irving E. Segal's cosmology, Edward L. Wright [October 2001 issue] points out a somewhat astonishing but minor blemish of little consequence in what is otherwise a very substantial, if at times controversial, rebuttal of his claims on the part of Segal. More to the point is the fact that Wright's assertion that $3\pi/2$ is an upper bound for his function $E(S_1, S_2)$ in chronometric cosmology (CC) is based in part on the statement, proved wrong in Segal's response, that in CC "a source can appear bright either by being close to the observer or close to the antipode where $\theta = \pi$ and $z = 0"$. In fact, Segal shows that the brightness of a source at the antipode must vanish. Moreover, Wright assumes, as he says in his letter, a homogeneous distribution of sources, which is a largely debated and debatable assumption and which is not assumed in CC. Further, Segal has noted several weak points in Wright's statistical methodology and about the reliability of the data he uses that throw much doubt on the empirical values of the function $E$.

We can only agree with the conclusion of Wright to the effect that to be viable a theory must agree with experimental data. This is a point emphasized by Segal and associates in numerous papers in which statistical evidence based on extensive available reliable astronomical data is presented that invalidates Hubble's law (which relates redshift and distance linearly) and is compatible with and even suggestive of the chronometric redshift-distance relation (which, for small redshifts, is quadratic). By contrast, Segal contends that purported evidence in favor of Hubble's law relies on unsubstantiated ad hoc assumptions and wrong statistical analyses.

Such studies of Segal and collaborators have generally been ignored by mainstream cosmologists. One more exception is the Koranyi and Strauss (KS) paper referred to in our January 2001 Notices article which professed also to defeat Segal's claims. The essence of Segal's unpublished rebuttal to the KS paper can be found in an article of one of the undersigned (AD), "Is the Universe Expanding?", to be published in the Proceedings of the International Conference "Scienze Democrazia/Science and Democracy" held in Naples, Italy, April 20–21, 2001.

As to the proclaimed demonstration of Hubble's law using data on Type Ia supernovae, Segal spells out his total lack of confidence in this approach to the redshift-distance relation in a 1997 paper ["Modern Statistical Methods for Cosmology Testing", pp. 70–71 in Statistical Challenges in Modern Astronomy II, Springer 1997] thus:

Today there is a new wave of claims for the validation of the Hubble law, on the basis of observations of another quite non-generic type of object, namely supernovae. Bold, if not somewhat disingenuous, claims for measurement of the distances to supernovae are made, notwithstanding that the crucial difficulty in extragalactic astronomy is that the distance to a source can never be measured in a truly model-independent way... The 'distances' of supernovae are, like the 'standard candle' character of the bright cluster galaxies, theorized rather than observed. Because of their transience, irregularity, scarcity, and difficulty of classification into appropriate types, the use of supernovae as primary sample objects for cosmological testing would probably serve to moot the redshift-distance relation indefinitely.

Big-Bang Cosmology

I would like to make a comment regarding the controversy concerning the Big-Bang cosmology which has been discussed here. The recent letter of Rochus Boerner [October 2001] purports to give evidence against the Big-Bang on the basis of some observational evidence due to the astronomer Halton Arp, based on high redshift of quasars which are claimed to be physically connected to low redshift galaxies. However, this argument was demolished in 1983 by the eminent astronomers, W. Kent Ford Jr. and Vera Rubin. (See Rubin's book, Bright Galaxies, Dark Matters, American Institute of Physics Press, 1997, pp. 59–61.) Contrary to what Boerner says, the disident faction of cosmologists opposed to the Big-Bang cosmology is actually a dwindling group of diehards.

Barnett Lecture Series

The University of Cincinnati has had an annual endowed lecture on number theory since 1975, the I. A. and Fannie Barnett Lecture Series. We are in the process of producing a plaque to commemorate the speakers in this series, but we have some gaps in our
history between 1979 and 1985. We have exhausted our local resources. The list of known speakers is posted at http://math.uc.edu/~mitroj/barnett.htm. If any reader—possibly a former speaker—has information that would help us fill in the missing names, please contact me at mitroj@math.uc.edu. Thanks.

—Joanna Mitro
University of Cincinnati

(Received September 13, 2001)

Negotiating Contracts with Publishers
I was very interested in Wilfrid Hodges’ article “What Do You Want from Your Publisher?” [November 2001 issue]. I am not any sort of expert in the area, having published but one book. Yet my coauthor Adam Shwartz and I developed a set of desiderata that did not appear in Hodges’ list, that I think others may share.

We came up with two primary requirements: low cover price and availability. We got a cover price of $55 written into our contract for the first year the book was out. Similar 500+ page books were selling for $70 or so at the time, so we were quite pleased with this stipulation. We were able to negotiate this by lowering our received royalties. We didn’t write the book to make money; we wanted it to be widely available, and so we were able to make what I still think was a very good trade-off. We got a verbal agreement from our editor that our book would not be subjected to a targeted price increase after the year was out, that it would only rise in price as part of an overall price increase. (Unfortunately, we didn’t insist that this be part of the contract, and when our editor was fired, and the book sold to a different publisher, the price jumped, at one time up to $90. After numerous complaints and threats, the current publisher has brought it down to a reasonable $70.)

Availability means we wanted anyone who wished to purchase the book to be able to do so. This means that we had a very strict definition of what “out of print” means. We had all rights revert back to us in case the book was unavailable for purchase for three consecutive months, with specifics about the disposition of unsold copies. I nearly invoked this clause in our contract immediately after the book was published; the publisher misplaced the books in their warehouse, and the book was actually unavailable for two months, until I tracked down the problem, even though it was listed as “in print”.

Clearly Hodges brought up very important points, such as the existence of electronic as well as paper publishing, and he encourages us to ponder the possibilities. I simply want to point out that there are other considerations that some of us may wish to consider before signing a contract.

—Alan Weiss
Bell Labs

(Received October 18, 2001)

Human Rights and the ICM
Upon reading the section on human rights concerns in the article entitled “Next Year, in Beijing” (September 2001 issue), I was struck by similarities with the old official Soviet writings, with which I am only too familiar. These include the following:

• A shift in the perspective from ethical considerations to pragmatic and political issues, the latter being contrasted with the scientific aims of the congress.
• The special emphasis placed on episodes of harassment and detention of scientists. This distorts the picture, since in a mature Marxist society, whereas the majority of victims belong to a wide range of groups among the general population.
• Condescending tolerance directed toward participants who limit their human rights activities to dinner-table conversations—otherwise, beware!

The painful and difficult problem, as I see it, resides not in the availability of visas and guarantees of personal safety, but in sustaining the intellectual objectives of the event without sycophantic kowtowing to a questionable regime and in minimizing the likelihood of visitors’ unwilling participation in unacceptable practices such as benefiting from the proceeds of forced labor or harvested human organ traffic.

I regret that no attempt was made to address this problem in the article and that there was no mention of reliable sources of information (compare with the “human rights in China” website, http://www.hrichina.org).

—Mikhael Gromov
Institut des Hautes Etudes Scientifiques

(Received October 31, 2001)
While his incredibly inventive mind enriched many fields, Claude Shannon's enduring fame will surely rest on his 1948 work "A mathematical theory of communication" [7] and the ongoing revolution in information technology it engendered.

Shannon, born April 30, 1916, in Petoskey, Michigan, obtained bachelor's degrees in both mathematics and electrical engineering at the University of Michigan in 1936. He then went to M.I.T., and after spending the summer of 1937 at Bell Telephone Laboratories, he wrote one of the greatest master's theses ever, published in 1938 as "A symbolic analysis of relay and switching circuits" [8], in which he showed that the symbolic logic of George Boole's nineteenth century Laws of Thought provided the perfect mathematical model for switching theory (and indeed for the subsequent "logic design" of digital circuits and computers). This work was awarded the prestigious Alfred Noble Prize of the combined engineering societies of the United States in 1940.

Spending the summer of 1938 at Woods Hole, Shannon decided to put the Mendelian laws of inheritance on a proper mathematical footing. His Ph.D. thesis in mathematics (M.I.T., 1940), "An algebra for theoretical genetics", was the result.

Done in complete isolation from the community of population geneticists, this work went unpublished until it appeared in 1993 in Shannon's Collected Papers [5], by which time its results were known independently and genetics had become a very different subject. After his Ph.D. thesis Shannon wrote nothing further about genetics, and he expressed skepticism about attempts to expand the domain of information theory beyond the communications area for which he created it.

Starting in 1938 Shannon worked at M.I.T. with Vannevar Bush's "differential analyzer", the ancestral analog computer. After another summer (1940) at Bell Labs, he spent the academic year 1940-41 working under the famous mathematician Hermann Weyl at the Institute for Advanced Study in Princeton, where he also began thinking about recasting communications on a proper mathematical foundation. In 1941 he returned to Bell Labs for the next fifteen years, initially working on projects related to the war effort.

In 1945 Shannon wrote a classified report, "A mathematical theory of cryptography", which was finally declassified and published in 1949 in the Bell System Technical Journal (BSTJ) as the "Communication theory of secrecy systems" [6]. Perhaps it was from thinking about cryptography in terms of the set of all possible keys that might be used in the encryption of messages that Shannon was led to his breakthrough in "A mathematical theory of communication", published in two installments in the BSTJ in 1948.

At the start of this epic paper, he acknowledged the work at Bell Labs in the 1920s of Harry Nyquist...
(who contributed the “sampling theorem" and “Nyquist diagrams" to communication and control theory) and R. V. L. Hartley, who recommended a logarithmic measure of "information"; but Shannon, like Newton, “standing on the shoulders of giants", was able to see much farther than any of his predecessors. Early in the paper, he wrote “[The] semantic aspects of communication are irrelevant to the engineering problem. The significant aspect is that the actual message is one selected from a set of possible messages” [Shannon's emphasis].

Shannon’s great insight was to think in terms of statistical ensembles: the source as the set of all messages that might possibly be sent; and the channel contributing the set of possible disturbances or corruptions (“noise”) to the message.

Shannon liberated the “entropy" of thermodynamics from physics and redefined it as a measure of uncertainty on probability distributions. While crediting the term “bit" (for “binary digit") to J. W. Tukey, Shannon defined his bit as the amount of information gained (or entropy removed) upon learning the answer to a question whose two possible answers were equally likely a priori. (When one possible answer is more likely than the other, learning the answer conveys less than one bit of information.) He derived formulas for the information rate of a source and for the capacity of a channel (in both the noiseless and noisy cases), each measured in bits per second, and he proved that for any information rate R less than the channel capacity C, it is possible (by suitable encoding) to send information at rate R, with an error rate less than any preassigned positive ε, over that channel. His ingenious proof considers the set of all possible encodings of source messages into streams of binary digits and shows that an encoding chosen “at random" from this set will have the desired property with extremely high probability.

When Shannon’s paper appeared, some communications engineers found it to be too mathematical (there are twenty-three theorems!) and too theoretical, while some mathematicians criticized it as being insufficiently rigorous. In reality Shannon had almost unfailing instinct for what was actually true and gave outlines of proofs that other mathematicians (such as Khinchin and Wolfowitz) would make fully rigorous.

Since 1948 generations of coding theorists have struggled to find actual codes that perform as well as Shannon’s “random" ones. Today there are communication systems operating over noisy channels within 0.005dB of the Shannon limit, and stored information (in computers, on CDs and DVDs) is protected with the same types of “error-correcting codes" used for transmitted information.

Shannon also pioneered the study of “source coding" (or “data compression") to remove all

Claude Shannon

"useless" redundancy from source messages, which, if they are then to be sent over noisy channels, can have “useful" redundancy (extra symbols for error detection and correction) added back.

Shannon was grateful to Bell Labs for tolerating (though certainly not encouraging) his work on “A mathematical theory...", which seemed (at that time!) to have no practical benefit for AT&T. The name “Bell Labs" is now used by Lucent, while "AT&T Research Labs" has been renamed "Shannon Labs".

At the end of "A mathematical theory...", Shannon acknowledged the contributions of several colleagues at Bell Labs, with a special mention of the influence that Norbert Wiener's work at M.I.T. had on his own thinking.

The Shannon bit, as the basic unit of information, though not a particle of physics, clearly has a reality of its own. There has been a serious proposal to rename this unit the shannon. If a message consists of N shannons, then the theoretically best “source encoding" could express it in N binary digits.

After 1948 Shannon wrote many more seminal papers in information theory. Also, in “Reliable circuits using less reliable relays" (BSTJ, 1956, in two installments coauthored with Edward F. Moore), he showed that arbitrarily reliable circuits could be built with unreliable parts, again using redundancy, akin to achieving arbitrarily reliable communication over unreliable (i.e., noisy) channels.

In 1956 Shannon left Bell Labs for M.I.T., where he was Donner Professor of Science from 1958 until his retirement in 1978. For decades, M.I.T. was
the leading university for information and communication theory.

The Information Theory Group of the Institute of Radio Engineers (IRE), founded in the early 1950s (later the "Information Theory Society" of the Institute of Electrical and Electronics Engineers (IEEE)), established the Shannon Award (originally called the "Shannon Lecture") as its highest honor. In 1973 Shannon himself delivered the first Shannon Lecture, at the International Symposium on Information Theory, in Ashkelon, Israel. When I spent most of fall 1959 visiting at M.I.T., I had gotten to know Shannon quite well, but it was an unexpected honor when Shannon attended my Shannon Lecture in 1985 in Brighton, England—the only one he attended after his own.

Shannon was a talented gadgeteer who built some of the earliest robotic automata, game-playing devices, and puzzle-solving machines. He could juggle while riding a unicycle and designed machines to juggle and to ride unicycle-like vehicles. Not working in any Nobel Prize field, but in the new science he had invented, he received innumerable honors and awards, including the U.S. National Medal of Science (1966), Israel's Harvey Prize (1972), and Japan's Kyoto Prize (1985). His research efforts bore bountiful fruit during his lifetime. His Collected Papers [5] include 127 publications from 1938 to 1982. The last few years of his life, Shannon was tragically afflicted with Alzheimer's disease. He died February 24, 2001, in Medford, Massachusetts, in his 85th year. Shannon is survived by his wife of more than fifty years, Mary Elizabeth Fields (Betty), a son Andrew, and a daughter Margarita. Another son, Robert, died in 1998.

Digital Communications, the title of a book I edited and coauthored with members of my JPL group, was still considered an oxymoron when the book appeared in 1964. (Dozens of similarly titled books have appeared since.) To most communications engineers, signals were quite obviously analog. But at Bell Labs in the late 1940s, the transistor was invented. With Shannon's remarkable theorems telling communications engineers what ultimate goals to strive for, and integrated circuits providing ever-improving hardware to realize these goals, the incredible digital communications revolution has occurred. (The theory of error-correcting codes also began in the late 1940s, largely independent of Shannon's work, with Richard W. Hamming at Bell Labs and Marcel Golay at IBM Research Labs.) It is no exaggeration to refer to Claude Shannon as the "father of the information age", and his intellectual achievement as one of the greatest of the twentieth century.

The following five contributions, all by winners of the Shannon Award, describe Shannon's influence and some subsequent developments in specific areas in which he pioneered. This presentation is a representative, but by no means exhaustive, indication of the many disciplines that Shannon's work profoundly enriched.

Elwyn Berlekamp

Shannon's Impact on Portfolio Theory
Shannon was quite interested in portfolio management. He personally gave several talks on the subject now called "financial mathematics" in the late 1960s and 1970s. He studied published data on large pension funds and other institutions to determine the net flows of cash into and out of the U.S. stock market, and he designed analog electric circuits intended to simulate the market. This work attracted little enthusiasm from financial professionals and was never published. But it did attract the interest of some within Shannon's circle, including Fano, whose unpublished work extended some of Shannon's.

John L. Kelly Jr. was a colleague of Shannon's at Bell Labs (although in a different department) who did publish. Kelly became interested in what is now called the "asset allocation problem", which is the question of how best to diversify one's total portfolio among different possible investments. Stated in the colorful terminology of horse racing, an investment opportunity may be attractive whenever the "true odds" known to the investor differ from the "betting odds" on which the payoffs are based. Kelly proved that given a long sequence of such opportunities, the maximum exponential growth rate that can be achieved with probability approaching 1 can be viewed as the capacity of the communication channel over which the investor receives his noisy tips!

The impact of this work emerged slowly but steadily over the subsequent decades. Here is an excerpt from a 1998 interview with Ed Thorpe, a very successful investor:

A June 1998 New York Times Science Times article attributed the degrees of separation idea to a sociologist in 1967. Yet it was well known to Shannon

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before 1960. For bet sizing in favorable games, Shannon suggested I look at a 1956 paper by Kelly [4]. I did and adapted it as our guide for blackjack and roulette, and used it later in other favorable games, sports betting, and the stock market. The principle was to bet to maximize the expected value of the logarithm of wealth. This has desirable properties that are discussed in detail by Cover and Ordentlich [2].

The IEEE Transactions on Information Theory began publishing papers on portfolio theory around 1980. The topic received considerable attention in the IEEE Shannon lectures of 1990 and 1993, both later published in the Information Theory Newsletter. Yet all this work still attracted only skeptical attention from financial scholars in the leading business schools. Applying the Kelly criteria to their favorite model of stock price series (Brownian motion or white Gaussian noise) led to substantially more aggressive investments than portfolio managers had historically deemed prudent. So they tended to reject the Kelly criteria as unsound. However, real price movements have big swings considerably more often than predicted by the normal distribution. When the calculations are done correctly, most of the alleged overaggressiveness disappears.

Perhaps the impact Shannon and Kelly have had on finance can now best be measured by the number and quality of Wall Street firms that are actively recruiting mathematicians and information theorists, an outstanding example of which is documented in the cover story of the November 2000 issue of Institutional Investor.

Thomas M. Cover

Shannon's Contributions to Shannon Theory

Shannon's landmark 1948 contribution [7] initiating information theory presented a capacity theorem for the transmission of information, an entropy theorem for data compression, and an asymptotic equipartition theorem for the probability of sequences from an ergodic process. When the Transactions on Information Theory was formed in the mid-1950s, some areas closely related to Shannon's original work were naturally included in the purview of the journal. These other areas included prediction, estimation, filtering, modulation, and detection. Also came the quickly growing body of work in algebraic coding theory, an area that comprises roughly a third of the contributions in the journal each year. Other areas, like the mathematical theory of learning and algorithmic complexity, were soon to follow. Because of this proliferation, Aaron Wyner used the term "Shannon theory" in the early 1970s to designate those theorems growing directly out of the study of Shannon's work. Roughly speaking, Shannon theory involves problems in which mutual information and entropy play a prominent role.

Some of the initial reactions to Shannon's work were interesting. For example, the publisher insisted that Warren Weaver write an expository chapter for the book [9], presumably to make it more accessible. Since Shannon wrote as simply as possible, Weaver's task was impossible.

J. L. Doob [3] wrote in Mathematical Reviews in 1949, "The discussion is suggestive throughout, rather than mathematical, and it is not always clear that the author's mathematical intentions are honorable." I hasten to add that Doob has recanted this remark many times, saying that it and his naming of super martingales (processes that go down instead of up) are his two big regrets.

On the question of mathematical rigor, however, we should say that after fifty years, it is clear that Shannon was correct in each of his assertions and that his proofs, some of which might be considered outlines, could eventually be filled out along the lines of his arguments. It also must be said, given the breadth and scope of his theorems, that Shannon's intuition must have been anchored in a deep and natural theoretical understanding.

In the Soviet Union, Shannon's paper was considered to be in the field of cybernetics, which had been deemed [10] "a false science of obscurantists" (izhenska mrakobesov). Even to publish its translation required special efforts. The great mathematician A. N. Kolmogorov became excited by Shannon's work and organized an informal seminar around these ideas in 1954. Those involved included I. M. Gel'fand, A. M. Yaglom, M. S. Finkler, R. L. Dobrushin, and Y. G. Sinai. Kolmogorov was eventually led to the definition of algorithmic complexity, the minimum length binary program needed for a Turing machine to print out a given sequence $x$. It turns out that the algorithmic complexity (pretty much simultaneously and independently put forth by Solomonoff, Chaitin, and Kolmogorov) is a very close counterpart to Shannon entropy.

Kolmogorov's attitude [1] expressed in 1983 was that "information theory must precede probability theory, and not be based on it."

Shannon's two most dominant theorems are on data compression and data expansion. In the data compression theorem, Shannon shows that there are $2^{nH}$ roughly equally probable sequences of length $n$ from an ergodic stochastic process ($H$ denotes entropy). The set of these so-called

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The general asymptotic equipartition theorem, also known as the Shannon-McMillan-Breiman theorem, is that if \( \{X_i\} \) is a stationary ergodic random process with probability mass function \( p(\cdot) \), then

\[
-(1/n) \log p(X_1, \ldots, X_n)
\]

converges with probability 1 to \( H \), where

\[
H = \lim_{n \to \infty} H(X_n | X_{n-1}, \ldots, X_1)
\]

is the entropy rate of the process.

The other primary theorem of Shannon is the channel capacity theorem. Suppose one has a communication channel \( p(y|x) \) with the understanding that the output \( Y \) is drawn according to \( p(y|x) \) when \( X \) is the input. The question is how many distinguishable inputs are there? The capacity \( C \) is the logarithm of the number of distinguishable inputs. Shannon argued that if this situation is presented \( n \) times, so that \( p(y^n|x^n) = \prod_{i=1}^{n} p(y_i|x_i) \), then this communication channel takes on a nice structure. Let \( (X, Y) \sim p(x,y) \), and define

\[
H(X) = E \log \left( \frac{1}{p(X)} \right),
\]

\[
H(X|Y) = E \log \left( \frac{1}{p(X|Y)} \right),
\]

\[
I(X; Y) = H(X) - H(X|Y).
\]

Fixing for a moment the type \( p(x) \) of the input sequence, we can see that there are \( 2^{nH(X)} \) typical inputs, and for each input there are \( 2^{nH(Y|X)} \) roughly conditionally equally probable outputs \( Y^n \). So we must merely count the number of distinguishable inputs in the sense that their output fans do not overlap. A simple sphere-packing argument shows that there can be no more than \( 2^{nH(Y)} / 2^{nH(Y|X)} \) such distinguishable inputs. In fact, there are exactly that many, at least to first order in the exponent, as Shannon showed by introducing a random coding argument. He merely picked the \( 2^H(X) \) input sequences \( X^n \) at random, where \( C = \max_{p(x)} I(X; Y) \).

Now I would like to comment on the research that these inquiries engendered. The first ideas in data compression were how to actually minimize the expected description length of a random variable \( X \) drawn according to a known probability mass function \( p(x) \). Shannon suggested assigning a binary sequence of length \( \log \frac{1}{p(x)} \) to \( x \). This achieves an expected description length within one bit of the entropy \( H = \sum -p \log p \). Then Huffman found an algorithm for achieving the minimum. In practice today, one does not use Huffman coding but instead uses either arithmetic coding (mapping the source sequence \( x_1, x_2, \ldots \) into the unit interval via the distribution function \( f(x_1, x_2, \ldots) \), thereby giving a uniform distribution) or Lempel-Ziv data compression in which one keeps track of each new phrase in the data sequence as it evolves and describes the next phrase by reference to the past ones. Since the phrases one is likely to see are the so-called typical ones, one has a very efficient reference library with respect to which one can describe the next phrase.

In 1961 Shannon wrote an important paper on the communication capacity of the two-way channel in which two senders interfere with each other as they try to talk over a common communication line. The simplest example of this is the binary multiplier channel in which the senders send either a 0 or a 1 and receive the product of what they send. Thus if both senders receive a 1, they know of course that they sent a 1 and that a 1 was transmitted by the other. On the other hand, if one sends a 1 and the other a 0, the first sender will know that a 0 was sent, but the second sender will not. To this day the capacity region of this channel is not known. This is one of many unsolved problems in network information theory.

I first met Shannon in 1972 in Ashkelon, Israel, a few years after he had retired from research. He had been asked to give the first Shannon Lecture and was delighted by the prospect, mostly because of the recursive aspect. The lecture was on feedback, which he illustrated with Campbell soup cans on which were pictures of Campbell soup cans, sounds built up of sounds of sounds, and lecturers receiving their own awards.

As for his place in history, Shannon blasted three fields into existence. First, switching theory, a subject that benefits from a mathematical foundation, but turns out not to be intrinsically deep. Then cryptography, where he illuminated an already existent highly mathematical subject. And finally, out of the blue, information theory, with its deep penetration of the mathematics of stochastic processes, the definition of intrinsic randomness, and the capacity relation between cause and effect—a whole beautiful field based on the ineffable idea of information. This ability to create new fields and develop their form and depth surely places Shannon in the top handful of creative minds of the century.
Robert G. Gallager

Shannon at M.I.T.
Claude Shannon spent both his graduate years and the latter half of his professional career at the Massachusetts Institute of Technology. He joined the M.I.T. electrical engineering department as a research assistant in 1936 to work on Vannevar Bush's differential analyzer, an early analog computer. While working on the analog gear mechanisms, he also became interested in the switching circuits that controlled the analyzer. He combined this experience, and a summer assignment at Bell Labs, with an undergraduate course in Boolean algebra to see that Boolean algebra was the right mathematical approach to the analysis of switching circuits. After fleshing this idea out, he wrote it up for his master's thesis.

This thesis, and the published version [8], won him both fame and the prestigious Alfred Nobel Prize for the best engineering paper of the year by an author under thirty. This paper is now recognized as the foundation of modern switching theory and was crucial for the growth of both the computer industry and the telephone industry.

Partly under Vannevar Bush's advice, Shannon began to study genetics. He switched to the mathematics department to do his Ph.D. work on a mathematical foundation for genetics. He continued his interests in switching and his burgeoning interest in communication theory while doing the thesis, and quickly left the genetics field after completing his thesis in 1940. The thesis work was unpublished and remained unknown until recently. His results would have been very important if known earlier, but most of the results have since been rediscovered independently.

After a very fruitful fifteen years at Bell Labs, Claude Shannon returned to M.I.T. in 1956, first as a visiting professor, and then, in 1958, as Donner Professor of Science, with a joint appointment in electrical engineering and in mathematics. There was a very active group in information theory at M.I.T. at that time, and students and younger faculty viewed Shannon as an idol. Many of these students are now leaders in the digital communication field, some in academic careers, some in industrial laboratories, and some as entrepreneurs of large successful corporations.

Shannon was somewhat inner directed and shy, but very easy to talk to after the initial connection had been made. It was relatively rare for him to be the actual supervisor of a thesis, but in many cases, when he talked to a student, he would find an interesting and novel new direction for the student's work. Although these interactions were not frequent, they were extremely important, since students learned to focus on the formulation and approach to a problem rather than getting immediately involved in technical details.

Shannon did not teach ordinary courses, but would give relatively frequent seminars, and once gave an entire seminar course with new results at each lecture. He did not like to replow old ground, and was so creative that, if he started to think of something old, he would look at it in a different way and create something entirely novel. He also disliked writing papers, although he recognized the need for doing this. Fortunately, he could work out all the needed details for a paper in his head, and then dictate the paper in virtually finished form.

While at M.I.T., he fleshed out quite a few results from his masterwork, The Mathematical Theory of Communication. Several of these papers developed bounds on achievable error probability for coding on noisy channels. These bounds were important, both to give an indication of whether noisy channel coding could be practical, and also to provide guidance on what types of schemes would work. Essentially he showed that almost any code would work very well and that the problem was in finding implementable decoders. It was during this period also that he looked at problems of feedback, side information, and interference from other channels.

Shannon always tended to work (or play) with many different types of problems at the same time. Along with writing his information theory papers at M.I.T., he was developing optimal portfolio theories for the stock market, continuing his interest in chess-playing machines, and investigating many other topics. Increasingly in his later years at M.I.T., he worked at home, and eventually retired in 1978.

James L. Massey

Shannon and the Development of Cryptography
Shannon's published work on cryptography is limited to the single paper "Communication theory of secrecy systems" [6], which appeared in October 1949. The first footnote in this paper indicates

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At the blackboard, M.I.T.

that its contents had appeared as a September 1945 confidential Bell Laboratories memorandum that was now declassified. There has been speculation that Shannon’s work on cryptography during the war (he wrote another Bell Laboratories memorandum on the subject in May 1943) led him to his formulation of information theory, but this seems not to be true. His October 1949 paper begins: “The problems of cryptography and secrecy systems furnish an interesting application of communication theory”, and he later confirmed that this was indeed the motivation for his interest in cryptography. Whatever its source, there is no doubt that this paper is one of Shannon’s “blockbusters” and that it has had an enormous influence on the subsequent development of cryptography.

The title of Shannon’s October 1949 paper is itself significant. It is now generally understood that cryptographic techniques have two quite independent goals, secrecy and authenticity. Shannon makes it clear that he is dealing only with secrecy. It would take another thirty-five years before a theory of authenticity, roughly on a par with that for secrecy provided by Shannon, was published by G. J. Simmons.

Shannon makes it very clear that there are two basic types of secrecy systems: those designed to protect against an attacker with unlimited computational resources and those designed to protect against an attacker with a given finite computational capability. Shannon called the kind of secrecy achieved by the former “theoretical secrecy” and that furnished by the latter “practical secrecy”—these terms have been replaced by “unconditional security” (or sometimes “information-theoretic security”) and “computational security” in modern usage, but their meaning is unchanged.

Shannon’s treatment of theoretical secrecy is conceptually rich. He gave the first precise definition of the “unbreakability” of a cipher, restricting himself to a ciphertext-only attack, as meaning that the cryptogram and the message it represents are statistically independent. He showed that the cipher proposed by G. S. Vernam in 1926, now often called the “one-time pad”, achieves “perfect secrecy”—which was Shannon’s term for such unbreakability. [Vernam had claimed that the “unbreakability” of his cipher was confirmed by field trials with the U.S. Army Signal Corps.] More significantly, Shannon showed that perfect secrecy requires a secret key whose length in binary digits is at least as great as the number of bits of information in the message encrypted. This made clear that practical secrecy is the best that one can hope to achieve in most realistic situations where the secret key is relatively short, and it led Shannon to define the “unicity distance” of a cipher as the amount of plaintext that essentially determines the secret key. His formula for estimating unicity distance is still widely used today.

Perhaps the most important aspect of Shannon’s October 1949 paper is its thoroughly scientific nature. The second section of his paper begins: “As a first step in the mathematical analysis of cryptography, it is necessary to idealize the situation suitably, and to define in a mathematically acceptable way what we shall mean by a secrecy system.” This was a radical departure from previous papers in cryptography where conjecture and imprecision reigned. It is no exaggeration to say that Shannon’s paper marked the transition of cryptography from art to science.

Even where Shannon argues on intuitive grounds, he was apparently right on the mark. His principles of “confusion” and “diffusion” for practical cipher design, for which he provided broad semimathematical definitions, were cited in the design of the enciphering algorithm of the 1977 U.S. Data Encryption Standard and are the principles most widely used today in the design of secret-key ciphers.

It must be said that Shannon appears to have missed the most important development of the past fifty years in cryptography, namely that a secret key shared between the communicating parties is not necessary for secrecy. M. E. Hellman, who together with W. Diffie announced this startling development in the 1976 paper that founded “public-key cryptography”, has nonetheless credited these words from Shannon’s 1949 paper as the inspiration for this discovery: “The problem of good cipher design is essentially one of finding difficult problems ... We may construct
our cipher in such a way that breaking it is equivalent to ... the solution of some problem known to be laborious." Whether Shannon truly missed something is not yet certain. After twenty-five years of public-key cryptography, there is still no proof that trapdoor one-way functions, which are the fundamen of the theory, exist.

Andrew J. Viterbi
Attaining Maximum Achievable Channel Transmission Rates: Fulfilling Claude Shannon's Prophesy
In his uniquely remarkable 1948 papers [7], Claude Shannon established all the key parameters and limits for the optimal compression and transmission of digital information. The most unexpected was the hard limit on the maximum rate of reliable transmission over noisy, or error-prone, channels. Its comprehension by the communication engineering community was severely limited, partly because of the unconventional nature of the result, whose proof was based on statistical averaging over ensembles of codes rather than on the construction of specific good codes.

Over the next two decades there emerged two disparate approaches to attaining the promise of Shannon's limit. The first involved the construction of code classes and their respective decoding algorithms based on algebraic theory. Though producing elegant results and some very useful encoder and decoder implementations, this fell far short of fulfilling the original purpose. The second more profitable approach built on Shannon's ensemble concept to establish reasonably tight upper and lower bounds on the achievable error probabilities for important code classes as a function of code length and channel parameters. Out of this came the first tangible progress, yielding results which promised the attainment of reliable transmission at rates above one-half of channel capacity.

The codes were drawn from an ensemble of very long convolutional codes, originally proposed by Elias. But the major contribution was that of an implementable decoding algorithm which performed a sequential search for the most likely path along the tree structure generated by the code. Progressively more refined decoding algorithms were developed by Wozencraft, Reiffen, and Fano. Sequential decoding suffered, however, from a drawback which limited its achievable rate to lie below a so-called computational cutoff rate, always less than capacity and approaching half capacity for very noisy channels. This was due to the fact that the computational load of sequential decoding is a random variable with a Pareto distribution whose exponent is less than negative unity (and hence has bounded mean) only below the cutoff rate.

Partly as an exercise to better understand the potential of convolutional codes, Viterbi in the late 1960s proposed a maximum-likelihood algorithm that recognized the reconvergence of tree paths to reduce the search to the best path traversed within a stationary Markov graph, whose complexity is proportional to its number of states, which in turn is exponential in the length of the convolutional encoder. Good performance was demonstrated even for short codes, guaranteeing a manageable number of states, and this led to their overwhelming acceptance as the codes of choice for most digital wireless transmission, whether over satellites or

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\footnote{This model subsequently gave rise to numerous applications of the algorithm unrelated to channel coding, ranging from voice recognition to DNA sequence alignment.}
terrestrial base stations, as well as for many wireline data channels.

To achieve very low error rates and to approach closer to capacity, the effective code length was greatly enlarged in the 1970s by employing concatenation, a technique first proposed by Forney, which involves passing the digital message through two encoders serially, with an interleaver in between, and at the receiver decoding the two codes in the inverse order to that in which they were encoded. This approach, however, still failed to attain capacity, largely because information was lost in the process of passing (hard decision) information between decoders.

In the 1980s, Hagenauer proposed means for preserving information by passing soft decisions (essentially likelihood ratios) between decoders, but it was not until the 1990s that Berrou and Glavieux recognized the need to iteratively refine these soft decisions by repeating the decoding process by each decoder with ever improved channel symbol estimates provided to and from the other decoder. The resulting overall performance of this so-called “turbo decoding” algorithm was so close to Shannon's capacity as to launch an intensified worldwide effort to scale the final peak.

Work of dozens of researchers validated and refined the turbo decoding concept and related it to Bayesian statistical concepts. The final and most promising word, however, came not from the convolutional and turbo decoding results but from a much earlier concept initially developed by Gallager in 1963, known as low-density parity check (LDPC) block codes, whose decoding employed both soft decisions and the iterative process, alternating between rows and columns of the parity check matrix. Modern refinements of Gallager’s technique by numerous authors at the turn of the century have led to implementable codes for reliable transmission within epsilon of channel capacity.

So ends successfully the half-century saga, leaving though the question of why it took so long when we were so close almost forty years ago. I propose a dual answer. First, the enabling technology for implementation of the (then) seemingly complex algorithms was nonexistent, Moore’s Law not yet even having been pronounced. Secondly, the research style of the time was first to prove theorems and then to attempt applications. Today, with practically unlimited computing power, we can simulate and computationally validate algorithms without first needing rigorous proofs of their performance.

References
The Performance of Block Codes

Elwyn Berlekamp

In his classic 1948 paper [10], Claude Shannon introduced the notions of communication channels and codes to communicate over them. During the following two decades, he remained active in refining and extending the theory. One of Shannon's favorite research topics was the fundamental performance capabilities of long block codes. In the 1950s and 1960s this topic also attracted the active involvement of several of Shannon's distinguished colleagues both at Bell Telephone Laboratories and at MIT, including P. Elias, R. M. Fano, R. G. Gallager, E. N. Gilbert, R. W. Hamming, I. M. Jacobs, B. Reiffen, D. Slepian, and J. M. Wozencraft, and several graduate students, including G. D. Forney and me. The work culminated in a book by Gallager [6] and in a sequence of two "Information and Control" papers by Shannon, Gallager, and Berlekamp [11]. In this article I present an overview of some of the more salient results and their impact.

Error Exponent Theory

A discrete memoryless channel has finite input and output alphabets related by any given matrix of transition probabilities. A block code of length $N$ consists of $M$ codewords, each of which is a sequence of $N$ symbols selected from the channel's input alphabet. The rate $R$ of the code in natural units is defined as $R = (\ln M)/N$. A message source selects one of the $M$ equiprobable codewords and transmits it over the channel. The received word is determined, symbol by symbol, according to the row of the transmission matrix specified by the corresponding input symbol. A decoder examines the received word, computes the a posteriori probabilities of each of the $M$ possible input words, and rank orders them. The decoder is considered correct if the transmitted codeword is the most likely. In a revealing generalization first studied by Elias [3], a "list of $L$" decoder is considered correct if the transmitted codeword appears anywhere among the $L$ most likely choices.

For any fixed channel, one seeks bounds on $P_e(N, M, L)$, the error probability of the best code of the specified codebook size $M$ and list size $L$. (In the most general case, in which the probability of decoding error may depend on which codeword is selected, one evaluates the code according to one of its worst codewords.) Even today, the best codes are known for relatively few channels, and even then only for very high or very low coderates and/or relatively short block lengths. Many of those that are known have interesting connections with other areas of mathematics.

Shannon was interested in getting bounds on the behavior of

$$P_e(N, \lfloor \exp(NR) \rfloor, L)$$

for fixed $L$ (often $L = 1$) and fixed $R$ as $N$ goes to $\infty$. For all $R$ less than the channel capacity $C$, it was shown that $P_e$ is an exponentially decreasing function of $N$. In particular, there is an error exponent $E(L)(R)$ such that $P_e < \exp(-NE(L)(R))$ for all sufficiently large $N$. 

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In the 1950s and 1960s, significant efforts were made to determine the best possible error exponent, which one might hope to define as

$$E_L(R) = \lim_{N \to \infty} (-1/N) \ln P_e(N, \exp(NR), L).$$

This definition measures information in natural units, called "nats". If the natural logarithm is replaced by the base 2 logarithm, then the units are converted from nats to bits. In either case, $E_L(R)$ is also called the channel's "reliability function". Upper bounds on $E_L(R)$ correspond to lower bounds on the probability of decoding error. To obtain such a bound for a given list size, a given code, and a corresponding decoding algorithm, one defines $M$ sets of received words, each set consisting of all words that are list-decoded into a particular codeword. One introduces an appropriate weighting function on the received words and computes the "volume" (total weight) of each such set and the volume $V$ of the entire space of all possible received words. For sufficiently symmetric channels, the weighting function is uniform, and the volume is simply a count of the number of points in the relevant set. Since each received word can belong to at most $L$ sets, it follows that there must be at least one particular codeword whose corresponding decoding region has volume no greater than $LV/M$. The probability of the received word lying within an arbitrary region of this given volume is maximal when the region is a sphere. That probability can be computed and used to determine the probability of decoding error of an idealized "perfect" code, whose decoding regions partition the set of all possible received sequences into perfect spheres.

This probability of decoding error for perfect codes can be calculated to an upper bound on $E_L(R)$. For any fixed positive integer $L$ and any fixed rate $R$ between 0 and $C$, this technique yields as $N$ goes to $\infty$ an upper bound on $E_L(R)$ that is independent of $L$. This bound is called either the "volume bound" or the "sphere-packing bound". As shown in Figure 1, this function is typically analytic. It is tangent to the $R$ axis at $R = C$, and tangent to the $E$ axis at $R = 0$. As we shall soon see, it happens to give the correct values of $E_\infty(R)$ for all values of $R$ between 0 and $C$, assuming that we interpret $E_\infty(R)$ as the limit of $E_L(R)$ as $L$ goes to $\infty$. Since each $E_L(R)$ is itself a limit as $N$ goes to $\infty$, it is important that the two limits be taken in the appropriate order. If $L$ and $N$ were allowed both to go to $\infty$ in such a way that $L$ were an exponentially growing function of $N$, we would get a different answer.

The volume bound remains valid even if the problem is modified to include a noiseless, delayless feedback link, which allows the encoder and the decoder to revise their code depending on previously received symbols.

Lower bounds on $E_L(R)$ correspond to upper bounds on the probability of decoding error. An important technique to get such bounds is the random coding argument introduced in Shannon's 1948 paper, in which all of the $MN$ letters in the codebook are selected independently at random from the same input distribution, which is determined by a careful optimization that depends critically on the statistics of the noisy channel. As $L$ goes to $\infty$, the random bounds approach a limit, which happens to coincide with the volume bound shown in Figure 1. The conclusion is that the volume bound is also the correct value of the function $E_\infty(R)$ for all rates $R$ between 0 and $C$. This is a very remarkable result: when the list size is sufficiently large, random codes are virtually as good as perfect codes. Although the proof of this result for sufficiently symmetric channels is reasonably straightforward, it is much more difficult for the general asymmetric case. One problem is that the reliability function itself is not very tractable. The most successful approach is Gallager's formulation, which expresses the function in terms of a quantity $\rho$, which turns out to be the negative slope, $-dE/dR$.

For each finite value of $L$, there is a corresponding critical rate $R_L$ such that the random coding bound on $E_L(R)$ agrees with $E_\infty(R)$ for code rates in the interval $R_L \leq R < C$. For code rates below $R_L$, however, the random coding bound is a straight line of slope $-L$ that joins the function $E_\infty(R)$ tangentially at the point $R = R_L$. The random coding bounds for $L = 1, 2, 3, 4, 5$ are shown in Figure 2.

In most applications, a list of size $L = 1$ is required. The coding theorems show that at sufficiently high code rates ($R_{\text{crit}} = R_L \leq R < C$), random codes are exponentially as good as perfect codes. At lower rates, however, the error exponent for random codes becomes a straight line of perfect slope $-1$ that veers off tangentially from the volume bound. With a list of size $L$, the error exponent for random
codes remains equal to the volume bound for another interval of rates, \( R_L \leq R \), but then it veers off tangentially from the volume bound with slope \(-L\).

The limit of \( E_1(R) \) as \( R \) approaches 0 is known precisely, and for most channels it is strictly between the random bound and the volume bound. An upper bound on \( E_1(0) \) is provided by

\[
\lim_{M \to \infty} \lim_{N \to \infty} -\frac{1}{N} \ln P_e(N, M, 1).
\]

For sufficiently symmetric channels, this double limit is relatively easy to compute, because for any fixed \( M \) and very large \( N \), the best codes can be constructed explicitly. Their key property is that they are equidistant, in the sense that the frequency with which any particular ordered pair of input symbols occurs in one pair of codewords is the same as the frequency with which it occurs in any other pair of codewords. Equidistant codes also happen to optimize the above double limit for arbitrary asymmetric channels, although that result was rather more difficult to prove.

A lower bound on \( E_1(R) \) that coincides with the correct value at \( R = 0 \) is obtained by a technique called "expurgation". One first selects a code at random. Then one computes the probability of confusing each pair of codewords, as if \( M = 2 \) and these two words were the only words in the code. A threshold is carefully selected, and any pair of codewords whose confusion probability exceeds this threshold is expurgated, meaning that both of those codewords are removed from the code. The threshold is chosen so that on the average, at least half of the codewords survive the expurgation. What remains is an expurgated random code that contains no pair of too-easily confused codewords. As shown in Figure 3, this yields an error exponent \( E_0(R) \), which improves the random coding bound in the region of rates \( 0 \leq R < R_x \). The \( E_0(R) \) curve joins the random coding bound tangentially at \( R = R_x \).

Finally, there is another general result that allows any upper bound on \( E_1(R) \) to be joined to any point on the volume bound by a straight line bound (also known as the SGB bound). As shown in Figure 3, the best such bound is attained by selecting points such that the straight line bound is tangent to the volume bound at its high-rate endpoint and to a low-rate bound at its low-rate endpoint. In Figure 3, the low-rate bound is the single-point double-limit upper bound on \( E_1(R) \) described above.

One communications channel of considerable practical importance is the binary-input Gaussian noise channel. This channel has only two inputs, which are taken as the real numbers +1 and -1. The input number is called the "signal". The noise is taken as an additive real number having zero mean and given variance. The output, also a real number, is the sum of the signal and the noise. In order to make the channel discrete, the output range is commonly partitioned into a finite number of intervals. Usually this is done by uniformly quantizing the output over some finite range, allowing the extreme intervals at either end to run to \( \infty \). For example, in the 2-input 8-output version of this model, the seven breakpoints between different output intervals are commonly set at \(-1.5, -1, -0.5, 0, +0.5, +1, \) and \(+1.5\).

More intricate models of this channel assume that the noise is white and that an appropriate figure of throughput for the entire system is the number of nats/sec or bits/sec. This turns out to be maximized by making the time interval for each transmitted bit very small, even though this yields a discrete-memoryless channel that is very noisy and that has a very small capacity per transmitted bit.

This motivation led to the study of "very noisy channels", whose probability transition matrices could be written as \( P_{i,j} = P_i(1 + \epsilon_{i,j}) \), where \( \epsilon_{i,j} \) is small for all \( i \) and \( j \). Reiffen [9] showed that the error exponent for any such channel depends on only one parameter, the capacity \( C \). As shown in Figure 4, the graph of \( E_0(R) \) is a parabola that attains a slope of \(-1\) at the critical rate \( R_1 = C/4 \). At rate \( R = 0 \), the average distance upper bound coincides with the random coding bound. So for such channels, expurgation gains nothing, and the random coding bound is optimal at all rates between 0 and the capacity \( C \). It coincides with the straight-line SGB bound at rates
Many early communication and memory systems were designed and deployed before sophisticated coding was practical. Others were designed and deployed before the benefits of sophisticated coding were understood and appreciated by the system designers. In either case, such systems worked by placing heavy investments in power and in analog equipment, and by constraining the users to relatively low throughput and often only marginally acceptable error-performance as well. When users of such systems expressed willingness to make further sacrifices in throughput in order to gain better error-performance, the coding engineers and theorists were presented with “very quiet channels”. Most such channels turned out to be highly symmetric. This is fortunate because, to this day, relatively little is known about very quiet asymmetric channels.

Perhaps the most-studied channel is the binary symmetric channel. It is a special case (with $q = 2$) of the $q$-ary symmetric channel, which has $q$ inputs and $q$ outputs. Each input goes to its corresponding output with probability $1 - p$. The parameter $p$, which is the probability of symbol error, is the same for all inputs. All kinds of symbol errors are equally likely, each occurring with probability $p/(q - 1)$. As $p$ approaches $(q - 1)/q$, the channel becomes very noisy, and its capacity approaches 0. But as for all very noisy channels, when properly normalized, the reliability approaches the function shown in Figure 4. On the other hand, when $p$ approaches 0, the capacity approaches $\ln q$ bits/symbol. Since $R_{\text{crit}}$ and $R_{x}$ both approach the capacity $C$, the high-rate region above $R_{x}$ disappears. Random codes become uniformly bad, because the reliability is dominated by minimum distance considerations rather than by volume considerations. Here minimum distance is the smallest number of input symbols in which any pair of codewords differ. The reliability approaches $\infty$ at all coderates between 0 and the capacity $C$, and the rate at which it approaches $\infty$ is proportional to $-\ln p$. So the interesting function to study is the “normalized reliability”, defined as

\[ e(R) = E_{1}(R)/(\ln p). \]

For the binary symmetric channel, $N \cdot e(R)$ is the best possible minimum distance of any block code of the specified (long) length and rate. From the mid-1950s through the mid-1970s, the classic bounds on $e(R)$ shown in Figure 5 were the best results known. Results for the more general symmetric $q$-ary channels were similar. But eventually, both the upper and lower bounds on $e(R)$ were partially improved. The first improvement on the Elias bound, at sufficiently small positive rates, was by Welch, McEliece, and Rumsey [15]. The first improvement on the Gilbert bound, for $q \geq 49$, was due to
Tsfasman, Vlăduţ, and Zink [13]. The latter result was a novel application of algebraic geometry. Despite further improvements, a gap still remains between the improved bounds.

Algebraic Coding

Even before Shannon’s retirement, many engineers, computer scientists, and mathematicians were creating innovative algorithms to specify and implement feasible coding strategies for particular noisy channels. The first such were the single-bit-error-correcting binary Hamming codes. Shannon mentioned the binary Hamming code with $2^4$ codewords of length $n = 7$ as an example in his 1948 paper. Binary Hamming codes with $2^{32}$ or $2^{64}$ codewords later became very widely used in computer memories.

In 1960, Bose-Chaudhuri-Hocquenghem and Reed-Solomon applied the theory of finite fields to construct error-correcting codes. Although subsequently seen to be special cases of a common generalization, the initial BCH codes were binary, while the initial RS codes used a large prime-power alphabet of size $q = N + 1$. The RS codes proved directly suitable for the original $q$-ary symmetric channel and for several of its close relatives with $q$ symmetric inputs but with more outputs. One such channel has an additional $(q + 1)$st “erasure” output, accessible from all $q$ inputs with the same transition probability. Another such channel has $2q$ output symbols, each pair of which corresponds to a “more reliable” and a “less reliable” estimate of each input signal.

The most widespread application of RS codes has been to a bursty (rather than a memoryless) version of the binary symmetric channel, the bit error probability varying with time. Any sequence of bits can be partitioned into $m$-bit characters, each of which can be viewed as a symbol in a finite field of order $q = 2^m$. This is particularly appropriate for certain binary channels in which errors tend to come in short bursts of lengths comparable to $m$. For such channels, doubly-interleaved RS codes are superior to multiply-interleaved binary BCH codes in numerous respects. They have superior performance. Surprisingly, they are easier to encode. They are also easier to decode. Partly because of this, and partly because of unusually fast and efficient decoding algorithms now associated with them, RS codes with high coders have become very widely used in many magnetic and optical storage systems.

The emphasis on high coders arises from a coincidence of several factors. On the system side, considerations of factors such as bit synchronization, latency, and delay make high coders attractive. On the coding side, all of the costs associated with RS codes grow linearly or as the square of the redundancy, $(\ln q - R)N$, and these costs become very small when $R$ is large. There is also a performance factor, because traditional RS decoding algorithms perform only as block codes with list size $L = 1$.

Sudan [12] introduced an innovative method to decode RS codes with low coderates using lists of size greater than 1. He also applied these methods to random proof-checking problems in theoretical computer science. When it is feasible to trade an increase in decoding complexity for improved performance, Sudan’s algorithm can be used to attain much higher reliability for low-rate RS codes even when $L = 1$. One first uses Sudan’s algorithm like a search committee, to reduce a large pool of candidates down to a short list. In many applications, there is auxiliary information available that allows another part of the decoder to scrutinize each of these candidates more carefully before making the final selection.

Convolutional Codes

Originally, Shannon used the block length $N$ as a rough measure of the delay and complexity of a coding/decoding system. Many coding theorists have long sought to refine this measure. In the 1950s, Elias introduced binary “convolutional codes” in which message and check bits were intermingled in the transmitted data stream, and in which each check bit was constrained to depend on only $N$ prior message bits. This approach replaced the block length with a constraint length and led Wozencraft, Fano, Jacobs-Berlekamp, and others to study sequential decoding algorithms. Viterbi [14] presented a very innovative approach showing that maximum-likelihood sequential decoding was feasible on sufficiently short convolutional codes and that the performance was adequate for many purposes, particularly on the binary-input Gaussian noise channel. This led to widespread use of Viterbi decoding on many communications channels. In the mid-1980s, NASA adopted standards for deep-space communications that required a concatenation of two codes: an inner Viterbi code of coderate 1/2, and an outer RS code of coderate 223/255 or 239/255. The Viterbi code converts a rather noisy memoryless Gaussian channel into a rather bursty binary symmetric channel, on which the RS code then attains a very low probability of decoding error.

Low Density Parity Check Codes

In 1962, Gallager [5] introduced “low density parity check codes” as a way to get some of the advantages of long block codes while constraining the cost of complexity. Although the topic then remained relatively dormant for nearly twenty years, the phenomenal decrease in the cost of memory led a number of computer scientists and engineers to revisit or rediscover and improve this approach in
the early 1980s. Gallager's methods had been random, but the modern resurgence of interest in this area has focussed more attention on specific constructions using expander graphs such as those constructed by Margulis [7] and by Lubotzky, Phillips, and Sarnak. This construction is a novel application of modular forms.

Conclusion

Most mathematicians are probably aware of names such as Conway, Margulis, and Sarnak, but they may not be aware of the enormous impact the coding work inspired by Shannon has had in other areas. Forney, Ungerboeck, and others used increasingly sophisticated coding techniques to improve speeds over local phone lines by almost two orders of magnitude, well beyond crude early estimates of capacity. Jacobs and Viterbi founded a company called Qualcomm, which dominates the intellectual property in the cell phone industry. Today, Reed-Solomon codes are used in most magnetic disks and optical CDs. The large part of Bell Telephone Labs that stayed with AT&T at the time of the Lucent spinoff was renamed "Shannon Labs". Statues of Shannon have been dedicated in his hometown of Gaylord, Michigan, and at both of his alma maters: University of Michigan and MIT, and at AT&T's Shannon Labs and at Lucent's Bell Labs, and at the Center for Magnetic Recording Research of the University of California at San Diego.

References

From Preprints to E-prints:  
The Rise of Electronic Preprint Servers in Mathematics  
Allyn Jackson

One of the earliest preprint servers in mathematics was launched in July 1991 in the mathematics department of the University of Texas at Austin. Called mp.arc, for “mathematical physics preprint archive”, it was the brainchild of Hans Koch, Rafael de la Llave, and Charles Radin, who had no grander scheme than to provide themselves and their colleagues in mathematical physics with an efficient and organized way of exchanging preprints. In the state next door, the hep.th preprint server went online in August that same year at Los Alamos National Laboratories (LANL) in New Mexico. Founded by physicist Paul Ginsparg, hep.th, which stands for “high energy physics— theoretical”, housed preprints in that rapidly moving field. Both mp.arc and hep.th operated by e-mail and ftp; the World Wide Web had not yet been invented.

These two servers made the jump to the Web and still exist today, and each has been successful in its own way. But their trajectories have been very different. The mp.arc has remained a small archive serving mathematical physicists, with about 2,700 papers and about 850 subscribers to its e-mail-notification service. By contrast, hep.th has grown into a behemoth now known as the arXiv. Its size is a moving target: At the time this article was written, the arXiv contained over 170,000 papers in all areas of physics, as well as mathematics, nonlinear science, and computer science. Around 25,000 people get daily e-mail about new postings to the arXiv, and around 35,000 users access the arXiv every day.

Preprint servers are fast becoming an integral part of the research culture in mathematics. Posting papers on preprint servers is now “part of the publication process”, says Dale Alspach of Oklahoma State University, who runs the Banach Space Archive. Over the approximately ten years that preprint servers have been in existence, their holdings have grown in size and in value. Attempts to manage the evolution of this new tool have produced considerable ferment within the worldwide mathematical community. Preprint servers have also raised tough questions about long-term electronic storage, copyrights, and peer review.

From Preprints to E-prints

In the days before the Internet, preprints were on paper and were usually circulated by postal mail or handed out at lectures. Preprints are now circulated mostly electronically, often through e-mail but increasingly through websites. A preprint server is an automated electronic mechanism, usually Web-based, for exchanging preprints of scholarly articles. The servers are fully accessible to anyone. Authors post their preprints; readers retrieve the preprints they are interested in. There are no gatekeepers judging the quality of the posted material (though oversight is exercised to eliminate inappropriate postings), and there are no access fees.

Sometimes preprints are removed from a server after publication, but because many servers retain the material in perpetuity, they call themselves “preprint archives”. What is more, a few journals
have begun to post published articles on these servers, rendering the term "preprint" a misnomer. Thus the phrase "e-print archive" has come into use. "People sometimes say 'e-print' instead of 'preprint,'" says Greg Kuperberg of the University of California at Davis, who has worked extensively on the mathematics section of the arXiv. "I go further. I say 'article' to make the same point." Indeed, the notion that this material is tentative or ephemeral is disappearing. Some believe that such archives will evolve to become the custodians of the primary research literature.

Such an evolution already seems to be occurring in physics, due to the arXiv. Some physicists who no longer feel the need to add to their publication lists have posted influential papers on the arXiv with no intention of submitting those papers to journals. More and more in physics (and to a lesser extent in mathematics) one sees arXiv numbers given as references to papers cited in bibliographies. In the past, when research articles appeared only on paper, the number of times an average article was cited grew slowly over a period of years. Citation analyses have shown that, for physics papers, the arXiv has shortened this citation time-lag to just months.

Subject-based Servers: Small, Efficient, Folksy

Worldwide, there are hundreds of preprint servers in mathematics, and they can be divided into two major categories: subject-based servers and general servers. The Directory of Preprint and e-Print Servers, provided by the AMS on its website, lists seventeen subject-based servers, and these together contain 6,000 to 7,000 papers. These servers are typically run by mathematicians themselves and provide easy-to-use, low-tech features for small communities of dedicated users. The mp_arc, which is limited to the subject of mathematical physics, is an example of a subject-based archive. Koch says that the mp_arc, which shut down its old gopher server after nobody had accessed it in a year. Although most users now access the mp_arc through the Web, the archive maintains an e-mail interface, because a small percentage of papers is still posted that way. "We keep it at a low technical level as far as access is concerned, because people in different parts of the world don't have all the latest gimmicks," he notes.

These servers put a premium on getting the user to the desired material as quickly as possible. For example, the home page of the K-theory Preprint Archives serves up the full list of about 500 papers, giving titles and authors. From there one click retrieves the abstract of a paper, and another click downloads a .dvi or PostScript file containing the full paper. Some servers offer a bigger range of file formats, including \TeX, \LaTeX, and PDF (Portable Document Format). A search function is a common feature: On some servers, like mp_arc, the full text of the papers is indexed and searchable, but on most others one can search only the "metadata"—that is, the titles, author names, and abstracts. Despite the lack of ornamentation, many of these sites have distinctive personalities. The Hopf Topology Archive, whose e-mail notification service reaches about 400 people, has a downright folksy feel. On the home page of this archive, its founder, Clarence Wilkerson of Purdue University, tells users he recently found an old roll of film with pictures from a conference in the early 1980s. "Write me if you can figure out when and where this was," he requests. "Current thought is the UWO conference from 1981." He is clearly addressing a small clan.

Why do mathematicians start preprint servers? "It wasn't a grand vision," explains Wilkerson, who started the Hopf Topology Archive in 1992. He wanted to avoid the expense and delays of sending paper preprints through the mail, especially overseas, and he also hoped to publicize his and his colleagues' work. With about 700 papers, the archive has clearly developed into a useful resource. Wilkerson points to some unforeseen side benefits as well. "The archive has allowed me as a topologist to get a view of what's currently going on in the field," he notes. The archive has also attracted authors from distant corners of the globe, who do not have easy access to paper versions of preprints. Says Wilkerson, "A psychological payback is that I often hear people thanking me if having this service available."

General Servers: A Variety of Flavors

The second category of preprint servers, that of general servers, includes those based at mathematics institutes or in mathematics departments. Most institutes have a place where visitors can post preprints of articles they worked on during their visits, and many mathematics departments have central servers where faculty can deposit their papers. There are hundreds of such servers, and they vary greatly in size, ranging from, for example, the tiny server at the mathematics department of the Royal Swedish Institute of Technology, which has about sixty papers, to the server at the Institute for Mathematics and its Applications at the
University of Minnesota, which has about 1,800. According to Kuperberg, mathematics institute and departmental servers together contain roughly as many papers as the mathematics section of the arXiv (which as of this writing had 16,400 papers).

A preprint server can be an important part of the image that an institute or department projects on the World Wide Web: A moribund departmental server, for example, can leave the impression that no one in the department is doing any research. When the Erwin Schrödinger Institute (ESI) was launched in Vienna in 1993, ESI immediately set up a preprint server, which was one of the very first to use HTML (Hypertext Markup Language). Today the server contains about 1,000 preprints. “We need the preprint server as documentation of our productivity,” explains ESI director Peter Michor. The institute is funded by the government of Austria, which, like all funders wants proof that its money was well spent.

Another example of a general preprint server is the mathematics section of the arXiv (pronounced the same as “archive”; the X is pronounced like the X in TjX). The arXiv differs from institute or departmental servers in not being closely tied to its home institution, Los Alamos National Laboratories (LANL). In fact, this year Paul Ginsparg accepted an offer to join the new Faculty of Computing and Information at Cornell University (with a joint position in the physics and computer science departments), and the main arXiv site will move with him. Cornell has become in recent years a center for innovation in electronic communications for academia, making it a natural home for the arXiv. Another difference is that the arXiv has outside funding: For the past few years, its funding totaled about $300,000 per year from the Department of Energy and the National Science Foundation. Most of the funding goes toward the salaries of the three staff members, including Ginsparg, who develop and maintain the arXiv; the hardware costs are comparatively minor. The Department of Energy funding will end with the move to Cornell, while the National Science Foundation will continue to fund research and development supporting the arXiv. The Cornell University Library will cover the arXiv’s basic infrastructure and maintenance as a “special collection” of the library.

The dedicated resources and attention put into the arXiv over the years have resulted in a highly robust system. The robustness is partly due to refinements in the software; the arXiv is, for example, one of the few preprint servers that has a TjX “autocompiler” that figures out what version of TjX a posted paper is in and then automatically compiles the paper in the appropriate version. In addition, seventeen mirror sites spread across six continents ensure that the arXiv data is preserved and always accessible. But, says Greg Kuperberg, “What I think sets the arXiv apart [from other preprint servers] is its oversight even more than its software. It has a full-time paid staff, several dedicated volunteer helpers, and an array of moderators and advisors. This escalation of policy and structure is just what you would expect for a system that now gets 30,000 submissions a year.”

The arXiv has gained a reputation for being, as an article in the online magazine Searcher put it, “somewhat user-unfriendly”. However, the site’s documentation, updated and refined over a decade, is clear and ample. First-time users in mathematics might find it easier to get started at the Front for the Mathematics arXiv, created by Kuperberg. The Front is an “overlay” of the arXiv, which means that it provides a different user interface for accessing the arXiv holdings. With more graphics and a more polished feel, the Front offers the same functionality as the arXiv. One additional feature available on the Front but not on the arXiv is an alphabetical listing of authors in mathematics; from this list, one can click on an author’s name and retrieve the full list of that author’s papers that have been posted on the arXiv.

Another kind of general preprint server is the “umbrella server”, which does not contain actual papers but instead provides links to where the papers reside. The prime example of an umbrella server in mathematics is MPRESS (Mathematical Preprint Search System). MPRESS grew out of D-MathNet, started in 1995 by the Deutsche Mathematiker Vereinigung (German Mathematical Society). D-MathNet provides a centralized way to access papers on about 40 mathematics department preprint servers in Germany. Created by Judith Plümer and Roland Schönwälder of the Universität Osnabrück, D-MathNet gives the departments an easy way of organizing preprint metadata into a form that can be “harvested” by Web-crawling robots. In 1998, the European Mathematical Society launched a project to expand the coverage of D-MathNet to servers outside Germany, and thus MPRESS was born. The Committee on Electronic Information and Communication of the International Mathematical Union has now appointed a committee to support the further development of MPRESS. MPRESS draws on not only the servers
Surfing for Preprints

Below is a listing of the URLs of preprint servers mentioned in this article. A comprehensive listing of preprint servers in mathematics may be found in the AMS Directory of Preprint and e-Print Servers, on the Web at http://www.ams.org/global-preprints/.

- Cite-Base Search: http://cite-base.ecs.soton.ac.uk/help/index.php3
- CogPrints: http://research.ecs.soton.ac.uk/projects/CogPrints.html
- Institute for Mathematics and its Applications, University of Minnesota: http://www.ima.umn.edu/preprints/new.preprintlist.html
- mp_arc: http://www.ma.utexas.edu/mp_arc
- MPRESS: http://mathnet.preprints.org
- ResearchIndex (formerly CiteSeer): http://citeseer.nj.nec.com
- Royal Swedish Institute of Technology: http://www.math.kth.se/math/harvest/brokers/tritamat
- Schrödinger Institute preprint archive: http://www.esi.ac.at/ESI-Preprints.html

under D-MathNet, but also servers in France and Austria, as well as the arXiv and a few subject-based servers in the United States; there are plans to bring yet more servers within the reach of MPress. A single search command typed into MPress allows one to search the metadata of around 40,000 papers (this figure includes duplicate papers residing in more than one server). The usefulness of MPress is clear: Plummer says that in 1999 some 50,000 queries were typed into the MPress search engine.

Last year saw the establishment of a new kind of preprint server: In May 2001 Elsevier Science launched the first mathematics preprint server sponsored by a commercial publisher (Elsevier started a preprint server in chemistry in 2000 and is considering starting one in computer science). Neither the server's URL, nor the site itself, advertises the Elsevier sponsorship. The server operates free of charge, and Elsevier has pledged to keep it free always. Anyone may post papers to the server, whether or not those papers are destined to be submitted to Elsevier journals. The Elsevier server has some unusual features: For example, users can rate papers on a scale of zero to five stars and can retrieve a list showing the papers in order from the highest ranked to the lowest. Michiel Kolman, Elsevier's publishing director for mathematics and computer science, says that authors publishing in journals on which Elsevier holds the copyright will be given permission to post the final versions of their papers on the Elsevier preprint server, making the papers available for free. Kolman says that the preprint server will be one component of the "math portal" that Elsevier hopes to introduce in 2002. This portal will provide a search service for metadata of articles published by Elsevier and other publishers. The basic idea of establishing these free services is to create Web traffic toward ScienceDirect, Elsevier's online service for subscribers to its journals.

What Other Sciences Are Doing

In physics, the arXiv has become an indispensable mode of scientific exchange. Apart from physics, mathematics is the field in the natural sciences that makes heaviest use of preprint servers. But use of these servers is not uniform across mathematics. For example, mathematical areas with ties to string theory, such as algebraic and differential geometry, are among the biggest users of preprint servers, due to the influence of the arXiv: During the growth of string theory in the 1990s, the arXiv became the central clearinghouse for papers in that rapidly moving field. The use of preprint servers is lower in, for example, numerical analysis, in part because this area has long-established traditions of using electronic tools like e-mail newsgroups and mailing lists for exchanging information about the latest developments.

Like numerical analysis, computer science lacks a tradition of using preprint servers. Rather, the tradition has been to post one's papers on one's own home page or on a departmental server. This fragmented system got a unifying boost when a service called CiteSeer was established by the NEC Research Institute, a computer science think tank.
in Princeton, New Jersey. ResearchIndex, as CiteSeer is now called, trolls the home pages of computer scientists on a regular basis, collecting and caching papers. ResearchIndex allows direct postings by authors, and there is now a computer science section of the arXiv, called Computing Research Repository, or CoRR. Joseph Halpern, a computer scientist at Cornell University who chairs the advisory committee for CoRR, notes that, while some computer scientists put their papers on CoRR (and the numbers are increasing every year), the majority seem content to post papers only on their home pages and let ResearchIndex collect them. Papers posted on CoRR will remain in perpetuity, while it is unclear how long the material cached in ResearchIndex will remain there.

In chemistry, the main preprint server is the one sponsored by Elsevier, which was started in August 2000. But with only about 300 preprints submitted since then, the server’s growth has been sluggish. Because patents and other proprietary information are often discussed in chemistry papers, the field does not have a well-established culture of exchanging preprints. However, the biggest barriers against preprint servers are found not in chemistry but in the biomedical sciences. Many biomedical journals not only prohibit their authors from posting preprints but also impose embargo rules whereby authors cannot even discuss the contents of an article before it appears in print. In recent years, researchers have found these kinds of rules increasingly restrictive. In 1999, the British Medical Journal started NetPrints.org, a repository for preprints of articles in the biomedical sciences. Many of the top biomedical journals—including the Journal of the American Medical Association, the New England Journal of Medicine, and Science—refuse to allow their authors to post preprints on the Web, thereby limiting the usefulness of sites like NetPrints.org.

Embargo rules and patent considerations aside, there is another reason it has been easier to set up preprint servers in mathematics, computer science, and physics than in chemistry and biomedical science: the pervasive use of \( \LaTeX \). David Morrison of Duke University, who chairs the advisory board for the mathematics section of the arXiv, notes that mathematicians inherited the “open source spirit” of \( \LaTeX \) from its founder, computer scientist Donald Knuth, who made this revolutionary typesetting language freely available. With \( \LaTeX \), mathematicians have an easy way to exchange files that are independent of users’ computer platforms and are convertible into other formats, such as PostScript and PDF. In some areas of science, the use of specialized commercial software packages makes it much more difficult to share files. (Morrison also points out another, unexpected advantage of \( \LaTeX \): “It provides a barrier to participation by amateurs.” In other words, because would-be angle-trisectors are unlikely to have mastered \( \LaTeX \), they are discouraged from attempting to post material to preprint servers.)

As the use of preprint servers has spread, a few scientist-led initiatives have sprung up to facilitate the growth of what has been to date mostly a cottage industry. One is the Open Archives Initiative (OAI), of which Ginsparg is a founder. The OAI is an international effort to develop interoperability standards for disseminating content over the Web. In January 2001, the OAI made available protocols for metadata that could facilitate the sharing of papers among different archives. A related effort is the “Self-Archiving Initiative” started by Stevan Harnad, a cognitive scientist at the University of Southampton in the United Kingdom. He has created free archiving software that complies with the OAI standards and that authors can use to construct their own archives. The software creates data that could be “harvested” by, as Harnad calls it, “a global virtual archive”. Harnad has begun such an archive, called Cite-Base, which draws its data from the arXiv and from Cogprints, the electronic archive Harnad created in cognitive science.

Launching a Server: A Risky Proposition?

Most of the mathematics preprint servers that have thrived have served relatively small communities of mathematicians, numbering in the hundreds, who share common interests. A high level of research activity can also spur a server’s growth, as string theory did for the arXiv. However, as Greg Kuperberg points out, starting a preprint server is risky. “Most preprint servers and archives fail, just like startup businesses,” he points out. “Most of them either never get off the ground or eventually stall.” Some servers had widespread support but died anyway. One such example is the AMS preprint server, which was launched in 1995 and shut down in early 1999.

The idea for starting the AMS preprint server came out of discussions of the Society’s Committee on Publications in the early 1990s. The original idea was to run the server using Ginsparg’s software from Los Alamos; Ginsparg agreed to share it with the AMS. Eventually this plan was scrapped because of concerns about whether the AMS could properly develop and maintain the software. Ginsparg now says that, with hindsight, the AMS probably made the right decision, because the advent of the World Wide Web necessitated major design changes in the Los Alamos archive. In the end the AMS decided to develop the software on its own. Surrounding the effort was a great deal of uncertainty about what impact emerging technologies like preprint servers might have on traditional journals. Richard Palais of Brandeis
University, who was chair of the Committee on Publications at the time, recalls a question that kept arising: "If people can get the papers electronically before publication, will they still buy the paper journals anymore?"

The AMS preprint server was envisioned primarily as an umbrella server (though it was also possible to post preprints directly to it). Umbrella servers always face the problem that they possess only links to papers, not the full text. So if, for example, mathematicians change jobs and move

all their papers from one departmental server to another, any umbrella server that pointed to those papers now has only dead links (and perhaps the metadata of the papers). Furthermore, the AMS preprint server was ephemeral by design: Every article posted to it had a date on which the article would be removed. The experience accumulated since the AMS preprint server was attempted has shown that reliability of access and permanence are two of the most important features of successful servers. In the end, the AMS preprint server died from lack of use. (A similar fate befell preprint servers launched around the same time by the Canadian Mathematical Society and by the American Physical Society.) Today, instead of offering its own server, the AMS maintains a comprehensive Web listing of preprint servers in mathematics (see sidebar for the URL).

Growing the Mathematics arXiv

The mathematics section of the arXiv has had its own share of growing pains. As chair of the advisory board for the mathematics arXiv, David Morrison has been deeply involved in its development. For several years he ran a preprint server in algebraic geometry that he started at Duke University in 1992 using Ginsparg's software. In the decade since then, Morrison has worked on various efforts to propagate the use of preprint servers in mathematics. One of these efforts was a collaboration between the Mathematical Sciences Research Institute (MSRI) at Berkeley and the Los Alamos server, in which preprint servers were established in each of three areas of concentration at MSRI during the 1994–95 academic year. As it turned out, only one of the three servers, that in differential geometry, took off. This server, together with the one in algebraic geometry at Duke, were eventually moved to Los Alamos. In 1997, a group of mathematicians, including Morrison, decided to form themselves into a committee to consider how to set up a mathematics section of the arXiv (this committee, with some additional members, later became the mathematics arXiv advisory board).

In the fall of 1997, the committee approached people who were running subject-based servers and asked them to move their holdings to the arXiv. About ten agreed. One was Dale Alspach of Oklahoma State University, who had started the Banach Space Archive in 1989. Alspach agreed to move his archive's approximately 340 papers to the arXiv in order to reduce his own administrative burden. He is now a moderator for the functional analysis section of the arXiv (Marc Rieffel of the University of California, Berkeley, is the moderator for the operator algebra section, and he and Alspach review postings in both sections as an additional check on the classifications). Being a moderator has allowed Alspach to stay in touch with new postings and to continue the e-mail notification service and website of the Banach Space Archive. In this way, the Banach Space Archive has become an overlay of the arXiv. "The Banach space people still exist as a group," Alspach says. "By maintaining the Web pages and the distribution list, the sense of community continues."

Others who run preprint servers decided against moving their holdings to the arXiv (though many of them encourage authors to post articles in both places). Some believe that keeping their own servers helps to raise the profile of their research areas. Some simply did not want to spend the time and effort needed to make the transition, especially when their servers were popular and functioning without any problems. But some also felt steamrollered by what they viewed as aggressive overtures of the much larger arXiv. Hans Koch, who is one of the people who run the mp_arc, says he found the arXiv committee inflexible and unwilling to compromise in their plans for merging smaller servers into the arXiv. "We would be open to the idea if there were a way to do it cooperatively and in a less centralized way... They were so sure they would be the only ones to survive, so they were not willing to compromise," he remarks. He adds, "There was a lot of pressure, and many of the smaller archives were totally run over. I think that this loss of diversity and competition is not good for our community." Morrison acknowledges that the committee inadvertently caused some resentment. "With hindsight, our self-appointed
committee was not as politically astute as we could have been," he says. "We ruffled some feathers, and I'm sorry about that." He says that "the door is open" if smaller servers want to join the mathematics arXiv.

The arXiv has been successful in getting journals to agree to "direct submissions" of papers posted to the arXiv. This means an author can submit a paper to a journal by first posting the paper to the arXiv and then letting the editor know the arXiv number of the paper; in the same way, the editor can circulate the paper to referees. About forty journals now permit direct submissions. In addition, four journals are now overlay journals of the arXiv, including one of the top journals in mathematics, *Annals of Mathematics* (published jointly by the Institute for Advanced Study and Princeton University). An overlay journal not only permits direct submissions but also guarantees that all of its published papers will be posted on the arXiv. Morrison says that the advisory board has been encouraged by its interactions with journals, and the board is clearly heartened by the prestige of the *Annals* overlay. The fact that the *Annals* is using the arXiv as a repository for its papers "has influenced a number of mathematicians who had dismissed the arXiv as a place to put their papers," Morrison remarks. "They are not so dismissive anymore."

**Big versus Small**

"Searching for math preprints currently is very difficult," wrote Martha Tucker, a librarian at the University of Washington, in an e-mail newsgroup. "One must try to guess which preprint server it is on, go hunt for it, not find it, guess again, etc. The current system may work fine for those working in [a] specific area, but students and non-specialists are having a difficult time. I usually end up tracking the author down instead...It would be a great idea to centralize access to all math preprints." Tucker's comments were made in 1997, but her point holds today. An umbrella server like MPRESS provides a way to find papers, but it does not have the papers themselves. At the other end of the spectrum, the centralized arXiv has a very large number of papers, but no way to get at papers not stored there. The contrast between these two kinds of servers, one distributed and the other centralized, points to a major question: Which is the best way to go?

Hans Koch believes a distributed system would be best. In much the same way that the world has moved away from centralized mainframe machines to distributed computing environments, he believes there will be a move away from huge centralized archives and toward distributed "virtual archives". A virtual archive would look to the user like one big archive, but its holdings would be distributed among smaller individual sites, such as those in mathematics departments or institutes. The individual sites could be mirrored so that if something is deleted it is not lost entirely. The sites would have to agree to be "a little satellite in this way", Koch says. He also worries that centralized archives could prove to be a drain on research funds and believes spreading the costs among individual sites is preferable. And, he says, spreading the responsibility for maintaining archival material means that those who are closest to, and most interested in, the material are the ones who keep track of it.

Others argue that monitoring such a constellation of sites would take as much work as running a centralized archive. When it comes to archiving, says Joseph Halpern, "bigger is better". Storage costs are small compared to personnel costs, and with a big operation like the arXiv, the personnel costs are concentrated. "The same code will run whether you have 100 papers or 100,000," Halpern remarks. "So economies of scale pay off." Furthermore, small servers based in departments or institutes are sometimes at the mercy of computer administrators. Two people who run such servers and who were interviewed for this article reported that they had been hampered in doing certain upgrades on their servers because of problems with departmental computer administrators. This kind of problem does not arise with the arXiv.

Asked about the pros and cons of distributed versus centralized archives, Peter Michor says that both are needed. "We need lots of mathematical material everywhere," he remarks. "Redundancy is what we need." The arXiv "sees itself as the ultimate archive of primary mathematical material,"
he explains. By contrast, an umbrella server like MPRESS tries to coordinate material in many smaller servers. "We don't have only one big central university library on earth," he notes. "We have thousands of libraries." In the same way, the world needs many different places where it can access mathematical material.

The Three Ps: Permissions, Peer Review, and Permanence

The advent of preprint servers in mathematics has raised various concerns about this form of communication and storage of scholarly literature. Some of the concerns most often cited are: copyright permissions, lack of peer review, and long-term permanence.

The issue of copyright permissions is a murky one, for the rules vary from publisher to publisher. For example, the AMS allows all authors to retain their own copyright if they wish. Elsevier retains copyright of all material it publishes, but authors can request permission to post published journal articles on the Web; according to Elsevier's publishing director for mathematics and computer science Michel Kolman, this permission is routinely granted.1 Some publishers allow papers to be posted on the authors' personal websites but not on preprint servers, while others allow authors to post preprint versions of a paper, but not the final published version. Interviews for this article indicate that it is rare for a publisher to ask a preprint server to remove a published article (although sometimes authors make this request). Suppose a paper is refereed, typeset, and ready to be published, and the copyright form is sent to the author, says Richard Palais. If at that stage the "author refuses to give up the electronic rights, will the publisher say it won't publish the paper?" he asks. Most publishers would relent, he believes.

Lack of peer review of material on preprint servers has also been a concern. Because the papers have not been peer-reviewed, how can one know whether they are correct? Could it be that preprint servers are filled with erroneous papers? "This is always a concern when people first hear about the arXiv," says Michor, who is on the mathematics arXiv advisory board. "But no one using the arXiv complains about it." When an author posts a paper to the arXiv, hundreds of people immediately receive the abstract of the paper through the e-mail notification service, so authors are fairly careful about what they post. The majority of articles posted to preprint servers are submitted to journals, but no statistics exist on what percentage eventually get published. As an experiment, Greg Kuperberg looked at the publication status of the first 100 papers in theoretical high energy physics posted to the arXiv in December 1998. He found that 81 had appeared in journals, 11 were conference proceedings or invited lectures, and 2 were Ph.D. theses. "Thus at least 94 of the 100 have been blessed by some form of peer review," he concludes.

Setting aside the issue of correctness of the papers, could it be that preprint servers are filled with uninteresting junk? That 850 people subscribe to the mp_arc e-mail notification service, for example, seems to argue against the notion that this archive contains mostly uninteresting material; usage statistics for the arXiv tell the same story. One might think that preprint servers receive a lot of amateur postings with "proofs" of Fermat's Last Theorem and the like. However, those interviewed for this article say that in fact such postings are surprisingly rare; they are also easy to spot and remove. Generally, mathematicians seem to be able to navigate their way through preprint servers to locate material they find interesting. Nevertheless, most of those interviewed for this article stress the importance of maintaining a clear distinction between preprints and peer reviewed papers published in journals. Indeed, with electronic communication making greater amounts of mathematical material more widely available, journals may become even more important in imposing standards and quality control on what might otherwise be an indigestible mass of material.

The final and perhaps biggest concern about preprint servers is permanence. One of the central questions is the long-term reliability of electronic storage. Paul Ginsparg argues that this is a logistical problem, not a fundamental one. Just as librarians have been migrating material on decaying acid paper to microfilm, electronic information can be moved to new formats as the need arises. "The databases need to be actively curated, accepting only the more stable formats, and over time flagging any formats likely to become obsolete and mass migrating to newer formats," he says. "Electronic documents that are ignored for a century could certainly be problematic, and that's what has to be avoided." A compelling argument for having one big archive is that such migrations can be done far more easily and efficiently than if the data is spread around in hundreds of smaller archives.

Others are less certain than Ginsparg. "I really think that this whole issue of converting to new formats has never been carefully addressed," argues Steven Krantz of Washington University in St. Louis. "I have been at meetings where people would flippantly assert that if you build 5 percent into your budget for conversions, then you are 'covered'

1 Elsevier publishes some journals on behalf of scientific societies, and these societies sometimes retain copyright of the journal articles. In such cases, Elsevier is not always at liberty to grant permission to post the articles. But Kolman says that when Elsevier holds the copyright, it will routinely grant this permission.
for all eternity, which is obviously nonsense. My experience is that converting to new formats is usually a low priority, and it usually involves unforeseen complications (operating system inconsistencies, media problems, etc.). In an opinion piece about electronic storage ("Freeware or Vaporware", Notices, December 2000, page 1357), Krantz mentioned several cautionary tales, such as the loss of data from the first Voyager mission in the 1970s. Although awareness of such problems has increased over the years, available solutions are often less than ideal. For example, several years ago the AMS converted its archive of published journal articles from one \LaTeX\ format to another. A computer program successfully converted 90 percent of the articles, but 10 percent had to be converted by hand, requiring substantial effort by highly trained personnel. For an archive containing, say, half a million articles, that problematic 10 percent would mushroom into a huge and costly task. "I think that electronic media are very valuable for dissemination and document creation," Krantz notes. His worries center on using these media for archiving.

Another concern pertaining to permanence of electronic archives is how to ensure their financial and institutional security. This concern is sometimes raised about departmental servers, which often depend on the energy and enthusiasm of a single individual. But more often it has been raised in connection with the mathematics arXiv, which is trying to position itself to become the centralized archive for the mathematical literature. Some believe that the arXiv lacks sufficient institutional and financial support to guarantee its long-term existence (though the move from Los Alamos to Cornell University should provide greater stability).

In response to this concern, one suggestion made is that a consortium of scientific professional societies could band together to provide long-term support for the arXiv. John Ewing, executive director of the AMS, believes this idea is unrealistic at the moment because the long-term costs of supporting a large electronic archive are unknown. Also, sharing the editorial, administrative, and technical decisions among a number of societies could prove to be an organizational nightmare. Ewing also worries about a single-minded focus on the arXiv at a time when scholarly communication is in so much flux. "No one knows what works best now, so it's extremely important to keep lots of different things going at the same time, until we know better what will develop," he says.

What is the future for preprint servers in mathematics? Many are convinced that in a decade or so, nearly all of the current mathematical literature will be accessible this way. Electronic archives may also eventually contain a portion of the peer-reviewed literature, especially that from electronic journals. Some dream of the day when MathSciNet will contain links not only to electronic versions of peer-reviewed articles but to articles on preprint servers as well. And some are also convinced that a new breed of search engines, ones that can understand mathematical content, will revolutionize the electronic navigation of mathematical literature.

Over the next several years, the mathematical community will have to come to grips with many of the issues raised by the increasing use of preprint servers. There is no road map that can provide directions toward the most successful route, and the paths broken by other sciences may not be the best ones for mathematics. Thus mathematicians themselves must guide the evolution of electronic archives. As Laurent Siebenmann, a mathematician at the Université de Paris-Sud, put it in an e-mail discussion group:2 "We have a baby in our care—the electronic math literature—and the vital task is to mother it today."

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2Electronic Math Journals Discussion List, EMJ@listserv.albany.edu, archived at http://math.albany.edu:8800/hm/emj/.
The main aim of this two-volume work is to provide in simple and accessible terms the full and complete answer to all and any questions that anyone might want to ask about the history of numbers and of counting, from prehistory to the age of computers.

—Georges Ifrah

The Universal History of Numbers (Foreword)

... historically unacceptable, a deception.


Number systems, like hair styles, go in and out of fashion—it's what's underneath that counts.

—Abraham Robinson

Yale Scientific Magazine (1973)

This is the first installment of a two-part book review. The second part will appear in the next issue of the Notices.

The Universal History of Numbers. From Prehistory to the Invention of the Computer (Volume I)
Georges Ifrah
Translated from the French by David Bellos, E. F. Harding, Sophie Wood, and Ian Monk
John Wiley & Sons, New York, 1999
xxii + 633 pages

The Universal History of Computing. From the Abacus to the Quantum Computer (Volume II)
Georges Ifrah
Translated from the French and with notes by E. F. Harding, Sophie Wood, Ian Monk, Elizabeth Clegg, and Guido Waldman
John Wiley & Sons, New York, 2000
410 pages

The dust jacket blurbs for the first of these two books (referred to in the following as Numbers) could not be more promising: "Georges Ifrah is the man. This book, quite simply, rules," wrote a reviewer for The Guardian. The International Herald Tribune declared that "Ifrah's book amazes and fascinates by the scope of its scholarship. It is nothing less than the history of the human race told through figures." The popular press in France was just as enthusiastic about the original French version, which appeared in 1994. Le Figaro was impressed that "[Ifrah's] amazing undertaking, describing humankind's relationship with numbers from Paleolithic times to the computer age, spans the world from Mayan ruins to Indian museums, from Egyptian hieroglyphics to Greek philosophers to Chinese libraries." Similarly, L'Express dubbed Ifrah "the Indiana Jones of arithmetic...who decided in 1974 to begin the search for his Grail, the origin of numbers."

Ifrah himself shows little restraint in declaring what he has accomplished: "I think I have brought together practically everything of significance," he writes, adding that "this is also probably the only book ever written that gives a more or less universal and comprehensive history of numbers and numerical calculation," (Numbers, pp. xvii-xviii).

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This despite the contributions of Karl Menninger and Tobias Dantzig, whom he mentions, and others who have also written on the subject like Graham Flegg, whom he does not. If Ifrah's two volumes actually delivered on his promises, they would indeed be remarkable. But in fact the aim of these books is more restrictive than their titles suggest, for what Ifrah really offers is a history of the Hindu-Arabic place-valued number system, along with the evolution of their numerals and the complementary history of computational devices from the abacus to the modern computer. Although the cover of volume II mentions the "quantum computer," Ifrah never gets that far. Mathematicians expecting to find truly "universal" histories of numbers and computation will be greatly disappointed, for there is little or nothing here about the truly interesting numbers—the ones that have done most to make modern mathematics what it is—π and e, the irrational, transcendental, and transfinite numbers, quaternions and infinitesimals, for example. Similarly, modern aspects of computation related to software, parallel processing, fifth-generation supercomputers, or the quantum computer are left unexplored.

Ifrah describes himself in his introduction as an "intellectual tourist." He explains how these books were the result of his inability, as a school teacher, to respond to the simplest questions raised by his pupils, such as "Where do numbers come from?" and "Who invented zero?" Ifrah discovered that such questions "soon drew me into the most fascinating period of learning and the most enthralling adventure of my life." He gave up his teaching job, and he turned to archaeology, psychology, even ethnology to help supply answers. He began to travel the world in search of evidence, and as Ifrah puts it, he "was soon to conquer the whole world, from America to Egypt, from India to Mexico, from Peru to China, in my search for more and yet more numbers. But as I had no financial backer, I decided to be my own sponsor, doing odd jobs (delivery boy, chauffeur, waiter, night watchman) to keep body and soul together," (Numbers, p. xvii). One cannot help but admire such determination!

Ifrah's quest was aided by his own personal history. As he notes, "a Moroccan by birth, a Jew by cultural heritage, I have been afforded a more immediate access to the study of the work of Arab and Hebrew mathematicians than I might have obtained as a born European," (Numbers, p. xvii). (Neither, it might be added, plays a large role in the history of number systems, at least as Ifrah tells the story.) Once back in France from his travels, he continued his research and "fired off thousands of questions to academic specialists in scores of different fields," (Numbers, p. xvii). But as will become apparent in a moment, he either wrote to the wrong experts, was indifferent to their responses, or was not prepared to settle for inconclusive results and the tentative nature of their research.

Ifrah is not a modest writer, and more than once he emphasizes the magnitude of what he has done, the importance of what he has accomplished, the new solutions he has to offer to old or neglected questions about numbers. He claims to be the first to have successfully deciphered the Elamite number system in use some 5,000 years ago in what is now modern Iran (the subject of study by a number of scholars whose work Ifrah should have known and acknowledged; more about this below). He also claims to have shown that Roman numerals derive from notching (but again, he is by no means the first to have suggested this; see for example [Menninger 1969, p. 241]). He writes, "There are also some new contributions on Mesopotamian numbering and arithmetic, as well as a quite new way of looking at the fascinating and sensitive topic of how 'our' numbers evolved from the unlikely conjunction of several great ideas. Similarly, the history of mechanical calculation culminating in the invention of the computer is entirely new" (emphasis added) (Numbers, p. xviii). This last remark is especially surprising because the story Ifrah tells of computing is basically chronological, conventional, and prosaic, adding nothing new to what is for the most part a well-established historical record.

The nonspecialist reader may well take these assertions at face value and believe that the two volumes under review here are truly universal in their coverage, that the information Ifrah delivers is genuine, and that his claims of breakthroughs are legitimate. However, those who specialize in the languages, texts, and documents with which Ifrah works have raised serious concerns about what he has written and about the possibly pernicious influence his books may have on students or those who would take his historical conclusions at face value.

Historians of mathematics in particular have voiced strong reservations about Ifrah's pronouncements on the history of number systems. Histoire Universelle des Chiffres was first published in 1981 (English translation, From One to Zero, 1986) and was considerably expanded in a revised version that appeared in 1994 with the same title (Numbers is a translation of the 1994 version). In 1995 a group of five experts in France agreed it was necessary to confront the popularity Ifrah's work was being accorded and to point out explicitly his numerous misreadings, misinterpretations, and pure fabrications. Earlier critics have also pointed up errors, some significant, that subsequently Ifrah apparently has chosen either to dismiss or ignore, for they almost all appear without change in the
current English translation. Having had plenty of time to respond to questions and doubts raised about his facts and conclusions, Ifrah could have made the British and American editions more authoritative, more accurate, more useful to students and teachers alike. Given that these volumes have been produced on a lavish scale and translated into many languages, it is regrettable that he chose not to. Because he has ignored the criticisms of his French colleagues and earlier critics, it is all the more important to take notice of those criticisms here.\(^1\)

**The Reaction to Ifrah's Works in France**

In 1995 the *Bulletin de l'Association des Professeurs de Mathématiques de l'Enseignement Publique* devoted two issues to a discussion, by recognized scholars, of the merits of Ifrah's work (references to the critiques cited in this review appear in the bibliography). Since the overarching theme of *The Universal History of Numbers* is the emergence of the decimal place-valued number system, which arose independently in four distinct cultures—in Mesopotamia, China, India, and Mayan meso-America—Ifrah's work in each of these areas was accorded special scrutiny. As Tony Lévy of the Centre National de la Recherche Scientifique asks in his opening remarks: Does Ifrah's work present the history of numbers fairly with respect to recent scholarship and current understanding of the sources? Can one regard as established the conclusions presented by Ifrah as "historical verities"? Lévy leaves no room for doubt: "La réponse est doublement négative"—in other words, "no" on both counts (Lévy, p. 532).

Lévy explains that he and his colleagues felt an obligation to "rectify [Ifrah's] deceptive, confused, even muddle-headed views." They felt compelled to do so because of Ifrah's relentless habit of presenting conclusions that are "often debatable, generally weak, and at times wholly imaginary," as if they were "historically valid theses" (Lévy, p. 532).

Lévy subjects to close scrutiny Ifrah's account of the evolution and transmission of a symbolic, written notation for the Hindu-Arabic number system. Whereas the specialists, Indianists and Arabists alike, deplore the lacunary state of the sources related to this history, Ifrah offers nothing but certainties. He writes with no doubts or reservations that "when the Arabs learnt this number system, they quite simply copied it (Fig. 25.3). In the middle of the ninth century, the Eastern Arabs' 1, 2, 3, 4, 5, 6, and 9 could easily be confused with their Indian Nāgari prototypes" (*Numbers*, p. 532). Where, Lévy asks, are the Arabic documents to support this thesis? It turns out that a single manuscript (Paris, BN, MS arabe 2547) cited in support of his claim (see Ifrah's Fig. 25.3, *Numbers*, p. 532) preserves the graphic forms of the ciphers 2, 3, and 6. What is its date? Ifrah says 969 AD, accepting a hypothesis of Franz Woepke (whose work on the subject, *Mémoire sur la Propagation des Chiffres Indiens* (1863), is now nearly a century-and-a-half old). But as Lévy points out, 969 is not really mid-ninth century, and in fact, this date is probably too early (and by nearly 300 years), since the manuscript in question includes mention of the date 1259 (which was perhaps introduced by a copyist but which nevertheless raises serious doubts about the exact date in question). Of the other manuscripts Ifrah uses, the three oldest are of the eleventh century, and depict only the numerals 1, 4, 5, and 9. Despite the uncertainties in the written record on which the historian must depend, Ifrah offers no reservations: "These are the forms that the Arabs used when they adopted Indian numeration" (*Numbers*, p. 380). But in the absence, Lévy underscores, of any satisfactory, detailed studies of either the Arab or Indian primary sources, what Ifrah presents with such confidence is "historically unacceptable, a deception." ("La description de M. Ifrah est historiquement irrecevable; elle est trompeuse" (Lévy, p. 534).)

If there is reasonable doubt about the general conclusions Ifrah draws about transmission of the Hindu-Arabic numerals and number system, what about the details he offers for each of the four civilizations that first advanced decimal place-valued systems?

**Mesopotamia**

James Ritter (Université de Paris VIII) admits that his first reaction to Ifrah's "universal" history was one of perplexity, due to the errors that "appear

\(^1\)The author would like to thank William Aspray, André Cauty, Pierre Sylvain Fillozat, Joran Friberg, David Grove, Allyn Jackson, Tony Lévy, Jean-Claude Martzloff, Karen H. Parshall, James Ritter, and Christoph J. Scriba for responding to questions and reading earlier drafts of this review; while I have made every effort to reflect accurately the views of those cited here, and to do justice to Ifrah's own work as well, I alone am responsible ultimately for my views as expressed herein.
on every page." Ritter, an Assyriologist, begins his critique with discussion of Ifrah’s views on oral numbers in the Sumerian language, which played an important part, says Ifrah, in the origins of the base 60 system. On p. 82 Ifrah gives a list of Sumerian numbers, from which he concludes that the identification of the names for "one" and "sixty" reveals the existence of a base 60 in the oral Sumerian language of numeration prior to the invention of writing.

Ritter simply declares all of this to be false, due to an erroneous conflation of sources. First of all, he takes Ifrah’s list to be a contrived amalgamation of names coming from all epochs. Over the more than 2000 years of this history, the connections between names and numbers changed. If one is concerned with the origins of the base 60 system, it is the earliest texts that are relevant. Although rare, texts from the end of the third millennium, Ritter maintains, are perfectly clear — and in those texts, one (ash) and sixty (gesh) are not pronounced the same way.

As for the origins of the base 60 itself, Ifrah offers the hypothesis that it came from the combination of Sumerians using a base 5 system and another, supposedly indigenous, people using a base 12 system. Counting in distinct ways on their fingers, the two supposedly combined forces to create the base 60, the least common multiple of the two. But as Ritter objects, and as Ifrah himself admits, there is no hint, not a trace of anything like this in any written texts. This is further complicated by the fact (noted by Ifrah in passing) that there was no one system of written numbers in Sumerian by the beginning of the third millennium, but at least six — and more if one includes variants. What led to the emergence of the unique base 60 system, Ritter explains, was rationalization of all these different systems with the administrative centralization of the third millennium, a simplification that can be followed progressively in the Sumerian texts (Ritter, p. 683).

Ritter is even more adamant in rejecting Ifrah’s account of the abacus in Mesopotamia. This time, Ifrah conflates provisional research with established fact. As Ritter explains: “After a wholly fabricated presentation of the 'calculists' and the 'abacists,' [Ifrah] takes, in an illegitimate way, several pages torn from their context of an article by the Assyriologist Stephen Lieberman” (Ritter, p. 683). Ifrah uses these pages to prove the existence of a word for "abacus" in the Mesopotamian texts, a suggestion made with many reservations and flagged with question marks by Lieberman. As Ritter cautions: “These readings are all controversial. Not all Assyriologists nor the great dictionaries accept them. All the terms under discussion are absent from all texts except for the tradition of lexical lists used in the schools” (Ritter, p. 683). For an instrument so universally used — as Ifrah maintains the abacus was — how can we account for the fact that it is passed over in complete silence in the thousands of mathematical texts and other documents left by Mesopotamian civilizations over three thousand years?

The final but greatest problem Ritter finds with Ifrah’s interpretation of the Mesopotamian record is “ignorance pure and simple.” Ifrah boasts of his having deciphered the proto-Elamite numerical systems, a means of writing developed in ancient Iran towards the end of the third millennium. But Ritter points out that this had already been accomplished by Assyriologists before any of Ifrah’s publications, thanks primarily to the research of Joran Friberg, Peter Damerow, and Robert Englund. Ifrah has consistently ignored or downplayed most work done in this domain since the 1950s, and in particular he seems unaware of the significant advances of the last fifteen years, especially of the important contributions of the Berlin group of Damerow, Englund, Friberg, Nissen, and others (see, for example, the recent survey article [Friberg 1999]).

**Chinese Mathematics**

Jean-Claude Martzloff of the Institut des Hautes Etudes Chinoises in Paris, one of the world’s leading authorities on the history of Chinese mathematics, finds similar fault with Ifrah’s account of Chinese mathematics. Martzloff notes “errors and hazardous suppositions often repeated and sometimes amplified,” which result in an “increasingly distorted image of the history of Chinese numeration” (Martzloff, p. 676). Martzloff takes Ifrah to task on three subjects: Chinese written calculation, the counting board, and the role of zero in Chinese mathematics.

As for Chinese written calculation, Martzloff warns of Ifrah’s uncritical use of Karl Menninger’s *Number Words and Number Symbols. A Cultural History of Numbers* (1957), where it is said that written calculations in China were explained in the *Ding Ju Suanfa* (The Arithmetic of Ding Ju (1355)), along with the method of checking a calculation by casting out nines. In fact, casting out nines does not appear in the *Ding Ju Suanfa*, and it was not until the seventeenth century that European missionaries introduced the method.

How could Menninger have made such an egregious error, one that Ifrah unfortunately repeats? It turns out that the text of the *Ding Ju Suanfa*
was included with another, the *Tongwen Suanzhi* (Treatise on European Arithmetic (1613)), when the two were reprinted together in Shanghai in 1936. In using this edition, Menninger simply failed to distinguish one from the other! But the error is reproduced by Ifrah and made all the more damaging because it causes him to misdate the chronology of the appearance of written calculations in China by several centuries.

Another main source upon which Ifrah depends is volume three of Joseph Needham's important series, *Science and Civilisation in China*, the first part of which is devoted to mathematics. As Martzloff points out, although Needham does mention a counting board on occasion, he does so only in passing, and it is clear that it is nothing more than a hypothesis. But most who have written subsequently about Chinese mathematics based upon Needham's account have forgotten the hypothetical character of his remarks and have simply advanced from hypothesis to certainty. One of these is Geneviève Guitel, who in her *Histoire Comparée des Numérations Ecrites* (1975) writes as if counting tables were not hypothetical but objects that really existed. Ifrah draws heavily on Guitel but goes even further, and, relying with great imagination on the rare pictorial images that exist relative to the practice of calculation, he produces from a late (sixteenth century) Chinese illustration a model "truer than nature" (Martzloff, p. 678) of a Chinese counting rod table.

There is nothing provisional about Ifrah's statement: "For arithmetical calculation, the Chinese used little rods made of ivory or bamboo called *chou* (calculating rods) which were placed on the squares of a tiled surface or a table ruled like a checkerboard" (p. 283). But this, says Martzloff, is pure fantasy, and the illustration (drawn by Ifrah himself) is not based on any real artifact or printed source describing such a table. What Ifrah starts from is an illustration from the *Suanfa Tongzong* (General Source of Computational Methods), a 1592 book about the abacus. But that work does not treat counting rods, and the illustration from it cannot plausibly be interpreted as a counting board.

The final criticism Martzloff levies against Ifrah involves a typographical error at a crucial point in Needham's study of Chinese mathematics, which misleads Ifrah into incorrectly dating by several centuries the first appearance of the zero in China. The error in question concerns a collection of Chinese manuscripts dating approximately to the tenth century, possibly earlier, and recovered from caves at Dunhuang at the beginning of the twentieth century. For more than twenty years, a French research team, of which Martzloff is a member, has catalogued and studied this collection in detail. Of the manuscripts dealing with mathematics, Martzloff reports that no zero in any form has been found among these materials! Assuming that the most ancient zero in China would have been contemporary with the more ancient Indian zero, Ifrah reconstructs the genesis of the Chinese zero based again on the counting table, Needham's faulty dating, and a "cascade of fantastic hypotheses which he takes to be established facts, but presented without the least justification" (Martzloff, p. 679). For example, Ifrah imagines the invention of a new system of Chinese numeration comprised in part of rods for calculating and Chinese characters for writing results (*Numbers*, p. 281). According to Martzloff "there is not the least shred of historical evidence" for such a system (Martzloff, p. 679).

### The Mayans

André Cauty of the Université de Bordeaux specializes in the study of the Indians of ancient Mexico. He is critical of Ifrah's treatment of how the Mayas counted orally and the means by which they presumably carried out and recorded the results of arithmetical operations. Cauty also finds fault with Ifrah's reconstruction of the Mayan vigesimal system. Ifrah insists: "Even though no trace of it remains, we can reasonably assume that the Maya had a numeral system of this kind, and that intermediate numbers were figured by repeating the signs as many times as was needed. That kind of numeral system, even if it worked perfectly well as a recording device, is of no use at all for arithmetical operations. So we must assume that the Maya and other Central American civilisations had an instrument similar to the abacus for carrying out their calculations" (*Numbers*, p. 308).

But once more there is virtually no evidence upon which to base such assumptions. What Ifrah offers instead is the fact that the Incas used some sort of counting board to manipulate counters to facilitate their arithmetic. He refers to an illustration from the Peruvian Codex of Guaman Poma de Ayale of the sixteenth century (Ifrah's Fig. 22.20, *Numbers*, p. 308). However, this is a counting board, not an abacus, and there is no indication of how it would have been used and whether it followed a decimal, vigesimal, or some other arrangement. And in any case, this has no connection with the Maya! All Ifrah is able to provide is conjecture because, as Cauty puts it, he cannot conceive of a civilization without a highly developed sense of arithmetical and some means of both carrying out arithmetical operations and then recording the results. Cauty is rightly dubious, since there is not the least bit of archaeological or textual evidence for the existence of a Mayan abacus.

### The Uncertainties of the History of Indian Numeration

Pierre S. Filliozat, a Sanskrit expert at the École Pratique des Hautes Études, is impressed by the
attention Ifrah devotes to India, which he notes is usually given short shift in most scholarly studies. Filliozat acknowledges the active interest, even the passion, in Ifrah's approach to the subject and says that "a leitmotiv of his book is praise for the works and genius of Indian mathematicians" (Filliozat, p. 542).

Nonetheless, Filliozat questions Ifrah's account of the Indian development of the place-valued number system and the appearance of the sign for zero, the sunya, meaning void. Ifrah (again!) maintains that this must have arisen in conjunction with use of an abacus, arranged according to powers of ten, the zero being necessary to write down the void places when no counters appeared on the abacus. Use of the zero, Ifrah maintains, would have freed scribes from having to use the abacus and permitted the direct notation of numbers. "This was the birth of the modern numerals, which signaled the death of the abacus and its columns" (Numbers, p. 437).

As Filliozat points out, the existence of the abacus at an early date is not documented in India; there is no archaeological evidence, and there are no literary descriptions or texts to bear out any of the speculations Ifrah presents. There is not even a word for "abacus" in Sanskrit, Filliozat notes (Filliozat, p. 547). And when an instrument did come into play in the fifth century, it was certainly not an abacus; it was nothing more than a common board upon which to write.

**Possible Influences on Indian Mathematics**

Ifrah briefly explores the possibility that the Indians may have been influenced by one of the other civilizations in which a decimal, place-valued system with zero arose: the Babylonians, the Chinese, or the Maya. He immediately eliminates the Maya for reasons of geography and rejects a Babylonian influence in part because the Babylonian base 60 is missing from the Indian system (Numbers, p. 408). This leaves the Chinese, but since the zero only appeared in Chinese mathematics around the eighth century, in all probability due to the influence of Indian Buddhist missionaries, Ifrah concludes that "it would seem highly probable under the circumstances that the discovery of zero and the place-value system were inventions unique to Indian civilisation" (Numbers, p. 409).

One Chinese source of which Ifrah is apparently unaware is the Sun Zi Suanjing (The Mathematical Classic of Sun Zi), written around 400 AD. This has been available in an English translation since 1992 in Fleeting Footsteps, an edition prepared with extensive commentary by Lam Lay Yong and Ang Tianse. This source not only gives a complete description of Chinese rod numerals but also describes in detail ancient procedures for multiplication and division. The most ambitious part of Lam and Ang's study, one not without controversy, argues that the Hindu-Arabic number system had its origins in the rod numeral system of the Chinese. The most persuasive evidence Lam and Ang offer is the fact that the complicated, step-by-step procedures for carrying out multiplication and division are identical to the earliest but later methods of performing multiplication and division in the West using Hindu-Arabic numerals, as described in the Arabic texts of al-Khwārizmī, al-Ṭāhir ibn Khālid, and al-Khwarizmi (for an extensive review of Lam and Ang's book, see Jean-Claude Martzloff, Historia mathematica 22 (1995), pp. 67-73).

It seems likely that the actual symbol for zero was introduced to China from India. Lam and Ang argue that the procedures for multiplication and division were in turn transmitted from China to the West via India, with Indian numerals taking the place of Chinese rod symbols for the purposes of writing down both the methods and results. This is certainly a hypothesis Ifrah should confront, especially given the many details that Lam and Ang provide and the relevance of their research for one of the main concerns of Ifrah's book.

**Negative Numbers**

There are numerous places where Ifrah has not asked what to a mathematician would have been the obvious or most pertinent question. One example will have to suffice here to give an idea of the technicalities that he either misses entirely, or has chosen to overlook. Ifrah cites a work by Brahmagupta of 628, the Brahmasphutasiddhanta, which defines zero as the result of the subtraction of a number from itself. This work also provides a table of results for operations involving negative numbers, in which the product of two negative numbers is given (according to Ifrah) as a negative number (Numbers, p. 439). But what Brahmagupta really writes about sign manipulation may be found in verses 30-35 of chapter 18 of the work in question, where the text clearly reads, "The product of a negative and a positive is negative, of two negatives positive." (I am grateful to Kim Plofker for having provided this translation from the actual text of the Brahmasphutasiddhanta, as well as the details that follow about terminology.) In any case, it would have been worth a few lines of commentary at this point to discuss the understanding necessary to see that the product of two negative numbers, or the division of two negative numbers, should yield a positive rather than a negative result, something that Brahmagupta clearly understood. Instead, what Ifrah says is that from the rules Brahmagupta gave for operations on "fortunes", "debts", and "nothing" (misunderstanding here that these are in fact technical terms in Sanskrit for positive, negative, and zero), "Modern algebra was born, and the mathematician had thus..."
formulated the basic rules...We can see that at that time the Indian mathematicians knew the famous 'rule of signs' as well as all the fundamental rules of algebra" (Numbers, p. 439). This is another example of the great leaps Ifrah is willing to make even in the face of evidence that the true situation is not exactly as he represents it.

**From One to Zero**

Ifrah's *The Universal History of Numbers* is a reworked version of his earlier book *From One to Zero*, which first appeared in French in 1981. The time between the two books gave him ample opportunity to respond to critical reviews and to take advantage of expert judgments in order to correct errors or modify exaggerated interpretations—or simply to take into account readers' responses. When John Allen Paulos reviewed the English translation of *From One to Zero* in the *New York Times Book Review* in 1986, he acknowledged that the book had been "glowingly reviewed in France." But, calling the book "exhaustive and at times exhausting," Paulos wrote that "too much of this long book reads like a collection of appendices, and I often found myself saying 'enough already' as Mr. Ifrah piled up his historical documentation." Rather than heed Paulos's words in writing his new books, Ifrah did just the opposite. *The Universal History of Numbers* "translated afresh—is many times larger, and seeks not only to provide a historical narrative, but also, and most importantly, to serve as a comprehensive, thematic encyclopaedia of numbers and counting" (Numbers, p. v). As a result, readers are faced not with one volume but two, which expand Ifrah's earlier effort to nearly twice its original length. Consequently, Paulos's earlier objections are now doubly justified!

The second part of this review will appear in the next issue of the Notices.

**References**


**About the Cover**

This month's cover accompanies the review of George Ifrah's book on numbers. It is a recent photograph of the well known Babylonian tablet YBC 7289, from the Yale Babylonian Collection. There are three numbers on it, written in sexagesimal place notation: 30, the square root of 2, and 30/2. Its exact function is not known, but it is surely one of the large number of "school tablets" from the Old Babylonian period, 1800-1600 B.C. The diagram forming a background to the numbers suggests that the Babylonians were aware of visual reasoning that leads to a proof of Pythagoras' Theorem for isosceles triangles.

More information can be found at [http://www.math.ubc.ca/people/faculty/cass/Euclid/ybc/ybc.html](http://www.math.ubc.ca/people/faculty/cass/Euclid/ybc/ybc.html). Our thanks to William W. Hallo and Ulla Kasten, Curator and Associate Curator of the Yale Babylonian Collection.

—Bill Casselman (covers@ams.org)
Norway Establishes Abel Prize in Mathematics

In August 2001, the prime minister of Norway announced the establishment of the Abel Prize, a new international prize in mathematics. Named in honor of the Norwegian mathematician Niels Henrik Abel (1802-1829), the prize will be awarded for the first time in 2003. The prize fund will have an initial capital of 200 million Norwegian kroner (about US$23 million). The amount of the prize will fluctuate according to the yield of the fund but will be similar to the amount of a Nobel Prize. The preliminary figure for the Abel Prize is 5 million Norwegian kroner (about US$570,000).

The idea of an international prize in honor of Abel was first suggested by the Norwegian mathematician Sophus Lie near the end of the nineteenth century. In 1902, King Oscar II of Sweden and Norway proposed establishing the prize, but the proposal died when the union between the two nations dissolved in 1905. The current initiative for the Abel Prize came out of the mathematics department of the University of Oslo. The department is hosting the Abel Bicentennial Conference, June 3–8, 2002, to mark the 200th anniversary of Abel's birth.

The Abel Prize will be administered by the Norwegian Academy of Science and Letters. In planning for the prize, the Norwegian Academy has been in close contact with its counterpart in Sweden, which administers the Nobel Prizes. In consultation with the International Mathematical Union (IMU), the Norwegian Academy will appoint a prize selection committee of perhaps five members and a larger scientific advisory panel of twenty to thirty members. The panel will generate nominations to be forwarded to the selection committee. The committee and panel will be international and will include a substantial number of mathematicians from outside Norway.

Various details of the prize have yet to be worked out, such as whether it can be given to more than one individual and whether recipients of the Fields Medal, long thought of as the "Nobel of mathematics", will be eligible. But one detail has been decided: There will be no age limit. According to Jens Fenstad, a University of Oslo mathematician who worked on getting the prize established, there will also be no limitation on mathematical areas in which the prize can be given. "The quality and the acceptance by the mathematical community—these are our primary aims," he said.

One of the goals in establishing the Abel Prize is to enhance the public visibility of mathematics and to encourage young people to study mathematics and science. Accordingly, a special Abel
Symposium will be held in conjunction with the prize ceremony. The symposium will be a conference for mathematicians but will also include activities aimed at the general public, including students and teachers.

Fenstad pointed out that the prize fits in well with Norway's efforts to be recognized internationally as a nation rich in culture and science. "We want to add the name of Abel to that of Ibsen in literature and Munch in painting" as part of Norway's international image, he said. Aligning mathematics with Norwegian culture, as well as with such issues as encouraging young people to study mathematics and the growing role of mathematics in modern society, proved an unbeatable combination. "We were almost surprised by the enthusiasm we were met with, from the IMU, from the European Mathematical Society [EMS], from the public, and from the ministry," Fenstad remarked. When the scientific community requests money from the government, the requests are usually combined with complaints about low funding for science, he noted. "This time, we came with something different and exciting."

According to Fenstad, one of the key elements in getting the prize established was the international support provided by the IMU and the EMS. Said Fenstad, "We will use the prize to better the condition of mathematics and to enhance its visibility, both at the international and the national levels."

"The establishment of the Abel Prize is a major event for the mathematics community," noted Phillip A. Griffiths, director of the Institute for Advanced Study and secretary of the IMU. "One reason, of course, is that Abel is one of the greatest mathematicians of all time; with hindsight, one sees that the whole development of the field of algebraic geometry in the 19th century was triggered in large part by the work of Abel. Second, the amount of the award recognizes mathematics as being at least on par with physics, chemistry, medicine, economics, etc. This comes at a most appropriate time for the field, which is undergoing a golden age."

—Allyn Jackson
Introduction to Quantum Groups and Crystal Bases
Jin Hong, Korea Institute for Advanced Study, Seoul, Korea, and Seok-Jin Kang
In this book, the authors start with the basic theory of quantum groups and their representations, and then give a detailed exposition of the fundamental features of crystal basis theory. They also discuss its applications to the representation theory of classical Lie algebras and quantum affine algebras, solvable lattice model theory, and combinatorics of Young walls.
Graduate Studies in Mathematics, Volume 42; 2002; approximately 328 pages; Hardcover; ISBN 0-8218-2656-5; Order code GSM/42NT201

Differential Geometry
Curves - Surfaces - Manifolds
Wolfgang Kühnel, University of Stuttgart, Germany
From a review for the German Edition:
The book covers all the topics which could be necessary later for learning higher level differential geometry. The material is very carefully sorted and easy to read.
—Mathematical Reviews
The main goal of the book is to get started in a fairly elementary way, then to guide the reader toward more sophisticated concepts and more advanced topics. There are many examples and exercises to help along the way. Numerous figures help the reader visualize key concepts and examples, especially in lower dimensions.
Student Mathematical Library, Volume 16; 2002; approximately 376 pages; Softcover; ISBN 0-8218-2565-6; List $46; All AMS members $35; Order code STML/16NT201

Operators, Functions, and Systems: An Easy Reading
Volume I: Hardy, Hankel, and Toeplitz
Nikolai K. Nikolski, University of Bordeaux I, Talence, France, and Steklov Institute of Mathematics, St. Petersburg, Russia
This unique book combines four formally distinct topics of modern analysis and its applications:
A. Hardy classes of holomorphic functions
B. Spectral theory of Hankel and Toeplitz operators
C. Function models for linear operators and free interpolations, and
D. Infinite-dimensional system theory and signal processing
This volume, Volume I, contains Parts A and B; Volume II contains Parts C and D.
The book is geared toward a wide audience of readers, from graduate students to professional mathematicians. It develops an elementary approach while retaining an expert level that can be applied in advanced analysis and selected applications.
Mathematical Surveys and Monographs, Volume 92; 2002; approximately 480 pages; Hardcover; ISBN 0-8218-1083-9; List $96; Individual member $59; Order code SURV/92NT201

Second Summer School in Analysis and Mathematical Physics
Topics in Analysis: Harmonic, Complex, Nonlinear, and Quantization
Salvador Pérez-Esteva, Universidad Nacional Autónoma de México, Cuernavaca, Morelos, México, and Carlos Villegas-Blas, Universidad Nacional Autónoma de México, Editors
For the second time, a Summer School in Analysis and Mathematical Physics took place at the Universidad Nacional Autónoma de México in Cuernavaca. The purpose of the schools is to provide a bridge from standard graduate courses in mathematics to current research topics, particularly in analysis. The lectures are given by internationally recognized specialists in the fields. The topics covered in this Second Summer School include harmonic analysis, complex analysis, pseudodifferential operators, the mathematics of quantum chaos, and non-linear analysis.
This volume is a joint publication of the American Mathematical Society and the Sociedad Matemática Mexicana. Members of the SMM may order directly from the AMS at the AMS member price.
Contemporary Mathematics, Volume 289; 2001; 272 pages; Softcover; ISBN 0-8218-2708-1; List $69; Individual member $41; Order code CONM/289NT201

Introduction to the Theory of Differential Inclusions
Georgi V. Smirnov, University of Porto, Portugal
Differential inclusions play an important role as a tool in the study of various dynamical processes described by equations with a discontinuous or multivalued right-hand side, occurring, in particular, in the study of dynamics of economical, social, and biological macrosystems. They also are very useful in proving existence theorems in control theory.
This text provides an introductory treatment to the theory of differential inclusions. The reader is only required to know ordinary differential equations, theory of functions, and functional analysis on the elementary level.
Graduate Studies in Mathematics, Volume 41; 2002; 226 pages; Hardcover; ISBN 0-8218-2977-7; List $54; All AMS members $27; Order code GSM/41NT201

Winter School on Mirror Symmetry, Vector Bundles and Lagrangian Submanifolds
Cumrun Vafa and S.-T. Yau, Harvard University, Cambridge, MA, Editors
This book brings together the latest research in a major area of mathematical physics, including the recent progress in mirror manifolds and Lagrangian submanifolds. In particular, several articles describing homological approach and related topics are included.
AMS/IP Studies in Advanced Mathematics, Volume 23; 2001; 446 pages; Softcover; ISBN 0-8218-2159-8; List $64; All AMS members $44; Order code AMS/IP/23NT201

To order, call: 1-800-321-4AMS (4267). In the U.S. and Canada, or 1-401-455-4000; fax: 1-401-455-4046; email: cust-serv@ams.org. Visit the AMS Bookstore and order online at www.ams.org/bookstore. Or write to: American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294. Prices subject to change without notice.
2001 CAREER Awards Made

Five mathematicians have been honored by the National Science Foundation (NSF) in fiscal year 2001 with Faculty Early Career Development (CAREER) awards. The NSF established the awards to support promising scientists, mathematicians, and engineers who are committed to the integration of research and education. The grants run from four to five years and range from $200,000 to $500,000 each.

The CAREER grant awardees for 2001 and the titles of their grant projects are: RICARDO CORTEZ (Tulane University), Regularization methods for fluid/filament interactions in three dimensions; ALEXANDER FURMAN (University of Illinois, Chicago), Rigidity of group actions in ergodic theory and geometry; SANDOR KOVACS (University of Washington), Theory of moduli; JOSE NATHAN KUTZ (University of Washington), Dispersive waves in nonlinear media: Dynamics and applications; and ITAY NEEMAN (University of California, Los Angeles), Large cardinals.

—From an NSF announcement

Alder and Kawasaki Win Boltzmann Medals

The 2001 Boltzmann Medals have been awarded to BERNI J. ALDER of the University of California, Davis, and Lawrence Livermore National Laboratory and to KYOZI KAWASAKI of the Los Alamos National Laboratory and Chubu University, Japan.

Alder was cited for inventing the technique of molecular dynamics simulation and showing that with such 'computer experiments' important discoveries in the field of statistical mechanics can be made, in particular the melting/crystallization transition of hard spheres and the long-time decay of autocorrelation functions in fluids. Kawasaki was honored for his contribution to our understanding of dynamic phenomena in condensed matter physics, in particular the mode-coupling theory of fluids near criticality, and nonlinear problems, such as critical phenomena in sheared fluids and phase separation".

The Boltzmann Medal is given every three years by the Commission on Statistical Physics in the name of the International Union of Pure and Applied Physics.

—Kurt Binder, Universität Mainz

AMS Awards Pi Mu Epsilon Student Prizes

Each year, the AMS sponsors the AMS Award for Outstanding Pi Mu Epsilon Student Paper Presentation. The awards, first presented in 1989, are made by Pi Mu Epsilon (PME), the U.S. honorary mathematics society, to recognize the best undergraduate student papers presented at a PME student paper session. Each awardee receives a prize of $150. Eight students received awards for presentations at the Student Conference held in Madison, Wisconsin, August 1–2, 2001. The conference was jointly sponsored by PME and the Mathematical Association of America. The names of the students, together with their institutions and the titles of their talks, are listed below.

ERIC APPELT, Miami University, "Bandwidth of a Product of Cliques of Uneven Size"; ERN BERTMAN, St. Norbert College, "Origami and Mathematics"; DAVE GERBER, Youngstown State University, "Scheduling Tournaments Using Combinatorial Designs"; BRENDAS JOHNSON, South Dakota State University, "Disjunctive Rado Numbers"; YAKOV KRONROD, Worcester Polytechnic Institute, "Pattern Formation in Biological Systems"; BRIAN MUSICA, Elmhurst College, "Binomial Basketball: Success String Possibilities"; TOM WAKEFIELD, Youngstown State University, "Factorizable Groups"; and KATHY WOODSIDE, North Carolina State University, "Protecting the Public Health: Predicting PM Fine in Forsyth County".

—Allyn Jackson
Mathematics Opportunities

NRC-Ford Foundation Postdoctoral Fellowships for Minorities

The National Research Council (NRC) administers the Ford Foundation Postdoctoral Fellowships for Minorities. This program enables teacher-scholars to engage in postdoctoral research and scholarship in an environment free from the interference of their normal professional duties and helps them to achieve greater recognition in their respective fields and to develop the professional associations that will make them more effective and productive in academic employment.

Approximately 30 postdoctoral fellowships will be awarded for 2002. The total award package for each fellowship is $40,000, which includes a $35,000 stipend and a travel and relocation allowance. Eligible applicants must be U.S. citizens or nationals who are members of one of the following ethnic minority groups: Alaskan Natives (Eskimo or Aleut), Black/African Americans, Mexican Americans/Chicanos/Chicanas, Native American Indians, Native Pacific Islanders (Polynesian or Micronesian), or Puerto Ricans. Applicants are required to have earned a Ph.D. or Sc.D. degree from a U.S. educational institution no earlier than January 1995 and no later than February 14, 2002, in a field supported by this program.

The deadline date for applications is January 7, 2002. Awards will be announced in April 2002. Further information is available at http://www4.nationalacademies.org/pga/fo.nsf, or contact the Fellowship Programs Office/FP, TJ 2041, National Research Council, 2101 Constitution Avenue, NW, Washington, D.C. 20418; telephone 202-334-2872; e-mail: infofell1@nas.edu.

—From an NRC announcement

Deadlines and Target Dates at the DMS

The Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) has a number of programs in support of mathematical sciences research and education. Listed below are some of the programs and their deadlines or target dates for the year 2002. Some dates are tentative; please refer to the program announcement or contact the program director for more information.

First week of January 2002 (target date): Mathematical Biology part of Applied Mathematics (includes all RUI proposals)

January 15, 2002 (target date): Mid-Career Methodological Opportunities


Late January 2002 (deadline; see solicitation): Major Research Instrumentation Program

February 1, 2002 (target date): Research Planning Grants and Career Advancement Awards for Minority Scientists and Engineers

Early April 2002 (target date; see solicitation): CBMS Regional Research Conferences in the Mathematical Sciences

June 2002 (letter of intent deadline; see solicitation): Grants for Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE)

July 2002 (proposal deadline; see solicitation): Grants for Vertical Integration of Research and Education in the Mathematical Sciences (VIGRE)

July 2002 (deadline; see solicitation): Faculty Early Career Development (CAREER) Program

August 15, 2002 (target date): Mid-Career Methodological Opportunities

Proposals for conferences, workshops, and special years that are submitted to the Statistics and Probability program or to the Topology and Foundations program can be sent...
Mathematics Opportunities

at any time. However, proposals for these activities that are submitted to all other DMS programs (Analysis, Algebra and Number Theory, Applied Mathematics, Computational Mathematics, and Geometric Analysis) must be submitted according to the target dates for those programs. Proposals for supplements for Research Experiences for Undergraduates may be submitted at any time.

For further information consult the DMS website at http://www.nsf.gov/mps/divisions/dms/news/c_deadlines.htm. The mailing address is Division of Mathematical Sciences, National Science Foundation, Room 1025, 4201 Wilson Boulevard, Arlington, VA 22230. The telephone number is 703-292-5111.

—From a DMS announcement

2002 Prize for Achievement in Information-Based Complexity

The 2002 Prize for Achievement in Information-Based Complexity consists of $3,000 and a plaque to be awarded at the Foundations of Computational Mathematics Conference to be held August 5–14, 2002. The prize committee will consist of Erich Novak, Sergei Pereverzev, Joseph F. Traub, Grzegorz W. Wasilkowski, and Henryk Wozniakowski. Anyone other than a current member of the prize committee is eligible. The members of the prize committee would appreciate nominations for the prize. However, a person does not have to be nominated to win the award.

The deadline for nominations for the award is March 31, 2002. The achievement can be based on work done in a single year, over a number of years, or over a lifetime. It can be published in any journal, number of journals, or monographs. Nominations for the prize may be sent to Joseph Traub, traub@santafe.edu.

—Joseph F. Traub, Santa Fe Institute

Goldstine Postdoctoral Fellowship

The Mathematical Sciences Department of the IBM Thomas J. Watson Research Center invites applications for its 2002-2003 Herman Goldstine Postdoctoral Fellowship for research in mathematical and computer sciences. The fellowship provides scientists of outstanding ability an opportunity to advance their scholarship as resident department members at the Research Center. The department provides an atmosphere in which basic research is combined with work on technical problems arising in industry.

One fellowship will be awarded. Candidates must have a doctorate and no more than five years of postdoctoral professional experience (with a preference for less) when the fellowship commences. The fellowship has a period of one year and may be extended another year by mutual agreement. The stipend is from $85,000 to $95,000, depending on experience, plus an allowance for moving expenses. The Research Center is located in Westchester County, less than an hour north of New York City.

The Mathematical Sciences Department does research in pure and applied mathematics and in theoretical and exploratory computer science. Close interaction with permanent department members is expected, but fellows are free to pursue their own research interests.

Applications must be received by January 9, 2002. For further information, visit the website http://www.research.ibm.com/math/goldstine.html or send e-mail to mathsci-postdoc@watson.ibm.com. The postal address is: Herman Goldstine Fellowship Committee, Department of Mathematical Sciences, Room 32-248, IBM T. J. Watson Research Center, P.O. Box 218, Route 134, Yorktown Heights, NY 10598.

—From an IBM announcement
For Your Information

Departments Coordinate Job Offer Deadlines

A group of mathematical sciences departments has adopted an agreement to coordinate deadlines for acceptance of postdoctoral job offers. The purpose is to ensure that applicants do not have to make decisions about job offers before the results of the National Science Foundation (NSF) postdoctoral fellowship competition are announced. The agreement applies only to offers of postdoctoral positions and not tenure-track positions, and only to applicants who are less than two years past the Ph.D.

The departments have agreed not to require these applicants to decide about a job offer before Monday, February 11, 2002. The NSF has agreed to notify postdoctoral fellowship recipients no later than Thursday, January 31, 2002. The list of participating departments, together with additional information, may be found on the Web at http://www.ams.org/employment/postdoc-offers.html.

—Allyn Jackson

DMS Employment Opportunities

Several of the technical staff of the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) serve one- to two-year visiting scientist or Intergovernmental Personnel Act appointments as program directors while on leave from universities, colleges, industry, or national laboratories. Since the timing of these positions is staggered, the division continually seeks talented applicants. In 2002 the division will be seeking to make appointments in all areas. Permanent program director appointments will also be considered.

The positions involve responsibility for the planning, coordination, and management of support programs for research (including multidisciplinary projects), infrastructure, and human resource development for the mathematical sciences. Normally, this support is provided through merit-reviewed grants and contracts that are awarded to academic institutions and nonprofit, nonacademic research institutions.

Applicants should have a Ph.D. or equivalent training in a field of the mathematical sciences, a broad knowledge of one of the relevant disciplinary areas of the DMS, some administrative experience, a knowledge of the general scientific community, skill in written communication and preparation of technical reports, an ability to communicate orally, and several years of successful independent research normally expected of the academic rank of associate professor or higher. Skills in multidisciplinary research are highly desirable. Qualified women, ethnic/racial minorities, and/or persons with disabilities are strongly urged to apply. No person shall be discriminated against on the basis of race, color, religion, sex, national origin, age, or disability in hiring by the NSF.

Applicants should send a letter of interest and a vita to Bernard R. McDonald, Executive Officer, Division of Mathematical Sciences, National Science Foundation, 4201 Wilson Boulevard, Suite 1025, Arlington, Virginia 22230, telephone 703-292-4851, fax 703-292-9032, e-mail: bmi@nsf.gov.

—NSF announcement

Mathematics Awareness Month 2002

The Joint Policy Board for Mathematics announces that this year’s Mathematics Awareness Month focuses on the contributions of mathematics to understanding of our own genome.

With the completion near of the sequencing of the human genome, the catalogue of all our genes and whatever else is in our chromosomes, scientists and indeed all of mankind have the sense that we are coming into possession of the key to enormous insights into many fundamental medical and biological problems. Unfortunately, even as we are inundated with waves of new data from these projects, the problem of interpreting and using this new store of data has arisen as a fundamental challenge to the way biomedical science will be carried out in the future. Mathematics has contributed centrally to the taming and understanding of this data to date and will play an ever larger role in its analysis in the future.

As data collection for the genome sequencing problems became automated, large, fast, efficient computer algorithms were utilized to reconstruct the genome from the fragments which experimenters could sequence and to help locate where genes were in this avalanche of sequence data. The static map of the genome is almost in hand, and we move on to the study of the dynamic system of proteins and RNAs produced from the genome and how that profoundly complex system is regulated. Both dynamical system methods from machine learning and statistics are being used to figure out how the control system of the genome has been “engineered”. Microarray technologies allow thousands of potential gene products to be measured simultaneously, affording a snapshot of the genome’s dynamics. Challenging issues in statistics are being dealt with in order to design experiments to
Intrigued?

Then consider joining a highly talented group of mathematicians who deduce structure where it is not apparent, find patterns in seemingly random sets, create order out of chaos—these are the mathematicians of the National Security Agency. They apply Number Theory, Group Theory, Finite Field Theory, Linear Algebra, Probability Theory, Mathematical Statistics, Combinatorics, and more to a world of challenges. They exchange ideas and work with some of the finest minds—and most powerful computers—in the country.

Send your resume and transcripts, in confidence, to:

For Your Information

optimize the information extracted from such experiments. These techniques are already being used to discern molecular "signatures" of tumor types, to be used in the prescription of cancer therapy regimens by clinicians.

Computational models of large biomolecules are now central to drug discovery in the pharmaceutical industry. The list goes on.

The Mathematics Awareness Month poster emphasizes some of these aspects of genome science today: the dynamics of DNA being initiated by transcription factor proteins, and the microarray technology and its accompanying host of statistical analyses.

This year's Mathematics Awareness Month program will provide resources to scientists, educators, and policy makers for exploring the role of the mathematical sciences in understanding the human genome and its role in medicine and biology.

These resources can be found at http://www.mathforum.org/mam/02/.

—Dan Burns
University of Michigan, Ann Arbor

Correction

In my article "The Continuum Hypothesis, Part II" [Notices, August 2001 issue, pages 681-690], the end of the second paragraph following the theorem in the second column on page 684 reads: "For example, the initial segment of length $\omega_1$ is given by the Borel sets, and the corresponding ordinal rank of a Borel set is closely related to its classical Borel rank."

This is not correct. It should read: "For example, the sets of countable ordinal rank are each Borel, and the ordinal rank of an arbitrary Borel set can be computed from its classical Borel rank."

—W. Hugh Woodin

Addition to "Backlog"

What follows are two additions to the the "Journal (Print)" section of the "Backlog of Mathematics Research Journals", which appeared in the December 2000 issue of the Notices, pages 1355-1358. Discrete and Continuous Dynamical Systems. Number of issues per year—4; approximate number of pages per year—1,200; 2000 median time (in months): submission to final acceptance—3; acceptance to final publication—4; editor's estimate of waiting time (in months) for paper submitted currently to be published—8. Discrete and Continuous Dynamical Systems, Series B. Number of issues per year—4; approximate number of pages per year—800; 2000 median time (in months): submission to final acceptance—2; acceptance to final publication—3; editor's estimate of waiting time (in months) for paper submitted currently to be published—5. Both journals are issued and published by the American Institute of Mathematical Sciences.

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

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

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

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

Information for Notices Authors
The Notices welcomes unsolicited articles for consideration for publication, as well as proposals for such articles. The following provides general guidelines for writing Notices articles and preparing them for submission.

Notices readership. The Notices goes to about 30,000 subscribers worldwide, of whom about 20,000 are in North America. Approximately 8,000 of the 20,000 in North America are graduate students who have completed at least one year of graduate school. All readers may be assumed to be interested in mathematics research, but they are not all active researchers.

Notices feature articles. Feature articles may address mathematics, mathematical news and developments, mathematics history, issues affecting the profession, mathematics education at any level, the AMS and its activities, and other such topics of interest to Notices readers. Each article is expected to have a large target audience of readers, perhaps 5,000 of the 30,000 subscribers. Authors must therefore write their articles for nonexperts rather than for experts or would-be experts. In particular, the mathematics articles in the Notices are expository. The language of the Notices is English.

Most feature articles, including those on mathematics, are expected to be of long-term value and should be written as such. Ideally each article should put its topic in a context, providing some history and other orientation for the reader and, as necessary, relating the subject matter to things that readers are likely to understand. In most cases, articles should progress to dealing with contemporary matters, not giving only historical material. The articles that are received the best by readers tend to

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

AMS Bylaws—November 2001, p. 1205
AMS E-mail Addresses—November 2001, p. 1195
AMS Ethical Guidelines—June 1995, p. 694
AMS Officers 2000 and 2001 (Council, Executive Committee, Publications Committees, Board of Trustees)—May 2001, p. 520
AMS Officers and Committee Members—October 2001, p. 1032
Conference Board of the Mathematical Sciences—September 2001, p. 843
Information for Notices Authors—January 2002, p. 47
Mathematics Research Institutes Contact Information—August 2001, p. 731
National Science Board—February 2001, p. 216
NRC Board on Mathematical Sciences and Staff—April 2001, p. 427
NRC Mathematical Sciences Education Board and Staff—May 2001, p. 517
NSF Mathematical and Physical Sciences Advisory Committee—March 2001, p. 328
Program Officers for Federal Funding Agencies—October 2001, p. 1009 (DoD, DoE); November 2001, p. 1198 (NSF)
relate different areas of mathematics to each other.

By design the Notices is partly magazine and partly journal, and authors' expository styles should take this into account. For example, many readers want to understand the mathematics articles without undue effort and without consulting other sources.

Mathematics feature articles in the Notices normally six to nine pages, sometimes a little longer. Shorter articles are more likely to be read fully than are longer articles. The first page is 400 or 500 words, and subsequent pages are about 800 words. From this one should subtract an allowance for figures, photos, and other illustrations, and an appropriate allowance for any displayed equations and any bibliography.

Form of articles. Except with very short articles, authors are encouraged to use section headings and subsection headings to help orient readers. Normally there is no section heading at the beginning of an article. Despite the encouraged use of internal headings, the assigning of numbers to sections and subsections is not permitted in any article.

The bibliography should be kept short. In the case of mathematics articles, bibliographies are normally limited to about ten items and should consist primarily of entries like books in which one may do further reading. To help readers who might want lists of recent literature, an author might include a small number of recent publications with good bibliographies.

Editing process. Most articles that are destined to be accepted undergo an intensive editing process. The purposes of this process are to ensure that the target audience is as large as practicable, that the content of the article is clear and unambiguous, and that the article is relatively easy to read. Usually it is members of the editorial board who are involved in this process. Sometimes outside referees are consulted.

Preparation of articles for submission. The preferred form for submitted articles is as electronic files. Authors who cannot send articles electronically may send the articles by fax or postal mail.

Articles with a significant number of mathematical symbols are best prepared in \TeX, \LaTeX, or \AMSTeX. There are no special style files for the Notices because \TeX code gets converted to something else during the production process. Since the Notices is set in narrow columns, keeping displayed formulas relatively short helps to minimize adjustments during the production process; avoiding non-standard supplementary files and complex sequences of \TeX definitions also helps. For the handling of figures and other illustrations, please consult the editor.

Articles without a significant number of mathematical symbols may be prepared as text files or in Microsoft Word. In the case of files prepared in Microsoft Word, it is advisable to send both the file and a fax of a printout.

Upcoming Deadlines
January 15, 2002: Applications for AMS-AAAAS Mass Media Fellowships. See http://ehr.aaaas.org/ehr/(click the "Projects" link), or contact Katrina Malloy, Program Coordinator, AAAS Mass Media Science and Engineering Fellows Program, 1200 New York Avenue, NW, Washington, DC 20005; telephone 202-326-6760; fax 202-371-9849; or the AMS Washington Office, 1527 Eighteenth Street, NW, Washington, DC 20036; telephone 202-588-1100; fax 202-588-1853; e-mail: amsdc@ams.org.
January 15, 2002: Applications for National Research Council Research Associateship Program. See http://www4.nationalacademies.org/pga/rap.nsf, or contact the National Research Council, Associateship Programs (TJ 2114), 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-2760; fax 202-334-2759; e-mail: rap@nas.edu.

February 1, 2002: NSF/AWM Travel Grants for Women. See http://www. awm-math.org/travelgrants.html; telephone 301-405-7892; e-mail: awm@math.umd.edu.
February 1, May 1, October, 2002: NSF/AWM Mentoring Travel Grants. See http://www. awm-math.org/travelgrants.html; telephone 301-405-7892; e-mail: awm@math.umd.edu.
April 15, 2002: National Research Council Research Associateship Program. See http://www4.nationalacademies.org/pga/rap.nsf, or contact the National Research Council, Associateship Programs (TJ 2114, 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-2760; fax 202-334-2759; e-mail: rap@nas.edu.

May 15, 2002: Fall 2002 semester of Math in Moscow and AMS scholarships. See http://www.mccme.ru/mathinmoscow/, or contact Math in Moscow, P.O. Box 524, Wynnewood, PA 19096; fax +7095-291-65-01; e-mail: mim@mccme.ru. For information about and application forms for the AMS scholarships, see http://www.ams.org/careers-edu/mincowh.html, or contact Math in Moscow Program, Professional Services Department, American Mathematical Society, 201 Charles Street, Providence RI 02904; e-mail: prof-serv@ams.org.

August 15, 2002: National Research Council Research Associateship Program. See http://www4.nationalacademies.org/pga/rap.nsf/, or contact the National Research Council, Associateship Programs (TJ 2114), 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-2760; fax 202-334-2759; e-mail: rap@nas.edu.

October 15, 2002: Spring 2003 semester of Math in Moscow and AMS scholarships. See http://www.mccme.ru/mathinmoscow/, or contact Math in Moscow, P.O. Box 524, Wynnewood, PA 19096; fax +7095-291-65-01; e-mail: mim@mccme.ru. For information about and application forms for the AMS scholarships, see http://www.ams.org/careers-edu/mincowh.html, or contact Math in Moscow Program, Professional Services Department, American Mathematical Society, 201 Charles Street, Providence RI 02904; e-mail: prof-serv@ams.org.

Reference and Book List

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


Gödel: A Life of Logic, by John L. Casti and Werner DePauli. Perseus,


*Added to "Book List" since the list's last appearance.
2002 AMS Election
Nominations by Petition

Vice President or Member at Large
One position of vice president and member of the Council ex officio for a term of three years is to be filled in the election of 2002. The Council intends to nominate at least two candidates, among whom may be candidates nominated by petition as described in the rules and procedures.

Five positions of member at large of the Council for a term of three years are to be filled in the same election. The Council intends to nominate at least ten candidates, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

Petitions are presented to the Council, which, according to Section 2 of Article VII of the bylaws, makes the nominations. The Council of 23 January 1979 stated the intent of the Council of nominating all persons on whose behalf there were valid petitions.

Prior to presentation to the Council, petitions in support of a candidate for the position of vice president or of member at large of the Council must have at least fifty valid signatures and must conform to several rules and operational considerations, which are described below.

Editorial Boards Committee
Two places on the Editorial Boards Committee will be filled by election. There will be four continuing members of the Editorial Boards Committee.

The President will name at least four candidates for these two places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Nominating Committee
Three places on the Nominating Committee will be filled by election. There will be six continuing members of the Nominating Committee.

The President will name at least six candidates for these three places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

Rules and Procedures
Use separate copies of the form for each candidate for vice president, member at large, or member of the Nominating and Editorial Boards Committees.

1. To be considered, petitions must be addressed to Robert J. Daverman, Secretary, American Mathematical Society, 312 D Ayres Hall, University of Tennessee, Knoxville, TN 37996-1330, and must arrive by 28 February 2002.

2. The name of the candidate must be given as it appears in the Combined Membership List (CML). If the name does not appear in the list, as in the case of a new member or by error, it must be as it appears in the mailing lists, for example on the mailing label of the Notices. If the name does not identify the candidate uniquely, append the member code, which may be obtained from the candidate’s mailing label or the Providence office.

3. The petition for a single candidate may consist of several sheets each bearing the statement of the petition, including the name of the position, and signatures. The name of the candidate must be exactly the same on all sheets.

4. On the next page is a sample form for petitions. Copies may be obtained from the secretary; however, petitioners may make and use photocopies or reasonable facsimiles.

5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column.

6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the Combined Membership List and the mailing lists. No attempt will be made to match variants of names with the form of name in the CML. A name neither in the CML nor on the mailing lists is not that of a member. (Example: The name Robert J. Daverman is that of a member. The name R. Daverman appears not to be.)

7. When a petition meeting these various requirements appears, the secretary will ask the candidate to indicate willingness to be included on the ballot. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving consent.
Nomination Petition for 2002 Election

The undersigned members of the American Mathematical Society propose the name of

as a candidate for the position of (check one):

☐ Vice President
☐ Member at Large of the Council
☐ Member of the Nominating Committee
☐ Member of the Editorial Boards Committee


Name and address (printed or typed)

________________________
Signature

________________________
Signature

________________________
Signature

________________________
Signature

________________________
Signature

________________________
Signature
Encyclopaedia of Mathematics
Supplement III

edited by Michiel Hazewinkel CWI, Amsterdam, The Netherlands

This is the third supplementary volume to Kluwer's highly acclaimed multi-volume Encyclopaedia of Mathematics. This additional volume contains nearly 500 new entries written by experts and covers developments and topics not included in the previous volumes. These entries are arranged alphabetically throughout and a detailed index is included. This supplementary volume enhances the existing twelve volumes, and together, the thirteen volumes represent the most authoritative, comprehensive and up-to-date Encyclopaedia of Mathematics available.

Some article titles in this volume:
- ANOVA
- Abstract algebraic logic
- Abstract analytic number theory
- Abstract prime number theory
- Atiyah-Floer conjecture
- Automatic continuity for Banach algebras
- Average-case computational complexity
- Baily-Borel compactification
- Banach-Jordan algebra
- Baxter algebra
- Benjamin-Bona-Mahony equation
- Black-Scholes formula
- Bombieri-Iwaniec method
- Borchers Lie algebra
- Braess paradox
- Brown-Douglas-Fillmore theory
- Current, Darbo fixed-point theorem
- Delsarte-Goethals code
- Generalized function algebras
- Geometric measure theory
- Geometric transversal theory
- Gershgorin theorem
- Moonshine conjectures
- Mori theory of extremal rays
- Motzkin transposition theorem
- Obstacle scattering
- Odlyzko bounds
- Okubo algebra
- Onsager-Machlup function
- Schubert calculus
- Sierpinski game
- Sorgenfrey topology
- Thom-Mather stratification
- Tilting theory
- Vertex operator algebra
- Viscous fingering
- Weil-Petersson metric
- Weyl-Kac character formula
- Whitham equations
- Zipf law

2002
Hardbound, ISBN 1-4020-0198-3
Price: EUR 249.00 / USD 229.00 / GBP 157.00
Contact James Finlay for further information / Email: james.finlay@wkap.nl
This section contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings and symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete list of meetings of the Society can be found on the last page of this issue.

An announcement will be published in the Notices if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in every third issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared.

In general, announcements of meetings and conferences held in North America carry only the date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the Notices in care of the American Mathematical Society in Providence or electronically to notices@ams.org or mathcal@ams.org.

In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the Notices prior to the meeting in question. To achieve this, listings should be received in Providence six months prior to the scheduled date of the meeting.

The complete listing of the Mathematics Calendar will be published only in the September issue of the Notices. The March, June, and December issues will include, along with new announcements, references to previously announced meetings and conferences occurring within the twelve-month period following the month of those issues. New information about meetings and conferences that will occur later than the twelve-month period will be announced once in full and will not be repeated until the date of the conference or meeting falls within the twelve-month period.

The Mathematics Calendar, as well as Meetings and Conferences of the AMS, is now available electronically through the AMS website on the World Wide Web. To access the AMS website, use the URL: http://www.ams.org/.
encouraged to apply.

**Speakers:** W. Ballmann (Bonn), J. Jost (Max-Planck Leipzig), P. Li (UC Irvine), F. Luo (Rutgers), R. Hamilton (UC San Diego), G. Margulis (Yale), J. Morgan (Columbia), W. Neumann (Columbia), R. Schoen (Stanford), S-T Yau (Harvard).

**Deadline:** Deadline for application of support: January 1, 2002. Information: [http://www.math.ohio-state.edu/](http://www.math.ohio-state.edu/) (to be set up soon, in the “Announcements of Upcoming Events” part) or contact F. Zheng directly at zhang@math.ohio-state.edu, phone: 614-292-0842.

**April 2002**

1. **June 30 Trimester on Algebraic Topology**, Centre de Recerca Matemàtica, Bellaterra (Barcelona).

**Topics:** Algebraic topology, especially some topics in modern homotopy theory, like homotopy finite group theory, functor calculus and model category structures.


4. **5-7 The 5th Riviere-Fabes Symposium on Analysis and PDE**, Univ. of Minnesota, Minneapolis, Minnesota.

**Speakers:** D. Jerison (Mass. Inst. of Tech.), N. Katz (Washington Univ.), M. Lacey (Georgia Inst. of Tech.), W. Schlag (California Inst. of Tech.), E. Stein (Princeton Univ.), E. T Toro (Univ. of Washington).

**Organizing Committee:** C. Kenig (Univ. of Chicago), C. Nair, N. Krylov, W. Littman, F. Retic, M. Saffonov (chair).

**Contacts:** M. Saffonov, e-mail: safonov@math.umn.edu; phone: (612) 625-8571, fax: (612) 626-2017.

**Information:** See also the section Programs and Events in [http://www.math.umn.edu](http://www.math.umn.edu).


**Speaker:** This year’s main speaker is M. Christ of the Univ. of California, Berkeley. Professor Christ will present five lectures on “Harmonic Analysis, Multilinear Operators, and Schroedinger Operators”.

**Information:** Regarding travel and lodging can be found at the conference website: [http://www.uark.edu/depts/mathinfo](http://www.uark.edu/depts/mathinfo). Limited funds are available to support recent Ph.D.’s and graduate students who would like to attend the conference.


**Sponsors:** The NSF, North Dakota EPSCoR, North Dakota State Univ., and the Univ. of North Dakota.

**Speakers:** S. Angenent, Wisconsin; B. Chow, UC San Diego; J. Dadok, Indiana Univ.; C. R. Graham, Univ. of Washington; L. Kauffman, Univ. of Illinois at Chicago; B. Kroetz, Ohio State; P. van Nieuwenhuizen (SUNY Stony Brook); A. Waldron, UC Davis.


**May 2002**


**Sponsor:** AIAA, IEEE, IFNA, IFIP.

**Program Scope:** Conference sponsors seek a spectrum of theoretical, computational, and experimental inquiries concerned with aviation, aerospace, aeronautics, and astronautics. This program will include keynote addresses, invited lectures, and contributed lectures and will involve communication with remote sites. * Non-linear means not necessarily linear; topics concerned with linear problems are also welcome.

**Conference Language:** English.

**Call for Papers:** Deadline for papers: Abstract of the paper due January 15, 2002; full paper due June 15, 2002.

**Information:** ICNAAA-2002, 3. Sivasundaram, 104 Snow Goose Ct., Daytona Beach, FL 32119; e-mail: info@icnpan.com; website: [http://www.icnpan.com/](http://www.icnpan.com/).


**Speakers:** Y. Benoist (ENS, Paris), R. Farb (Univ. Chicago), D. Fried (Boston Univ.), R. Grigorchuk (Steklov Inst., Moscow), F. Labourie (Orsay, Paris), A. Lubotzky (Hebrew Univ. of Jerusalem) (to be confirmed), G. Soifer (Univ. Bar Ilan).

**Topics:** Geometric group theory; Group actions on manifolds; Crystallographic groups and their generalisations (affine, polynomial, almost-crystallographic groups); Discrete subgroups of Lie groups; Applications in and beyond these fields.

**Program:** Short communications by participants will be scheduled.

**Organizers:** H. Abd's (Bielefeld), Y. Felix (Louvain-la-Neuve), W. Goldman (College Park), F. Grunewald (Duesseldorf), P. Igodt (Leuven/Kortrijk), K. B. Lee (Norman, OK).


**Short Description:** In this workshop, we will explore the connections between molecular biology and such critical and interrelated areas of discrete mathematics as combinatorial designs, codes, graphs, and categorical sequences; some of the fascinating new insights into these discrete concepts that arise from work in molecular biology; recent applications of concepts from discrete mathematics (broadly defined) in molecular biology. We will explore combinatorial design issues arising in the identification of clones containing a specific DNA sequence, coding theory problems with codewords used to identify sequences, and graph theoretical concepts that arose originally from DNA reconstruction when the ends of some of the clones are radioactively tagged. We will also explore the use of group testing methods in identifying positive clones, which is a crucial step in physical-map-based sequencing.

**Sponsors:** DIMACS Center, Rutgers Univ., Piscataway, NJ and Chiao Tung Univ., Hsinchu, Taiwan.

**Contacts:** F. Hwang, Chiao Tung Univ.; F. Roberts, DIMACS, Rutgers Univ.; D. Torney, Los Alamos National Labs.

**Information:** [http://dimacs.rutgers.edu/Workshops/index.html](http://dimacs.rutgers.edu/Workshops/index.html).
Mathematics Calendar

magnetic fields, industrial topics, computational mathematics and simulation.
Information: http://cage.rug.ac.be/~acomien; e-mail: acomien@cage.rug.ac.be.

June 2002

*2-8 Combinatorics 2002, Maratea (Potenza), Italy.
Conference Theme: Combinatorial theory, finite geometries, incidence structures, coding theory, designs and graphs.
Invited Speakers: J. Bierbrauer (Michigan Technological Univ., Houghton, USA), P. V. Cuckerscheri (Univ. "La Sapienza", Rome, Italy), C. Herling (Univ. Tübingen, Tübingen, Germany), J.W.P. Hirschfeld (Univ. of Sussex, Brighton, UK), B. Jackson (Goldsmiths College, London, UK), N.L. Johnson (Univ. of Iowa, Iowa City, USA), C.C. Lindner (Auburn Univ., Auburn, USA), L. Lovász (Microsoft Research, Redmond, Washington, USA, and Eötvös Loránd Univ., Budapest, Hungary), G. Lunardon (Univ. "Federico II", Naples, Italy), K. Metsch (Univ. Gießen, Gießen, Germany), T. Pentilla (Univ. of Western Australia, Crawley, Australia), T. Szönyi (Eötvös Loránd Univ., Budapest, Hungary), J.A. Thas (Univ. Gent, Gent, Belgium), Q. Xiang (Univ. of Delaware, Newark, USA).
Organizing Committee: A. Bonisoli, A. Cossidente, M. Funk, G. Korchmáros, V. Pizzonia, A. Scillow, M. Sommese; e-mail: comb20022univab.it.

Information: http://www2.unibas.it/utenti/comb2002/.

*10-14 Théories d'Homologie, Représentations et Algèbres de Hopf, CIRM, Luminy, Marseille, France.
Description: Homological theories, representation theory, and Hopf algebras, mainly in a noncommutative nor semisimple finite dimensional frame. This meeting is part of the cooperation program between France and various countries of South America. The number of places is limited. Inscriptions of any interested mathematician are welcome.
Deadline for inscriptions: May 5, 2002.

*18-22 The Barcelona Conference on Stochastic Inequalities and Their Applications (A EuroConference), Bellaterra (Barcelona).
Scientific committee: E. Giné, Ch. Houdré, and D. Nualart.
Information: http://www.crm.es/stoicheq/.

*19-21 The EUROMECH Colloquium 437: Identification and Updating Methods of Mechanical Structures, Prague, Czech Republic.
Scientific Topics: Parametric identification in frequency and time domain, Curve fitting of transfer functions, Identification of vibrating systems with small nonlinearity, Spectral and modal sensitivity, Updating methods of finite element models, Tuning and vibrodiagnostics of mechanical structures, Robustness of model-based decisions with respect to uncertainties.
Chairpersons and Contacts: I. J. Kozanek, Inst. of Thermomechanics, Academy of Sciences of the Czech Republic, Dolejskova 5, 182 00 Prague 8, Czech Republic; fax +420-2-8584695; e-mail: ec437@it.cas.cz; euromech437@it.cas.cz; G. Lallement, Applied Mechanics Laboratory RC, Univ. of Besançon, 24, rue de l'Epitaphe, 250 00 Besançon, France.
Information: http://www.it.cas.cz/~ec437/.

*24-28 The Third International Conference on High Dimensional Probability, Sandbjerg Estate, Denmark.
Information: http://www.mathysto.de/events/HDRP2002/.

July 2002

*1-6 Advanced Course on Mathematical Finance: Further Models, Bellaterra (Barcelona).
Coordinator: J. del Castillo.

Information: http://www.crm.es/mathfin/.

*2-6 2002 Barcelona Conference on Algebraic Topology (a EuroConference), Institut d'Estudis Catalans, Barcelona.
Scientific committee: C. Broto, C. Casacuberta, H. Miller.
Organizing committee: J. Aguadé, C. Casacuberta.
Information: http://www.crm.es/2002bac/

*7-12 The 5th Americas Conference in Differential Equations and Nonlinear Dynamics, Univ. of Alberta, Edmonton, Canada.
Scientific committee: J. Cossio (Colombia), T. Langford (Canada), H. Leiva (Venezuela), R. Manasevich (Chile), K. Mischaikow (US), H. Rodrigues (Brazil), O. Rubio (Peru).
Plenary Speakers: J. Hale (USA), H. Rodrigues (Brazil), M. Lewis (Canada), J. Wu (Canada), R. Manasevich (Chile), A. Castro (Colombia, USA), A. Minzoni (Mexico), T. Gedeon (USA), R. Gardner (USA), K. Lu (USA), J. Mallet-Paret (USA), P. Polacik (USA), Y. Yi (USA), H. Leiva (Venezuela).
Organizing Committee: M. Li (Alberta), Co-Chair; K. Lu (Brigham Young); K. Mischaikow (Georgia Tech.); J. Muldowney (Alberta), Co-Chair; J. Wu (York).
Information: Contact website: http://www.math.ucalgary.ca/~nll/america.htm; e-mail: mlimath@ucalgary.ca.

*8-11 The Tenth International Symposium on Dynamic Games and Applications, Saint Petersburg State Univ., Saint Petersburg, Russia.
Description: The International Symposium on Dynamic Games and Applications is a biennial professional event. The tenth symposium is the first one to be held in Russia. The four-day technical program will consist of plenary sessions and presentations of contributed papers.
Organizing Committee: L. A. Petrosjan, Chairperson (Saint Petersburg State Univ., Russia); V. V. Zakharov and E. Lezhninna, Co-chairpersons (Saint Petersburg State Univ.); victor@lontsif.ru; mcvictor@icape.nw.ru.
Program Committee: T. E. S. Raghavan, Chairperson (Univ. of Illinois).
Information: More information, including accommodation, registration, submission, social events, may be founded on the website http://www.isdgrus.ru/ISDG2002/.

*8-12 14th International Conference on Formal Power Series and Algebraic Combinatorics, Univ. of Melbourne, Australia.
Topics: All aspects of combinatorics and their relationship with other parts of mathematics, computer science, and physics.
Program: Invited lectures, contributed presentations, poster session, problem session, and software demonstrations.
Program Committee: A. Gutmans (Melbourne, co-chair), O. Foda (Melbourne, co-chair), S. Ariki (Tokyo), S. Billey (MIT), M. Delest (France), A. Duval (Texas-El Paso), F. Sottile (Massachusetts), S. Fomin (Michigan), V. Gasharov (Cornell), A. Hamel (Waterloo), R. King (Southampton), G. Labelle (UQAM), J-C. Novelli (Lille), R. Pinzani (Florence), A. Rechnitzer (Toronto & Melbourne), L. Terada (Tokyo), J-Y. Thibon (Marne-la-Vallée), D. Welsh (Oxford), T. Welsh (Melbourne), N. Wormald (Melbourne).
Organizing Committee: A. Gutmann (Melbourne, chair), N. Bergerson (York), R. Brak (Melbourne), C. Greenhill (Melbourne), A. Owczarek (Melbourne).
Invited Speakers: The list of invited speakers is not complete yet. However, the following scientists have already accepted to give a problem talk at FPSAC 2002: H. Barcelo (USA); J. de Gier (Australia); P. Di Francesco (France), F. Forrester (Australia), C. Krattenthaler (Austria), B. McKay (Australia), T. Prellberg (Germany), A. D. Sokal (USA), O. Warnaar (Australia).
Languages: English and French.
Information: See the conference homepage at http://www.fpsac.ms.unimelb.edu.au/ or e-mail: fpsac@ms.unimelb.edu.au.

8-19 Dynamic Equations on Time Scales (Measure Chains), Univ. of Wyoming, Laramie, Wyoming.
Description: The theory of dynamic equations on time scales has recently received a lot of attention and was introduced by Stefan Hilger in his Ph.D. thesis in 1988 (supervised by Bernd Aulbach) in order to unify continuous and discrete analysis. A time scale is a closed subset of the real numbers. If the time scale is the set of real numbers, the dynamic equation is an ordinary differential equation, while if the time scale is the set of integers, then the dynamic equation is a difference equation. However, since there are many other time scales, dynamic equations are much more general than ordinary differential equations and difference equations. The theory of dynamic equations on time scales has a tremendous potential for applications.
Speakers: A. Peterson (Univ. of Nebraska-Lincoln) and M. Bohner (Florida Inst. of Technology).
Sponsors: Rocky Mountain Mathematics Consortium and the Univ. of Wyoming.
Information: A. D. Porter or B. L. Shader, Math. Dept., Univ. of Wyoming, Laramie, WY 82071; e-mail: bshader@uwyo.edu; http://math.uwyo.edu/.

15-18 Modular Curves and Abelian Varieties (A EuroConference), Bellaterra (Barcelona).
Coordinator: J. Quer.
Information: http://www.crm.es/mcav02/.

15-19 6th International Conference on the Electrical Transport and Optical Properties of Inhomogeneous Media (ETOPIM 6), Cliff Lodge, Snowbird, Utah.
Aim: The aim of the conference is to bring together mathematicians, physicists, and engineers to present and discuss their research findings on the electrical, magnetic, and optical properties of inhomogeneous media.
Conference Topics: Electrical transport and optical properties in composites; localization in nonlinear periodic media; photonic crystals and band-gap structures; semiconductor heterostructures; porous media and percolation; biocomposites; active composite systems such as electro- and magneto-rheological fluids, smart composites and sensors; transport in geophysical media, such as sea ice, glacial ice, soils, and rocks; electromagnetic inverse problems and imaging in inhomogeneous media; numerical methods for composites; giant magnetoresistance; magnetic nanostructures and spintronics; transport properties of nanostructures; thin film composite structures; localization in inhomogeneous materials; quantum phenomena in composites.
Information: See http://www.math.utah.edu/etopim/ for more information.

Description: The conference is being held in honour of Neil Trudinger's 60th birthday and is part of a Special Year on Nonlinear Partial Differential Equations organized by the School of Mathematics at the Australian National Univ..
Topics: Nonlinear partial differential equations and their applications, calculus of variations, geometric evolution problems.
Speakers: A preliminary list of speakers includes M. Crandall (Santa Barbara), N. Fusco (Naples), M. Giaquinta (Pisa), E. Giusti (Florence), S. Hildebrandt (Bonn), G. Huisken (Tubingen), H. Ishii (Tokyo), N. Ivovchikina (St. Petersburg), N. Krylov (Minnesota), H. J. Kuo (Taiwan), F. H. Lin (New York), M. Safonov (Minnesota), R. Schoen (Stanford), L. Simon (Stanford), G. Tian (MIT).
Information: For further information see http://wwwmaths.anu.edu.au/conferences/npde2002/ or contact J. Urbas (Chair of the Organizing Committee), urbas@maths.anu.edu.au.

*16-22 7th International Spring School "Nonlinear Analysis, Function Spaces and Applications" (NAFSA 7), Prague, Czech Republic.
Invited Speakers: J. Appell (Univ. of Wurzburg), J. Cerdá (Univ. of Barcelona), E. B. Davies (King's College, Univ. of London), B. Franchi (Univ. of Bologna), P. Koskela (Univ. of Jyväskylä), J. Malý (Charles Univ., Prague), C. J. Neugebauer (Purdue Univ.).
Organizers: Mathematical Institute of the Academy of Sciences of the Czech Republic and Department of Mathematics of the Czech Univ. of Agriculture.
Chairman: B. Opic.
Information: http://www.math.cas.cz/~nafssa7/e-mail:nafssa7@karlin.mff.cuni.cz.

*27-29 The Fifth Annual International Conference of Bridges: Mathematical Connections in Art, Music, and Science, Towson Univ., Towson, Maryland.
Special Tour: One-day Bridges special tour of Baltimore and Washington, D.C., July 30, 2002.
Suggested Topics: Mathematical visualization, Mathematics and music, Computer generated art, Symmetry structures, Origami, Mathematics and architecture, Tessellations and tilings, Aesthetical connections between mathematics and humanities, Geometric art in two and three dimensions, Geometries in quilting. If a presenter is not able to submit a paper for presentation, he or she may still send an abstract (not more than 1 page), due by 5/15/02, for inclusion in the Conference Proceedings.
Information: For other information not available on the web page (or if you want to add your e-mail address to the Bridges mailing list), you may contact: R. Sarhangi, Bridges Conference, Math. Dept., Towson Univ., 8000 York Road, Towson, MD 21252, (410) 704-4922, rsarhangi@towson.edu. Bridges Advisory Board members for contacts regarding the conference: A. Assadi, Dept. Math., Univ. of Wisconsin, Madison, WI 53706, URL: http://www.math.wisc.edu/~evg/, e-mail: abassidi@facstaff.wisc.edu; D. Daniel, Integrative Studies Program, Southwestern College, 100 College Street, Winfield, KS 67156, e-mail: ddaniel@sccks.edu. S. Jablan, The Math. Inst., Knezav Mihaila 35, 11001 Beograd, p.p. 367, Belgrade, Yugoslavia, e-mail: jablans@smu.ac.yu. M. Leyton, Center for Discrete Math. and Theoretical Computer Sci., Rutgers Univ., New Brunswick, NJ 08904, mleyton@psych.rutgers.edu; N. Friedman, Dept. Math. and Stat., Univ. at Albany, State Univ. of New York, Albany, NY 12222, e-mail: artmath@math.albany.edu. C. Sequin, Computer Sci. Division, ECE Dept., Univ. of California, Berkeley, CA 94720, e-mail: sequin@cs.berkeley.edu.

*29-August 3 Escuela Latinoamericana de Matemáticas (ELAM), Cartagena de Indias, Colombia.
Focus: ELAM will be focused on nonlinear analysis and approximation methods in the study of differential equations and its applications. ELAM congregate, mainly, Latinamerican mathematicians and also participation of outstanding mathematicians of Asia, Europe, and USA.
Scientific Committee: A. Castro (USA), J. Fernaando Escobar (USA), H. Frid (Brasil), Y. Lu (Colombia), G. Ponce (USA), J. Palis (Brasil), M. Zuluaga (Colombia).
Organizers: Unión Matemática de América Latina y del Caribe (UMALCA), Sociedad Colombiana de Matemáticas (SCM), Academia Colombiana de Ciencias Exactas Fisicas y Naturales (ACCEFYN, Escuela Regional de Matemáticas (ERM)).
Contacts: L. Rondón (rondon@matematicas.unal.edu.co), M. Zuluaga (mzuluaga@matematicas.unal.edu.co).
August 2002

* 11-17 The 7th International Conference on Difference Equations and Applications (7th ICDEA), Hunan Univ. at Changsha, China.

Description: The 7th ICDEA will be held under the auspices of the International Society of Difference Equations. It is one of the satellite conferences connected with the International Congress of Mathematician (ICM), which will be held in Beijing, China.

Topics: All of the topics included in the Journal of Difference Equations and Applications including general theory of difference equations.

- General theory of difference equations; Asymptotic behavior; Oscillation theory, stability theory, discrete dynamical systems; Complex dynamics; Control theory; Combinatorics; Bifurcation theory, iterated function systems; Numeric analysis; Functional equations; Stochastic processes; Dynamics equations on one scale, and discrete analogues of continuous mathematics.

- Applications in economic theory, biology, physics, engineering, computer science and other disciplines that use difference equations in a significant way.

Contact Persons: To get information about the conference you may contact one of the following:

- China: L. Huang (applemath@mail.hunu.edu.cn), College of Math. and Econometrics, Hunan Univ., Changsha 410081, China.
- Germany: E. Aulbach (aulbach@math.uni-augsburg.de), Inst. of Math., Univ. of Augsburg, D-86900 Augsburg, Germany.
- Canada: Z. Zou (zzou@math.mun.ca), Dept. of Math. and Stat., Memorial Univ. of Newfoundland, St. John’s, NF, Canada A1C 5S7.
- USA: G. Ladas (gadasmath@uri.edu), Dept. of Math., Univ. of Rhode Island, Kingston, RI 02881-0816.
- USA: S. Elaydi (elaydi@trinity.edu), Dept. of Math., Trinity Univ., San Antonio, TX 78212-7200.

Call for Organizers: If you are interested in organizing a special session on any of the above topics or other related topics, please send your proposal to one of the professors listed above.


Organizers: L. Hogben (lhogben@iastate.edu), B. Cain (bcain@iastate.edu), L. DeAlba (luz.dealba@drake.edu), I. Hentzel (hentzel@iastate.edu), M. Mills (mills@central.edu), Y. T. Poon (ytpoon@iastate.edu), H. Wu (isuwhu@iastate.edu).

Invited Speakers: S. Hedayat (ILAS Lecturer), Univ. of Illinois-Chicago; D. P. Jacobs, Clemson Univ.; C. R. Johnson, College of William and Mary; C. K. Li, College of William and Mary; H. Schneider, Univ. of Wisconsin-Madison.

Description: This conference will provide an opportunity for those working in several areas of linear algebra to meet, share ideas, and work together. The conference is organized around the following topics: matrix completion problems, numerical ranges, matrix stability and convergence, applications of linear algebra to nonassociative algebra, statistical applications of linear algebra. For each topic there will be a presentation by an invited speaker, a session for contributed papers, and a work session. There will also be a contributed paper session for areas of linear algebra within the focus of the conference but not specifically within one of the topics. Speakers will have the opportunity to submit their papers for publication in a special issue of the Electronic Journal of Linear Algebra (ELA), "Proceedings of the Topics in Linear Algebra Conference". All papers will be refereed by ELA to its usual standards.

Call for Papers: Contributed talks of 20 minutes in length are invited. To contribute a talk, submit the title and abstract by May 1, 2002, to L. DeAlba (luz.dealba@drake.edu).


October 2002

* 9-11 The 7th Conference "Shell Structures. Theory and Applications" (SSTA2002), Gdansk, Poland.

Information: (http://www.pg.gda.pl/ssta2002/). For additional information please contact Conference Secretary (ssta2002@pg.gda.pl).

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.

September 2002

* 10-20 Advanced Course on Geometric 3-Manifolds, Bellaterra (Barcelona).

Coordinator: J. Porti.

Information: http://www.crm.es/geom-mani/.

New Publications Offered by the AMS

Algebra and Algebraic Geometry

The Regulators of Beilinson and Borel
José I. Burgos Gil, Universidad de Barcelona, Spain

This book contains a complete proof of the fact that Borel’s regulator map is twice Beilinson’s regulator map. The strategy of the proof follows the argument sketched in Beilinson’s original paper and relies on very similar descriptions of the Chern-Weil morphisms and the van Est isomorphism. The book has two different parts. The first one reviews the material from algebraic topology and Lie group theory needed for the comparison theorem. Topics such as simplicial objects, Hopf algebras, characteristic classes, the Weil algebra, Bott’s Periodicity theorem, Lie algebra cohomology, continuous group cohomology and the van Est Theorem are discussed. The second part contains the comparison theorem and the specific material needed in its proof, such as explicit descriptions of the Chern-Weil morphism and the van Est isomorphisms, a discussion about small cosimplicial algebras, and a comparison of different definitions of Borel’s regulator.

Contents: Introduction; Simplicial and cosimplicial objects; $H$-spaces and Hopf algebras; The cohomology of the general linear group; Lie algebra cohomology and the Weil algebra; Group cohomology and the van Est isomorphism; Small cosimplicial algebras; Higher diagonals and differential forms; Borel’s regulator; Beilinson’s regulator; Bibliography; Index.

CRM Monograph Series, Volume 15

Boundary Cohomology of Shimura Varieties, III: Coherent Cohomology on Higher-Rank Boundary Strata and Applications to Hodge Theory

Michael Harris, Université Paris, France and Steven Zucker, Johns Hopkins University, Baltimore, Maryland

A publication of the Société Mathématique de France.

In this book, the authors complete the verification of the following fact: The nerve spectral sequence for the cohomology of the Borel-Serre boundary of a Shimura variety $S_b$ is a spectral sequence of mixed Hodge-de Rham structures over the field of definition of its canonical model. To achieve that, they develop the machinery of automorphic vector bundles on mixed Shimura varieties, for the latter enter in the boundary of the toroidal compactifications of $S_b$; and study the nerve spectral sequence for the automorphic vector bundles and the toroidal boundary. They also extend the technique of averting issues of base-change by taking cohomology with growth conditions. They give and apply formulas for the Hodge gradation of the cohomology of both $S_b$ and its Borel-Serre boundary.

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: Introduction; Automorphic vector bundles on mixed Shimura varieties; Mixed growth conditions and coherent cohomology; The nerve spectral sequence for coherent cohomology; Hodge theoretic applications; On the comparison of Hodge structures; Bibliography; Mémoires de la Société Mathématique de France, Number 85 July 2001, 116 pages, Softcover, ISBN 2-85629-107-4, 2000 Mathematics Subject Classification: 14G35, 11G18, 14C30, 11F75, Individual member $30, List $33, Order code SMFMEM/85N
Theorie d'Iwasawa des Representations p-Adiques Semi-Stables
Bernadette Perrin-Riou, Université Paris-Sud, Orsay, France
A publication of the Société Mathématique de France.

Let \( F \) be a finite unramified extension of \( \mathbb{Q}_p \) and \( V \) a \( p \)-adic galois semi-stable representation on \( F \) of dimension \( d \). The author develops Iwasawa theory for \( V \) and the \( Z_p \)-cyclotomic extension: she constructs a logarithm (regulator map) from the Iwasawa module associated to the Galois cohomology of \( V \) in a very explicit module on an algebra generated by analytic functions on the annulus \( \{ p^{-1}/|x| < 1 \} \) and log\( x \).

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: Introduction; Anneaux de fonctions; Modules d'Iwasawa associés à un \((\mathbb{Q}_p, N)\)-module; Construction d'éléments de \( \mathcal{D}_{m,*}(D) \); Théorèmes de structure des \( \mathcal{D}_{m,*}(D) \); Exponentielle; Normes universelles; A. Digression: le polylogarithme; B. Étude de \( B^\psi \); Quelques formules; Bibliographie; Index.


New Publications Offered by the AMS

The questions that have been at the center of invariant theory since the 19th century have revolved around the following themes: finiteness, computability, and special classes of invariants. This book begins with a survey of many concrete examples chosen from these themes in the algebraic, homological, and combinatorial context. In further chapters, the authors pick one or the other of these questions as a departure point and present the known answers, open problems, and methods and tools needed to obtain these answers. Chapter 2 deals with algebraic finiteness. Chapter 3 deals with combinatorial finiteness. Chapter 4 presents Noetherian finiteness. Chapter 5 addresses homological finiteness. Chapter 6 presents special classes of invariants, which deal with modular invariant theory and its particular problems and features. Chapter 7 collects results for special classes of invariants and coinvariants such as (pseudo) reflection groups and representations of low degree. If the ground field is finite, additional problems appear and are compensated for in part by the emergence of new tools. One of these is the Steenrod algebra, which the authors introduce in Chapter 8 to solve the inverse invariant theory problem, around which the authors have organized the last three chapters.

The book contains numerous examples to illustrate the theory, often of more than passing interest, and an appendix on
commutative graded algebra, which provides some of the required basic background. There is an extensive reference list to provide the reader with orientation to the vast literature.

Contents: Invariants, their relatives, and problems; Algebraic finiteness; Combinatorial finiteness; Noetherian finiteness; Homological finiteness; Modular invariant theory; Special classes of invariants; The Steenrod algebra and invariant theory; Invariant ideals; Lamé’s $T$-functor and applications; Review of commutative algebra; References; Typography; Notation; Index.

Mathematical Surveys and Monographs, Volume 94

Analysis

Entire Functions in Modern Analysis
Boris Levin Memorial Conference

Yuri Lyubich, Technion-Israel Institute of Technology, Haifa, Israel, Vitali Milman, Tel Aviv University, Israel, Iossif Ostrovskii, Bilkent University, Ankara, Turkey, Mikhail Sodin, Tel Aviv University, Ramat-Aviv, Israel, Vadim Tkachenko, Ben Gurion University of the Negev, Beer-Sheva, Israel, and Lawrence Zalcman, Bar Ilan University, Ramat Gan, Israel, Editors

A publication of the Bar-Ilan University.

Distributed Worldwide by the American Mathematical Society.

This volume presents the proceedings from the conference, "Entire Functions in Modern Analysis" held at Tel-Aviv University (Ramat-Aviv, Israel) in memory of Professor Boris Levin, an outstanding mathematician and a brilliant teacher whose mathematical activity spanned over 60 years. Levin's scientific interests lay principally in the theory of analytic functions and its applications to harmonic analysis, functional analysis, and operator theory. His ideas and results in this area, as expressed both through his personal influence and his papers and books, have influenced several generations of mathematicians.


A. Goldberg, Approximation of subharmonic functions by logarithms of moduli of entire functions in integral metrics; A. F. Grishin and T. I. Malyutina, Subharmonic functions satisfying the local Levin condition; V. P. Havin and A. H. Berss, Bounded separation of singularities of analytic functions; O. M. Katkova and A. M. Vishnyakova, Zeros sets of entire absolutely monotonic functions; B. N. Khabibullin, Dual approach to certain questions for weighted spaces of holomorphic functions; S. L. Krushkal, Quasiconformal reflections and mirrors; Y. Lyubarskii and K. Seip, A splitting problem for unconditional bases of complex exponentials; V. Matsaev and M. Sodin, Entire functions and compact operators with $Sp$-imaginary component; V. V. Napalkov, Jr. and R. S. Younukhametov, Criterion of surjectivity of the Cauchy transform operator on a Bergman space; M. Novitskii and Yu. Safarov, Periodic points of quasinormal Hamiltonian billiards; A. Olevskii, Change of variable in Fourier expansions: Some old and new results; L. V. Ostrovskii, On zero distribution of sections and tails of power series; R. Rocha-Chávez and M. Shapiro, On singular integrals of the time-harmonic relativistic Dirac bispinors theory; N. Roytvarf, Generalized moments, composition of polynomials and Bernstein classes; N. Skiba and V. Zahariuta, Bernstein-Walsh theorems for harmonic functions in $R^n$; A. Ulanskii, Measures whose supports do not have periodic holes.

Israel Mathematical Conference Proceedings, Volume 15
January 2002, 392 pages, Softcover, 2000 Mathematics Subject Classification: 30Dxx; 30Fxx, 0.200, Institutional member $81, List $130, Institutional member $104, Order code IMCP/15N

Discrete Mathematics and Combinatorics

$q$-Series with Applications to Combinatorics, Number Theory, and Physics
Bruce C. Berndt, University of Illinois, Urbana, and Ken Ono, University of Wisconsin, Madison, Editors

The subject of $q$-series can be said to begin with Euler and his pentagonal number theorem. In fact, $q$-series are sometimes called Eulerian series. Contributions were made by Gauss, Jacobi, and Cauchy, but the first attempt at a systematic development, especially from the point of view of studying series with the products in the summands, was made by E. Heine in 1847. In the latter part of the nineteenth and in the early part of the twentieth centuries, two English mathematicians, L. J. Rogers and F. H. Jackson, made fundamental contributions.

In 1940, G. H. Hardy described what we now call Ramanujan's summation theorem as "a remarkable formula with many parameters." This is now one of the fundamental theorems of the subject.
Despite humble beginnings, the subject of \( q \)-series has flourished in the past three decades, particularly with its applications to combinatorics, number theory, and physics. During the year 2000, the University of Illinois embraced The Millennial Year in Number Theory. One of the events that year was the conference \( q \)-Series with Applications to Combinatorics, Number Theory, and Physics. This event gathered mathematicians from the world over to lecture and discuss their research.

This volume presents nineteen of the papers presented at the conference. The excellent lectures that are included chart pathways into the future and survey the numerous applications of \( q \)-series to combinatorics, number theory, and physics.

**Contents:** B. C. Berndt and K. Ono, \( q \)-series Piano recital: Levis faculty center; Congruences and conjectures for the partition function; MacMahon’s partition analysis VII: Constrained compositions; Crystal bases and \( q \)-identities; The Bailey-Rogers-Ramanujan group; Multiple polylogarithms: A brief survey; Swinnerton-Dyer group; Multiple polylogarithms; A brief survey; Frobenius partitions; More generating functions for \( L \)-function values; On sums of an even number of squares, and an even number of triangular numbers; An elementary approach based on Ramanujan’s \( \psi \) summation formula; Some remarks on multiple Sears transformations; Another way to count colored Frobenius partitions; Proof of a summation formula for an \( \hat{A} \)-basic hypergeometric series conjectured by Warnaar; On the representation of integers as sums of squares; 3-regular partitions and a modular K3 surface; A new look at Hecke’s indefinite theta series; A proof of a multivariable elliptic summation formula conjectured by Warnaar; Multilateral transformations of \( q \)-series with quotients of parameters that are nonnegative integral powers of \( q \); Completeness of basic trigonometric system in \( L^p \); The generalized Borwein conjecture. I. The Burge transform; Mock \( \psi \)-functions and real analytic modular forms.

**Contemporary Mathematics, Volume 291**


**General Interest**

**Taniguchi Conference on Mathematics Nara 1998**

Masaki Maruyama, Kyoto University, Japan, and Toshikazu Sunada, Tohoku University, Japan, Editors

A publication of the Mathematical Society of Japan.

Published for the Mathematical Society of Japan by Kinokuniya, Tokyo, and distributed worldwide, except in Japan, by the AMS.

In 1929, Mr. Toyotaburo Taniguchi established the Taniguchi Foundation with the goal of promoting research in the basic sciences in Japan and to engender mutual understanding on an international level via the exchange of ideas and research. In 1956, he instituted a division for mathematics within the Foundation and sponsored the first summer seminar. Since that time, the seminar has been held each year on various mathematical topics.

In 1974, Mr. Taniguchi promoted and sponsored an International Symposium in various fields of science on a smaller scale. His aim was to raise the level of scientific thought and research, while providing a forum where promising young scholars the world over could gather informally to exchange thoughts and to contribute their knowledge. These gatherings were held until 1999.

This volume is a collection of the research manuscripts written by the invited speakers at the final conference set up by the Taniguchi Foundation, the “Taniguchi Conference on Mathematics ‘98”, held in Nara, Japan. The conference was aimed at gathering all previous participants of Taniguchi Symposia. The subject areas were chosen to include all important and active fields of mathematics. Hence the topics in this volume are quite diverse. The contributors are world-class mathematicians who are generally reporting on subjects for which they are well known. For example, contributions include R. E. Borcherds on vertex algebras, M. Kontsevich on non-commutative algebraic manifolds, P.-L. Lions on fluid mechanics, M. Kashiwara on micro-localization, J. Kollár on the topology of algebraic varieties, S. Mori on rational curves in algebraic varieties, and others.


**Advanced Studies in Pure Mathematics, Volume 31**

Geometry and Topology

Knots, Braids, and Mapping Class Groups—Papers Dedicated to Joan S. Birman

Jane Gilman, Rutgers University, Newark, NJ, William W. Menasco, State University of New York, Buffalo, and Xiao-Song Lin, University of California, Riverside, Editors

There are a number of specialties in low-dimensional topology that can find in their “family tree” a common ancestry in the theory of surface mappings. These include knot theory as studied through the use of braid representations and 3-manifolds as studied through the use of Heegaard splittings. The study of the surface mapping class group (the modular group) is of course a rich subject in its own right, with relations to many different fields of mathematics and theoretical physics. But its most direct and remarkable manifestation is probably in the vast area of low-dimensional topology. Although the scene of this area has been changed dramatically and experienced significant expansion since the original publication of Professor Joan Birman’s seminal work, *Braids, Links, and Mapping Class Groups* (Princeton University Press), she brought together mathematicians whose research span many specialties, all of common lineage.

The topics covered are quite diverse. Yet they reflect well the aim and spirit of the conference: to explore how these various specialties in low-dimensional topology have converged in the past 20–25 years, as well as to explore common threads and potential future directions of development. This volume is dedicated to Joan Birman by her colleagues with deep admiration and appreciation of her contribution to low-dimensional topology.

Contents: J. Cantarella, D. DeTurck, and H. Gluck, Upper bounds for the writhing of knots and the helicity of vector fields; O. T. Dasbach and B. S. Mangum, The automorphism group of a free group is not subgroup separable; R. Ghrist, Configuration spaces and braid groups on graphs in robotics; J. Gilman, Alternate discreteness tests; S. P. Humphries, Intersection-number operators for curves on discs and Chebyshev polynomials; O. Kharlampovich and A. Myasnikov, Implicit function theorem over free groups and genus problem; M. E. Kidwell and T. B. Stanford, On the 2-degree of the Kauffman polynomial of a tangle decomposition; W. Li, Knot invariants from counting periodic points; X.-S. Lin and Z. Wang, Random walk on knot diagrams, colored Jones polynomial and Ihara-Selberg zeta function; F. Luo, Some applications of a multiplicative structure on simple loops in surfaces; W. W. Menasco, Closed braids and Heegaard splittings; J. H. Przytycki, Homotopy and q-homotopy skein modules of 3-manifolds: An example in algebra Situs; T. Stanford and R. Trapp, On knot invariants which are not of finite type.


Previously Announced Publications

Rudiments de Dynamique Holomorphe

Michèle Audin, Université Louis Pasteur et CNRS, Strasbourg, France

A publication of the Société Mathématique de France.

This book is an introduction to rational iteration theory. In the first four chapters, the authors deal with the classical theory. The basic properties of the Julia set and its complement, the Fatou set, are presented; the highest points of the treatment are the classification of the components of the Fatou set and Sullivan’s non-wandering theorem.

The second part of the book studies several topics in more detail. The authors begin by considering at length two classes of rational maps: the chaotic maps and the hyperbolic maps. In the closing chapters, they include respectively a study of holomorphic families of rational maps with a view to discussing Fatou’s famous problem concerning the density of hyperbolic maps and an exposition of the methods of potential theory, touching on questions of ergodicity, which may serve as a preparation for generalizations in higher dimensions.

A number of the developments treated here appear for the first time in book form. Several original proofs are presented.

Cours Spécialisés—Collection SMF, Number 7


Les Systèmes Hamiltoniens et Leur Intégrabilité

Michèle Audin, Université Louis Pasteur et CNRS, Strasbourg, France

A publication of the Société Mathématique de France.

This book presents some modern techniques in the theory of integrable systems viewed as variations on the theme of action-angle coordinates. These techniques include analytical methods coming from the Galois theory of differential equations, as well as more classical algebro-geometric methods related to Lax equations. Many examples are given.

Cours Spécialisés—Collection SMF, Number 8


Geometrization of 3-Orbifolds of Cyclic Type

Michel Boileau, CNRS, Université Paul Sabatier, Toulouse, France, Joan Porti, Universitat Autónoma de Barcelona, Bellaterra, Spain, and Michael Heusener, Université Blaise Pascal, Aubière, France

A publication of the Société Mathématique de France.

In this book, the authors prove the orbifold theorem in the cyclic case: If $\phi$ is a compact oriented irreducible atoroidal 3-
Symbolic Computation: Solving Equations in Algebra, Geometry, and Engineering

Edward L. Green, Virginia Polytechnic Institute and State University, Blacksburg, Serkan Hosten, San Francisco State University, CA, Reinhard C. Laubenbacher, New Mexico State University, Las Cruces, NM, and Victoria Ann Powers, Emory University, Atlanta, GA, Editors

This volume contains papers related to the research conference, "Symbolic Computation: Solving Equations in Algebra, Analysis, and Engineering," held at Mount Holyoke College (MA). It provides a broad range of active research areas in symbolic computation as it applies to the solution of polynomial systems. The conference brought together pure and applied mathematicians, computer scientists, and engineers, who use symbolic computation to solve systems of equations or who develop theoretical background and tools needed for this purpose. Within this general framework, the conference focused on several themes: perspectives of polynomial systems, differential equations, systems of differential equations, noncommutative systems, and applications.

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


Contemporary Mathematics, Volume 286


Function Theory of One Complex Variable

Second Edition

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

From a review of the First Edition:

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

—Mathematical Reviews

Complex analysis is one of the most beautiful subjects that we learn as graduate students. Part of the joy comes from being able to arrive quickly at some "real theorems". The fundamental techniques of complex variables are also used to solve
real problems in neighboring subjects, such as number theory or PDEs.

This book is a text for a first-year graduate course in complex analysis. It is an engaging and modern introduction to the subject, reflecting the authors' expertise both as mathematicians and as expositors.

All the material usually treated in such a course is covered here, but following somewhat different principles. To begin with, the authors emphasize how this subject is a natural outgrowth of multivariable real analysis. Complex function theory has long been a flourishing independent field. However, an efficient path into the subject is to observe how its rudiments arise directly from familiar ideas in calculus. The authors pursue this point of view by comparing and contrasting complex analysis with its real variable counterpart.

Explanations of certain topics in complex analysis can sometimes become complicated by the intermingling of the analysis and the topology. Here, the authors have collected the primary topological issues in a separate chapter, leaving the way open for a more direct and less ambiguous approach to the analytic material.

The book concludes with several chapters on special topics, including full treatments of special functions, the prime number theorem, and the Bergman kernel. The authors also treat $H^p$ spaces and Painlevé's theorem on smoothness to the boundary for conformal maps.

A large number of exercises are included. Some are simply drills to hone the students' skills, but many others are further developments of the ideas in the main text. The exercises are also used to explore the striking interconnectedness of the topics that constitute complex analysis.

Graduate Studies in Mathematics, Volume 40
December 2001, approximately 561 pages, Hardcover, ISBN 0-8218-2905-X, LC 2001046415, 2000 Mathematics Subject Classification: 30-01; 30-00, 30-02, All AMS members $55, List $69, Order code GSM/40RT201

Lectures on Hilbert Modular Varieties and Modular Forms
Eyal Z. Goren, McGill University, Montreal, PQ, Canada

This book is devoted to certain aspects of the theory of $p$-adic Hilbert modular forms and moduli spaces of abelian varieties with real multiplication.

The theory of $p$-adic modular forms is presented first in the elliptic case, introducing the reader to key ideas of N. M. Katz and J.-P. Serre. It is re-interpreted from a geometric point of view, which is developed to present the rudiments of a similar theory for Hilbert modular forms.

The theory of moduli spaces of abelian varieties with real multiplication is presented first very explicitly over the complex numbers. Aspects of the general theory are then exposed, in particular, local deformation theory of abelian varieties in positive characteristic.

The arithmetic of $p$-adic Hilbert modular forms and the geometry of moduli spaces of abelian varieties are related. This relation is used to study $q$-expansions of Hilbert modular forms, on the one hand, and stratifications of moduli spaces on the other hand.

The book is addressed to graduate students and non-experts. It attempts to provide the necessary background to all concepts exposed in it. It may serve as a textbook for an advanced graduate course.

CRM Monograph Series, Volume 14

An Introduction to Morse Theory
Yukio Matsumoto, University of Tokyo, Japan

In a very broad sense, "spaces" are objects of study in geometry, and "functions" are objects of study in analysis. There are, however, deep relations between functions defined on a space and the shape of the space, and the study of these relations is the main theme of Morse theory. In particular, its feature is to look at the critical points of a function, and to derive information on the shape of the space from the information about the critical points.

Morse theory deals with both finite-dimensional and infinite-dimensional spaces. In particular, it is believed that Morse theory on infinite-dimensional spaces will become more and more important in the future as mathematics advances.

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

On the other hand, finite-dimensional Morse theory has its own significance, not just as a bridge to infinite dimensions. It is an indispensable tool in the topological study of manifolds. That is, one can decompose manifolds into fundamental blocks such as cells and handles by Morse theory, and thereby compute a variety of topological invariants and discuss the shapes of manifolds. These aspects of Morse theory will continue to be a treasure in geometry for years to come.

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

Translations of Mathematical Monographs (Iwanami Series in Modern Mathematics), Volume 208

Advances in Wave Interaction and Turbulence
Paul A. Milewski, Leslie M. Smith, and Fabian Waleffe, University of Wisconsin, Madison, and Esteban G. Tabak, New York University-Courant Institute of Mathematical Sciences, NYC, Editors

We often think of our natural environment as being composed of very many interacting particles, undergoing individual chaotic motions, of which only very coarse averages are perceptible at scales natural to us. However, we could as well think of the world as being made out of individual waves. This is so not just because the distinction between waves and parti-
Many contemporary mathematical problems, as in the case of waves, occur at many spatial and temporal scales. Many of these waves have small enough amplitude that they can be approximately described by linear theory. However, the joint effect of large sets of waves is governed by nonlinear interactions which are responsible for huge cascades of energy among very disparate scales. Understanding these energy transfers is crucial in order to determine the response of large systems, such as the atmosphere and the ocean, to external forcings and dissipation mechanisms which act on scales decades apart.

The field of wave turbulence attempts to understand the average behavior of large ensembles of waves, subjected to forcing and dissipation at opposite ends of their spectrum. It does so by studying individual mechanisms for energy transfer, such as resonant triads and quartets, and attempting to draw from them effects that should not survive averaging.

This book presents the proceedings of the AMS-IMS-SIAM Joint Summer Research Conference on Dispersive Wave Turbulence held at Mt. Holyoke College (MA). It drew together a group of researchers from many corners of the world, in the context of a perceived renaissance of the field, driven by heated debate about the fundamental mechanism of energy transfer among large sets of waves, as well as by novel applications and old ones revisited—to the understanding of the natural world. These proceedings reflect the spirit that permeated the conference, that of friendly scientific disagreement and genuine wonder at the rich phenomenology of waves.

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


Contemporary Mathematics, Volume 283

Supplementary Reading

Variational Problems in Geometry
Seiki Nishikawa, Mathematical Institute, Tohoku University, Sendai, Japan

A minimal length curve joining two points in a surface is called a geodesic. One may trace the origin of the problem of finding geodesics back to the birth of calculus.

Many contemporary mathematical problems, as in the case of geodesics, may be formulated as variational problems in surfaces or in a more generalized form on manifolds. One may characterize geometric variational problems as a field of mathematics that studies global aspects of variational problems relevant in the geometry and topology of manifolds. For example, the problem of finding a surface of minimal area spanning a given frame of wire originally appeared as a mathematical model for soap films. It has also been actively investigated as a geometric variational problem. With recent developments in computer graphics, totally new aspects of the study on the subject have begun to emerge.

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

The first two chapters treat variational problems of the length and energy of curves in Riemannian manifolds, with an in-depth discussion of the existence and properties of geodesics viewed as solutions to variational problems. In addition, a special emphasis is placed on the facts that concepts of connection and covariant differentiation are naturally induced from the formula for the first variation in this problem, and that the notion of curvature is obtained from the formula for the second variation.

The last two chapters treat the variational problem on the energy of maps between two Riemannian manifolds and its solution, harmonic maps. The concept of a harmonic map includes geodesics and minimal submanifolds as examples. Its existence and properties have successfully been applied to various problems in geometry and topology. The author discusses in detail the existence theorem of Eells-Sampson, which is considered to be the most fundamental among existence theorems for harmonic maps. The proof uses the inverse function theorem for Banach spaces. It is presented to be as self-contained as possible for easy reading.

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

This is the English translation of a book originally published in Japanese. It is an outgrowth of lectures delivered at Tohoku University and at the Summer Graduate Program held at the Institute for Mathematics and its Applications at the University of Minnesota. It would make a suitable textbook for advanced undergraduates and graduate students. This item will also be of interest to those working in analysis.

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

Translations of Mathematical Monographs (Iwanami Series in Modern Mathematics), Volume 205
Nilpotent Orbits, Associated Cycles and Whittaker Models for Highest Weight Representations

Kyo Nishiyama, Kyoto University, Japan, Hiroyuki Ochiai, Tokyo Institute of Technology, Japan, Kenji Taniguchi, Aoyama Gakuin University, Tokyo, Japan, Hiroshi Yamashita, Hokkaido University, Sapporo, Japan, and Shohei Kato, Nakakasai, Edogawa-ku, Tokyo, Japan

A publication of the Société Mathématique de France.

Let $G$ be a reductive Lie group of Hermitian type. The authors investigate irreducible (unitary) highest weight representations of $G$ which are not necessarily in the holomorphic discrete series. The results of three articles of this volume include the determination of the associated cycles, the Bernstein degrees, and the generalized Whittaker models for such representations. They give a convenient description of $K$-types via branching rules for representations of classical groups. An integral formula for the degrees of small nilpotent orbits is established for arbitrary Hermitian Lie algebras. The generalized Whittaker models for each unitary highest weight module are specified by means of the principal symbol of a gradient-type differential operator, and also in relation to the multiplicity in the associated cycle. They also present expository introductions of the key notions treated in this volume, such as associated cycles, Howe correspondence for dual pairs where one member of the pair is compact, and the realization of highest weight representations on the kernels of the differential operators of gradient type.

Supplementary Reading

Advances in Moduli Theory

Yuji Shimizu and Kenji Ueno, Kyoto University, Japan

The word "moduli" in the sense of this book first appeared in the epoch-making paper of B. Riemann, Theorie der Abelschen Funktionen, published in 1857. Riemann defined a Riemann surface of an algebraic function field as a branched covering of a one-dimensional complex projective space, and found out that Riemann surfaces have parameters. This work gave birth to the theory of moduli.

However, the viewpoint regarding a Riemann surface as an algebraic curve became the mainstream, and the moduli meant the parameters for the figures (graphs) defined by equations. In 1913, H. Weyl defined a Riemann surface as a complex manifold of dimension one. Moreover, Teichmüller's theory of quasiconformal mappings and Teichmüller spaces made a start for new development of the theory of moduli, making possible a complex analytic approach toward the theory of moduli of Riemann surfaces. This theory was then investigated and made complete by Ahlfors, Bers, Rauch, and others. However, the theory of Teichmüller spaces utilized the special nature of complex dimension one, and it was difficult to generalize it to an arbitrary dimension in a direct way.

It was Kodaira- Spencer's deformation theory of complex manifolds that allowed one to study arbitrary dimensional complex manifolds. Initial motivation in Kodaira-Spencer's discussion was the need to clarify what one should mean by number of moduli. Their results, together with further work by Kuranishi, provided this notion with intrinsic meaning.

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

This is the English translation of a book originally published in Japanese. Other books by Kenji Ueno published in this AMS series, Translations of Mathematical Monographs, include An Introduction to Algebraic Geometry, Volume 166, Algebraic Geometry 1: From Algebraic Varieties to Schemes, Volume 185, and Algebraic Geometry 2: Sheaves and Cohomology, Volume 197.

Translations of Mathematical Monographs (Iwanami Series in Modern Mathematics), Volume 206
Probability Theory

S. R. S. Varadhan, New York University - Courant Institute of Mathematical Sciences, NY

This volume presents topics in probability theory covered during a first-year graduate course given at the Courant Institute of Mathematical Sciences. The necessary background material in measure theory is developed, including the standard topics, such as extension theorem, construction of measures, integration, product spaces, Radon-Nikodym theorem, and conditional expectation.

In the first part of the book, characteristic functions are introduced, followed by the study of weak convergence of probability distributions. Then both the weak and strong limit theorems for sums of independent random variables are proved, including the weak and strong laws of large numbers, central limit theorems, laws of the iterated logarithm, and the Kolmogorov three series theorem. The first part concludes with infinitely divisible distributions and limit theorems for sums of uniformly infinitesimal independent random variables.

The second part of the book mainly deals with dependent random variables, particularly martingales and Markov chains. Topics include standard results regarding discrete parameter martingales and Doob's inequalities. The standard topics in Markov chains are treated, i.e., transience, and null and positive recurrence. A varied collection of examples is given to demonstrate the connection between martingales and Markov chains.

Additional topics covered in the book include stationary Gaussian processes, ergodic theorems, dynamic programming, optimal stopping, and filtering. A large number of examples and exercises is included. The book is a suitable text for a first-year graduate course in probability.

COURANT LECTURE NOTES, Volume 7


Cohomological Analysis of Partial Differential Equations and Secondary Calculus

A. M. Vinogradov, University of Salerno, Baronissi (SA), Italy

This book is dedicated to fundamentals of a new theory, which is an analog of affine algebraic geometry for (nonlinear) partial differential equations. This theory grew up from the classical geometry of PDE's originated by S. Lie and his followers by incorporating some nonclassical ideas from the theory of integrable systems, the formal theory of PDE's in its modern cohomological form given by D. Spencer and H. Goldschmidt and differential calculus over commutative algebras (Primary Calculus). The main result of this synthesis is Secondary Calculus on diffieties, new geometrical objects which are analogs of algebraic varieties in the context of (nonlinear) PDE's.

Secondary Calculus surprisingly reveals a deep cohomological nature of the general theory of PDE's and indicates new directions of its further progress. Recent developments in quantum field theory showed Secondary Calculus to be its natural language, promising a nonperturbative formulation of the theory.

In addition to PDE's themselves, the author describes existing and potential applications of Secondary Calculus ranging from algebraic geometry to field theory, classical and quantum, including areas such as characteristic classes, differential invariants, theory of geometric structures, variational calculus, control theory, etc. This book, focused mainly on theoretical aspects, forms a natural dipole with Symmetries and Conservation Laws for Differential Equations of Mathematical Physics, Volume 182 in this same series, Translations of Mathematical Monographs, and shows the theory "in action".

This item will also be of interest to those working in algebra and algebraic geometry.

Translations of Mathematical Monographs, Volume 204


Supplementary Reading

Kvant Selecta: Combinatorics, I

Serge Tabachnikov, University of Arkansas at Fayetteville, AR, Editor

There is a tradition in Russia that holds that mathematics can be both challenging and fun. One fine outgrowth of that tradition is the magazine, Kvant, which has been enjoyed by many of the best students since its founding in 1970. The articles in Kvant are written so as to present genuine mathematics and combinatorics. Several of the topics are well known: nonrepeating sequences, detecting a counterfeit coin, and linear inequalities in economics, but they are discussed here with the entertaining and engaging style typical of the magazine. The two previous collections treat aspects of algebra and analysis, including connections to number theory and other topics. They were published as Volumes 14 and 15 in the Mathematical World series.

The articles are written so as to present genuine mathematics in a conceptual, entertaining, and accessible way. The books in the Mathematical World series are designed to be used by students and teachers who love mathematics and want to study its various aspects, deepening and expanding upon the school curriculum.

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


Mathematical World, Volume 17

December 2001, 131 pages, Softcover, ISBN 0-8218-2171-7, 2000 Mathematics Subject Classification: 00-01, 00A08; 97A20, All AMS members $23, List $29, Order code MAWRDL/17RT201

Previously Announced Publications
2001: Year in Review

Below is a selection of top titles published by the AMS in 2001. Included are books of historical interest, research monographs, translated volumes, classic works, and course texts. All have something vital to offer to any mathematical books collection. To learn more about these and many more AMS titles, go to www.ams.org/bookstore.

Algebraic Geometry 2
Sheaves and Cohomology
Kenji Ueno, Kyoto University, Japan
Overall, this book is an excellent instructional exposition for an introduction to algebraic geometry.
—Mathematical Reviews
Translations of Mathematical Monographs (Iwanami Series in Modern Mathematics), Volume 197; 2001; ISBN 0-8218-1357-9; 184 pages; Softcover; All AMS members $23, List $29, Order Code MMONO/197CT201

Chaotic Elections! A Mathematician Looks at Voting
Donald G. Saari, University of California, Irvine
Written with flair and imagination, making it entertaining and interesting to read... Saari has written an original, topical, and enjoyable book combining thoughtful social commentary with interesting and accessible mathematics.
—MAA Online
2001; ISBN 0-8218-2847-9; 159 pages; Softcover; All AMS members $18, List $23, Order Code ELECTCT201

Function Theory of One Complex Variable
Second Edition
Robert E. Greene, University of California, Los Angeles, and Steven G. Krantz, Washington University, St. Louis, MO
From a review of the First Edition:
The authors have produced a modern, quality work that could serve as an excellent model for writing and teaching graduate texts... it will occupy a distinguished place in the extensive literature on the subject.
—Mathematical Reviews
Graduate Studies in Mathematics, Volume 40; 2002; ISBN 0-8218-2925-X; approximately 561 pages; Hardcover; All AMS members $55, List $69, Order Code GSM/40CT201

Geometry of Manifolds
Richard L. Bishop, University of Illinois, Urbana, and Richard J. Crittenden
From a review of the First Edition:
The style is elegant and at the same time considerate for the needs of a beginner... anybody who chooses to base his course on differential geometry at the graduate level on this book could do no better.
—Mathematical Reviews

Lyapunov Exponents and Smooth Ergodic Theory
Luis Barreira, Instituto Superior Técnico, Lisbon, Portugal, and Yakov B. Pesin, Pennsylvania State University, University Park
University Lecture Series, Volume 23; 2002; ISBN 0-8218-2921-1; 151 pages; Softcover; All AMS members $23, List $29, Order Code ULECT/23CT201

A Modern Theory of Integration
Robert G. Bartle, Eastern Michigan University, Ypsilanti, and University of Illinois, Urbana
Graduate Studies in Mathematics, Volume 32; 2001; ISBN 0-8218-0845-1; 458 pages; Hardcover; All AMS members $47, List $59, Order Code GSM/32CT201

Plates's Problem
An Invitation to Variifold Geometry
Frederick J. Almgren, Jr.
Student Mathematical Library, Volume 13; 2001; ISBN 0-8218-2747-2; approximately 88 pages; Softcover; All AMS members $15, List $19, Order Code STML/13CT201

Probability Theory
S. R. S. Varadhan, New York University - Courant Institute of Mathematical Sciences
Courant Lecture Notes, Volume 7; 2001; ISBN 0-8218-2852-5; 167 pages; Softcover; All AMS members $19, List $24, Order Code CLN/7CT201

A Tour of Subriemannian Geometries, Their Geodesics and Applications
Richard Montgomery, University of California, Santa Cruz
Mathematical Surveys and Monographs, Volume 91; 2002; ISBN 0-8218-1391-9; 259 pages; Hardcover; Individual member $41, List $69, Institutional member $55, Order Code SURV/91CT201

Triangle of Thoughts
Alain Connes, André Lichnerowicz, and Marcel Paul Schützenberger
2001; ISBN 0-8218-2614-X; 179 pages; Hardcover; All AMS members $24, List $30, Order Code TOTCT201

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GRADUATE STUDIES in MATHEMATICS

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Rick Miranda, Colorado State University, Ft. Collins
A wealth of concrete examples ... enhance the rich theoretical material developed in the course of the exposition, very much so to the benefit of the reader. Another advantage of this excellent text is provided by the pleasant and vivid manner of writing ... Altogether, the present book is a masterfully written, irresistible invitation to complex algebraic geometry and its generalization to the rich theory of algebraic schemes.

Rings and Things and a Fine Array of Twentieth Century Associative Algebra
Carl Faith, Professor Emeritus, Rutgers University, New Brunswick, NJ
Researchers in algebra should find it both enjoyable to read and very useful in their work. In all cases, [Faith] cites full references as to the origin and development of the theorem ... I know of no other work in print which does this as thoroughly and as broadly.

Surgery on Compact Manifolds
Second Edition
C. T. C. Wall, University of Liverpool, England, and A. A. Ranicki (Editor), University of Edinburgh, Scotland

An Introduction to the Analysis of Paths on a Riemannian Manifold
Daniel W. Stroock, Massachusetts Institute of Technology, Cambridge

Arithmeticity in the Theory of Automorphic Forms
Goro Shimura, Princeton University, NJ

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Department of Mathematical Sciences

The Department of Mathematical Sciences at the University of Alabama in Huntsville invites applications for a tenure track position at the rank of assistant professor or associate professor, beginning August 2002. Applicants must possess a Ph.D. degree in mathematics or applied mathematics and show evidence of excellence in teaching and research. Preference will be given to applicants whose research areas match those of the department, particularly the areas of probability/statistics, discrete mathematics, numerical analysis, and differential equations.

Applicants should send a curriculum vita with the AMS standard cover sheet, transcripts, and three letters of recommendation (with at least one letter addressing teaching) to:

Chairman
Department of Mathematical Sciences
University of Alabama in Huntsville
Huntsville, AL 35899.

For more information about the department, visit our website at http://www.math.uah.edu/.

Review of applications will begin January 15, 2002, and will continue until the position is filled. Women and minorities are encouraged to apply. The University of Alabama in Huntsville is an Affirmative Action, Equal Opportunity Institution.

**ARIZONA**

**ARIZONA STATE UNIVERSITY**

Department of Mathematics

The Department of Mathematics at Arizona State University invites applications for a tenure-track position at the assistant professor level, pending budgetary approval, beginning in the fall semester of 2002. Applicants are required to have a Ph.D. in mathematics or other closely related discipline with a strong background in mathematics by August 16, 2002. Candidates must also have demonstrated potential for excellence in mathematics education research and teaching at all levels. The successful candidate will be expected to conduct research and publish in the area of mathematics education and provide quality teaching of undergraduate and graduate courses. These courses will include graduate courses on research in mathematics education as well as undergraduate mathematics courses and courses for preservice and inservice secondary mathematics teachers. Candidates should expect to participate in on-campus interdisciplinary mathematics education activities and appropriate professional service.

The main campus of Arizona State University has approximately 45,000 students and is located in the rapidly growing metropolitan Phoenix area, which provides a wide variety of recreational and cultural opportunities. The Department of Mathematics currently has 52 full-time faculty members and over 70 supported graduate students. The Department has high-quality and growing Ph.D., masters, and undergraduate programs in mathematics education. Demand for mathematics education research and instruction at ASU is expected to continue to increase, and ASU has numerous opportunities for interdisciplinary collaboration. In particular, mathematics educators in the Department supervise Ph.D. students in the College of Education's Interdisciplinary Ph.D. program in mathematics education and are collaborating on grants with science educators in the College of Liberal Arts and Sciences as well as with mathematics and science educators in the College of Education.

Applicants must send i) a curriculum vita, ii) an AMS cover sheet (available at http://www.ams.org/employment/coversheet-info.html), iii) a research agenda, iv) a statement of teaching philosophy, v) unofficial undergraduate and graduate transcripts, and vi) must arrange for at least three letters of recommendation to be sent to: Andrew Brenner, Chair, Mathematics Education Search Committee, Department of Mathematics, Arizona State University, PO Box 871804, Tempe, AZ 85287-1804.

Review of the applications will begin on January 7, 2002, and will continue weekly until the position is filled. AA/EOE

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Submission: Promotions Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940; or via fax: 401-331-3842; or send e-mail to classifieds@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.
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Statistics (assoc./asst. prof.) Teach graduate stat. courses and undergraduate and service courses in stat. or math.; advise graduate students. Preference given to applicants with expertise in more than one of: statistical modeling, multivariate stat., biostatistics, design of experiment, estimation theory, statistical consulting. Min. qual.: Ph.D. in stat. or math. or related area. Initial review of applications 2/8/02.

Pure Math (asst. prof.). Teach major courses in pure math and service courses in math.; advise undergraduate and graduate students. Preference given to applicants with expertise in more than one of: algebra, complex analysis, geometry, history of math, logic, number theory, real analysis, set theory, topology and/or those who have participated in math ed. activities. Min. qual.: Ph.D. in math. Initial review of applications 2/8/02.

All positions: Salary dependent on qualifications. Required: evidence of teaching excellence, ability to direct master's theses, potential for conducting scholarly activities, ability to work with diverse student body. Completion of terminal degree by Sept. '02. Review of applications continues until position is filled or closed. Submit application form (with name of position), curriculum vitae, transcripts, and min. of 3 reference letters to: Faculty Search Committee, Math Dept., CSPU Pomona, 3801 W. Temple Ave., Pomona, CA 91768-4007; lamborcher@ csupomona.edu; 909-869-4008; fax 909-869-4904; http://www.csupomona.edu/ math/. AA/EO.

CALIFORNIA STATE UNIVERSITY, LOS ANGELES Department of Mathematics

Applications are invited for a tenure-track position in mathematics education at the level of assistant/associate professor, starting June or September 2002.

Ph.D. in mathematics with a commitment to mathematics education or a doctorate in education with a strong background in mathematics required. Doctorate degrees must be from an accredited institution of higher education. Successful candidate will teach both mathematics and mathematics education classes. Publications in peer-reviewed journals and/or grant activity is required. CSULA is on the quarter system. Review of applications will begin March 1, 2002. Send a letter of application and vita to: Dr. P. K. Subramanian, Chair, Department of Mathematics, California State University at Los Angeles, 5151 State University Drive, Los Angeles, CA 90032. An Equal Opportunity/Affirmative Action/Title IX/ADA Employer. Qualified women and minorities are encouraged to apply.

COLORADO
COLORADO SCHOOL OF MINES Department of Mathematical and Computer Sciences

Applications are invited for one or more tenure-track/tenured positions at the assistant/associate levels starting August 2002. In an exceptional case, an appointment may be made at the full professor level.

Applicants in all areas of applied and computational mathematics compatible with the research interests of the department are encouraged to apply. An earned Ph.D. in mathematics or a related field is required. Evidence of interest or successful involvement in interdisciplinary collaborative research in engineering or physical sciences is desirable.

For the official announcement please see http://csmin.cbas.illinois.edu/Library/Positions/Mines_Professorship inconsidertable.

CSM is an EO/AA employer and is committed to enhancing the diversity of its faculty and staff, and therefore, encourages applications from women, minorities, veterans, and persons with disabilities.

COLOMBIA
UNIVERSITY OF CENTRAL FLORIDA Department of Mathematics Chair and Professor of Mathematics

The Department of Mathematics at the University of Central Florida is seeking nominations and applications for the position of department chair, appointment to begin August 2002. The department offers a B.S. degree in mathematics, with options in pure, applied, computational, and engineering/physics tracks; an M.S. in mathematical science; and a Ph.D. in mathematics. The department has 32 faculty members in tenure or tenure-track positions and participates actively with a number of campus research centers through joint appointments.

FLORIDA
UNIVERSITY OF CENTRAL FLORIDA Department of Mathematics Assistant Professor

The Department of Mathematics anticipates several openings for faculty positions at the assistant professor level, starting fall 2002. Appointments at higher levels are possible in exceptional cases. Candidates must have a Ph.D. and strong evidence of excellent research and teaching ability. Targeted areas of hiring are financial mathematics and computational methods in mathematics. Preference will also be given to candidates whose research interests strengthen existing programs within the department, in particular, analysis and topology. Salary is commensurate with experience.

The review of applications will begin in December 2001. Send resume and at least three letters of recommendation to Hiring Committee, Department of Mathematics, CSU, University of Connecticut, Storrs, CT 06269. The University of Connecticut is an Equal Opportunity/Affirmative Action Employer. We encourage applications from underrepresented groups, including minorities, women, and people with disabilities.

UNIVERSITY OF CONNECTICUT Department of Mathematics Postdoctoral Fellow

The Department of Mathematics anticipates 3-5 openings for postdoctoral fellow positions beginning in fall 2002. Candidates must have received a Ph.D. within the last four years and demonstrate evidence of excellent teaching ability and outstanding research potential. The positions are for a maximum of three years. Postdoctoral fellows normally teach two courses a semester and are expected to participate in the research activities of the department. Preference will be given to candidates whose research interests intersect those of the permanent faculty.

The review of applications will begin January 1, 2002. Send resume and at least three letters of recommendation to Hiring Committee, Department of Mathematics, 5151 University Drive, Los Angeles, CA 90032. The University of Connecticut is an Equal Opportunity/Affirmative Action Employer. We encourage applications from underrepresented groups, including minorities, women, and people with disabilities.

NOTICES OF THE AMS
The University of Central Florida is a major public institution of higher education with over 35,000 students. The university has strong research programs in several areas related to the growing high-technology industries in Central Florida, including microelectronics, photonics, space sciences, and simulation and modeling. The university operates several state-funded research centers, including centers that focus on optics, materials research, modeling and simulation, drug discovery, and solar energy.

The department is seeking an internationally recognized scholar, with a strong commitment to excellence in undergraduate and graduate teaching, and with appropriate administrative experience and interpersonal skills, which will help the faculty identify opportunities for growth and excellence in mathematical sciences. Minimum qualifications are an earned Ph.D. in mathematics or a closely related discipline. The preferred candidate will have a record of publications and scholarly impact suitable for appointment at the full professor level with tenure, a record of research productivity and external funding, and administrative experience relevant to a highly interdisciplinary department.

For further information about the department, please view http://www.math.ucf.edu/. Applicants should send a letter of application, complete CV with publications, awards, administrative history, and a list of 5 references to: Chair Search Committee, Department of Mathematics, University of Central Florida, Orlando, Florida 32816-1364. Inquiries or nominations may be sent to Professor B. P. Tonner, Chair of the Mathematics Search, at chair@physics.ucf.edu.

UCF is an Equal Opportunity/Affirmative Action Employer. All applications are available for public view upon request. Review of applications will begin January 1, 2002, and continue until the position is filled.

**UNIVERSITY OF MIAMI**
Department of Mathematics
Faculty Positions

The University of Miami Department of Mathematics has positions at the assistant or associate professor level, open for fall 2002. Applicants must have a Ph.D. in mathematics, excellent research potential, and a strong commitment to teaching. We are particularly interested in three areas: algebraic combinatorics (topological and geometric combinatorics; symmetric functions; enumerative combinatorics); algebraic geometry/complex analysis (geometry of affine spaces; intrinsic measures and metrics; topology of algebraic varieties, several complex variables and analytic spaces, Riemann surfaces, algebraic geometry over fields of characteristic zero); and modeling (with sufficient background in applied mathematics to interact with a broad range of consumers of mathematics; applied or computational mathematics, continuous or discrete focus), but we will consider outstanding candidates in any areas.

To apply, send a letter of application, curriculum vita, and three letters of recommendation to:

Prof. Alan S. Zame, Search Committee
Department of Mathematics
University of Miami
PO Box 249085
Coral Gables, FL 33124-4250
e-mail: zame@math.miami.edu

Screening of applications will begin immediately and will continue until the positions are filled. Women and minorities are encouraged to apply.

The University of Miami is an Equal Opportunity/Affirmative Action Employer.

**UNIVERSITY OF WEST FLORIDA**
Department of Mathematics and Statistics


**University of West Florida**
Department of Mathematics and Statistics


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**GEORGIA**

**MOREHOUSE COLLEGE**
Department of Mathematics
Chairperson

Morehouse College invites applications for the position of chairperson of the Department of Mathematics, to begin July 31, 2002. Applicants should hold a doctorate in mathematics and have appropriate research and teaching experience to qualify for a tenured appointment at either the associate or full professor level. As an undergraduate institution, Morehouse values excellent teaching and mentoring. The successful applicant should demonstrate a capacity to assume a leadership role in the department and will be expected to maintain an active research program and to have a strong commitment to enhancing the research capacity of the department. For more information on the department and college, visit our website at http://www.math.morhouse.edu. A full curriculum vitae, official graduate school transcript, and three letters of reference must be received by January 22, 2002, by:

J. K. Haynes, Ph.D.
Dean, Division of Science and Mathematics
Morehouse College
680 Westview Drive, S.W.
Atlanta, Georgia 30314

Morehouse College is an Equal Opportunity Employer.

**SOUTHERN POLYTECHNIC STATE UNIVERSITY**
Mathematics Program

The Mathematics Program of SPSU invites applications for at least one tenure-track assistant professor position to begin in August 2002. Applicants must have a Ph.D. in mathematics or a closely related field and a strong commitment to teaching a wide range of courses across the mathematics curriculum. Responsibilities include 12 hours of teaching per semester, scholarly activity, and service. SPSU offers day and evening courses and degrees in science and technology-related fields, including a B.S. and B.A. in mathematics. Applicants from all areas of mathematics are invited to apply. The position is open until filled. Review of applications will begin on January 20, 2002. For more details, see http://www2.SPSTU.edu/math/jobs/. Send letter of application, vita, and three letters of recommendation to Alan Gabrielli, Acting Dean, School of Arts & Sciences, Southern Polytechnic State University, Marietta, GA 30060-2896. SPSU is an AA/ADA/EEO Employer.
INDIANA UNIVERSITY PURDUE UNIVERSITY INDIANAPOLIS
Department of Mathematical Sciences

The Department of Mathematical Sciences at Indiana University Purdue University Indianapolis invites nominations and applications for the newly endowed Bittinger Chair in the area of mathematics education. We seek a distinguished and well-established colleague with national and international recognition whose current research concerns primarily mathematics education at the university level.

Applicants must have a Ph.D. degree in mathematics or in mathematics education with a proven strong background in mathematics and documented academic accomplishments adequate for appointment to full professor. The successful candidate must have a strong research interest and expertise in the area of college mathematics education, especially in developmental and undergraduate mathematics, and a record of funding at the national level. The successful candidate must also have an exemplary record of teaching excellence and will have demonstrated a commitment to working on the forefront efforts to advance the teaching and learning of mathematics.

The Department of Mathematical Sciences, with a faculty of 32 members, houses the mathematics and statistics disciplines and offers a range of undergraduate and graduate degree programs, including a Ph.D. degree in mathematics as well as masters degrees in pure mathematics, applied mathematics, applied statistics, and mathematics education. The department offers this chair position a competitive salary, commensurate with background, experience, and record of professional achievements, and excellent fringe benefits.

Screening of applications will begin on December 1, 2001, and will continue until the position is filled. All application material, including a letter of interest, a detailed curriculum vitae, and the names and the contact information of at least four references should be mailed to:

The Bittinger Chair Search Committee
Department of Mathematical Sciences
Indiana University Purdue University Indianapolis
402 N. Blackford St. Suite 270
Indianapolis, IN 46202-3216

IUPUI is an Equal Opportunity/Affirmative Action Employer and strongly encourages applications from women and underrepresented minorities. Additional information about IUPUI and the department is available at http://www.iupui.edu/ and http://www.math.iupui.edu/.

LOUISIANA UNIVERSITY OF LOUISIANA AT LAFAYETTE
Department of Mathematics

The Department of Mathematics of the University of Louisiana at Lafayette invites applications for tenure-track positions at the rank of assistant professor. The appointments will commence August 14, 2002, or at the beginning of a subsequent term. Duties will include teaching courses at both the undergraduate and graduate level, conducting research, and engaging in departmental and professional service. Applicants should have a Ph.D. in mathematics or statistics and a commitment to excellence in teaching and research. Preference will be given to applicants in the fields of algebra, differential equations, or applied analysis, but applications with specialties in other areas will also be considered.

The University of Louisiana at Lafayette is a doctoral/research-intensive public institution with an established Ph.D. program in mathematics. Information about the university and the mathematics department is available on the university's website at http://www.louisiana.edu/.

We will review applications as they are received and continue until positions are filled. Letters of application with curriculum vitae should be sent to:

Dr. Roger Waggoner
Department of Mathematics
Box 41010
University of Louisiana at Lafayette
Lafayette, LA 70504-1010
rwaggoner@louisiana.edu

Applicants should also arrange to have three letters of reference sent directly to Professor Waggoner.

The University of Louisiana at Lafayette is an Affirmative Action/Equal Opportunity Employer.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics
Tenured or Tenure-Track Faculty Non-Tenure-Track Faculty

The Department of Mathematics may make appointments, at the level of lecturer and assistant professor or higher, in pure mathematics for the year 2002-03. The teaching load will be nine hours for the academic year (eight hours for assistant professor appointments). These positions are open to mathematicians with doctorates who show definite promise in research. Applications should be complete by January 15. Applicants should arrange to have sent (a) vita, (b) three letters of reference, (c) a description of their most recent
research, and (d) a research plan for the immediate future to: Pure Mathematics Committee, Massachusetts Institute of Technology, Room 2-263, 77 Massachusetts Ave., Cambridge, MA 02139-4307. MIT is an Equal Opportunity/Affirmative Action Employer.

For more information about the position or institution see http://www-math.mit.edu/.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics
Non-Tenure-Track Faculty

C.L.E. Moore Instructorships in Mathematics. These positions are open to mathematicians with doctorates who show definite promise in research. The teaching load will be nine hours for the academic year. Applications should be complete by January 15. Applicants should arrange to have sent (a) a vita, (b) three letters of reference, (c) a description of the research in their thesis, and (d) a research plan for the next year to: Pure Mathematics Committee, Massachusetts Institute of Technology, Room 2-263, Cambridge, MA 02139-4307. MIT is an Equal Opportunity/Affirmative Action Employer.

For more information about the position or institution see http://www-math.mit.edu/.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics
Tenured or Tenure-Track Faculty

APPLIED MATHEMATICS:

Applications are invited for a limited number of positions in applied mathematics starting fall 2002. Available positions include instructorships, lectureships, assistant professorships, and possibly higher levels. Appointments will be made mainly on the basis of demonstrated research accomplishments and potential. Complete applications must be received by January 3. To apply, please send a vita with a description of your recent research and research plans and arrange to have sent three letters of reference to: Committee on Applied Mathematics, Department of Mathematics, Room 2-345, MIT, 77 Massachusetts Ave., Cambridge, MA 02139-4307. MIT is an Equal Opportunity/Affirmative Action Employer.

For more information about the position or institution see http://www-math.mit.edu/.

WILLIAMS COLLEGE
Department of Mathematics and Statistics
Williamstown, MA 01267

Tenure-track position in statistics, beginning fall 2002, at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research and a Ph.D. at the time of appointment are required.

Please send a vita and have sent three letters of recommendation on teaching and research to the Statistics Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Evaluation of applications will begin on or after December 10. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

WILLIAMS COLLEGE
Department of Mathematics and Statistics
Williamstown, MA 01267

Tenure-track position in mathematics or statistics, beginning fall 2002, at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research and a Ph.D. by time of appointment are required.

Please send a vita and have sent three letters of recommendation on teaching and research to the Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Evaluation of applications will begin on or after December 10. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

WORCESTER POLYTECHNIC INSTITUTE
Mathematical Sciences Department

The Worcester Polytechnic Institute (WPI) Department of Mathematical Sciences invites applications for one or more anticipated tenure-track faculty positions in applied or computational mathematics in 2002. Candidates at all academic ranks will be considered.

An earned Ph.D. or equivalent degree is required. Successful candidates must be able to contribute strongly to both the department's research activities and its innovative, project-based educational programs. Areas of research in the department include partial differential equations with applications in fluid and continuum mechanics, composite materials, computational modeling and simulation, numerical analysis, optimization, control theory, discrete mathematics, applied probability, and applied statistics.

WPI is a private and highly selective technological university with an enrollment of 2,700 undergraduates and about 1,100 full- and part-time graduate students. Worcester, located forty miles west of Boston, offers ready access to the diverse economic, cultural, and recreational resources of the region.

The Mathematical Sciences Department has 24 tenured/tenure-track faculty and supports B.S., M.S., and Ph.D. programs in applied and computational mathematics and applied statistics. For additional information, see http://www.wpi.edu/ath/. Qualified applicants should send a detailed curriculum vitae, a one-page statement of specific teaching and research objectives, and the names of four references with mail/e-mail addresses and telephone/fax numbers to: Mathematics Search Committee, Mathematical Sciences Department, WPI, 100 Institute Road, Worcester, MA 01609-2280.

Applications will be considered on a continuing basis beginning October 1, 2001, until the position is filled.

To enrich education through diversity, WPI is an Affirmative Action/Equal Opportunity Employer.

MICHIGAN

EASTERN MICHIGAN UNIVERSITY
Department of Mathematics Head

Eastern Michigan University invites nominations and applications for the position of head of the Department of Mathematics. The appointment will be at the rank of professor with tenure and will be effective August 1, 2002. EMU is located in Ypsilanti, MI (10 miles from Ann Arbor and 30 miles from Detroit), with a total enrollment of approximately 24,000. The mathematics department offers undergraduate degrees with concentrations in mathematics, mathematics education (both elementary and secondary), and statistics, plus a joint actuarial science concentration with the Department of Economics. The department also offers master's degrees in mathematics, mathematics education, and statistics, as well as a joint degree with the Department of Computer Science.

Candidates for the position of head of the Department of Mathematics should possess a Ph.D. in mathematics, an established record of research/scholarly activity, and university/professional service appropriate for a tenured appointment at the rank of professor. Candidates should also demonstrate effective leadership that includes good communication and administrative skills. Additionally, the candidate should be actively supportive of innovative technological and pedagogical initiatives that promote the mathematics department's goal for teaching excellence. Further information about the
NEW YORK

MANHATTAN COLLEGE
Department of Mathematics and Computer Science

Manhattan College, located in the Riverdale section of NYC, is an independent Catholic coeducational Institution in the Lasallian tradition, with Schools of Arts, Business, Education, Engineering and Science. Applications are invited for a tenure-track assistant professor position in mathematics for August 2002. A Ph.D. in the mathematical sciences is required. There is also a position available in computer science. A commitment to excellence in teaching is essential. Classes are small. The department typically graduates 10-15 math/math-ed majors per year.

Candidates should submit a letter of application, a resume, three letters of recommendation (at least two of which should address teaching ability), and a statement of teaching philosophy to the Chair, Department of Mathematics and Computer Science, School of Science, Manhattan College, Riverdale, NY 10471. Review of applications will start upon receipt and will continue until the position is filled. Women and minorities are encouraged to apply. We are committed to a diverse work force. An AA/EO Employer M/F/D/V.

COLUMBIA UNIVERSITY
Department of Computer Science

The Department of Computer Science anticipates one or more non-tenure-track openings for outstanding classroom instructors with a strong background in computer science or in any computer-related mathematical discipline. These positions carry the rank of assistant professor or higher, depending upon qualifications. Length of service is one to seven years. Salary competitive.

The favorable teaching load, presently 2-1, facilitates research activity with other computer science faculty. Recent non-tenure-track assistant professors have made career steps into areas including computer vision, financial modeling, and genomics. Our department currently has 23 tenure-track faculty and 5 non-tenure-track faculty, and we expect the number of faculty to increase. Our present non-tenure-track faculty earned their Ph.D.s at Berkeley, Brandeis, Johns Hopkins, and Stanford.

We have close ties to the nearby research laboratories of AT&T, IBM, Lucent, Siemens, Verizon, Telcordia Technologies, NEC, and other leading industrial companies, including those on Wall Street and in Manhattan's Silicon Alley. Columbia's enclosed campus of tree-lined walks is located in Morningside Heights on the Upper West Side of New York City, one of the cultural, financial, and communications capitals of the world.

Please submit a CV, a statement of proposed teaching and research activity at Columbia, an e-mail address, and the names and e-mail addresses of three references, preferably by filing an online application using the form at http://www.cs.columbia.edu/recruit/. A confirmation of receipt will be sent by e-mail.

Further information may be obtained from Professor Jonathan L. Gross, Assistant Professor Non-tenure-track Search Chair by e-mail: gross@cs.columbia.edu.

Columbia University is an Equal Opportunity/Affirmative Action Employer. We encourage applications from women and minorities.

RENSSELAER POLYTECHNIC INSTITUTE
Department of Mathematical Sciences

The Department of Mathematical Sciences at Rensselaer invites nominations and applications for the Margaret A. Darrin Distinguished Chair in Applied Mathematics at the rank of full professor. The previous holder of this endowed chair was Julian Cole.

An exceptional record of research in applied mathematics is essential. It is expected that the holder of the chair will build a strong research program within the department and be an academic and scientific leader, both at Rensselaer and in the applied mathematics community. Of particular interest are those with research interests that align with the university's initiatives in information- and bio-technology, which includes areas such as data science, imaging, and computational science.

Nominations and inquiries should be sent to Mark Holmes at the address below or else via email at holmes@rpi.edu.

Applicants should send a letter of interest, curriculum vitae, and names and addresses of three references to: Mark Holmes, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, Troy, NY 12180. Review of the applica-
Classified Advertisements

OHIO

CASE WESTERN RESERVE UNIVERSITY
Department of Mathematics

Contingent on funding and staffing needs, the Department of Mathematics anticipates one or more visiting professor positions for the academic year 2002-03, with some possibility of renewal for up to two additional years. The research interests of a candidate should complement those of the department members. The position includes a 2/2 teaching responsibility, and it is important a candidate have a record of successful classroom teaching experience. Required: Ph.D. in mathematics with experience in teaching. A complete application should contain AMS cover sheet, letter of application (including e-mail address and fax number), curriculum vitae. A candidate should arrange to have three confidential letters sent, these letters should address the candidate's research and teaching. Mail all materials to: James Alexander, Chair, Department of Mathematics, Case Western Reserve University, Cleveland, OH 44106-7058. No e-mail or fax applications will be accepted. Screening applications will begin February 1; however, applications will be accepted until positions are filled. CWRU is an Equal Opportunity/Affirmative Action Employer. Women and minorities are strongly encouraged to apply.

PENNSYLVANIA

LEHIGH UNIVERSITY
Department of Mathematics

As part of campus-wide research initiatives at Lehigh, the Department of Mathematics intends to expand its interdisciplinary research focus by establishing a new research group that will both complement the department's existing strengths and interact with developing research groups in biosciences/biotechnology and in complex systems. Areas of particular interest include mathematical modeling of fundamental biological processes and systems, biomathematics, biostatistics, bioinformatics, and biological materials.

The department anticipates regular hiring over the next few years and is now seeking to fill two positions, both tenure or tenure-track, with appointments beginning in fall 2002. Applications from exceptional candidates in all areas of applied mathematics are welcome; however, preference will be given to those whose interests relate to mathematical biology.

The first position is for a senior scholar and will be filled at the associate or full professor level. The successful candidate will provide leadership in the establishment of this research group. This candidate will have an established record of research, including external funding, and an international reputation in the field, and a record of successful teaching at both the undergraduate and graduate levels.

The second position is for a junior scholar and will be filled at the assistant professor level. The successful candidate will demonstrate great research potential and have a record of successful teaching commensurate with the position. This position is open to new or recent Ph.D.'s.

As part of their application, candidates should submit: (a) an AMS cover sheet; (b) a complete vita, including a list of publications; (c) a research plan; and (d) at least four letters of recommendation, at least one of which addresses the applicant's teaching.

Applications received by January 15 will be assured of full consideration. Application materials should be sent to:

Hiring Committee
Department of Mathematics
Lehigh University
Bethlehem, PA 18015-3714

Lehigh University is an Equal Opportunity/Affirmative Action employer.

For more information see http://www.math.brown.edu/math/.

RHODE ISLAND

BROWN UNIVERSITY
Department of Mathematics

One professorship at the associate professor or professor level, with tenure to begin July 1, 2003. Candidates should have a distinguished research record and a strong commitment to excellence in undergraduate and graduate teaching. Preference to be given to applicants with research interests consonant with those of the present members of the department (for more information see http://www.math.brown.edu/faculty/faculty.html). Qualified individuals are invited to send a vita and arrange for at least five letters of recommendation to be forwarded to: Senior Search Committee, Department of Mathematics, Box 1917, Brown University, Providence, RI 02912. Applications must be postmarked by February 18, 2002, in order to receive full consideration. E-mail inquiries may be addressed to aresearch@math.brown.edu. Brown University is an Equal Opportunity/Affirmative Action Employer and encourages applications from women and minorities.

BROWN UNIVERSITY
Division of Applied Mathematics
Position in Statistics and Probability

The Division of Applied Mathematics seeks applicants for a position at the Assis-
t. Associate Professor or Full Professor rank, in the general area of statistics and probability. (This supersedes an earlier announcement with restricted ranks). Preference will be given to applicants who combine research in statistical theory and methods with novel applications to science, or applicants who add distinct new dimensions to the research in probability currently in the Division. Candidates at the Associate Professor and Full Professor levels are expected to demonstrate substantial contributions in both theory and application, and candidates at the Full Professor level are expected to be acknowledged leaders in their specialties. All applicants must have good communication and teaching skills.

Candidates should submit curriculum vitae, representative preprints or reprints, and a concise description of research interests and goals to:
Professor Chi-Wang Shu, Chairman
Division of Applied Mathematics
Brown University
Box F - Attention: Statistics Search
Providence, RI 02912

Additionally, candidates should arrange to have at least three letters of recommendation sent directly to the Search Committee at this address.

To receive full consideration, complete applications should be received by January 31, 2002.

Brown University is an affirmative action, equal opportunity employer. Women and minorities are encouraged to apply.

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TENNESSEE

UNIVERSITY OF TENNESSEE AT KNOXVILLE
Mathematics Department
The mathematics department at The University of Tennessee at Knoxville seeks to fill a postdoctoral position in analysis. Primary consideration will be given to candidates whose interests overlap with existing faculty. The position is normally for two years and may be extended for at most a third year. The teaching load for this position will be three semester-long courses during each academic year.

Candidates should provide evidence of ability to teach in English and should have had their Ph.D.s for no more than two years by September 2002. Review of applications will begin January 15 and continue until the position is filled.

Candidates should submit a curriculum vitae, a description of their research accomplishments and plans, and a statement about teaching. These documents as well as three letters of recommendation should be submitted to us at the MathJobs website http://www.mathjobs.org/ or mailed to Professor John B. Conway, Mathematics, University of Tennessee, Knoxville, TN 37996-1300. Use of the AMS application form is encouraged.

UT is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA employer.

VANDERBILT UNIVERSITY
Department of Mathematics
1326 Stevenson Center
Nashville, TN 37240

The Biomathematics Study Group at Vanderbilt University invites applications for two non-tenure-track positions, beginning fall 2002. Each position is a two-year appointment at the level of post-doctoral fellow or assistant professor, depending on qualifications. Successful applicants will participate in collaborative research with the members of the Biomathematics Study Group as well as with scientists in life science and medicine at Vanderbilt. Topics include, but are not limited to, neuroscience, molecular biology and signal transduction, ligand-receptor binding problems, growth of malignant tissues, cellular kinetics, registration and functional imaging, computational biology and physiology, and the mathematical modeling and analysis of medical procedures and devices. The applicants must have a doctorate in mathematics or a closely related area (e.g. computer science) and a background in biology or medicine. Submit your application and supporting material in a single mailing, inclusive of an e-mail address, a fax number, an AMS standardized curriculum vitae, and a research summary. Do not send additional information (including letters of recommendation) unless requested to do so after our initial screening. Evaluation of the applications will commence on November 15, 2001, and continue until the positions are filled. Prospective applicants are invited to visit the Biomathematics Study Group's website (http://www.math.vanderbilt.edu/~biomath/) for the research interests of the faculty.

Vanderbilt University is an Affirmative Action/Equal Opportunity Employer.

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TEXAS

UNIVERSITY OF HOUSTON
Department of Mathematics
We invite applications for a senior position in computational mathematics/numerical analysis. Candidates should have a record of exceptional scientific achievement and leadership in areas that complement the interests of existing faculty and are supportive of the strategic goals of the department and the university. An excellent record of funding, clear evidence of the ability to develop and direct multidisciplinary program projects, and a successful history of directing graduate research are essential. The University of Houston is an equal opportunity affirmative action employer. Minorities, women, veterans, and persons with disabilities are encouraged to apply. The search will continue until the position is filled. The application package should contain a complete CV and a list of at least three references for the department to contact. Applications should be sent to:
Search Committee for
Computational Mathematics
Department of Mathematics
University of Houston
Houston, Texas 77204-3008

ST. MARY'S UNIVERSITY
Assistant Professor-Mathematics
Tenure-track assistant professor position beginning fall 2002. Ph.D. in mathematics, quality teaching various undergraduate courses, and scholarly activity required. All areas considered. Some preference given to the areas of statistics and applied mathematics. Send application, resume, and three letters of reference by 1/29/02 to: Dr. Mary Wagner-Krankel, Department of Mathematics, St. Mary's University, San Antonio, TX 78228-8560. St. Mary's University is an Equal Opportunity/Affirmative Action Employer.

TEXAS TECH UNIVERSITY
Department of Mathematics and Statistics
Applications are invited for four tenure-track assistant professor positions beginning fall 2002. Higher-level appointments are possible in exceptional cases. All areas of pure and applied mathematics, statistics, and mathematics education will be considered, with priority being given to candidates having research interests compatible with those of the department. Strong promise or accomplishment in research and teaching and a Ph.D. degree at the time of appointment are required. Applications can be either submitted online at http://www.mathjobs.org/ or mailed to: Alex Wang, Hiring Chair, Department of Mathematics and Statistics, Texas Tech University, Lubbock, TX 79409-1042. Please submit a resume and completed AMS Standard Cover Sheet, and arrange to have three letters of reference sent directly. Texas Tech University is committed to diversity among its faculty. Women and minorities are strongly encouraged to apply. Review of applications will begin immediately. Additional information is available at http://ttmath.ttu.edu/ "awang/emplo/emplo/ht.html. Texas Tech is an AA/EEO Employer.

THE UNIVERSITY OF TEXAS
AT AUSTIN
Department of Mathematics
Openings for fall 2002 include: (a) in-
instructor@math.utexas.edu) is encouraged.

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Those wishing to apply for tenure-track/tenured positions are asked to send a vita and a brief research summary to the above address, c/o Recruiting Committee. Transmission of the preceding items via e-mail (address: recruiting@math.utexas.edu) is encouraged.

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Applications should include a curriculum vitae, a teaching profile outlining experience and/or interests, and the names of three references. Applications should be sent to: Anthony To-Ming Lau, Chair, Department of Mathematical and Statistical Sciences, University of Alberta, Edmonton, Alberta, Canada, T6G 2G1. The closing date for applications is February 1, 2002. For more information about the department and our university, please see our Web page, http://www.math.ualberta.ca/.

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Further Information Prof. Dr. H.W. Broer, Professor of Dynamical Systems and Analysis, phone +31 50 3633959, fax +31 50 3633800, e-mail <broer@math.rug.nl>
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For Foreign Bank Transfers: Citizens Bank, 1 Citizens Drive, Riverside, RI 02915, ABA #011-500-120, for American Mathematical Society, Acct #1107602021.

□ American Express □ Discover □ VISA □ MasterCard

Account number ____________________________ Expiration date ____________________________

M02NO
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.

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

Introductory ordinary member rate applies to the first five consecutive years of ordinary membership. Eligibility begins with the first year of membership in any category other than student and nominee. Dues are $52.

For ordinary members whose annual professional income is below $75,000, the dues are $105; for those whose annual professional income is $75,000 or more, the dues are $140.

Minimum dues for contributing members are $210. The amount paid which exceeds the higher ordinary dues level is purely voluntary may be treated as a charitable contribution.

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

The annual dues for reciprocity members who reside outside the U.S. are $70. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement. Annual verification is required. Reciprocity members who reside in the U.S. must pay ordinary member dues ($105 or $140).

The annual dues for category-S members, those who reside in developing countries, are $18. Members can choose only one privilege journal. Please indicate your choice below.

For either students or unemployed individuals, dues are $35, and annual verification is required.

2002 Dues Schedule (January through December)

Ordinary member, introductory rate ........................................ $52
Ordinary member ............................................................... $105 $140
Joint family member (full rate) .............................................. $105 $140
Joint family member (reduced rate) ........................................ $85 $120
Contributing member (minimum $210) ................................... $35
Student member (please verify) ............................................. $35
Unemployed member (please verify) ...................................... $70 $105 $140
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
### Change of Address

**Members of the Society** who move or change positions are urged to notify the Providence Office as soon as possible.

Journal mailing lists must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

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

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

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

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

or send the information on the form by e-mail to:
amsmem@ams.org or cust-serv@ams.org

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Meetings & Conferences of the AMS

IMPORTANT INFORMATION REGARDING MEETINGS PROGRAMS: AMS Sectional Meeting programs do not appear in the print version of the Notices. However, comprehensive and continually updated meeting and program information with links to the abstract for each talk can be found on the AMS website. See http://www.ams.org/meetings/. Programs and abstracts will continue to be displayed on the AMS website in the Meetings and Conferences section until about three weeks after the meeting is over. Final programs for Sectional Meetings will be archived on the AMS website in an electronic issue of the Notices as noted below for each meeting.

San Diego, California
San Diego Convention Center
January 6-9, 2002

Meeting #973
Joint Mathematics Meetings, including the 108th Annual Meeting of the AMS, 85th Meeting of the Mathematical Association of America (MAA), with minisymposia and other special events contributed by the Society for Industrial and Applied Mathematics (SIAM); the annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM); and the winter meeting of the Association for Symbolic Logic (ASL).
Associate secretary: John L. Bryant
Announcement issue of Notices: October 2001
Program first available on AMS website: November 1, 2001
Program issue of electronic Notices: January 2002
Issue of Abstracts: Volume 23, Issue 1

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

AMS Program Updates
Lawrence Craig Evans, University of California Berkeley, will give the Colloquium Lectures on Entropy Methods for Partial Differential Equations in three parts: Entropy and entropy flux pairs; Entropy, equilibrium, and irreversibility; and Maximum principle methods on Sunday, Monday, and Tuesday, respectively, at 1:00 p.m.

Using the AMSREFS Package for \LaTeX\ Bibliographies, Monday, 1:00 p.m. to 2:00 p.m., presented by Michael Downes, AMS. This new package for authors addresses a number of shortcomings in the usual current methods of bibliography production that tend to cause authors unnecessary extra work. Using this package when submitting manuscripts electronically will significantly increase the quality of the bibliography data for archival purposes. This presentation is oriented toward authors who are writing typical research-level mathematics.

New Directions at the NSF, Tuesday, 9:45 a.m. to 10:45 a.m. Panelists include David Eisenbud and Michael F. Singer, Mathematical Sciences Research Institute; Douglas N. Arnold, Institute for Mathematics and its Applications; Mark L. Green, Institute for Pure and Applied Mathematics; and Philippe Tondeur, NSF Division of Mathematical Sciences. The panel will be moderated by Tony F. Chan, UCLA.

Who Wants to Be a Mathematician, Tuesday, 10:00 a.m. to 10:55 a.m., organized by Michael A. Breen and Annette W. Emerson, AMS, and William T. Butterworth, Barat College. Come watch ten of San Diego's top high school students as they have the chance to compete for cash and prizes by answering questions about mathematics. There's no partial credit to agonize over, and the top prize is $2,000. Contestants can ask for help from the audience, so the more people in the audience who know mathematics, the better it is for the contestants. You're invited
to come and take part in this educational and fun presentation.

**MAA Program Updates**

Course Portfolios and the Scholarship of Teaching and Learning, Sunday, 4:15 p.m. to 5:45 p.m., organized by Thomas F. Banchoff, Brown University. A course portfolio is "a form of scholarly inquiry and communication through which we can represent and exchange the scholarship of teaching" (Shulman 1998). In this session, panelists, who have all been participants in the Carnegie Academy for Teaching and Learning, will discuss how course portfolios might be most profitably used in the discipline of mathematics, illustrated by portfolios in progress. Discussion will follow. Panelists for the session include Bruce N. Cooperstein, University of California, Santa Cruz; Curtis D. Bennett, Bowling Green State University; Anita J. Salem, Rockhurst University; and John P. Holcomb, Cleveland State University.

Presentations by Teaching Award Recipients, Tuesday, 3:30 p.m. Presenters and the titles of their talks include Dennis DeTurck, University of Pennsylvania, *Polymath teaching; Paul J. Sally Jr., University of Chicago, Teaching up and down the mathematical ladder; and Edward L. Spitznagel Jr., Washington University (St. Louis), Pharmacokinetics.*

**Social Events**

Purdue Mathematics Department Alumni Reception, Monday, 6:00 p.m. to 7:00 p.m.

**Registration at the Meetings**

Individuals who registered by November 7 and who so elected will have their badge and the final program mailed to them before the Meetings. All other registrants will receive the final program at the Meetings. The additional information below is to assist those who will register at the Meetings and those who registered in advance but elected not to receive their badges and final programs by mail.

Advance and on-site meeting registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register and should be prepared to show the Meetings badge, if so requested. Badges are required to obtain discounts at the AMS and MAA Book Sales and to cash a check with the Meetings cashier. If advance registrants should arrive too late in the day to pick up their badges, they may show the acknowledgment received from the Meetings Service Bureau (MMSB) as proof of registration.

Registration fees may be paid at the Meetings in cash, by personal or traveler's check, or by VISA, MasterCard, American Express, or Discover. Letters verifying attendance at the Meetings may be obtained from the cashier or at the Registration Assistance section of the Registration Desk.

Participants wishing to attend sessions for one day only may take advantage of a one-day fee. These special fees are effective daily, January 6 through 9, and are available at the Meetings to both members and nonmembers. These one-day fees are not applicable to librarians, high school teachers, unemployed or emeritus participants, or high school, undergraduate, or graduate students.

**Joint Mathematics Meetings**

- **Member of AMS, ASL, Canadian Mathematical Society (CMS), MAA**
  - Emeritus Member of AMS, MAA
  - Nonmember
  - Temporarily Employed
  - Graduate Student/Unemployed
  - Librarians/High School Teachers
  - Developing Country Participant
  - Undergraduate Students
  - High School Students
  - Nonmathematician Guest

**Joint Mathematics Meetings One Day**

- **Member of AMS, ASL, CMS, MAA**
  - Nonmember

**MAA Minicourses (if openings available)**

- Minicourses #9–15
- Minicourses #3–8

**Employment Center**

- Employer (First Table)
- Employer (Each Additional Table)
- Applicant (All Services)
- Applicant (Message Center Only)

**AMS Short Course**

- Student/Unemployed
- Member of AMS or MAA
- All Other Participants

**MAA Short Course**

- MAA member
- Nonmember
- Student/Unemployed/Emeritus

**Accommodations and Travel**

Participants who did not reserve a room during advance registration but who would like to obtain a room at one of the hotels listed on pages 1112-1113 in the October issue of the Notices should call the hotels directly after December 14. However, we regret that after that date the MMSB can no longer guarantee availability of rooms or of the special convention rates.

Please see the October issue for special discount fare information on USAirways, Delta, and Southwest Airlines as well as driving directions to the San Diego Convention Center and Marriott Hotel & Marina.

**Registration Dates, Times, and Locations**

AMS and MAA Short Courses
Marina Foyer, Marriott
Friday, January 4
7:30 a.m. to 4:00 p.m.

**Joint Mathematics Meetings and MAA Minicourses**

Hall B1, San Diego Convention Center
Saturday, January 5
3:00 p.m. to 7:00 p.m.
Sunday–Tuesday, January 6-8
7:30 a.m. to 4:00 p.m.
Wednesday, January 9
7:30 a.m. to 2:00 p.m.
Employment Center
Hall B2, San Diego Convention Center
Sunday, January 6 7:30 a.m. to 4:00 p.m.
(registration for scheduled interviews, Interview Center)
Monday, January 7 7:00 a.m. to 7:30 p.m.
(schedule distribution, interviews, Interview Center)
Tuesday, January 8 8:15 a.m. to 7:30 p.m.
(scheduled interviews and Interview Center)
Wednesday, January 9 9:00 a.m. to 1:00 p.m.
(Interview Center only)

Employment Center registrants who are participating in the computer-scheduled interviews must register and fill out interview request forms on Sunday, January 6. There will be no registration on Monday and Tuesday; only interviews will take place on these days.

Ann Arbor, Michigan
University of Michigan
March 1–3, 2002

Meeting #974
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: January 2002
Program first available on AMS website: January 17, 2002
Program issue of electronic Notices: May 2002
Issue of Abstracts: Volume 23, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: January 9, 2002

Invited Addresses
Lazlo Babai, University of Chicago, Title to be announced.
Netts Katz, Washington University, Title to be announced.
Alan Reid, University of Texas at Austin, Title to be announced.
Lihe Wang, University of Iowa, Title to be announced.
Thaleia Zariphopoulou, University of Texas at Austin, Pricing and risk management in incomplete markets.

Special Sessions
Algebraic Combinatorics (Code: AMS SS H1), Patricia Hersh, University of Michigan, Ann Arbor, and Brian D. Taylor, Wayne State University.

Algebraic Topology (Code: AMS SS F1), Robert Bruner, Wayne State University, and Igor Kriz, University of Michigan, Ann Arbor.

Biological Applications of Dynamical Systems (Code: AMS SS J1), J. M. Cushing, University of Arizona, Shandelle M. Henson, Andrews University, and Anna M. Spagnuolo, Oakland University.

Commutative Algebra (Code: AMS SS D1), Florian Enescu and Anurag K. Singh, University of Utah, and Karen E. Smith, University of Michigan, Ann Arbor.

Differential Geometry (Code: AMS SS K1), Lizhen Ji, Krishnan Shankar, and Ralf Spatzier, University of Michigan, Ann Arbor.

Hyperbolic Manifolds and Discrete Groups (Code: AMS SS E1), Richard D. Canaday, University of Michigan, Ann Arbor, and Alan W. Reid, University of Texas, Austin.

Integrable systems and Poisson geometry (Code: AMS SS C1), Anthony Block, University of Michigan, Philip Foth, University of Arizona, and Michael Gekhtman, University of Notre Dame.

Mapping class groups and geometric theory of Teichmuller spaces (Code: AMS SS P1), Benson Farb, University of Chicago, Nikolai Ivanov, Michigan State University, and Howard Masur, University of Illinois, Chicago.

Mathematical Models in Medicine and the Life Sciences (Code: AMS SS M1), Patrick Nelson, University of Michigan, Ann Arbor.

Moduli Spaces (Code: AMS SS G1), Angela Gibney, University of Michigan, Ann Arbor.

Numerical Analysis and Applications of Partial Differential Equations (Code: AMS SS L1), Joan Remskii and Jennifer Zhao, University of Michigan, Dearborn.

Partial Differential Equations (Code: AMS SS N1), Qing Han, University of Notre Dame, and Lihe Wang, University of Iowa.

Quantum Topology in Dimension Three (Code: AMS SS A1), Charles Frohman, University of Iowa, and Joanna Kania-Bartoszynska, Boise State University.

Topics in Geometric Function Theory (Code: AMS SS B1), David A. Herron, University of Cincinnati, Nageswari Shanmugalingam, University of Texas, and Jeremy T. Tyson, SUNY at Stony Brook.

Accommodations
Participants should make their own arrangements directly with the hotel of their choice and request the AMS/Sectional Meeting discount. The AMS is not responsible for rate changes or for the quality of the accommodations.

On-campus hotels:
The Inn at the Michigan League, 911 North University, Ann Arbor, MI 48109; 313-764-3177; $115 single, $125 double ($10 each additional person), $205 single suite, $220 double suite. Deadline for reservations is February 1.

Bell Tower, 300 South Thayer, Ann Arbor, MI 48104, 800-666-8693; 2001 rates: $135 single and $150 double (2002 rates to be determined). Deadline for reservations is January 28.

Campus Inn, 615 East Huron, Ann Arbor, MI 48104; 800-666-8693; 2001 rates: $120 single and $137 double (2002 rates to be determined). Deadline for reservations is January 28.

Off-campus hotels (approx 5 miles from Central Campus):
HOLIDAY INN-NORTH CAMPUS, 3600 PLYMOUTH RD., ANN ARBOR, MI 48105, 800-800-5560; $86 single or double. DEADLINE FOR RESERVATIONS IS FEBRUARY 1. VAN SERVICE TO CENTRAL CAMPUS PROVIDED SUBJECT TO AVAILABILITY.

FOOD SERVICE
There are a number of restaurants adjacent to the campus. A list of restaurants will be available at the registration desk.

LOCAL INFORMATION
Please visit the website maintained by the Department of Mathematics at http://www.math.lsa.umich.edu and the University of Michigan, Ann Arbor campus information site at http://www.umich.edu/~info/.

OTHER ACTIVITIES
AMS BOOK SALE: Examine the newest titles from AMS! Most books will be available at a special 50% discount offered only at meetings. Complimentary coffee will be served, courtesy of AMS Membership Services.

AMS EDITORIAL ACTIVITY: An acquisitions editor from the AMS Book Program will be present to speak with prospective authors. If you have a book project that you would like to discuss with the AMS, please stop by the book exhibit.

PARKING
Visitor parking is available in a number of lots located throughout campus. At some locations, central pay stations are installed. To use these machines, note the parking space number as this information will be required when paying.

Parking fees and the maximum hours of use are indicated either on individual meters or central pay station. The period of time a vehicle may be parked in a particular space should be noted. For example, some spaces may allow parking for 30 minutes while others in the same location may be used for 4 hours or more. The parking rate is $6.00 per hour at all locations.

Convenient parking is available in the lot located at the corner of Forest and S. University. Parking is only free available on Friday and Saturday after 6:00 p.m. for non-UM employees and available to everyone all day on Sunday.

For details on campus parking visit http://www.umich.edu/~newsinfo/ccamp.html.

REGISTRATION AND MEETING INFORMATION
The registration desk will be located in the Mathematics Atrium, 1st Floor Atrium, East Hall, and will be open from 11:30 a.m. to 4:30 p.m. on Friday, and 8:00 a.m. to 4:30 p.m. on Saturday. Talks are in East Hall and Dennison Hall.

REGISTRATION FEES: (payable on-site only) $40/AMS members; $60/nonmembers; $5/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, Mastercard, Discover, or American Express.

TRAVEL
BY AIR: The Detroit Metro Airport (DTW) is located approximately 25 miles from campus (approx 35 minutes by car) and is served by all major airlines. For more information visit http://www.metroairport.com. For information on Amtrak and Greyhound Bus service visit http://www.umich.edu/~info/transportation.html. In addition to taxi service (approx $40-50 one way), transportation from the airport is provided by the following:

METRO CARS SERVICE: Metro Cars can be reached at 734-946-5700 or visit http://metrocars.net. The cost to Ann Arbor is $47 (for 1-4 people) one way. Metro Cars accepts cash or credit card. To use Metro Cars, go to the blue curb at the airport which is located at the lower level baggage (go through the double doors, cross over to the blue curb).

Metropolitan Shuttlebus Service costs $22 per person for a one-way trip ($40 roundtrip). They will pick up or drop off anywhere on campus. The shuttle stops at all airport terminals and the airport Marriott. For more information or to make a reservation, call 734-727-1740 or contact them at http://1link1270@aol.com.

Ken's Airport Shuttle Service costs $45 one-way or $85 round-trip to transport 1-4 people. They will pick up or drop off anywhere on campus. For information or to make a reservation (they are required!), call 734-941-7777 or 888-789-6187.

DRIVING: East Hall and Dennison Hall are located on Central Campus of the University of Michigan, Ann Arbor:

FROM DETROIT (heading West) 1-94 (FORD FREeway): Take State Street Exit 177. Turn right (north). Continue on State Street approximately 2 miles to the main campus area.

FROM CHICAGO (heading East): Take State Street Exit 177. Turn left (north). Continue on State Street approximately 2 miles to the main campus area.

U.S. 23 FROM OHIO (heading NORTH): Take Washtenaw Ann Arbor Exit 378 and turn right (west) onto Washtenaw.
split (approximately 2-3 miles), stay to the right on Washtenaw following the Hospital signs. Take a left at Hill Street (you’ll see “The Rock”). Continue down Hill Street (campus buildings will be on your right). Take a right on State Street. Go two blocks. The Michigan Union is on your left at the South State Street and South University intersection.

**U.S. 23 from Northern MI (heading South):** Take U.S. 23 South to M-14 West. Follow M-14 West signs closely. At the fork, stay to the right following the “Ann Arbor” signs. Take the second exit after the fork, Exit #3, marked “Downtown Ann Arbor; this will become Main St. Follow Main St. to William St. Take a left on William and follow it until it ends at State St. Take a right on State St. Go one block. The Michigan Union is on your right at the intersection of South State Street and South University.

**I-696 (W. P. Rueher Freeway) from Northwest Suburbs:** Take I-696 to I-275 South to M-14 West. Follow M-14 West signs closely. At the fork, stay to the left following the “Ann Arbor” signs. Take the second exit after the fork, Exit #3, called “Downtown Ann Arbor”, this will become Main St. Follow Main St to William St. Take a left at William St. Continue down William Street until it ends at State St. Take a right on State St. Go one block. The Michigan Union is on your right at the intersection of South State Street and South University.

**I-96 (also called the Jeffries Freeway) from parts of Detroit, Redford, Plymouth and Canton:** Take I-96 to M-14 West. Follow M-14 West signs closely, as by Ann Arbor it forks to the left. Take the second exit after the fork, Exit #3, which is marked “Downtown Ann Arbor”; this will become Main St. Follow Main St to William St. Turn left on William and follow it until it ends at State St. Take a right on State St to head towards the Michigan Union.

**Car rental:** Special rates have been negotiated with Avis Rent A Car for the period February 22–March 10. All rates include unlimited free mileage; the weekend rates quoted are available from noon Thursday until Monday at 11:59 p.m. Rates do not include state or local surcharges, tax, optional coverages, or gas refueling charges. Renter must meet Avis’ age, driver, and credit requirements. Make reservations by calling 800-331-1600 or online at http://www.avis.com. Nonweekend and weekly rates are also available. Please quote Avis Discount Number B159266 when making reservations.

Daily weekend rates are Subcompact, $22.99; Compact, $23.99; Intermediate, $25.99; Full size (2-door), $28.99; Full size (4-door), $30.99; Premium, $32.99; Luxury, $65.99; Minivan, $65.99; and Sport Utility, $65.99.

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**Atlanta, Georgia**

**Georgia Institute of Technology**

**March 8–10, 2002**

**Meeting #975**

Southeastern Section

Associate secretary: John L. Bryant

Announcement issue of Notices: January 2002

Program first available on AMS website: January 31, 2002

Program issue of electronic Notices: May 2002

Issue of Abstracts: Volume 23, Issue 2

**Deadlines**

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: January 22, 2002

**Invited Addresses**

Georgia Benkart, University of Wisconsin, Madison, *Title to be announced.*

Robert L. Bryant, Duke University, *Title to be announced.*

Johnny Henderson, Auburn University, *Title to be announced.*

Nigel J. Kalton, University of Missouri, Columbia, *Title to be announced.*

James G. Oxley, Louisiana State University, *The interplay between graphs and matroids.*

**Special Sessions**

**Algebraic Combinatorics** (Code: SS T1), Mihai A. Ciucu, Georgia Institute of Technology.

**Automated Reasoning in Mathematics and Logic** (Code: SS S1), Johan G. F. Belinfante, Georgia Institute of Technology.

**Banach Spaces and Their Applications** (Code: SS B1), Peter G. Casazza and N. J. Kalton, University of Missouri-Columbia.

**Collaborative Learning Classroom Activities** (Code: SS M1), Sabrina A. Hessinger, Armstrong Atlantic State University.

**Combinatorics and Graph Theory** (Code: SS A1), John M. Harris, Furman University.

**Computation in the Mathematical Sciences** (Code: SS X1), Sabrina A. Hessinger, Armstrong Atlantic State University, and Mark D. Cawood, Clemson University.

**Dynamic Equations on Time Scales** (Code: SS V1), Martin J. Bohner, Florida Institute of Technology, and Billur Kaymakcalan, Georgia Southern University.

**Elementary Mathematical Modelling** (Code: SS L1), Mary Ellen Davis, Georgia Perimeter College.

**Frames, Wavelets, and Operator Theory** (Code: SS K1), Christopher E. Heil and Yang Wang, Georgia Institute of Technology.
Meetings & Conferences

Graphs and Matroids (Code: SS H1), James G. Oxley and Bogdan Oporowski, Louisiana State University, and Robin Thomas, Georgia Institute of Technology.

Harmonic Analysis (Code: SS E1), Gerd Mockenhaupt and Michael T. Lacy, Georgia Institute of Technology, and Akos Magyar, University of Georgia.

Introductory/Elementary Statistics (Code: SS Y1), Patricia G. Monroe, Greenville Technical College.

Linear Algebra and Matrix Theory (Code: SS N1), Frank J. Hall and Zhongshan Li, Georgia State University.

Low Dimensional Topology (Code: SS C1), Wolfgang H. Heil, Florida State University, and Jose Carlos Gomez-Larrañaga, CIMAT, Mexico.

Mathematical Models in Biology (Code: SS P1), Robert D. Fray, Furman University.

Number Theory (Code: SS R1), David Penniston, Furman University.

Numerical Linear Algebra and Its Applications (Code: SS J1), Michele Benzi, Emory University, Steven B. Damelin, Georgia Southern University, and James Nagy, Emory University.

Quantum Structures (Code: SS D1), Alexander G. Wilce, Juniata College, Richard J. Gineche, Louisiana Technical University, and Franklin E. Schroek, Florida Atlantic University.

Real World Applications of Mathematics (Code: SS U1), Mark C. Ginn, Appalachian State University.

Research on the Mathematical Education of Undergraduates (Code: SS W1), Joe Wimbish, Huntingdon College.

Symplectic and Contact Topology (Code: SS Q1), Margaret Symington, Georgia Institute of Technology, and Gordana Matic, University of Georgia.

Technology and Distance Learning (Code: SS F1), Tom Morley, Georgia Institute of Technology, and Martha Abel, Georgia Southern University.

Three Bridges from “Applied” to “Mathematics” (Code: SS G1), Peter Mucha, John A. Pelesko, John E. McCuan, and Guillermo H. Goldszteing, Georgia Institute of Technology.

Short Courses
Four Short Courses will be presented on Friday morning, 8:30 a.m. to 11:30 a.m. There is a registration fee of $20 for each course, which is separate from the general meeting fee. Please see abstracts for each Short Course with specific instructions on how to register in advance (no later than February 15, 2002) at http://www.maa.org/southeastern.

Cryptology: Mathematics, Craft, and Implementation, presented by Thomas H. Barr, Rhodes College.

An Introduction to the Mathematics of Biology, presented by Edward Yeargers, Georgia Institute of Technology (Biology); Ronald W. Shonkwiler, Georgia Institute of Technology, and James Herod, Georgia Institute of Technology.

Optimal Use of Technology in Teaching Geometry at the College-University Level, presented by Subhash C. Saxena, Coastal Carolina University.

Teaching Mathematics from Afar, presented by Linda Boyd, Georgia Perimeter College.

Undergraduate Poster Session
This session features results of research by undergraduate students. Students are encouraged to present their research from academic-year work or from summer research projects. Students will be expected to be available for one hour at the poster session to discuss their research with interested persons. When submitting the abstract electronically select UNDERGRAD as the session code. Questions or suggestions are welcomed by Robert L. Bernhardt, East Carolina University, Greenville, NC 27858-4353, phone: 252-328-4109, e-mail: bernhardt@emai l.ecu.edu.

Contributed Paper Sessions
There will be sessions for ten-minute contributed talks, grouped by similar topic insofar as possible. See the electronic abstract submission instructions at http://www.ams.org/abstracts/instructions.html. Submitting via the web form is the easiest method. Please select CP 1 as the event code for this session. The deadline for receipt of abstracts is January 22, 2002; this deadline will be strictly enforced.

Accommodations
Participants should make their own arrangements directly with a hotel of their choice. Because there is a technical convention of 20,000 attendees and the ACC Men’s Basketball Conference (40,000 expected) in Atlanta over the same weekend as the meeting, accommodations may sell out early. Blocks of rooms have been reserved at special rates at the properties below for the nights of Thursday, Friday, and Saturday, March 7-9. Room rates do not include the tax of 14%. Please cite the group name Georgia Tech Math when making a reservation. Hotels have varying cancellation or early checkout penalties; be sure to ask details when making your reservation. The AMS and MAA are not responsible for rate changes or for the quality of the accommodations.

Days Inn Peachtree, 683 Peachtree St., Atlanta, GA 30308, 404-874-9200, 404-873-4245 (fax). Rates are $69/single or double; approximately 3/4 mile from the meeting site. Deadline for reservations is February 7, 2002.

Fairfield Inn by Marriott in Midtown Atlanta, 1470 Spring St, NW, Atlanta, GA 30309, 404-872-5821, 404-874-3602 (fax). Rates are $89/single or double; approximately 1.5 miles from the meeting site. Deadline for reservations is February 7, 2002.

Hampton Inn (Atlanta-Midtown), 1152 Spring St., Atlanta, GA 30309, 404-872-3234, 404-872-2434 (fax). Rates are $89/single or double. Rates include free parking, coffee in rooms; approximately one mile from the meeting site. Deadline for reservations is February 8, 2002.

Holiday Inn Express North Ave., 244 North Ave., NW, Atlanta, GA 30313, 1-800-HOLIDAY (465-4329) or 404-
Meetings & Conferences

881-0881. Rates are $80/one king bed or $87/two double beds; approximately three to four blocks from the meeting site. Deadline for reservations is February 15, 2002.

Regency Suites Hotel, 975 West Peachtree at 10th St., Atlanta, GA 30309, 800-642-3629, 404-876-5003, 404-817-7511 (fax). Rates are $89/king bed or $99/two double beds. Parking is $8/night; approximately one mile from the meeting site. Deadline for reservations is February 7, 2002.

Wyndham Midtown Atlanta, 125 10th St., NE, Atlanta, GA, 404-873-4800. Rates are $108/single or $118/double; approximately one mile from the meeting site. Deadline for reservations is February 7, 2002.

Food Service

See http://www.accessatlanta.com/ajc/living/dining/ for a comprehensive restaurant list. Campus locations will be available at the meeting.

Local Information

Please see the website maintained by Georgia Institute of Technology at http://www.gatech.edu, with maps at http://www.gtalumni.org/campusmap.

Other Activities

Book Sales: Examine the newest titles from the AMS and the MAA! Several other publishers have been invited to participate in the exhibits. Many of the AMS books will be available at a special 50% discount available only at the meeting. Complimentary coffee will be served courtesy of AMS membership Services. The exhibits will be in the atrium of the Instructional Center.

AMS Editorial Activity: An acquisitions editor from the AMS Book program will be present to speak with prospective authors. If you have a book project that you would like to discuss with the AMS, please stop by the book exhibit.

T. A. Rush: This event provides an opportunity for students to meet with representatives of graduate programs. If your institution wishes to participate and to be listed in the exhibits, please call Mr. Jason Huffman Jacksonville State University, phone: 256-782-5822, e-mail: jhuffman@jsucc.jsu.edu by January 15, 2002. This event will be scheduled during lunch on Friday in conjunction with a pizza lunch for students. There is a $25 fee for each participating graduate institution.

MAA Project NEXT (Southeastern Section): This national program is for new or recent Ph.D.'s in the mathematical sciences interested in improving the teaching and learning methods of undergraduate mathematics. A workshop will be held on Thursday, March 7, to discuss topics of special relevance to beginning faculty. For information and an application form, see http://www.mathsci.appstate.edu/~jmh/NeEXTSE.

Parking

Parking on Friday is available in the Visitor Lot immediately adjacent to the Student Center and in the Visitor Lot at Ferst and State Streets (both lots are accessible from Ferst Street). Cost is $5.50/hour with a $6 maximum. On Saturday and Sunday, you may park in one of the Visitor Lots (A05 or A06 on the campus map) next to the Student Center. See driving directions below.

Reception

All meeting participants are invited to a cash bar reception on Friday evening at 6:00 p.m. in the Presidential Suites of the Moore Student Success Center. Drop by to visit with colleagues before going out-on-the-town for dinner.

Registration

Scientific sessions will take place in the Instructional Center. The Invited Addresses will take place in Ferst Theater and the Tennenbaum Auditorium in the Instructional Center.

All meeting registration will be done on site in the Instructional Center, on Friday and Saturday, 8:00 a.m. to 4:30 p.m., with the exception of the Short Course where one must register in advance as described above. Registration fees are $25/members of AMS or MAA; $45/nonmembers; $5/students, emeritus, unemployed; and are payable by cash, check, VISA, Mastercard, Discover, or American Express.

Travel

By air: Atlanta, Georgia is served by Hartsfield International Airport. Taxes charge a standard rate of $25 to bring someone from the airport to the Georgia Tech campus. There are various shuttle and limo services with varying rates, depending on the number of passengers. Atlanta Airport Shuttle offers individual transportation to the George Tech area for $14/person, and also offers group rates as follows: 10-passenger minivan: $93.94, 20-passenger minibus: $137.25, or a 55-passenger motorcoach: $465.45. Also see the information on MARTA below.

Car rental: Special rates have been negotiated with Avis Rent A Car for the period March 1 to March 17, 2002, beginning at $22.99/day for a subcompact car at the weekend rate. All rates include unlimited free mileage; the weekend rates quoted are available from noon Thursday until Monday at 11:59 p.m. Rates do not include state or local surcharges, tax, optional coverages, or gas refueling charges. Renter must meet Avis' age, driver, and credit requirements, and return to the same renting location. Make reservations by calling 800-331-1600 or online at http://www.avis.com. Higher nonweekend and weekly rates are also available. Please quote Avis Discount Number B159266 when making reservations.

Driving North on I-75/85 into Atlanta (from the airport): Take Exit #249D (North Avenue, Spring Street, West Peachtree Street). At the top of the exit ramp, proceed through the first intersection (Spring Street). At the next intersection (West Peachtree), turn left. Continue on West Peachtree for approximately one block and turn left on North Avenue. Cross over the interstate, and go past Techwood Drive (the first light). Proceed to the next right, which is Cherry Street. Turn right onto Cherry Street and then left onto Ferst Drive. After the road curves right, the Student Center will be on the right and the Instructional Center will be on the left.
Center is a bit farther on the right. See parking options above.

**Driving South on I-75/85 into Atlanta:** Take Exit #249D (North Avenue). At the top of the exit ramp, turn right onto North Avenue. Cross over the interstate, and go past Techwood Drive (the first light). Proceed to the next right, which is Cherry Street. Turn right onto Cherry Street and then left onto Ferst Drive. After the road curves right, the Student Center will be on the right and the Instructional Center is a bit farther on the right. See parking options above.

**Metropolitan Atlanta Rapid Transit Authority (MARTA):** You may catch the MARTA train at the airport. Fare is $1.75 one way, and exact change is required (change machines are available at MARTA stations). Take the train to the North Avenue station (N3). A MARTA/Remote Lot Stinger leaves this station every 15 minutes. Alternately, walk three blocks west on North Avenue to campus or transfer to a bus on route #13 to Tech. These buses leave the station approximately every 15 to 20 minutes. On weekends and holidays, buses depart approximately every 30 minutes.

**Weather**

In early March, expect average daytime highs of about 63 and lows of about 41. Average precipitation is about 5.8.

# Montréal, Québec Canada

**Centre de Recherches Mathématiques, Université de Montréal**

**May 3–5, 2002**

**Meeting #976**

**Eastern Section**

Associate secretary: Lesley M. Sibner
Announcement issue of Notices: March 2002
Program first available on AMS website: March 21, 2002
Program issue of electronic Notices: July 2002
Issue of Abstracts: Volume 23, Issue 3

**Deadlines**

For organizers: Expired
For consideration of contributed papers in Special Sessions: January 15, 2002
For abstracts: March 12, 2002

**Invited Addresses**

Nicholas M. Ercolani, University of Arizona, **Title to be announced.**

Lars Hesselholt, Massachusetts Institute of Technology, **Title to be announced.**

Niky Kamran, McGill University, **Title to be announced.**

Rafael de la Llave, University of Texas at Austin, **Title to be announced.**

**Special Sessions**

Asymptotics for Random Matrix Models and Their Applications (Code: AMS SS J1), Nicholas M. Ercolani, University of Arizona, and Kenneth T.-R. McLaughlin, University of North Carolina at Chapel Hill and University of Arizona.

Combinatorial Hopf Algebras (Code: AMS SS C1), Marcelo Aguiar, Texas A&M University, and Françoise Bergeron and Christophe Reutenauer, Université du Québec à Montréal.

Combinatorial and Geometric Group Theory (Code: AMS SS C1), Olga G. Kharlampovich, McGill University, Alexei Myasnikov and Vladimir Shpilrain, City College, New York, and Daniel Wise, McGill University.

Commutative Algebra and Algebraic Geometry (Code: AMS SS G1), Irena Peeva, Cornell University, and Hema Srinivasan, University of Missouri-Columbia.

Curvature and Topology (Code: AMS SS E1), Regina Rotman, Courant Institute, New York University, Christina Sormani, Lehman College, CUNY, and Kristopher R. Tapp, SUNY at Stony Brook.

Function Spaces in Harmonic Analysis and PDEs (Code: AMS SS D1), Galia D. Dafni and Jie Xiao, Concordia University.

Potential Theory (Code: AMS SS B1), Paul M. Gauthier, Université de Montréal, K. Gowri Sankaran, McGill University, and David H. Singman, George Mason University.

Shape Theory in Dynamics (Code: AMS SS F1), Alex Clark, University of North Texas, and Krystyna M. Kuperberg, Auburn University.

Spectral Geometry (Code: AMS SS H1), Dmitry Jakobson, McGill University, and Yiannis Petridis, McGill University and Centre de recherches Mathématiques.

# Pisa, Italy

**June 12–16, 2002**

**Meeting #977**

First Joint International Meeting between the AMS and the Unione Matematica Italiana.

Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: Not applicable
Issue of Abstracts: Not applicable

**Deadlines**

For organizers: Expired
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: Abstract submission procedures, including the setting of deadlines, are being arranged by the UMI.
Please watch their website at http://www.dm.unipi.it/%7Emeet2002/ for announcements.

**Invited Addresses**

Luigi Ambrosio, Scuola Normale Superiore, Title to be announced.

Luis A. Caffarelli, University of Texas at Austin, Title to be announced.

Claudio Canuto, Politecnico of Torino, Title to be announced.

L. Craig Evans, University of California Berkeley, Title to be announced.

Giovanni Gallavotti, University of Rome I, Title to be announced.

Sergio Klainerman, Princeton University, Title to be announced.

Rahul V. Pandharipande, California Institute of Technology, Title to be announced.

Claudio Procesi, University of Roma, Title to be announced.

**Special Sessions**

Advances in Complex, Contact and Symplectic Geometry, Paolo De Bartolomeis, University of Firenze, Yakov Eliashberg, Stanford University, Gang Tian, MIT, and Giuseppe Tomassini, Scuola Normale Superiore, Pisa.

Advances in Differential Geometry of PDE's and Applications, Valentino Lychagin, University of Heights, Newark, and Agostino Prastaro, University of Roma, La Sapienza.

Algebraic Logic and Universal Algebra, Paolo Agliano, University of Siena, Keith A. Kearnes, University of Colorado, Franco Montagna, University of Siena, Don Pigozzi, Iowa State University, and Aldo Ursini, University of Siena.

Algebraic Vector Bundles, Vincenzo Ancona, University of Firenze, Mohan Kumar, Washington University, Giorgio Maria Ottaviani, University of Firenze, Christopher Peterson, Colorado State University, and Prabhakar Rao, University of Missouri.

Analytic Aspects of Convex Geometry, Stefano Campi, University of Modena, Richard Gardner, Western Washington University, Erwin Lutwak, Polytechnic University Brooklyn, and Aljosa Volbic, University of Trieste.

Classification Theory and Topology of Algebraic Varieties, Fabrizio Catanese, University of Goettingen, Janos Kollar, Princeton University, and Shing-Tung Yau, Harvard University.

Commutative Algebra and the Geometry of Projective Varieties, Ciro Ciliberto, University of Roma II, Anthony Geramita, University of Genova, Rick Miranda, Colorado State University, and Ferruccio Orecchia, University of Napoli.

Commutative Algebra: Hilbert Functions, Homological Methods and Combinatorial Aspects, Aldo Conca, University of Genova, Anna Guerri, University of L'Aquila, Claudia Polini, University of Oregon, and Bernd Ulrich, Michigan State University.
Meetings & Conferences

Mathematical Problems in Soft Matter Modelling, Eugene C. Gartland, Kent State University, and Epifanio Virga, University of Pavia.

Mathematical Problems in Transport Theory, Carlo Cercignani, Politecnico of Milano, and Irene Gamba, University of Texas.

Mathematical Schools: Italy and the United States at the Turn of the Twentieth Century, Umberto Bottazzini, University of Palermo, and Karen Hunger Parshall, University of Virginia.

Mathematics in Polymer Science, Antonio Fasano, University of Firenze, and Kumbakonam R. Rajagopal, Texas A&M University.

Microlocal Analysis and Applications to PDE, Daniele Del Santo, University of Trieste, M. K. Venkatesha Murthy, University of Pisa, and Daniel Tataru, Northwestern University.

Nonlinear Analysis, Antonio Ambrosetti, SISSA, Trieste, Vieri Benci, University of Pisa, Haim Brezis, Rutgers University, and Paul Rabino witz, University of Wisconsin.

Nonlinear Elliptic and Parabolic Equations and Systems, Gary Lieberman, Iowa State University, and Antonio Maugeri, University of Catania.

Nonstandard Methods and Applications in Mathematics, Alessandro Berarducci, University of Milano, and Ping Xu, University of Virginia.

Operator Algebras, Sergio Doplicher, University of Roma, La Sapienza, and Edward George Effros, University of California Los Angeles.

Optimization and Control, Roberto Triggiani, University of Virginia, and Tullio Zolezzi, University of Genova.

Partial Differential Equations of Mixed Elliptic-Hyperbolic Type and Applications, Daniela Lupo, Politecnico of Milano, Kathleen S. Morawetz, Courant Institute, and Kevin R. Payne, University of Milano.

Periodic Solutions of Differential and Difference Equations, Massimo Furi, University of Firenze, and Mario Umberto Martelli, Claremont McKenna College.

Poisson Geometry and Integrable Systems, Franco Magri, University of Milano, and Ping Xu, Pennsylvania State University.

Quantum Cohomology and Moduli Spaces, Angelo Vistoli, University of Bologna, and Aaron Bertram, University of Utah.

Scaling Limits and Homogenization Problems in Physics and Applied Sciences, Mario Pulvirenti, University of Roma, and George Papanicolaou, Stanford University.

Semigroups of Operators and Applications, Francesco Altomare, University of Bari, and Frank Neubrander, Louisiana State University.

Semigroups, Automata and Formal Languages, Alessandra Cherubini, Politecnico of Milano, and John Meakin, University of Nebraska-Lincoln.

Simulation via Quantum Computation, Thomas L. Clarke, University of Central Florida, Orlando, and Massimo Pica Ciamarra, University of Napoli.

Some Mathematics Around Composites, Robert V. Kohn, Courant Institute, and Vincenzo Nesi, University of Roma, La Sapienza.

Structured Matrix Analysis with Applications, Dario Andrea Bini, University of Pisa, and Thomas Kailath, Stanford University.

The Topology of 3-manifolds, Ricardo Benedetti and Carlo Petronio, University of Pisa, Dale Rolf sen, University of British Columbia, Vancouver, and Jeffrey Weeks, Canton, New York.

Variational Analysis and Applications, Franco Giannessi, University of Pisa, Boris S. Mordukhovich, Wayne State University, Detroit, Biagio Ricceri, University of Catania, and R. Tyrrell Rockafellar, University of Washington.

Viscosity Methods in PDE's and Applications, Piermarco Cannarsa, University of Roma II, Italo Capuzzo Dolcetta, University of Roma, La Sapienza, and Panagiotis Souganidis, University of Texas, Austin.

White Noise Theory and Quantum Probability, Luigi Accardi, University of Roma, Tor Vergata, and Hui-Hsiung Kuo, Louisiana State University.

Portland, Oregon

Portland State University

June 20-22, 2002

Meeting #978

Meeting held in conjunction with the Pacific Northwest Section of the Mathematical Association of America.

Western Section

Associate secretary: Bernard Russo

Announcement issue of Notices: April 2002

Program first available on AMS website: May 9, 2002

Program issue of electronic Notices: August 2002

Issue of Abstracts: Volume 23, Issue 2

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: March 5, 2002

For abstracts: April 30, 2002

Special Sessions

Algebraic Geometry and Combinatorics (Code: AMS SS B1), Eric Babson and Rekha Thomas, University of Washington, and Sergey Yuzvinsky, University of Oregon.

Boston, Massachusetts
Northeastern University
October 5–6, 2002

Meeting #979
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 2002
Program first available on AMS website: August 22, 2002
Program issue of electronic Notices: December 2002
Issue of Abstracts: Volume 23, Issue 4

Deadlines
For organizers: March 6, 2002
For consideration of contributed papers in Special Sessions:
  June 18, 2002
For abstracts: August 13, 2002

Invited Addresses
Lou P. van den Dries, University of Illinois, Urbana-Champaign, Title to be announced.
Diane Henderson, Pennsylvania State University, Title to be announced.
Christopher K. King, Northeastern University, Title to be announced.
Xiaobo Liu, University of Notre Dame, Title to be announced.

Special Sessions
Ergodic Theory and Dynamical Systems (Code: AMS SS B1), Stanley J. Eigen, Northeastern University, and Vidhu S. Prasad, University of Massachusetts, Lowell.
Modern Schubert Calculus (Code: AMS SS A1), Frank Sottile, University of Massachusetts, Amherst, and Christopher T. Woodward, Rutgers University.

Madison, Wisconsin
University of Wisconsin-Madison
October 12–13, 2002

Meeting #980
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: August 2002
Program first available on AMS website: August 29, 2002
Program issue of electronic Notices: December 2002

Deadlines
For organizers: March 12, 2002
For consideration of contributed papers in Special Sessions:
  June 25, 2002
For abstracts: August 20, 2002

Invited Addresses
Lawrence Ein, University of Illinois at Chicago, Title to be announced.
Eleny Ionel, University of Wisconsin, Title to be announced.
Mikhail Safonov, University of Minnesota, Title to be announced.
John Sullivan, University of Illinois, Urbana-Champaign, Title to be announced.

Special Sessions
Arithmetic Algebraic Geometry (Code: AMS SS A1), Ken Ono and Tonghai Yang, University of Wisconsin-Madison.
Arrangements of Hyperplanes (Code: AMS SS E1), Daniel C. Cohen, Louisiana State University, Peter Orlik, University of Wisconsin-Madison, and Anne Shepler, University of California, Santa Cruz.
Biological Computation and Learning in Intelligent Systems (Code: AMS SS S1), Shun-ichi Amari, RIKEN, Amir Asadi, University of Wisconsin-Madison, and Tomaso Poggio, Massachusetts Institute of Technology.
Combinatorics and Special Functions (Code: AMS SS T1), Richard Askey and Paul Terwilliger, University of Wisconsin-Madison.
Dynamical Systems (Code: AMS SS P1), Sergey Bolotin and Paul Rabinowitz, University of Wisconsin-Madison.
Effectiveness Questions in Model Theory (Code: AMS SS J1), Charles McCoy, Reed Solomon, and Patrick Speissegger, University of Wisconsin-Madison.
Geometric Methods in Differential Equations (Code: AMS SS H1), Gloria Mari Beffa, University of Wisconsin-Madison, and Peter Olver, University of Minnesota.
Geophysical Waves and Turbulence (Code: AMS SS M1), Paul Milewski, Leslie Smith, and Fabian Waleffe, University of Wisconsin-Madison.
Group Cohomology and Homotopy Theory (Code: AMS SS G1), Alejandro Adem, University of Wisconsin-Madison, and Jesper Grodal, Institute for Advanced Study.
Harmonic Analysis (Code: AMS SS C1), Alex Ionescu and Andreas Seeger, University of Wisconsin-Madison.
Lie Algebras and Related Topics (Code: AMS SS N1), Georgia Benkart and Arun Ram, University of Wisconsin-Madison.
Multiresolution Analysis and Data Presentation (Code: AMS SS F1), Amos Ron, University of Wisconsin-Madison.
Meetings & Conferences

Partial Differential Equations and Geometry (Code: AMS SS D1), Sigurd Angenent and Mikhail Feldman, University of Wisconsin-Madison.

Probability (Code: AMS SS R1), David Griffeath, University of Wisconsin-Madison, and Timo Seppalainen, Iowa State University.

Ring Theory and Related Topics (Code: AMS SS L1), Don Passman, University of Wisconsin-Madison.

Several Complex Variables (Code: AMS SS B1), Pat Ahern, Xianghong Gong, Alex Nagel, and Jean-Pierre Rosay, University of Wisconsin-Madison.

Salt Lake City, Utah
University of Utah

October 26-27, 2002

Meeting #981
Western Section
Associate secretary: Bernard Russo
Announcement issue of Notices: September 2002
Program first available on AMS website: September 16, 2002
Program issue of electronic Notices: January 2003
Issue of Abstracts: Volume 23, Issue 4

Deadlines
For organizers: March 26, 2002
For consideration of contributed papers in Special Sessions: July 10, 2002
For abstracts: September 4, 2002

Orlando, Florida
University of Central Florida

November 9-10, 2002

Meeting #982
Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of Notices: September 2002
Program first available on AMS website: September 26, 2002
Program issue of electronic Notices: January 2003
Issue of Abstracts: Volume 23, Issue 4

Deadlines
For organizers: April 10, 2002
For consideration of contributed papers in Special Sessions: July 23, 2002
For abstracts: September 17, 2002

Baltimore, Maryland
Baltimore Convention Center

January 15-18, 2003

Joint Mathematics Meetings, including the 109th Annual Meeting of the AMS, 86th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).

Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: April 15, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Baton Rouge, Louisiana
Louisiana State University

March 14-16, 2003

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: August 14, 2002
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Bloomington, Indiana
Indiana University

April 4-6, 2003

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced
Deadlines
For organizers: September 4, 2002
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

Seville, Spain
June 18–21, 2003
First Joint International Meeting between the AMS and the Real Sociedad Matematica Española (RSME).
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: May 15, 2002
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

Special Sessions
Nonlinear Dispersive Equations (Code: AMS SS A1), Gustavo Ponce, University of California, Santa Barbara, and Luis Vega, Universidad del Pais Vascos.

Binghamton, New York
SUNY-Binghamton
October 10–12, 2003
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: March 10, 2003
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

Phoenix, Arizona
Phoenix Civic Plaza
January 7–10, 2004
Associate secretary: Bernard Russo
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced

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

Deadlines
For organizers: April 2, 2003
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Athens, Ohio
Ohio University
March 26–27, 2004
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: August 26, 2003
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

Atlanta, Georgia
Atlanta Marriott Marquis and Hyatt Regency Atlanta
January 5–8, 2005
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: April 5, 2004
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced
Program of the Sessions
San Diego, California, January 6-9, 2002

Friday, January 4

AMS Short Course on Symbolic Dynamics
9:00 AM - 4:30 PM
Organizer: Susan G. Williams, University of South Alabama
7:30 AM Registration
9:00 AM Introduction to Symbolic Dynamics.
   (1) Susan Williams, University of South Alabama
10:15 AM Break
10:45 AM Combining Modulation Codes and Error-Correction Codes.
   Brian Marcus, IBM Almaden Research Center
2:00 PM Complex Dynamics and Symbolic Dynamics.
   (3) Robert L. Devaney, Boston University
3:15 PM Break
3:45 PM Discussion

MAA Short Course on A Sampler of Applications of Graph Theory
9:00 AM - 5:15 PM
Organizer: Fred S. Roberts, Rutgers University
7:30 AM Registration.
9:00 AM Graph theory and social networks.
   (4) Fred S. Roberts, Rutgers University
11:00 AM Applications to statistical physics.
   (5) Peter Winkler, Bell Labs
2:15 PM Applications of graph theory to molecular biology.
   (6) R. Ravi, Carnegie Mellon University
4:00 PM Graphs in the theory of location of facilities.
   (7) K. Brooks Reid, California State University, San Marcos

Saturday, January 5

MAA Minicourse #1: Part A
8:00 AM - 10:00 AM
Using interactive labs to explore abstract algebra topics.
Organizers: Allen C. Hibbard, Central College
Kenneth M. Levasseur, University of Massachusetts, Lowell

MAA Board of Governors
8:30 AM - 4:00 PM

AMS Short Course on Symbolic Dynamics
9:00 AM - 4:45 PM
Organizer: Susan G. Williams, University of South Alabama
9:00 AM Multi-Dimensional Symbolic Dynamics.
   (8) Douglas L. Lind, University of Washington
10:15 AM Break
10:45 AM Symbolic Dynamics and Tilings of R^d.
   (9) E. Arthur Robinson, George Washington University
2:00 PM Strong shift Equivalence and Positive Algebraic K-Theory.
   (10) J. B. Wagoner, University of California, Berkeley
3:15 PM Break
3:45 PM Discussion

MAA Short Course on A Sampler of Applications of Graph Theory
9:00 AM - 3:15 PM
Organizer: Fred S. Roberts, Rutgers University
9:00 AM Graph structure on the World Wide Web.
   (11) Sridhar Rajagopalan, IBM Almaden
11:00 AM Applications to network visualization.
   (12) Nathaniel Dean, Rice University

The time limit for each AMS contributed paper in the sessions is ten minutes. The time limit for each MAA contributed paper varies. 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. 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 23, Issue 1 of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.
A sampler of applications of Graph Theory.
(Fred S. Roberts, Rutgers University)

MAA Minicourse #2: Part A
10:30 AM - 12:30 PM
Mathematical algorithms, models, and graphic representations using spreadsheets.
Organizers: Robert S. Smith, Miami University
Deane E. Arganbright, University of Tennessee at Martin
Erich Neuwirth, University of Vienna

MAA Minicourse #1: Part A
1:00 PM - 3:00 PM
Using interactive labs to explore abstract algebra topics.
Organizers: Allen C. Hibbard, Central College
Kenneth M. Levasseur, University of Massachusetts, Lowell

AMS Council
1:00 PM - 10:00 PM

Joint Meetings Registration
3:00 PM - 7:00 PM

MAA Minicourse #2: Part A
3:30 PM - 5:30 PM
Mathematical algorithms, models, and graphic representations using spreadsheets.
Organizers: Robert S. Smith, Miami University
Deane E. Arganbright, University of Tennessee at Martin
Erich Neuwirth, University of Vienna

Sunday, January 6
Ecumenical Christian Worship Service
7:00 AM - 7:45 AM

Joint Meetings Registration
7:30 AM - 4:00 PM

Employment Center
7:30 AM - 6:00 PM
Registration, orientation, and interview center (see article for specific hours)

AMS-MAA-MER Special Session on Mathematics and Education Reform, I
8:00 AM - 10:20 AM
Organizers: William H. Barker, Bowdoin College
Jerry L. Bona, University of Texas at Austin
Naomi D. Fisher, University of Illinois at Chicago

AMS Special Session on Symbolic Dynamics, I
8:00 AM - 10:50 AM
Organizers: Aimee S. A. Johnson, Swarthmore College
Kathleen M. Madden, Drew University

San Diego, CA, Sunday, January 6 – Program of the Sessions
AMS Special Session on Combinatorial and Algebraic Geometry, I

8:00 AM – 10:50 AM

Organizers: Paul C. Roberts, University of Utah
Anurag K. Singh, University of Utah

8:00 AM
Remarks on bounding local cohomology of Frobenius powers of ideals. Preliminary report.
Ian M. Aberbach, University of Missouri (973-13-1342)

8:30 AM
Frobenius action on local cohomology modules. Preliminary report.
Florian Enescu, University of Utah (973-13-1119)

9:00 AM
Tight closure and linkage classes in Gorenstein rings.
Adela N. Vraciu, University of Kansas (973-13-690)

9:30 AM
p-fractals and ideal classes. Preliminary report.
Paul Monsky, Brandeis University (973-13-686)

10:00 AM
Kawamata's Effective Non-Vanishing Conjecture and the Core of an Ideal. Preliminary report.
Eero Hyry, Helsinki University, and Karen E. Smith*, University of Michigan (973-14-1402)

10:30 AM
Limit Hilbert-Kunz Multiplicities.
Claudia Miller*, University of Toronto, and Anurag K Singh, University of Utah (973-13-1356)

AMS Special Session on Computability Theory with Applications, I

8:00 AM – 10:50 AM

Organizers: Douglas Cenzer, University of Florida
Jeffrey B. Remmel, University of California San Diego

8:00 AM
Invariance and Noninvariance in the Lattice of \(\Pi^0_1\) Classes.
Peter A Cholak, University of Notre Dame, and Rod G Downey*, Victoria University, NZ (973-03-945)

8:30 AM
A Decision Procedure for the AE-theory of the Lattice of \(\Pi^0_1\) Classes.
Linda Lawton, Western Illinois University (973-03-1208)

9:00 AM
Definability and structural properties for the lattice of \(\Pi^0_2\)-classes.
André Nies, University of Chicago (973-03-1385)

9:30 AM
The Lattice of \(\Pi^0_1\) Classes. Preliminary report.
Douglas Cenzer, University of Florida, and Farzan Riaziati*, Savannah College of Art and Design (973-03-742)

10:00 AM
Medeved degrees of \(\Pi^0_1\) classes are dense.
Douglas A Cenzer, University of Florida, and Peter G Hinman*, University of Michigan (973-03-821)

10:30 AM
Computability of the Common Derivation in Locally Determined Logic Programs. Preliminary report.
Amy K. C. S. Vanderbilt, Xavier University (973-03-929)

AMS Special Session on Fractal Geometry and Applications: A Jubilee of Benoît Mandelbrot, I

8:00 AM – 10:50 AM

Organizers: Michel L. Lapidus, University of California Riverside
Machiels Van Frankenhuysen, Rutgers University

8:00 AM
The wavelet formalism for multifractal analysis. Preliminary report.
Jesús Utrías* and Salomé J Murguía, IICO-UASLP (973-37-1154)

8:30 AM
Multifractal products of poissonian random weights.
Julien Barral, I.N.R.I.A. (973-60-1480)

9:00 AM
Directional entropy and complexity in lattice dynamical systems. Preliminary report.
Valentin S Afraimovich, IICO-UASLP (973-37-1140)

9:30 AM
Multifractal Rigidity: More Questions Than Answers.
Yakov B Pesin, Pennsylvania State University (973-37-1239)

10:00 AM
Graph Directed Markovian Systems.
Daniel R Mauldin* and Mariusz Urbanski, University of North Texas (973-37-1133)

10:30 AM
The role of the Mandelbrot set in complex dynamics.
Mitsushiro Shishikura, Kyoto University (973-37-1273)

AMS Special Session on Graph Theory, I

8:00 AM – 10:50 AM

Organizers: André Kundgen, California State University, San Marcos
K. Brooks Reid, California State University, San Marcos

8:00 AM
The Relaxed Game Chromatic Number of Graphs.
Charles Dunn and H. A. Kierstead*, Arizona State University (973-05-1194)

8:30 AM
The Relaxed Game Chromatic Index of k-degenerate Graphs. Preliminary report.
Charles L. Dunn, Arizona State University (973-05-175)

9:00 AM
Splittable colorings.
Radhika Ramamurthi*, University of California at San Diego, Zoltan Furedi, University of Illinois / Renyi Institute, and André Kundgen, California State University at San Marcos (973-05-1057)

9:30 AM
On Anti-Ramsey numbers of graphs.
Maria Axenovich, Iowa State University (973-05-892)

10:00 AM
Constrained Ramsey numbers of graphs.
Tao Jiang, Miami University (Ohio) (973-05-859)

10:30 AM
Pattern Ramsey Numbers.
Robert E Jamison, Clemson University, and Douglas B West*, University of Illinois (973-05-1236)

AMS Special Session on Low Dimensional Topology, I

8:00 AM – 10:50 AM

Organizer: Tim D. Cochran, Rice University
San Diego, CA, Sunday, January 6 - Program of the Sessions

8:00AM - 10:00AM

MAA Minicourse #13: Part A
Getting students involved in undergraduate research.
Organizers: Aparna W. Higgins, University of Dayton
Joseph A. Gallian, University of Minnesota, Duluth
Stephen G. Hartke, Rutgers University

MAA Minicourse #9: Part A
The Fibonacci and Catalan numbers.
Organizer: Ralph P. Grimaldi, Rose-Hulman Institute of Technology

AMS Session on Lattice Theory
8:00AM - 10:55AM

8:00AM Lattice Homomorphisms and Convex Partitions.
(54) Preliminary report.
Scott R Sykes, University of West Georgia (973-06-1344)
8:15AM The use of lattices as vector quantizers for still image coding applications. Preliminary report.
Joan Serra-Sagrista, Universitat Autonoma Barcelona (973-06-141)
8:30AM On the Enumeration of Equivalent Lattice Paths.
(62) Rick Gillman, Valparaiso University (973-06-125)
8:45AM Commutative Cancellative Residuated Lattices.
(66) Preliminary report.
James A Cole, Vanderbilt University (973-06-1453)
9:00AM Partitioning the Boolean lattice into a minimal number of chains of relatively uniform size. Preliminary report.
Tim Hsu, San Jose State University, Mark J Logan*, Shahriar Shahriari, Pomona College, and Christopher Towsse, Scripps College (973-06-1329)
9:15AM Lattice Geometry and Linear Code Constructions.
(65) Marcus Greferath, San Diego State University (973-05-1261)

9:30AM Posets and totally nonnegative matrices.
(66) Preliminary report.
Mark Skandera, University of Michigan (973-06-1169)
9:45AM The type-set of a variety is not computable.
(67) Ralph McKenzie, Vanderbilt University, and Japheth Wood*, University of Louisville (973-06-1108)
10:00AM Extension theory for infinite lattices. Preliminary report.
George Grätzer* and Matthew Greenberg, University of Manitoba (973-06-687)
(69) Jie Fang*, University of Los Andes, and Tom S Blyth, University of St. Andrews (973-06-209)
10:30AM How small posets and algebras on the web produced uncountably many minimal varieties of residuated lattices. Preliminary report.
Peter Jipsen, Vanderbilt University (973-06-165)
10:45AM Connections between Formal Concept Analysis and Classification Theory.
Lance Miller, Alex J Pogel* and Stefan E Schmidt, NMSU (973-94-160)

SIAM Minisymposium on Modeling and Simulation for Thin Films
8:00AM - 10:50AM
Organizer: Russel Caflisch, University of California Los Angeles
8:00AM Connecting Ab Initio and Kinetic Models: Simulation of the Equilibrium and Growth Kinetics of III-V Semiconductor Surfaces.
Mark F Gyure and Frank Grosse*, HRL Laboratories (973-82-1486)
8:35AM Kinetic Monte-Carlo simulations and approximations.
(73) Tim P Schulze, University of Tennessee (973-82-1474)
(74) Cameron R Connell* and Russel E Caflisch, UCLA (973-74-1478)
9:45AM Morphological stability of strained alloy film growth.
(75) Brian J Spencer, University at Buffalo (973-74-1476)
10:20AM Feedback Control of Plasma Etching of Silicon Nitride Thin Films.
L G Rosen*, Department of Mathematics/University of Southern California, and Baris Fidan, Department of EE-Systems/University of Southern California (973-93-1484)

AMS Session on History of Mathematics in the Second Millennium, I
8:00AM - 10:55AM
Organizers: Janet L. Beery, University of Redlands
C. Edward Sandifer, Western Connecticut State University
8:00AM Welcome.
8:05AM Euler and the Greatest Homework Ever?
(77) Edward Sandifer, Western Connecticut State U (973-A1-468)
8:30AM The Quadrature of Lunes, from Hippocrates to Euler. Preliminary report.
(78) Stacy G Langton, University of San Diego (973-A1-551)
8:00AM-10:55 AM Program of the Sessions - K-12, I

8:00AM (79) Johan Huyde's "Epistola secunda de maximis et minimis": Maxima and minima, including an early version of the quotient rule, before Newton and Leibniz.
Daniel J Curtin, Northern Kentucky University (973-A1-724)

9:20AM (80) Three Examples of Mathematical Reasoning from the Printed Works of Mexico in the Sixteenth and Seventeenth Centuries. Preliminary report.
Bruce S. Burdick, Roger Williams University (973-A1-609)


10:10AM (82) Views of the real numbers and continuum. Preliminary report.
Joanne E Snow, Saint Mary's College (973-A1-864)

MAA Session on Mathematics Courses for Teachers, K-12, I

8:00AM - 10:55 AM

Organizers: Ira J. Papick, University of Missouri, Columbia
Duane Porter, University of Wyoming
Diane M. Spresser, National Science Foundation

8:00AM (84) Improving Mathematical Content Knowledge for the Elementary or Alternatively Certified Middle School Teacher.
Linda K Griffith*, University of Central Arkansas, and Jean J McGehee, University of Central Arkansas (973-B1-494)

8:20AM (85) Math ADEPT: A Program for Middle School Inservice Teachers. Preliminary report.
Homer W Austin* and Harel Barzilai, Salisbury University (973-B1-305)

8:40AM (86) Middle Grades Teachers Revisit Geometry.
Judy S. O'Neal, North GA College & State University (973-B1-48)

9:00AM (87) Recruiting and Preparing Middle Grades Teachers. Preliminary report.
David C. Carothers* and Jeanne Fitzgerald, James Madison University (973-B1-717)

9:20AM (88) Professional Development Program for Strengthening Middle School Teacher Content Knowledge that Utilizes the Mathematics Textbook Series from Singapore.
Richard Bisk, Worcester State College (973-B1-557)

9:40AM (89) Geometric Visualization in Problem Solving by Teachers of Grades 4-8: A Middle School/University Joint Project.
Jeanne Fitzgerald* and Judy B Kidd, James Madison University (973-B1-507)

10:00AM (90) Teaching Middle School Math in College: The Connected Mathematics Project as a College Curriculum for Teachers. Preliminary report.
Susan L Addington* and David Dennis, University of Texas, El Paso (973-B1-620)

10:20AM (91) Connecting with Mathematics: Content materials for inservice and preservice teachers connecting the mathematics they learn with the mathematics they teach.
Steve R Benson, Education Development Center (973-B1-527)

John K Beem* and Ira J Papick, University of Missouri-Columbia (973-B1-123)

MAA Session on Integrating Mathematics and Other Disciplines, I

8:00AM - 10:55 AM

Organizers: William G. McCallum, University of Arizona, Tucson
Deborah Hughes Hallett, University of Arizona, Tucson
Yajun Yang, SUNY at Farmingdale

8:00AM (93) Mathematics for Health Sciences: An Interdisciplinary Prescription for Student Success.
Fred Peskoff, Borough of Manhattan Community College/CUNY (973-C1-626)

8:15AM (94) An Introductory Modeling Course on Sustainability.
Fusun Akman, Coastal Carolina University (973-C1-646)

8:30AM (95) Teaching an Interdisciplinary Math & Biology course. Preliminary report.
Janet L Andersen, Hope College (973-C1-1143)

8:45AM (96) Biology applications for an applied calculus course.
Raymond N Greenwell*, Hofstra University, and Nathan P Ritchey, Youngstown State University (973-C1-71)

9:00AM (97) Mathematics and Mendelian Genetics.
Steven E Blasberg, West Valley College (973-C1-579)

9:15AM (98) What should we teach in the course "Discrete Mathematical Structures"? Preliminary report.
Niandong Shi, East Stroudsburg University of Pennsylvania (973-C1-581)

Ignatios E Vakalis, Capital University (973-C1-338)

9:45AM (100) ICF - The Integrated Curriculum in Engineering Part I Applications from Physics and Engineering in the Calculus.
John R Watret*, Charles J Martin, James Ladesic and Robert Brown, Embry-Riddle University (973-C1-532)

Bernd S.W. Schroeder, Louisiana Tech University (973-C1-97)

10:15AM (102) Combining Java Programming and Differential Equations.
Garrett D Heath, U.S. Military Academy (973-C1-1460)

10:30AM (103) Linear Algebra and Digital Image Processing.
Mohamed Allali, Chapman University (973-C1-528)

Richard D West, Francis Marion University (973-C1-439)
MAA Session on Innovative Uses of the World Wide Web in Teaching Mathematics, I

8:00 AM - 10:55 AM

Organizers: Marcelle Bessman, Jacksonville University
Marcia Birken, Rochester Institute of Technology
Lawrence S. Husch, University of Tennessee, Knoxville
Brian E. Smith, McGill University

8:00AM Calculus on the Web and Online Mathematics
► (105) Courses.
Dan Reich, Temple University (973-D1-560)

Dan Reich, Temple University (973-D1-560)

8:40AM Developing Effective Course Web Pages for Undergraduate Mathematics Courses For Non-Majors.
Cathy M Frey* and Gerard T LaVarnway, Norwich University (973-D1-274)

9:00AM Web-based, problem-solving tutorials as part of a structured study program for calculus.
Al Shenk, UCSD (973-D1-444)

9:20AM Writing Mathlets: A Call To Math Professionals.
Thomas E Leathrum, Jacksonville State University (973-D1-580)

9:40AM Using JAVA Applets to Teach Probability, Geometry, Function and Number Concepts.
Holly P Hirst, Appalachian State University (973-D1-402)

10:00AM Integrated and interactive web based modules for multivariable calculus.
Revathi Narasimhan, Kean University (973-D1-312)

10:20AM An Online Multivariable Calculus Textbook.
Jeff R Knisley, East Tennessee State University (973-D1-451)

Preliminary report.
Garrett D Heath, United States Military Academy (973-D1-572)

MAA Session on General Contributed Papers, I

8:00 AM - 10:55 AM

Organizers: Shawnee L McMurrin, California State University, San Bernardino
Laura Wallace, California State University, San Bernardino
Sarah L Mabrouk, Framingham State College

8:00AM The use of Poster Sessions in Liberal Arts Mathematics (and other) Courses. Preliminary report.
Edwin P Herman, University of St. Thomas (973-T1-587)

8:20AM Using Journals in a Liberal Arts Mathematics Class.
Mark A Mills, Central College (973-T1-435)

8:40AM Dances with Ncate or How I learned to Stop Worrying and Love the Rubric.
David E. Boliver, University of Central Oklahoma (973-T1-475)

9:00AM Opening the Classroom Door - Experiences in Distance Learning.
Mary Ellen Davis and Virginia W Parks*, Georgia Perimeter College (973-T1-481)

9:20AM Integrated Calculus: Combining calculus, precalculus, and algebra in one course to effectively train math and science majors. Preliminary report.
Laura A Taalman, James Madison University (973-T1-277)

Kendra S Kilemitch, Anamaria Dent, Colorado State University, and Julia Walters, Diablo Valley College (973-T1-710)

10:00AM Elliptic Curve Cryptography with Maple and Java (Preliminary Report). Preliminary report.
Richard E Klima, State University of New York at Oswego (973-T1-421)

10:20AM Reflecting Projectiles: Constructing a "Mirror" for a Bouncing Ball.
Darryl K Nester, Bluffton College (973-T1-453)

10:40AM A Meta-Analysis of the Effects of Calculators on Students in Precalculus Mathematics Classes.
Aimee J Ellington, Virginia Commonwealth University (973-T1-394)

AMS Special Session on Chaos, Stability, and Asymptotics in Difference Equations, I

8:30 AM - 10:50 AM

Organizers: Saber N. Elaydi, Trinity University
Gerasimos Ladas, University of Rhode Island
Donald A. Lutz, San Diego State University

8:30AM On the Global Character of
y(n+1)=(py(n-1)+y(n-2k))/q+y(n-2k)) where p and q are positive real numbers and k is a non-negative integer.
Edward A Grove, Gerasimos Ladas, Michela Predescu, University of Rhode Island, and Michael A Radin*, Rochester Institute of Technology (973-39-184)

9:00AM On the recursive sequence x(n+1)=p+x(n-k)/x(n).
Witold A Kosmala*, Appalachian State University, Richard DeVault, Northwestern State University, and Candace M Kent, Virginia Commonwealth University (973-39-93)

9:30AM Asymptotic behavior of solutions of x(n+1) = p + \frac{x(n-k)}{x(n)}.
Preliminary report.
Richard DeVault*, Northwestern State University of LA, and Elias Camouzis, American College of Greece (973-39-51)

10:00AM Effects of education or/and vaccination or/and treatment on HIV transmission in homosexuals with genetic heterogeneity.
Sara Y Del Valle*, Arlene Evangelista and Maria Cristina Velasco-Narvaez, MTBI Cornell University (973-92-1489)

10:30AM A Reduction Principle of Difference Equations.
Preliminary report.
Zhivko S Athanassov, Institute of Mathematics, Bulgarian Academy of Sciences (973-39-916)

AMS Special Session on Nonlinear Elliptic Partial Differential Equations, I

8:30 AM - 10:40 AM

Organizers: Maya Chhetri, University of North Carolina at Greensboro
Program of the Sessions – San Diego, CA, Sunday, January 6 (cont’d.)

AMS Session on History and Logic

8:30 AM – 10:40 AM

8:30 AM Kashani’s fundamental theorem. Preliminary report.
→ (136) Mohammad K Azarian, University of Evansville (973-01-36)

8:45 AM The Historical Perspective on Mathematics as Art and/or Science. Preliminary report.
→ (137) G. Arthur Mihran*, Princeton, NJ, and Danielle Mihram, University of Southern California (973-01-137)

9:00 AM Ulughbek: the great mathematician and astronomer of the XVth century. Preliminary report.
→ (138) Burkhan I Ochilov, Samarkand Agricultural Institute (973-01-392)

9:15 AM Poincare’s Role in the Creation of the Theory of Functions of Several Complex Variables. Preliminary report.
→ (139) John A Synowiec, Indiana University Northwest (973-01-831)

9:30 AM Cyclic Distribution: Voter’s Paradox in 3-valued Logic.
→ (140) Nathaniel S Hellerstein, City College of San Francisco (973-03-961)

9:45 AM Cardinal arithmetic and embedding subgroups into 2^ω. Preliminary report.
→ (141) Moses G Klein, Lawrence University (973-03-985)

10:00 AM Classifying the complexity of homeomorphisms of the circle up to conjugacy. Preliminary report.
→ (142) Patrick W Friel, UCLA (973-03-1411)

10:15 AM Break.

→ (143) More Undecidable Lattices of Steinitz Exchange Systems.
→ (144) Lisa R Galminas*, Northwestern State University of LA, and John W Rosenthal, Ithaca College (973-03-1414)

10:30 AM On the Storage Capacity of Fuzzy Bidirectional Associate Memories. Preliminary report.
→ (145) Zhong L Xu, University of Texas at Brownsville (973-03-976)

AMS Session on Number Theory, I

8:30 AM – 10:55 AM

8:30 AM Congruence Restricted Modular Forms.
→ (145) Kurt E Ludwick, Salisbury University (973-11-431)

8:45 AM On the Solitary Galois Extensions of Algebraic Number Fields. Preliminary report.
→ (146) Leonid Stern, Towson University (973-11-443)

→ (147) John H. Jr, Lake Superior State University (973-11-668)

9:15 AM A generalized abc-conjecture over function fields.
→ (148) Pei-chu Hu, Shandong University, and Chung-chun Yau*, The Hong Kong Unv. of Sci.&Tech. (973-11-788)

9:30 AM On S^1,eq Sets.
→ (149) Megan M Foster* and Akliu Zelke, Alma College (973-11-873)

→ (150) Jonathan Bigler* and Lenny Jones, Shippensburg University (973-11-919)

10:00 AM Maximum LCM Partitions: Part II. Preliminary report.
→ (151) Tim Ferguson*, Linnegagee High School, and Lenney Jones, Shippensburg University (973-11-934)

10:15 AM Additive and Multiplicative 4x4 Magic Squares.
→ (152) Preliminary report.
→ (153) Carl A Libis, Assumption College (973-11-964)

10:30 AM Annihilating Theorems in the Witt Ring. Preliminary report.
→ (154) Thomas C Palfrey, Xavier University of Louisiana (973-11-419)

10:45 AM A new proof of an identity concerning Ramanujan’s tau function.
→ (155) Neville Robbins, San Francisco State University (973-11-363)

SIAM Minisymposium on Optimization for Modeling and Simulation: Theory Versus Practice

8:30 AM – 10:55 AM

Organizers: Juan C. Meza, Sandia National Laboratories
Tammy Kolda, Sandia National Laboratories

AMS Special Session on Quantum Computation and Information, I

8:30 AM – 10:50 AM

Organizers: Philip L. Bowers, Florida State University
Washington Mio, Florida State University
John Preskill, California Institute of Technology

8:30 AM Quantum information, dynamics, and quantum phase transitions.
→ (131) Michael A Nielsen, University of Queensland (973-81-426)

9:00 AM Entanglement of two, three and four qubits.
→ (132) Guifre Vidal, University of Innsbruck, Austria (973-81-1271)

9:30 AM Quantum Data Hiding.
→ (133) David P. DiVincenzo*, Debbie Leung and Barbara M Terhal, IBM (973-81-415)

10:00 AM Tentative title: The nonabelian hidden subgroup problem.
→ (134) Leonard J Schulman, Caltech (973-66-1445)

→ (135) Wim van Dam*, UC Berkeley / MSRI / Hewlett-Packard, Sean Hallgren, Caltech, and Lawrence Ip, UC Berkeley (973-68-1431)

AMS Session on History and Logic

8:30 AM – 10:40 AM

AMS Session on Number Theory, I

8:30 AM – 10:55 AM

AMS Special Session on Quantum Computation and Information, I

8:30 AM – 10:50 AM

AMS Session on History and Logic

8:30 AM – 10:40 AM
8:30 AM  Some Optimization Challenges in the Oil and Gas Industry.  
Amr S El-Bakry, ExxonMobil Upstream Research Company (973-49-1193)

9:00 AM  A Comparison of Interior Point and SQP Methods on Optimal Control Problems.  
Joerg M Gablonsky* and John T Betts, The Boeing Company (973-65-1213)

9:30 AM  Lagrange-Newton-Krylov Methods and Applications to the Optimal Control of Navier-Stokes equations.  
George Biros*, Courant Institute, and Omar Ghattas, Carnegie Mellon University (973-49-1158)

10:00 AM  Minimization Techniques in Computational Molecular Biology.  
Leticia Velazquez, University of Texas at El Paso (973-49-467)

10:30 AM  Choosing Effective Search Strategies for Parallel Optimization Methods.  
Juan Meza* and Patricia Hough, Sandia National Laboratories (973-65-1204)

AMS Special Session on Analysis and Application of Quasilinear Partial Differential Equations, I

9:00 AM - 10:50 AM
Organizers: Sunčica Čanić, University of Houston  
Eun Heui Kim, California State University, Long Beach

9:00 AM  Nonlocal problems for quasilinear parabolic equations.  
Gary M. Lieberman, Iowa State University (973-35-841)

9:30 AM  Transonic Shocks for Steady Potential Flows and Free Boundary Problems I.  
Gui-Qiang G Chen*, Northwestern University, and Mikhail Feldman, University of Wisconsin at Madison (973-35-1234)

10:00 AM  Transonic shocks for steady potential flows and free boundary problems II.  
Gui-Qiang Chen, Northwestern University, and Mikhail Feldman*, University of Wisconsin-Madison (973-35-357)

10:30 AM  Subsonic solutions for the pressure-gradient equation. Preliminary report.  
Kyungwoo Song, Indiana University, and Yuxi Zheng*, Penn State University (973-35-1341)

MAA Minicourse #3: Part A

9:00 AM - 11:00 AM
Optimal use of technology in teaching geometry at the college-university level.  
Organizers: Subhash C. Saxena, Coastal Carolina University  
Nick Jackiw, Key Curriculum Press

MAA Panel Discussion

9:00 AM - 10:30 AM  
AP calculus: Bridges and bumps between school and college.  
Organizers: Judith E. Broadwin, The College Board  
Susan Kornstein, The College Board  
Panelists: Ray Cannon, Baylor University  
Thomas P. Dick, Oregon State University  
Bernard L. Madison, MAA

Lawrence H. Riddle, Agnes Scott College  
Jane L. Wortman, Beverly Hills High School  
Judith E. Broadwin  
Susan Kornstein

MAA Committee on Two-Year Colleges Panel Discussion

9:00 AM - 10:30 AM  
Teaching at two-year colleges: Rewards, research, resources, and recommendations.  
Organizers: Jay A. Malmstrom, Oklahoma City Community College  
Janet P. Ray, Seattle Central Community College  
Moderator: Jay A. Malmstrom  
Panelists: Susan S. Wood, J. Sargeant Reynolds Community College  
Curtis C. McKnight, University of Oklahoma  
Sandy Gokey, Greenfield Community College  
Stephen B. Rodi, Austin Community College

MAA Committee on the Undergraduate Program in Mathematics Panel Discussion

9:00 AM - 10:30 AM  
A new CUPM curriculum guide.  
Organizer: Harriet S. Pollatsek, Mount Holyoke College

AMS Retiring Presidential Address

10:05 AM - 10:55 AM  
Reflections on the future of mathematics.  
Felix E. Browder, Rutgers University (973-00-09)

AMS-MAA Invited Address

11:10 AM - NOON  
Helicity of vector fields in geometry, biology, and plasma physics.  
Dennis DeTurck*, University of Pennsylvania  
Jason Cantarella, University of Georgia, and Herman Gluck, University of Pennsylvania (973-53-13)

Book Sales and Exhibits

NOON - 5:30 PM

AMS Colloquium Lectures: Lecture I

1:00 PM - 2:00 PM  
Lawrence Craig Evans, University of California Berkeley (973-35-03)
AMS Special Session on Symbolic Dynamics, II

2:15 PM - 5:35 PM

Organizers: Aimee S. A. Johnson, Swarthmore College

Kathleen M. Madden, Drew University


Arthur Robinson*, George Washington University, Maki Furukado, Yokohama National University, Japan, and Shinji Ito, Tsuda College, Japan (973-37-1123)


Lorenzo A Sadun, University of Texas at Austin (973-37-321)

3:15 PM Symmetry versus density in aperiodic tilings.

(182) Charles Radin, University of Texas at Austin (973-52-704)

3:45 PM Substitution sequences in \(2^d\) with a nonsimple Lebesgue component in the spectrum.

Natalie Priebe Frank, Vassar College (973-37-1217)

4:15 PM Asymptotic orbits for primitive substitutions.

(184) Preliminary report.

Marcy Barge, Montana State University, Beverly Diamond, College of Charleston, and Charles Holton*, University of California at Berkeley (973-05-1455)

4:45 PM Computing Entropy for Two-Dimensional Tiling Systems.

Larry A. Pierce II, Oregon State University (973-37-772)

5:15 PM Uniform transitivity of multi-dimensional shifts.

(186) Preliminary report.

Ethan M Coven*, Wesleyan University, and Natasha Jonoska, University of South Florida (973-37-1063)

AMS Special Session on Commutative Algebra and Algebraic Geometry, II

2:15 PM - 5:35 PM

Organizers: Paul C. Roberts, University of Utah

Anurag K. Singh, University of Utah

2:15 PM New resultants and other applications of exterior algebra.

(187) David Eisenbud, MSRI / UC Berkeley (973-14-1036)

2:45 PM Yoneda Ext algebras and Poincaré series of algebras with monomial relations.

Luchezar L Avramov, University of Nebraska (973-13-1258)

3:15 PM On SC-modules.

(189) Jee H Koh, Indiana University (973-13-1148)

3:45 PM Syzygies of Semi-Regular Sequences. Preliminary report.

(190) Keith A Pardeue*, Haverford College, and Benjamin Richert, University of Michigan (973-13-1291)

4:15 PM Integral cohomology of certain non-compact toric varieties. Preliminary report.

Miriam Ruth Kantorovitz*, University of California, Berkeley, and Eugene M Lerman, University of Illinois (973-13-1095)

4:45 PM Stably equivalence problem.

(192) Jie-Tai Yu, The University of Hong Kong (973-14-170)

5:15 PM Discussion
AMS Special Session on Analysis and Application of Quasilinear Partial Differential Equations, II

2:15 PM - 5:35 PM
Organizers: Sunčica Čanić, University of Houston
Eun Heui Kim, California State University, Long Beach

2:15PM Inverse Elasticity. Preliminary report.
- (193) James V Ralston* and Gregory Eskin, University of California at Los Angeles (973-35-1223)
- Howard A. Levine*, Anna L. Tucker, Iowa State University, and Marit Nilsen-Hamilton, Department of Biochemistry, Biophysics and Molecular Biology, Iowa State University (973-92-316)

3:15PM Dynamic contact lines and driven thin liquid films.
- (194) Michael Shearer, North Carolina State University (973-35-937)
- Michael Sever, The Hebrew University, Jerusalem, Israel (973-35-348)
4:15PM Inhomogeneous boundary value problems for the three-dimensional evolutionary Navier-Stokes equations.
- A. V Fursikov, Moscow State University, M. D Gunzburger* and L. S Hou, Iowa State University (973-35-1116)
4:45PM Finite dimensionality and regularity of attractors for 2-D semi-linear wave equation with non-linear dissipation.
- Irena Lasiecka and Anastasia A Ruzmaikina*, University of Virginia (973-35-728)

5:15PM Admissibility of of function spaces with respect to higher order differential equations.
- Thanh Lien Nguyen, Ohio University (973-34-784)

AMS Special Session on Chaos, Stability, and Asymptotics in Difference Equations, II

2:15 PM - 6:05 PM
Organizers: Saber N. Elaydi, Trinity University
Gerasimos Ladas, University of Rhode Island
Donald A. Lutz, San Diego State University

2:15PM Open Problems and Conjectures:
- (200) Gerasimos Ladas, University of Rhode Island (973-39-279)
- M.R.S. Kulenovic*, Gerry Ladas and Kenn P Wilkinson, University of Rhode Island (973-39-954)
3:15PM On the difference equation
- (202) \( y_{n+1} = y_n - (2k+1) + p \)
- Edward A Grove*, Gerasimos Ladas, Lynn C McGrath, University of Rhode Island, and Hamdi A El-Metwally, Mansoura University (973-39-932)
3:45PM On \( x_{n+1} = \max \left\{ \frac{a_n}{x_n}, \frac{b_n}{x_{n-1}} \right\} \) with Arbitrary Periodic Parameters. Preliminary report.
- Candace M. Kent, Virginia Commonwealth University (973-39-200)

4:15PM Equivalent of the Painlevé property for difference equations and study of their solvability.
- Ovidiu Costin, Rutgers University (973-39-921)
4:45PM On a second order rational difference equation.
- (205) Preliminary report.
- Hristo D. Voulov, Southern Illinois University (973-39-108)
5:15PM Periodic solutions of a difference equation with maximum. Preliminary report.
- Dimitar P. Mishev, William T. Patula* and Hristo D. Voulov, Southern Illinois University (973-39-92)
- Martin J Bohner*, Florida Institute of Technology, Ondrej Dosly, Masaryk University, and Werner Kratz, University Ulm (973-39-1220)

AMS Special Session on Computation Theory with Applications, II

2:15 PM - 6:05 PM
Organizers: Douglas Cenzer, University of Florida
Jeffrey B. Remmel, University of California San Diego

2:15PM Computable models, invariants and numberings.
- (208) Preliminary report.
- Serguei S Goncharov, Novosibirsk State University, Novosibirsk, Russia (973-03-960)
2:45PM Isomorphism problems and computable classification.
- Sergey S Goncharov, Novosibirsk State University, and Julia F Knight*, University of Notre Dame (973-03-534)
3:15PM Complexity of Diagrams of Countable Structures.
- (210) Preliminary report.
- Valentina S Harizanov*, George Washington University, Julia F Knight, University of Notre Dame, and Andrei S Morozov, Sobolev Institute of Mathematics (973-03-1248)
3:45PM Computably Categorical Trees of Finite Height I.
- (211) Preliminary report.
- Steffen Lempp, Charles McCoy, University of Wisconsin-Madison, Russell Miller*, Cornell University, and Reed Solomon, University of Wisconsin-Madison (973-03-1257)
4:15PM Computably Categorical Trees of Finite Height II.
- (212) Steffen Lempp, Charles McCoy*, University of Wisconsin, Madison, Russell Miller, Cornell University, and Reed Solomon, University of Wisconsin-Madison (973-03-1189)
4:45PM Computable choice functions for computable linear orderings. Preliminary report.
- Manuel Lerman*, University of Connecticut, Storrs, and Richard M Watnick, University of Connecticut, Stamford (973-03-355)
5:15PM Degree Spectra of Prime Models.
- (214) Barbara F. Csima, University of Chicago (973-03-1054)
5:45PM Computability, Differential Geometry, and Model Theory.
- Robert I Soare* and Barbara F. Csima, University of Chicago (973-03-1500)

AMS Special Session on Fractal Geometry and Applications: A Jubilee of Benoît Mandelbrot, II

2:15 PM - 6:05 PM
Organizers: Michel L. Lapidus, University of California Riverside
AMS Special Session on Graph Theory, II

2:15 PM – 6:05 PM

Organizers: Andre Kundgen, California State University, San Marcos
K. Brooks Reid, California State University, San Marcos

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<tr>
<th>Time</th>
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<th>Authors/Institutions</th>
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<tr>
<td>2:15PM</td>
<td>Coloring graphs on nonorientable versus orientable surfaces. Preliminary report.</td>
<td>Joan P. Hutchinson*, Macalester College, and John P. Hutchinson, Macalester College (973-05-753)</td>
</tr>
<tr>
<td>2:45PM</td>
<td>Graph Color Extensions: When Embedding Helps.</td>
<td>Michael O. Albertson*, Smith College, and Joan P. Hutchinson, Macalester College (973-05-753)</td>
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<tr>
<td>3:15PM</td>
<td>Graphs minimal with respect to crossing number k.</td>
<td>Bruce Richter, University of Waterloo (973-05-1426)</td>
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<tr>
<td>4:15PM</td>
<td>Equitably k-Choosable Graphs.</td>
<td>Michael J. Pelsmajer*, Alexander V. Kostochka and Douglas B. West, University of Illinois at Urbana-Champaign (973-05-1205)</td>
</tr>
<tr>
<td>4:45PM</td>
<td>An Upper Bound for Representations of Graphs Modulo n.</td>
<td>Darren A. Narayan, Rochester Institute of Technology (973-05-159)</td>
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<tr>
<td>5:15PM</td>
<td>Sum List Coloring Problems.</td>
<td>Garth T. Isaak, Lehigh University (973-05-872)</td>
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<tr>
<td>5:45PM</td>
<td>Colored and chromatic distance in graphs.</td>
<td>Peter J. Slater, University of Alabama at Huntsville (973-05-1182)</td>
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AMS Special Session on Nonlinear Elliptic Partial Differential Equations, II

2:15 PM – 5:55 PM

Organizers: Maya Chhetri, University of North Carolina at Greensboro
Jon T. Jacobsen, Pennsylvania State University

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<tr>
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<tr>
<td>2:15PM</td>
<td>Positive Steady States of an Elliptic System from Biomechanics.</td>
<td>Linghai John Zhang, University of Minnesota, Minneapolis, Minnesota (973-35-1016)</td>
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<td>2:45PM</td>
<td>Diffusive Logistic Equation with Constant Yield Harvesting.</td>
<td>Shobha Oruganti*, Mississippi State University, jumping Shi, College of William and Mary, and Ratnasingham Shivaji, Mississippi State University (973-35-1060)</td>
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<tr>
<td>4:45PM</td>
<td>Discussion</td>
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AMS Special Session on Quantum Computation and Information, II

2:15 PM – 5:35 PM

Organizers: Philip L. Bowers, Florida State University
Washington Mio, Florida State University
John Preskill, California Institute of Technology

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<tr>
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<tr>
<td>2:15PM</td>
<td>Quantum Adiabatic Evolution Versus Classical Local Search.</td>
<td>Edward Farhi*, Jeffrey Goldstone, MIT, and Sam Gutmann, Northeastern University (973-68-1320)</td>
</tr>
<tr>
<td>2:45PM</td>
<td>Topological Quantum Computation.</td>
<td>Zhenghan Wang, Indiana University (973-57-1482)</td>
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<td>3:15PM</td>
<td>Encryption and authentication of quantum information.</td>
<td>Alain Tapp, Montreal University (973-68-1475)</td>
</tr>
<tr>
<td>3:45PM</td>
<td>On Quantum Coin Flipping. Preliminary report.</td>
<td>Dorit Aharonov, Hebrew University, Jerusalem, Israel (973-68-1077)</td>
</tr>
<tr>
<td>4:15PM</td>
<td>Quantum algorithms for structured search problems.</td>
<td>Markus Hunziker, University of Georgia, and David A. Meyer*, University of California/San Diego (973-81-1387)</td>
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NOTICES OF THE AMS  VOLUME 49, NUMBER 1
AMS Special Session on Low Dimensional Topology, II
2:15 PM - 6:05 PM
Organizer: Tim D. Cochran, Rice University

2:15 PM
Infinitely many hyperbolic 3-manifolds which contain no Reebless foliation.
Rachel Roberts*, John Shaneshan, Washington University, and Melanie Stein, Trinity College (973-57-384)

2:45 PM
There are no unexpected tunnel number one knots of genus one.
Martin G Scharlemann, UC Santa Barbara (973-57-675)

3:15 PM
Higher-Order Polynomial Invariants of 3-Manifolds Giving Lower Bounds for the Thurston Norm.
Shelly L Harvey, Rice University (973-57-1197)

3:45 PM
Homology cobordism and classical knot invariants.
Ronnie Lee, Yale University (973-57-391)

4:15 PM
The orbifold theorem. Preliminary report.
Daryl Cooper*, UCSB, Craig D Hodgson, University of Melbourne, and Steve P Kerckhoff, Stanford (973-57-369)

4:45 PM
Trace fields of hyperbolic knots. Preliminary report.
Jim E Hoste*, Pitzer College, and Patrick D Shanahan, Loyola Marymount University (973-57-968)

5:15 PM
Emily Hamilton, Emory University (973-57-726)

5:45 PM
Abelian Subgroups of the Torelli Group. Preliminary report.
William Vautaw, Michigan State University (973-57-1010)

MAA Minicourse #10: Part A
2:15 PM - 4:15 PM
A dynamical systems approach to the differential equations course.
Organizers: Paul A. Blanchard, Boston University and Robert L. Devaney, Boston University

MAA Minicourse #14: Part A
2:15 PM - 4:15 PM
Viewing mathematics via interrelations, for undergraduate courses.
Organizer: Simon R. Quint, Stockton College of New Jersey

MAA Minicourse #4: Part A
2:15 PM - 4:15 PM
Environmental mathematics.
Organizer: Ben Fusaro, Florida State University

AMS Session on Probability and Statistics
2:15 PM - 5:25 PM

2:15 PM
Bounds on bivariate distribution functions with given margins and measures of association.
Roger B. Nelsen*, Lewis & Clark College, Jose Juan Quesada Molina, Universidad de Granada, Jose Antonio Rodriguez Lallena and Manuel Ubeda Flores, Universidad de Almeria (973-60-189)

2:30 PM
An Algorithm for a Maintenance and Replacement Model.
Nabil Moussa, American Univ. in Cairo (973-60-195)

2:45 PM
Optimal stopping rules for correlated random walks with a discount.
Pieter C. Allaart, University of North Texas (973-60-268)

3:00 PM
Quasi-stationary states of Indy 500 model.
Anastasia A Ruzmaikina*, University of Virginia, Michael Alzerman, Princeton University, and Pierluigi Contucci, University of Bologna (973-60-597)

3:15 PM
Lattices with percolation thresholds and average degrees in the same order. Preliminary report.
John C Wierman, Johns Hopkins University (973-60-681)

3:30 PM
Almost sure central limit theorems for nonlinear functionals of dependent random variables. Preliminary report.
Khurelbaatar Gonchigdanzan, University of Louisville (973-60-684)

3:45 PM
Highway Relativity.
Bryan Dawson* and Troy D Riggs, Union University (973-60-757)

4:00 PM
On the Global and Local Moduli of Continuity for Brownian Motion.
Lisa E Marano, LaSalle University (973-60-783)

4:15 PM
Integration by parts formulas involving conditional analytic Feynman integrals and transforms.
Seung J Chang, Dankook University, and David L Skoug*, University of Nebraska (973-60-942)

4:30 PM
David A Rolls* and Glen K Takahara, Queen's University at Kingston (973-60-1250)

4:45 PM
A Semiparametric Approach to Hazard Estimation Under the Coxie-Green Model of Random Censorship.
Ke Wu, California State University, Fresno (973-62-758)

5:00 PM
Inferences on the reliability of a series system.
Alvard Y. Arzayan* and Nabendu Pal, University of Louisiana at Lafayette (973-62-1045)

5:15 PM
Randomization techniques in fractional factorial experiments.
Matthew Koehler, SUNY-Binghamton (973-62-1348)

AMS Session on Biology, Economics, and the Social Sciences
2:15 PM - 5:10 PM

2:15 PM
Actuarial and economic perspective on life insurance backdating. Preliminary report.
James M Carson and Krzysztof M Ostaszewski*, Illinois State University (973-91-362)
AMS Session on Number Theory, II

2:15 PM - 5:10 PM

2:15PM e-constants and Orthogonal Representations.
   (277) Darren B Glass, University of Pennsylvania (973-11-966)

2:30PM New special polynomials with prescribed vanishing
   integer sets with distinct subset sums.
   (278) Peter Borwein, Simon Fraser University, and
   (279) J Mossinghoff*, UCLA (973-11-974)

2:45PM On the Eigenvectors and Eigenvalues of a Certain
   Matrix of Bernoulli Coefficients.
   Curtis N Cooper, Central Missouri State University
   (973-11-995)

3:00PM Explicit Multiplicative Relations Between Causs
   Sums.
   (280) Brian J Murray, Louisiana State University
   (973-11-1014)

3:15PM New lower bounds for the prime divisors of odd
   tripertfect numbers. Preliminary report.
   (281) Douglas E Iannucci, University of the Virgin Islands
   (973-11-1015)

3:30PM The difference between consecutive primes in an
   arithmetic progression. Preliminary report.
   (282) Angel V Kumchev, University of Toronto
   (973-11-1161)

3:45PM Collisions of Binary Sequences and Cullen Numbers.
   (283) Preliminary report.
   (284) Pantelimon Stanica, Auburn University Montgomery
   (973-11-1253)

4:00PM Regular Quadratics in \( \sqrt{2} \). Preliminary report.
   (285) Joseph Palen, Millsaps College (973-11-1266)

4:15PM Renormalized period integrals on GL(3). Preliminary report.
   (286) Jennifer E Beineke*, Western New England College, and
   (287) Daniel W Bump, Stanford University
   (973-11-1314)

4:30PM Computing lowest slopes of p-adic modular forms.
   (288) Lawren M Smithline, Cornell University
   (973-11-1352)

4:45PM Vector valued modular forms and other modular
   forms.
   (289) Howard Skogman, SUNY Brockport (973-11-1368)

5:00PM Fibonacci identities.

SIAM Minisymposium on Applications of Symmetry in
Dynamical Systems

2:15 PM - 5:10 PM

Organizer: Debra K. Lewis, University of California Santa Cruz

2:15PM Spectral Intervals and Stability of Lyapunov
   Exponents.
   (289) Luca Dieci, Georgia Institute of Technology, and
   (290) Erik S Van Vleck*, Colorado School of Mines
   (973-37-1420)

2:45PM Geometric integration: An application in material
   science.
   (291) Nilima Nigam, McGill University

3:15PM Applications of symmetric spaces and Lie triple
   systems in numerical analysis.
   (292) Hans Munthe-Kaass, Universitetsbergen

3:45PM Break.

4:15PM Computing Statistics for Hamiltonian Systems:
   (293) Symmetry-Conserving vs. Step-and-Project Methods.
   (294) Paul Frederick Tupper, SCCM, Stanford University
   (973-65-1527)

4:45PM Stability-preserving bifurcations of symmetric
   relative equilibria.
   (295) Eric T Matsui, University of California, Santa Cruz
   (973-12-1227)

MAA Session on Initiating and Sustaining
Undergraduate Research Projects and Programs, I

2:15 PM - 4:55 PM

Organizers: John R. Swallow, Davidson College
(296) Suzanne M. Lenhart, University of Tennessee

118 NOTICES OF THE AMS VOLUME 49, NUMBER 1
MAA Session on Learning to Prove in Cooperative Learning and Technology Supported Environments

2:15 PM - 5:55 PM

Organizers: G. Joseph Wimbish, Huntingdon College
Connie M. Campbell, Millsaps College
Draga D. Vidakovic, Georgia State College

2:15 PM Don't Forget the Proofs! Preliminary report.
William T Mahavier, Lamar University (973-F1-713)

2:30 PM Proofs in Collaborative Settings: Mathematics is often a team sport and never a spectator sport.
Mary T Treanor, Valparaiso University (973-F1-624)

2:45 PM Computer Activities for Learning Mathematical Induction. Preliminary report.
William E Fenton, Bellarmine University (973-F1-598)

3:00 PM A Low-Tech Revolution in Active, Cooperative Proving.
Julian F Fleron and Philip K Hotchkiss*, Westfield State College (973-F1-588)

3:15 PM Dynamic Visualization and Proof.
Barbara J Pence, San Jose State Univ (973-F1-320)

3:30 PM From Hanoi's Tower to the Internet: A Sampler of Activities Designed to Help Students Develop Proofwriting Ability.
Teresa D Magnus, Rivier College (973-F1-569)

3:45 PM A Discovery-Based Course in Number Theory.
Jeffrey J Holt*, University of Virginia, and John W Jones, Arizona State University (973-F1-559)

4:00 PM (Cooperative) Groups and Geometry in a Lab-based Environment. Preliminary report.
Jeff Connor* and Barbara Grover, Ohio University (973-F1-520)

4:15 PM Proof in Discrete Mathematics.
Nancy L Hagelgans, Ursinus College (973-F1-480)

4:30 PM Experimenting With Classroom Formats to Encourage Problem Solving.
Eileen Fernandez, Montclair State University (973-F1-462)

4:45 PM Learning Properties of Relations by Playing Cards.
Beth E Schaubroeck, U.S. Air Force Academy (973-F1-492)

5:00 PM Induction: It's Only Natural. Preliminary report.
James W Crawley, Shippensburg University (973-F1-432)

5:15 PM The Importance of Proof in a Cooperative Learning Environment.
Raymond F Coughlin, Temple University (973-F1-374)

5:30 PM Learning to prove in a Problem-Based Learning environment. Preliminary report.
Gianmario Besana*, DePaul University, and Vesna Kilibarda, Indiana University Northwest (973-F1-180)

5:45 PM Group Exercises for Abstract Algebra.
David J Hunter, Westmont College (973-F1-96)

MAA Session on Changing Student Views Regarding the Usefulness of Mathematics in Order to Increase the Number of Mathematics Majors

2:15 PM - 5:35 PM

Organizer: Sarah L Mabrouk, Framingham State College

2:15 PM Creating a Mathematically Rich Environment.
Melinda W Certain, University of Wisconsin-Madison (973-G1-1263)

2:35 PM Recruitment of Mathematics Majors at a Four-Year, Comprehensive University. Preliminary report.
Kevin E Charlwood, Washburn University (973-G1-346)

2:55 PM Retaining Math Majors at King's College.
Denise M Reboli, King's College (973-G1-221)

3:15 PM An Integrated Professional Development Program For Mathematics Majors.
G. Daniel Callon, Franklin College (973-G1-493)

3:35 PM Building a Mathematical Community to Strengthen an Undergraduate Mathematics Program.
Julian F Fleron* and Philip K Hotchkiss, Westfield State College (973-G1-594)

3:55 PM Inspiring Mathematics Majors through Personal Experience.
David B. Streid, Maharishi University of Management (973-G1-589)

4:15 PM Rush Hour and Dijkstra's Algorithm.
Mark Stamp, MediaSnap, Inc. (973-G1-1470)

4:35 PM Celebrating Mathematics at South Dakota State University.
Donna L Flint, South Dakota State University (973-G1-473)
Program of the Sessions – San Diego, CA, Sunday, January 6 (cont’d.)

2:15 PM - 4:50 PM
MAA Session on Computational Mathematics in Linear Algebra and Differential Equations, I

Organizers: Richard J. Marchand, SUNY at Fredonia
Elias Y. Deeba, University of Houston-Downtown
Timothy J. McDevitt, Millersville University

2:15PM
A Model of the Activated-Sludge Process in a Natural Wastewater Treatment System.
James A Walsh, Oberlin College (973-H1-43)

2:35PM
Symplectic Integrators for the Undergraduate Classroom.
Frank Zizza, University of Arizona, South (973-H1-562)

2:55PM
The Algebraic Connectivity of Two Trees Connected By an Edge of Infinite Weight.
Jason J Molitierno, Sacred Heart University (973-H1-393)

3:15PM
Learning rules projects in linear algebra.
Elias y Deeba and Andre De Korvin, University of Houston-Downtown (973-H1-389)

3:55PM
Bifurcation Analysis of a Dynamical System in Linear Algebra and Differential Equations.
Douglas B Meade, University of South Carolina (973-H1-258)

4:35PM
A Predator-Prey Model With a Computer Algebra System.
Mary Ann Connors*, Westfield State College, and Edward A Connors, University of Massachusetts (973-H1-429)

4:55PM
Examples of how Symbolic, Hand-held Calculators have Changed the way we Teach Differential
Kathleen Pineau and Michel Beaudin, École de technologie supérieure (973-H1-237)

4:55PM
Richard D West, Francis Marion University (973-H1-448)

2:15PM - 3:30PM
AMS-MAA Joint Panel Discussion
Highlights from the 2000 CBMS Survey of the Mathematical Sciences.
Presenters: David J. Lutzer, College of William and Mary
Stephen B. Rodi, Austin Community College

MAA Session on General Contributed Papers, II

Organizers: Shawnee L. McMurran, California State University, San Bernardino
Laura Wallace, California State University, San Bernardino
Sarah L Mabrouk, Framingham State College

2:15PM
An Elementary Diversity Index Developed Using Taylor Series and Lagrange Multipliers.
Donald E Hooley, Bluffton College (973-T1-196)

2:35PM
A Simple Proof of Rolle's Theorem for Finite Fields.
Cristina Ballantine*, Dartmouth College, and Joel Roberts, Bowdoin College (973-T1-234)

2:55PM
Curved Asymptotes: Connecting Algebra and Calculus. Preliminary report.
Michael J. Bossé, Indiana University of Pennsylvania, and N. R. Nandakumar*, Delaware State University (973-T1-501)

3:15PM
How is the Koch Curve Like a Well-Written Paper?
Daylene Zielinski, Bellarmine University (973-T1-322)

3:35PM
The Interdisciplinary Scholarship of Teaching in IUSB's Connections Program, A Learning Community.

3:55PM
IUSB Connections: Promoting Retention by Addressing the Needs of Students in Developmental Mathematics and English.
Richard A Cook*, Rebecca Brittenham, Janet B Hall, Phyllis C Moore-Whitesell, Morteza Shafii-Mousavi, Jay Showalter, Kenneth A Smith, Indiana University South Bend, Connie D Ruhl-Smith, Bowling Green State University, and Karen L White, Indiana University South Bend (973-T1-67)

4:15PM
Online Mathematics Testing for Retention of Engineers. Preliminary report.
Jerry Johnson*, Jeff Mortensen, Sami Fadali, University of Nevada, Reno, and Jeff McGough, South Dakota School of Mines and Technology (973-T1-207)

4:35PM
The Introduction to Fuzzy Mathematics in the Undergraduate Curriculum.
Carlos C Huerda, United States Military Academy at West Point (973-T1-828)

4:55PM
Gender Equity in Oklahoma. Preliminary report.
Dana S Craig* and Charlotte K Simmons, University of Central Oklahoma (973-T1-1030)

2:15 PM - 3:30 PM
MAA-Project NExT Panel Discussion
Introduction to the hiring process: Preparation, execution, and follow-up.
Organizers: Sarah Marie Belcastro, University of Northern Iowa and Bowdoin College
Dusty E. Sabo, Southern Oregon University

Panelists: Tamara B. Veenstra, University of Redlands
Carolyn Yackel, Mercer University
Dennis M. Luciano, Western New England College
Mark J. Nielsen, University of Idaho
San Diego, CA, Sunday, January 6 – Program of the Sessions

MAA Special Presentation

2:15 PM – 3:45 PM

NCTM’s work to improve mathematics education for all students.
Organizers: Johnny W. Lott, University of Montana
Eric Hart, Western Michigan University, Maharishi University of Management, and University of Iowa

MAA Panel Discussion

2:15 PM – 3:45 PM

A comprehensive department-based program for the preparation and professional development of graduate teaching assistants (GTAs) in mathematics.
Organizer: Eileen T. Shugart, Virginia Polytechnic Institute and State University
Panelists: Lesa L. Beverly, University of Texas at Tyler
Brian Camp, Virginia Polytechnic Institute and State University
Gregory Hartman, Virginia Polytechnic Institute and State University
Abigail Kohler, Virginia Polytechnic Institute and State University
Dustin P. Potter, Virginia Polytechnic Institute and State University
Eileen T. Shugart

MAA Invited Address

3:20 PM – 4:10 PM

Sophie Germain’s grand plan for proving Fermat’s Last Theorem. Preliminary report.
David J. Pengelley, New Mexico State University (973-A0-35)

MAA Panel Discussion

3:20 PM – 4:30 PM

Mathematics after high school: How to promote success for more.
Organizers: Cathy B. Kessel
Suzanne M. Lenhart, University of Tennessee and Oak Ridge National Laboratory
Teri Jo Murphy, University of Oklahoma
Moderators: Teri Jo Murphy
Bettye Anne Case, Florida State University
Panelists: Rebecca Ambrose, San Diego State University
Melinda W. Certain, University of Wisconsin, Madison
Cathy Kessel
Judy Walker, University of Nebraska, Lincoln

MAA Panel Discussion

4:00 PM – 5:30 PM

Mathematical preparation and support of teachers through rural universities.
Organizers: Warren P. Koepp, Sul Ross State University
Raymond A. Beaulieu, Sul Ross State University
Panelists: Leslie Garrison, San Diego State University
Harel Barzilai, Salisbury State University
Raymond A. Beaulieu

MAA CUPM Subcommittee on Calculus Reform and the First Two Years Panel Discussion

4:00 PM – 5:30 PM

Modeling in college algebra.
Organizer: Donald B. Small, U. S. Military Academy
Moderator: Della D. Bell, Texas Southern University
Panelists: Benny D. Evans, Oklahoma State University
Alexander H. Fluellen, Clark Atlanta University
Florence S. Gordon, New York Institute of Technology
Scott Herriott, Maharishi University of Management

Welcoming Reception for Undergraduate Students

4:00 PM – 5:00 PM

Course portfolios and the scholarship of teaching and learning.
Organizer: Thomas F. Banchoff, Brown University
Panelists: Bruce N. Cooperstein, University of California, Santa Cruz
Curtis D. Bennett, Bowling Green State University
Anita J. Salem, Rockhurst University
John P. Holcomb, Cleveland State University
Program of the Sessions – San Diego, CA, Sunday, January 6 (cont’d.)

MAA Minicourse #5: Part A
4:30 PM – 6:30 PM
Using physical and computerized puzzles as models of permutation groups in teaching abstract algebra.
Organizer: John O. Kiltinen, Northern Michigan University

AMS Committee on the Profession Panel Discussion
4:30 PM – 6:00 PM
How the world sees mathematicians.
Organizer: Allyn Jackson, AMS
Panelists: Dave Bayer, Columbia University
K. C. Cole, Los Angeles Times
Keith J. Devlin, Stanford University

MAA Section Officers
4:30 PM – 6:30 PM

AWM Membership Meeting
4:35 PM – 5:00 PM

AMS-MAA Graduate Student Reception
5:00 PM – 6:00 PM

Mathematical Sciences Institutes Reception
5:30 PM – 7:30 PM

Reception for First-Time Participants
6:00 PM – 7:00 PM

Young Mathematicians Network Town Meeting
7:15 PM – 8:15 PM

AMS Josiah Willard Gibbs Lecture
8:30 PM – 9:30 PM
Making light of mathematics.
Michael V. Berry, Bristol University (973-78-01)

AWM Reception
9:30 PM – 11:00 PM

Monday, January 7

Employment Center
7:00 AM – 7:30 PM
Distribution of schedules, scheduled interviews, and interview center (see article for specific hours).

Joint Meetings Registration
7:30 AM – 4:00 PM

AMS-MAA-MER Special Session on Mathematics and Education Reform, III
8:00 AM – 10:50 AM
Organizers: William H. Barker, Bowdoin College
Jerry L. Bona, University of Texas at Austin
Naomi D. Fisher, University of Illinois at Chicago
Kenneth C. Millett, University of California Santa Barbara

8:00 AM
Contemporary College Algebra, base course for a QL Program. Preliminary report.
Don B Small, U.S. Military Academy (973-97-1378)

8:30 AM
Contemporary College Algebra - Inclusion of Collaborative Learning and Technology.
Laurrette B Foster, Prairie View A&M University (973-97-1451)

9:00 AM
Tracking Students through Algebra, Pre-Calculus and Calculus Courses. Preliminary report.
Steven R Dunbar, University of Nebraska-Lincoln (973-97-1254)

9:30 AM
The Challenges of Revitalizing College Algebra.
Judy Clark, University of Massachusetts, Boston (973-97-1448)

10:00 AM
Improving College Algebra by Developing Alternative Courses.
Bruce C Cruader, Oklahoma State University (973-97-1176)

10:30 AM
William Barker, Bowdoin College (973-97-1367)

AMS Special Session on Commutative Algebra and Algebraic Geometry, III
8:00 AM – 11:50 AM
Organizers: Paul C. Roberts, University of Utah
Anurag K. Singh, University of Utah

8:00 AM
A generalized amplitude inequality. Preliminary report.
Srikanth Iyengar*, University of Missouri-Columbia, and Hans-Bjorn Foxby, University of Copenhagen (973-13-309)

8:30 AM
Bivariate Hilbert Functions for the Torsion Functor.
Emanoil Theodorescu, University of Kansas (973-13-799)

9:00 AM
Depths of higher Tors.
Craig Huneke, University of Kansas, and Roger Wiegand*, University of Nebraska (973-13-867)

9:30 AM
Domains inside power series rings. Preliminary report.
William Heinzer, Purdue University, Christel Rotthaus, Michigan State University, and Sylvia M Wiegand*, University of Nebraska (973-13-1232)

10:00 AM
The Szegedy Theorem in Mixed Characteristic.
Phillip A Griffith, University of Illinois (973-13-399)

10:30 AM
Attached Primes of Graded Modules.
Andrew S. Richardson, University of Illinois (973-13-734)

11:00 AM
Limiting Behavior on Restriction of Divisor Classes to Hypersurfaces.
Sandra M Spiroff, University of Illinois at Urbana-Champaign (973-13-993)

11:30 AM
Some conditions for the Gorenstein property.
Douglas Hanes*, University of Minnesota, and Craig Huneke, University of Kansas (973-13-729)
AMS Special Session on Algebraic Coding Theory, I
8:00 AM – 11:50 AM
Organizers: Marcus Greferath, San Diego State University
Michael E. O’Sullivan, San Diego State University
Roxana N. Smarandache, San Diego State University
8:00 AM The Development of Coding Theory over Finite Rings.
Jay A Wood, Western Michigan University (973-94-1121)
9:00 AM The Structure of Quaternary Codes with respect to Rosenblum-Tsfasman Metric. Preliminary report.
Mehmet Ozen, Sakarya University, Irfan Slap, Adiyaman Faculty of Education, Gaziantep University, and Fethi Calliaup, Dogus University (973-05-1070)
9:30 AM Quasicyclic codes and codes over rings.
Patrick France Sore, CNRS/INS (973-94-1286)
10:00 AM Homogeneous weights and exponential sums.
Jose’ Felipe Voloch, University of Texas, and Judy L. Walker*, University of Nebraska, Lincoln (973-11-1277)
10:30 AM A New Construction Technique for Lattices from Subfields of Q(\sqrt[p]{q}). Preliminary report.
J. Carmelo Interlando*, Trajano P Nobrega Neto and Andre L Flores, Universidade Estadual Paulista – UNESP (973-91-912)
11:00 AM Representation theory and space-time coding.
Jonathan H. Hall, Michigan State University (973-94-1357)
11:30 AM Space-Time Block Codes and their Decoding.
Stefan E Schmidt*, New Mexico State University, and Paul E Wright, MeasuRisk (973-94-1005)

AMS Special Session on Algebras, Forms, and Algebraic Groups, I
8:00 AM – 11:50 AM
Organizers: R. Skip Garibaldi, University of California Los Angeles
David J. Saltman, University of Texas at Austin
Adrian R. Wadsworth, University of California San Diego
8:00 AM The trace form of a central simple algebra of degree four. Preliminary report.
Jean-Pierre E Tignol, Universite catholique de Louvain (973-16-962)
9:00 AM Decomposition of Involution on Inertially Split Division Algebras.
Patrick J Morandi*, New Mexico State University, and B. A Sethuraman, California State University Northridge (973-16-967)
9:30 AM Octonion Algebras Obtained from Associative Algebras with Involution.
Michel L Racine*, University of Ottawa, and Holger P Petersson, FernUniversitett Hagen (973-17-1064)
10:00 AM Effective Diagonalization Property for *-Fields.
Preliminary report.
Douglas W Larmour, New College of Florida (973-16-812)
10:30 AM Trace forms of Galois field extensions in the presence of roots of unity.
Zinovy Reichstein, University of British Columbia (973-12-764)
11:00 AM On the structure of the universal algebra for algebras that become hyperbolic over a given extension. Preliminary report.
Su-chi Wen, Indiana University (973-16-219)
11:30 AM Structure in the Witt ring of a field and powers of the fundamental ideal.
Richard S Elman, UCLA (973-12-911)

AMS Special Session on Chaos, Stability, and Asymptotics in Difference Equations, III
8:00 AM – 11:50 AM
Organizers: Saber N. Elaydi, Trinity University
Gerasimos Ladis, University of Rhode Island
Derek A. Lutz, San Diego State University
8:00 AM The Impact Of Dispersal Corridors On The Evolution Of Life-History Dynamics.
Carlos Castillo-Chavez, Cornell University, and Abdul-Aziz Yakubu*, Cornell University/Howard University (973-92-854)
8:30 AM Complex Dynamics in Ecology: Lattice Effects.
Shandell M. Henson*, Andrews University, R. F. Costantino, University of Rhode Island, J. M. Cushing, University of Arizona, Robert A. Desharnais, California State University, Los Angeles, Brian Dennis, University of Idaho at Moscow, and Aaron King, University of California, Davis (973-92-706)
9:00 AM A Convergence Theorem for Lattice Maps.
Preliminary report.
Jim M Cushing, University of Arizona (973-37-698)
9:30 AM Numerical Studies of the Combustion Equation.
Ronald E Mickens, Clark Atlanta University (973-39-306)
10:00 AM Unbounded orbits of chaotic systems in the real line. Preliminary report.
Mario U Martelli*, Claremont McKenna College, and Marc Chamberland, Grinnell College (973-37-818)
Mourad E.H. Ismail*, University of South Florida, Shao-shiung Lin, Taiwan University, and Shi-shyr Roan, Academia Sinica (973-39-29)
11:00 AM Cycling Chaos in Coupled Iterated Maps.
Preliminary report.
Antonio Palacios, San Diego State University (973-37-135)
11:30 AM On the global stability of hyperbolic and nonhyperbolic fixed points. Preliminary report.
Saber N Elaydi, Trinity University (973-39-807)

AMS Special Session on Computability Theory with Applications, III
8:00 AM – 11:50 AM
Organizers: Douglas Cenzer, University of Florida
Jeffrey B. Remmel, University of California San Diego
8:00 AM Logical Aspects of Ramsey’s Theorem. Preliminary report.
Theodore A. Slaman, University of California, Berkeley (973-03-1252)
AMS Special Session on Graph Theory, III

8:00 AM - 11:50 AM
Organizers: Michel L. Lapidus, University of California Riverside

8:00 AM
Split Graphs.
(402) Russell L Merris, California State University, Hayward (973-05-951)

9:00 AM
Some results about integer flows.
(401) C. Q. Zhang, West Virginia University (973-05-433)

9:30 AM
Binary Gray Codes with Long Bit Runs.
(401) Luis A. Goddyn and Pavol Gvozdyk, Simon Fraser University (973-05-855)

10:00 AM
Kneser graphs are Hamiltonian for n > 26k.
(404) Ya-Chen Chen, Arizona State University (973-05-1185)

11:00 AM
Interval Orders, Graph Coloring, Hamiltonian Paths and a Sequences: Part 2, Preliminary report.
(405) William T Trotter, Arizona State University (973-05-1446)

AMS Special Session on Fractal Geometry and Applications: A Jubilee of Benoît Mandelbrot, III

8:00 AM - NOON
Organizers: Michel L. Lapidus, University of California Riverside

Marcel van Frankenhuysen, Rutgers University

8:00 AM
The Spectrum of the Laplacian on the Pentagasket.
(390) Bryan Adams, S. Alex Smith, Robert S Tristram, Cornell University, and Alexander Teplayaev, University of California River City (973-00-1430)

8:30 AM
Some connections between Bernoulli convolutions and analytic number theory. Preliminary report.
(391) Titus W Hilberdink, University of Reading (973-11-1278)

9:00 AM
Some connections between multifractal functions and number theory.
(392) Stephane Paradis, University Paris 12 (973-26-1127)

9:30 AM
Complex Dimensions of Self-Similar Fractal Strings.
(393) Michel L Lapidus, University of California, Riverside, and Marcel van Frankenhuysen, Rutgers University (973-11-1017)

10:00 AM
Minkowski measurability and lacunarity of self-similar sets in ℂ.
(394) Marc Frant, Indiana University (973-28-267)

10:30 AM
Fractal Geometry and Number Theory: From Fractals Strings to Fractal Membranes and Beyond.
(395) Michel L. Lapidus, University of California, Riverside (973-37-1464)

11:10 AM
Multifractal Products of Stochastic Processes.
(396) Petteri Manninen, Ilkka Norros, VTT Information Technology, and Rudolf H Riedl, Rice University (973-28-847)

11:40 AM
Random multifractals, negative dimensions and infinite moments. Preliminary report.
(397) Benoit B Mandelbrot, Yale University (973-60-1301)

AMS Special Session on Nonlinear Elliptic Partial Differential Equations, III

8:00 AM - 11:40 AM
Organizers: Maya Chhetri, University of North Carolina at Greensboro and Jon T. Jacobsen, Pennsylvania State University

8:00 AM
Free boundary problems for nonlinear wave equations. Preliminary report.
(406) Eun Heui Kim, California State University at Long Beach, Suncica Canic and Barbara Keyfitz, University of Houston (973-35-1375)

8:30 AM
A Hamiltonian System with no Convexity Condition on the Nonlinearity.
(407) Greg S Spradlin, Embry-Riddle Aeronautical University (973-34-1485)

9:00 AM
Weighted Elliptic Equations With Critical Sobolev Exponents.
(408) Florin Catrina, University of Rochester (973-35-1051)

9:30 AM
A Liouville-Gelfand Equation for k-Hessian Operators.
(409) Jon T Jacobsen, Penn State (973-35-1403)
**AMSA Special Session on Low Dimensional Topology, III**

**8:00 AM - 11:50 AM**

**Organizer:** Tim D. Cochran, Rice University

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<td><strong>Noncommutative Knot Theory.</strong>  Tim D Cochran, Rice University (973-57-1365)</td>
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<td>8:30AM</td>
<td><strong>On the &quot;Volume&quot; limit of the colored Jones polynomial.</strong> Preliminary report. Oliver T Dasbach*,</td>
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<td>Oklahoma State University, and Xiao Song Lin, UC Riverside (973-57-849)</td>
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<td><strong>Towers of knots and analytic signatures.</strong> Preliminary report. Tim D Cochran, Rice University,</td>
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<td>Kent E Orr*, Indiana University, Bloomington, and Peter Teichner, University of California, San Diego</td>
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<td>10:00AM</td>
<td><strong>Non-slice knots with vanishing Casson-Gordon invariants.</strong> Taehee Kim, Indiana University, Bloomington,</td>
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<td>10:30AM</td>
<td><strong>Generalizations of Gusarov’s groups of knots.</strong> Preliminary report. Ted Stanford, New Mexico State</td>
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<td>University (973-57-996)</td>
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<td>11:00AM</td>
<td><strong>A Lie Bialgebra Structure on Graphs and Graph Homology.</strong> Preliminary report. James Conant* and Karen</td>
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<td>Vogtmann, Cornell University (973-57-474)</td>
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<td>11:30AM</td>
<td><strong>Torsion in the Kauffman bracket skein module via Hochschild homology.</strong> Preliminary report. Michael</td>
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<td>S McLendon, University of Iowa (973-57-991)</td>
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**MAA Minicourse #11: Part A**

**8:00 AM - 10:00 AM**

Incorporating discrete mathematics in the preparation of K-12 mathematics teachers.

**Organizer:** Lolina Alvarez, New Mexico State University

**MAA Minicourse #15: Part A**

**8:00 AM - 10:00 AM**

Mathematical finance.

**Organizer:** Walter R. Stromquist, Berwyn, PA

**MAA Minicourse #6: Part A**

**8:00 AM - 10:00 AM**

WeBWorK, an Internet-based system for generating and delivering homework problems to students.

**Organizers:** Arnold K. Pizer, University of Rochester

**AMS Session on Group Theory**

**8:00 AM - 11:55 AM**

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**AMS Session on Topology**

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8:15AM  Finite groups in which every normal subgroup has a proper supplement.
Luise-Charlotte Kappe*, SUNY-Binghamton, and
Joseph Kirtland, Marist College (973-20-877)

8:30AM  Finite Groups with a Minimal Frattini Subgroup Property.
Joseph Kirtland, Marist College (973-20-282)

8:45AM  Frattini Duals.
Homer Bechtell, University of New Hampshire
(973-20-843)

9:00AM  Abelian SP-Groups. Preliminary report.
> Chad Lower* and Lenny Jones, Shippensburg
University (973-20-936)

9:15AM  Nonabelian Groups With Perfect Order Subsets.
> Carrie E Finch*, University of South Carolina,
and Lenny Jones, Shippensburg University
(973-20-938)

9:30AM  The power structure of powerful p-groups.
L. Wilson, University of Chicago (973-20-1003)

9:45AM  Semidirect Product Decompositions of E-groups.
Gregory M Boudreaux, The University of North
Carolina at Asheville (973-20-1007)

10:00AM  Norms and the Bieri-Neumann-Strebel Invariant.
Reva S Kasman, University of Illinois, Chicago
(973-20-1012)

10:15AM  Subgroups that Satisfy the Frattini Argument.
> Joseph Evan, King’s College (973-20-1141)

10:30AM  Break.

Michael Bacon, SUNY-Oneonta (973-20-1319)

11:00AM  Expressing the Total Character of a Group as a Polynomial.
Stephen M Gagola, Jr., Kent State University
(973-20-1360)

11:15AM  Representations of Infinite Monomial Groups.
Sarina A Hessinger, Armstrong Atlantic State
University (973-20-1373)

11:30AM  Cayley color graphs of inverse semigroups and groupoids.
Nandor Sieben, Northern Arizona University
(973-20-1461)

11:45AM  Powers of SL(n, q). Preliminary report.
> Kim Gilbert, Shippensburg University, Darin
Kapanjie*, Lynchburg College, and Lenny Jones,
Shippensburg University (973-20-1241)

AMS Session on Numerical Analysis and Ordinary
Differential Equations

8:00AM – 11:55 AM

8:00AM  A Comparison Between the Wavelet-Galerkin and
the Sinc-Galerkin Methods for Solving Partial
Ahmed L Zayed*, DePaul University, and Mohamed
M. El-Gamel, Mansoura University (973-35-947)

8:15AM  Existence Theorems for Slow Diffusion Equations.
Guy Bernard, University of Central Arkansas
(973-35-1153)

8:30AM  The Numerical solution of exterior Neumann
problem for Helmholtz’s equation via modified
Green’s functions approach.
Yajni Madhu Warnapala-Yehiya*, Roger
Williams University, and T.C. Lin, University of
Wisconsin-Milwaukee (973-65-85)

8:45AM  Investigation of the nonlinear ODE for a model
neuron. Preliminary report.
Stanley R Lenihan, Del Norte Research &
Development (973-65-665)

9:00AM  Directions for Computing Multivariate Taylor Series
Coefficients. Preliminary report.
Richard D Neldinger, Davidson College
(973-65-1160)

9:15AM  A Numerical Method for Approximating the Solution
to a Non-Linear Differential Equation with
Discontinuities.
Donna L Flint, South Dakota State University
(973-65-1384)

9:30AM  The computation of eigenfunctions for one
nonlinear problem of the theory of elasticity.
Preliminary report.
Aliki Muradova, Jawaharlal Nehru University
(973-65-1028)

9:45AM  Numerical differentiation for approximating certain
series. Preliminary report.
Rick Kreminski, Texas A&M University - Commerce
(973-65-1456)

10:00AM  Precise numerical solution of PDE initial value
problems. Preliminary report.
Oliver G Aherth, Texas A & M University
(973-35-1349)

10:15AM  Stabilization, Controllability and Observability for
Electromagnetic Fields in Material Regions.
Weijiu Liu* and Bingyu Zhang, University of
Cincinnati (973-78-891)

10:30AM  Atmospheric Refraction. Preliminary report.
Ivle Stein, Jr., The University of Toledo
(973-78-701)

10:45AM  A Mathematical Evolution Model for
Phyto-remediation of Metals.
Diana M Thomas*, Lynn Vandemeulebroeke,
Montclair State University, and Kenneth
Yamaguchi, New Jersey City University
(973-34-149)

11:00AM  Functional Equations for HIV.
Terry J Quinn*, Ohio University Southern, Sanjay
Rai, Jacksonville University, and Bob L Robertson,
Drury University (973-34-901)

11:15AM  Multiple symmetric positive solutions of a class of
boundary value problems for higher order ordinary
differential equations.
John R. Graef, University of Tennessee at
Chattanooga, Chuanxi Qian and Bo Yang*,
Mississippi State University (973-34-1490)

11:30AM  Schrödinger’s equation with time dependent
Hamiltonian and NMR of rotating samples.
Preliminary report.
Partha Srinivasan, Florida State University,
Zhehong Gan, NHMFL, and Jack Quine*, Florida
State University (973-81-1391)

11:45AM  Approximation and Interpolation Employing
Divergence-free Matrix-valued Radial Basis
Functions.
Svenja Lowitzsch, Texas A&M University, College
Station, TX (973-41-1180)

SIAM Minisymposium on Mathematics and Computers
in Biology and Medicine

8:00 AM – 10:50 AM
Organizer: Angela Y. Cheer, University of
California Davis
MAA Session on History of Mathematics in the Second Millennium, II

8:00 AM - 11:50 AM

Organizers: Janet L. Beery, University of Redlands
C. Edward Sandifer, Western Connecticut State University

8:00 AM
Comments on the evolution of the normal curve.
(472) Preliminary report.

8:25 AM
The Waffle Algorithm for Egyptian Fractions.
(473) Robert E. Bradley, Adelphi University (973-A1-776)

8:50 AM
Acceleration of convergence of fixed-point iterations in medieval Sanskrit mathematics.
(474) Kim Plofker, Dibner Institute for the History of Science and Technology, MIT (973-A1-226)

9:15 AM
Jou Gu Ce Yuan Ji-1 "Chinese approach" to Trigonometry in 18th Century China. Preliminary report.
(475) Ji-Ping Ch Chen*, St. Cloud State University, and Minghui Hu, UCLA (973-A1-133)

9:35 AM
Rabbintical Mathematics, its History and Applications. Preliminary report.
(476) Carlos C Huerta, United States Military Academy at West Point (973-A1-814)

9:55 AM
Solving Polynomial equations-its historical importance in the development of algebra.
(477) Mysore S Jagadish, Barry University (973-A1-584)

10:15 AM
How Fundamental is the Fundamental Theorem of Calculus?
(478) Lawrence A D’Antonio, Ramapo College of New Jersey (973-A1-949)

10:35 AM
Euler on Cevians.
(479) Homer S White, Georgetown College (973-A1-314)

10:55 AM
Roger Cotes’ Measures of Ratios and Angles.
(480) Preliminary report.
Robert G. Stein, California State University, San Bernardino (973-A1-1164)

11:15 AM
Controversy at the US Coast and Geodetic Survey during the Dufﬁeld Administration (1894-1897).
(481) Preliminary report.
Mark McKinzie, Monroe Community College (973-A1-586)

11:35 AM
The crescents of Hippocrates from the second millennium BCE to the second millennium CE.
Preliminary report.
Una Bray, Skidmore College, Saratoga Springs, NY (973-A1-1392)

MAA Session on Mathematics Courses for Teachers, K-12, II

8:00 AM - 11:55 AM

Organizers: Ira J. Papick, University of Missouri, Columbia
Duane Porter, University of Wyoming
Diane M. Spresser, National Science Foundation

8:00 AM
Explorations in Algebra: Deepening Understandings of Functions.
(483) Barbara J. Pence, San Jose State Univ (973-B1-319)

8:20 AM
Teaching and Learning the Foundations of Geometry.
(484) Charles P. Funkhouser, University of Wyoming (973-B1-371)

8:40 AM
Scissors and String; Conjectures and Theorems.
(485) Preliminary report.
Kevin L. Hartshorn, UC Davis (973-B1-404)

9:00 AM
(486) Yolanda Manzano*, Baylor University - NSF Summer Intern, and Elizabeth J. Teles, NSF - Program Director - Division of Undergraduate Education (973-B1-63)

9:20 AM
A Capstone Course for PreService and Inservice Secondary Mathematics Teachers. Preliminary report.
(487) Gordon S Woodward and David Fowler*, University of Nebraska-Lincoln (973-B1-422)

9:40 AM
(488) Charlotte Kaye Simmons* and Jesse William Byrne, University of Central Oklahoma (973-B1-606)

10:00 AM
Report on Bridging The Gap and other projects.
(489) Preliminary report.
Tamas Szabo, Weber State University (973-B1-458)

10:20 AM
A Capstone Course for Pre-Service 9-12 Teachers.
(490) Kimberly M. Childs* and William D. Clark, Stephen F. Austin State University (973-B1-442)

10:40 AM
Motivating and facilitating achievement in a technology-rich, WWW-based Geometry for Teachers course.
(491) David A. Thomas, Ball State University (973-B1-232)

11:00 AM
(492) Vince Schielack, Texas A&M University (973-B1-617)

11:20 AM
(493) Karen J Graham*, University of New Hampshire, Neil Portnoy, California State University, Chico, and Todd Grundmeier, University of New Hampshire (973-B1-635)

11:40 AM
Our Profession In Crisis.
(494) William P Fox, Francis Marion University (973-B1-304)
Program of the Sessions – San Diego, CA, Monday, January 7 (cont’d.)

MAA Session on Integrating Mathematics and Other Disciplines, II

8:00 AM – 11:55 AM

Organizers: William G. McCallum, University of Arizona, Tucson
Deborah Hughes Hallett, University of Arizona, Tucson
Yajun Yang, SUNY at Farmingdale

8:00 AM

An Interdisciplinary Quantitative Reasoning Program at Hollins University. Preliminary report.
Caren L. Diefenderfer* and Patricia W. Hammer, Hollins University (973-C1-536)

8:15 AM

An Interdisciplinary Honors Seminar: The Art and Science of Patterns.
Donna L Beers, Simmons College (973-C1-192)

8:30 AM

Teaching Seminar Courses in Mathematics for Undergraduate Social Science Students. Preliminary report.
Daniel King, Sarah Lawrence College (973-C1-592)

8:45 AM

Heavenly Mathematics: Highlights of Cultural Astronomy.
Helmer Aslaksen, National University of Singapore (973-C1-388)

9:00 AM

Marcia Birken* and Anne C Coon, Rochester Institute of Technology (973-C1-99)

9:15 AM

Stefanos Gialamas, DeVry University (973-C1-243)

9:30 AM

Customized Math Lab Projects for Algebra and Precalculus.
Mako E Haruta* and Raymond J McGivney, University of Hartford (973-C1-546)

9:45 AM

Modeling Historical Data in the Mathematics Classroom.
Deirdre L Smeltzer, Eastern Mennonite University (973-C1-508)

10:00 AM

Meteorology and Mathematics, a Course Pairing in the Making Connections Program at Clarion University.
Stephen I Gendler* and Anthony J Vega, Clarion University (973-C1-230)

10:15 AM

Why is there a warning on my can of diet soda? The Mathematics and Ethics of Medical Screening Tests.
Michael A Brilleslyper, U. S. Air Force Academy (973-C1-131)

10:30 AM

Martin E Flashman, Humboldt State University (973-C1-513)

10:45 AM

Math with a Purpose-A Dynamic Approach to Modeling.
James T Sandefur, Georgetown University (973-C1-440)

11:00 AM

Some Matrix Applications to Logistics of Air Shipping Using MATLAB.
Alexander Stanoyevitch, University of Guam (973-C1-524)

11:15 AM

An object oriented approach for studying queuing models. Preliminary report.
Leann Karl, University of Massachusetts, and Robert M Tardiff*, Salisbury University (973-C1-465)

11:30 AM

Multimedia Mathematics Help For Business Majors And Their Teachers.
Richard B Thompson, University of Arizona (973-C1-380)

11:45 AM

Using Project-Based Learning to Integrate Statistics and Business Applications in a First-year Mathematics Course.
Paul Kochanowski* and Morteza Shafi-Mousavi, Indiana University South Bend (973-C1-106)

MAA Session on Innovative Uses of the World Wide Web in Teaching Mathematics, II

8:00 AM – 11:55 AM

Organizers: Marcelle Bessman, Jacksonville University
Brian E. Smith, McGill University

8:00 AM

College Algebra on the Web.
Denise J LeGrand, UALR (973-D1-456)

8:20 AM

Jon R Becker, Indiana University Northwest (973-D1-300)

8:40 AM

Using both video and text on the web in a linear algebra course.
Gregory P Dresden, Washington & Lee University (973-D1-460)

9:00 AM

Donald E Spickler, Salisbury University (973-D1-313)

9:20 AM

Mathematics and MERLOT (Multimedia Educational Resource in Learning and Online Teaching).
James J Rutledge, St. Petersburg College (973-D1-262)

9:40 AM

A Web intensive Business Calculus Class and Text.
Brian H Helkel, Appalachian State University (973-D1-199)

10:00 AM

Web Resources for Mathematics of Flight.
George T Rublein, College of William and Mary (973-D1-564)

10:20 AM

Online solutions for math textbook homework problems.
Charles A Grant*, Hotmath, Inc, and Robert A Bekes, Santa Clara University (973-D1-631)

10:40 AM

Paving the math way on the web.
J. J. Uhl* and Debra Woods, Univ of Illinois (973-D1-1165)

11:00 AM

GroupLearn: Electronically simulating a calculus study group.
Larry Copes, Institute for Studies in Educational Mathematics (973-D1-705)

11:20 AM

Web-based Development and Assessment of Fundamental Math Skills (WebFSE).
Darryl K. Ahner* and Mary Beth Brilleslyper, U. S. Air Force Academy (973-D1-451)

11:40 AM

Kyle T Siegrist, University of Alabama in Huntsville (973-D1-611)

AMS Special Session on Quantum Computation and Information, III

8:30 AM – 11:50 AM

Organizers: Philip L. Bowers, Florida State University
Washington Mio, Florida State University
John Preskill, California Institute of Technology

8:30AM - 11:55AM

AMS Special Session on Symbolic Dynamics, III
9:00AM - 11:50AM

Organizers: Aimee S. A. Johnson, Swarthmore College
Kathleen M. Madden, Drew University

9:00AM
Measures of relative maximal entropy.
(535) Karl Petersen, University of North Carolina, Anthony N. Quas*, University of Memphis, and Sujin Shin, University of Victoria (973-37-325)

9:30AM
Bounded orbit equivalence for minimal $Z^d$-actions. Preliminary report.
(536) Nicholas S. Ormes*, University of Connecticut, and Kathleen Madden, Drew University (973-37-848)

10:00AM
From homomorphisms to embeddings for $Z^d$ subshifts: $d > 2$.
(537) Samuel J Lightwood, University of Wisconsin-Stout (973-37-1435)

10:30AM
Some topological properties of two-dimensional weakly coupled map lattices. Preliminary report.
(538) Antonio L Morante, IICO, UASLP (973-37-1246)

11:00AM
Bowen-Franks groups associated with iterated maps on the interval.
(539) Nuno Martins* and Jose Sousa Ramos, Instituto Superior Tecnico (973-37-981)

11:30AM
Modeling ergodic, measure preserving actions on higher dimensional shifts of finite type. Preliminary report.
E. Arthur Robinson, George Washington University, and Ayse A Sahin*, DePaul University (973-37-1421)

MAA Session on General Contributed Papers, III
9:00AM - 11:55AM

Organizers: Shawnee L. McMurrin, California State University, San Bernardino
Laura Wallace, California State University, San Bernardino
Sarah L. Mabrouk, Framingham State College

9:00AM
The Complexity of Card Games.
(541) Michael S McClendon, University of Central Oklahoma (973-T1-365)

9:20AM
A Perfect Game of Dominos - A Graph Theoretical Approach. Preliminary report.
Jay A Malmstrom, Oklahoma City Community College (973-T1-518)

9:40AM
Equitable, Envy-Free, and Efficient Cake Cutting for Two People and Its Application to Discrete Goods.
(543) Michael A Jones, Montclair State University (973-T1-241)

10:00AM
The Wallet Paradox Revisited.
(544) Maureen Carroll, University of Scranton, Michael A Jones, Montclair State University, and Elyn Rykken*, Muhlenberg College (973-T1-549)

10:20AM
Banking on "The Weakest Link".
(545) Paul R Coe, Dominican University (973-T1-634)

10:40AM
Utility Of CART: Classification And Regression Tress For Improving College and University Retention. Preliminary report.
Gerard T LaVarmay* and Cathy M Frey, Norwich University (973-T1-294)

11:00AM
The Integration of Mathematics and Science Through Standards-Based, Enrichment, and Safety-Net Activities.
(547) Faiz B Al-Rubae, University of North Florida (973-T1-599)

SIAM Minisymposium on Partial Differential Equations and Applications
8:30AM - 10:55AM

Organizer: Oscar P. Bruno, California Institute of Technology

8:30AM
The yield set of rigid-plastic polycrystals.
(529) Guillermo H Goldsztein, Georgia Institute of Technology (973-35-714)

9:00AM
Fernando Reitich, University of Minnesota (973-35-755)

9:30AM
High-Order Accurate Numerical Solution of Conservation Laws.
Jan S Hesthaven*, Brown University, and Tim Warburton, The University of New Mexico (973-65-715)

10:00AM
Homogenization of PDE: Microscopic misfits in composites and polycrystals.
(532) Oscar P Bruno, Caltech (973-35-941)

10:30AM
Rigorous multiple scale scattering solver: Analyticity, Asymptotics and Taylor-Fourier Algebras.
Oscar P Bruno, California Institute of Technology, Alain Sell* and Marla Z Caponi, TRW (973-35-802)

AWM Emmy Noether Lecture
9:00AM - 9:50AM

(534) Computing over the Reals: Where Turing meets Newton.
Lenore Blum, Carnegie Mellon University

January 2002  Notices of the AMS 129
Program of the Sessions – San Diego, CA, Monday, January 1 (cont’d.)

11:20AM

11:40AM

MAA Committee on Mathematics and the Environment Panel Discussion
9:00 AM - 10:30 AM
The environment: A context for learning.
Organizers: Marcia Sward Doherty, Ocean View, DE
Ben Fusaro, Florida State University
Moderator: Patricia Clark Kenschaft, Montclair State University
Presenters: Gerald Lieberman
Nancy E. Zumoff, Kennesaw State University
Lee Seitelman, Pratt & Whitney and University of Connecticut

MAA Panel Discussion
9:00 AM - 10:30 AM
JOMA authors presentation.
Organizers: David A. Smith, Duke University
Lang Moore, MAA and Duke University
Presenters: David A. Smith
Thomas E. Leathrum, Jacksonville State University
John O. Kiltinen, Northern Michigan University

MAA Committee on the Mathematical Education of Teachers Panel Discussion
9:00 AM - 10:30 AM
Changing attitudes in the elementary education mathematics content courses: What works?
Organizers: Bonnie L. Oppenheimer, Mississippi University for Women
Sigrid E. Wagner, Ohio State University
Joan S. Morrison, Goucher College
Panelists: Charles E. Lamb, Texas A&M University
Robert B. Brown, Ohio State University
Anne L. Madsen, University of New Mexico

MAA Panel Discussion
9:00 AM - 10:30 AM
Opportunities for mathematically motivated youth.
Organizer: Richard D. Sommer, Stanford University
Panelists: Linda Brody, Johns Hopkins University
Carol Blackburn, Johns Hopkins University
Rafe A. Mazzeo, Stanford University
Raymond Ravaglia, Stanford University
Zvezdelina E. Stankova-Frenkel, Mills College

MAA Project NExT Panel Discussion
9:00 AM - 10:30 AM
How to make the most of teaching evaluations.
Organizers: T. Christine Stevens, St. Louis University
Joseph A. Gallian, University of Minnesota, Duluth
Aparna W. Higgins, University of Dayton
Panelists: Jeffrey S. Connor, Ohio University
Carl C. Cowen, Purdue University
William E. Fenton, Bellarmine University
Pamela B. Pierce, College of Wooster

Book Sales and Exhibits
9:30 AM - 5:30 PM

MAA Invited Address
10:05 AM - 10:55 AM
Probability, combinatorics, and physics in analytic number theory.
Organizers: Andrew J. Granville, University of Georgia
(973-A0-33)

MAA Minicourse #7: Part A
10:15 AM - 12:15 PM
Creating and exporting computer animations to the Web.
Organizers: William D. Emerson, Metropolitan State College of Denver
Louis A. Talman, Metropolitan State College of Denver
Bradford Kline, Metropolitan State College of Denver

MAA Panel Discussion
10:45 AM - 12:15 PM
NSF funding opportunities for learning and teaching in the mathematical sciences.
Organizers: Dennis E. Davenport, NSF/Division of Undergraduate Education
James H. Lightbourne, NSF/Division of Undergraduate Education
Elizabeth J. Teles, NSF/Division of Undergraduate Education
Lee L. Zia, NSF/Division of Undergraduate Education
MAA Panel Discussion

10:45 AM - 12:15 PM

College credit by examination: The Advance Placement (AP®) and College-Level Examination (CLEP®) Programs.

Organizer: Gloria S. Dion, Educational Testing Service
Moderator: Gloria S. Dion
Panelists: James R. Choike, Oklahoma State University
Jane P. Coffee, College of Staten Island, CUNY
Roxy Peck, California Polytechnic State University, San Luis Obispo
Lawrence H. Riddle, Agnes Scott College

Life after a math sciences major: Tracking and using alumni career information.

Organizer: John D. Fulton, Virginia Polytechnic Institute and State University
Moderator: Michael G. Monticino, University of North Texas
Presenters: Andrew Sterrett
David J. Lutzer, College of William and Mary
Laura J. Person, SUNY at Potsdam
Lisa M. Traynor, Bryn Mawr College

SIAM Invited Address

11:10 AM - NOON

Variational PDE models and algorithms in image processing.
Tony F. Chan, University of California Los Angeles and Institute for Pure and Applied Mathematics

AMS Colloquium Lectures: Lecture II

1:00 PM - 2:00 PM

Lawrence Craig Evans, University of California Berkeley (973-35-04)

AMS-MAA-MER Special Session on Mathematics and Education Reform, IV

1:00 PM - 2:20 PM

Organizers: William H. Barker, Bowdoin College
Jerry L. Bona, University of Texas at Austin
Naomi D. Fisher, University of Illinois at Chicago
Kenneth C. Millett, University of California Santa Barbara

1:00 PM Connecting Mathematics Education Research and Teaching Practice Panel Discussion.
Jerry L. Bona, University of Illinois at Chicago (973-97-1226)

AMS-ASL Special Session on Set Theory and Classification Problems, III

1:00 PM - 3:50 PM

Organizer: Simon R. Thomas, Rutgers University
The Lascar group.
(554) Anand Pillay, Univ. Illinois at Urbana-Champaign (973-03-659)

1:30 PM On groups definable in o-minimal structures.
(555) Preliminary report.
Sergei Starchenko, University of Notre Dame (973-03-743)

2:00 PM Algebraic dimension on subgroups of the multiplicative group of algebraically closed fields of characteristic zero. Preliminary report.
Kitty L Holland, Northern Illinois University (973-03-712)

2:30 PM Existential Lefschetz Principles for Power Series
(557) Rings and Artin Approximation.
Hans Schoutens, Ohio State University (973-03-485)

3:00 PM The role of torsors for elimination of imaginaries.
(558) Deirdre Haskell*, McMaster University, Ehud Hrushovski, Hebrew University, and Dugald Macpherson, University of Leeds (973-03-535)

3:30 PM The greatest common divisor of two integers cannot be computed in a uniformly bounded number of steps. Preliminary report.
Lou van den Dries, University of Illinois (973-03-423)

AMS Special Session on Symbolic Dynamics, IV

1:00 PM - 3:50 PM

Organizers: Aimee S. A. Johnson, Swarthmore College
Kathleen M. Madden, Drew University

1:00 PM Dimension groups of finite rank and subshifts.
(560) Mike Boyle, University of Maryland, College Park (973-37-1041)

1:30 PM Limit measures for Linear Cellular Automata II.
(561) Reem Yassawi*, Trent University, and Marcus Pivato, University of Houston (973-28-517)

2:00 PM Branching Cellular Automata.
(562) Peter van der Wal, Oregon State University / Delft University of Technology (the Netherlands) (973-37-1145)

2:30 PM Positive K-theory for finitary isomorphisms of Markov chains.
Ricardo Gomez-Aiza, Universidad Nacional Autonoma de Mexico (UNAM) (973-37-1256)

3:00 PM Maximal n-circuit directed graphs.
(564) David Hobby, Donald Silberger, SUNY New Paltz, and Sylvia Silberger*, Hofstra University (973-05-1087)

3:30 PM A variational principle for AP-dimensions.
(565) Preliminary report.
Edgardo Ugalde, IICO-UASLP (973-37-1145)

AMS Special Session on Dynamic Equations on Time Scales, I

1:00 PM - 4:10 PM

Organizers: Martin J. Bohner, University of Missouri, Rolla
Billur Kaymakcalan, Georgia Southern University
AMS Special Session on Algebraic Coding Theory, II

1:00 PM - 4:10 PM
Organizers: Marcus Greferath, San Diego State University

Michael E. O'Sullivan, San Diego State University
Roxana N. Smarandache, San Diego State University

1:00 PM
List decoding of Reed-Solomon codes and codes from curves. Preliminary report.
> (579) Ralf Koetter*, University of Illinois, and Alexander Vardy, University of California, San Diego (973-94-1166)

2:00 PM
Gr"obner bases and interpolation in decoding.
> (580) Eimear Byrne, Patrick Fitzpatrick* and Henry O'Keeffe, University College Cork (973-94-822)

2:30 PM
The minimum distance of some Hermitian codes.
> (581) Gretchen L. Matthews, Clemson University (973-94-1350)

3:00 PM
Subspace subcodes of Reed-Solomon codes.
> (582) Sarah A Spence, Cornell University (973-94-1034)

3:25 PM
Convolutional Codes, an Algebraic Geometric Point of View.
> (583) Joachim Rosenthal, University of Notre Dame (973-94-815)

AMS Special Session on Algebras, Forms, and Algebraic Groups, II

1:00 PM - 4:10 PM
Organizers: R. Skip Garibaldi, University of California Los Angeles
David J. Saltman, University of Texas at Austin
Adrian R. Wadsworth, University of California San Diego

1:00 PM
Special Forms of Two Symbols are Division Algebras.
> (584) Bill Jacob*, UCSB, and Roberto Araujo, Universidad Arturo Prat (973-16-1067)

1:30 PM
Weakly Azumaya Algebras and Frobenius Algebras.
> (585) Preliminary report.
Darrell E. Haile, Indiana University (973-16-1066)

2:00 PM
Birational Isomorphisms Between Severi-Brauer Varieties.
> (586) Daniel R Krasenh, University of California, Los Angeles (973-16-1053)

2:30 PM
Stable rationality of the center of the generic division ring.
> (587) Esther Beneish, Northwestern University (973-16-1108)

3:00 PM
p-algebras of exponent p.
> (588) Uzi Vishne, Yale University (973-16-1427)

3:25 PM
Division Algebras with PSL(2,q)-Galois Maximal Subfield.
> (589) Preliminary report.
Elizabeth S Allman*, University of Southern Maine, and Murray M Schacher, UCLA (973-12-52)

3:50 PM
Alternate forms and the Brauer group of a field containing the roots of unity. Preliminary report.
> (590) Eric S Brussel, Emory University (973-16-1188)

AMS Special Session on Analysis and Application of Quasilinear Partial Differential Equations, III

1:00 PM - 4:10 PM
Organizers: Suncica Canic, University of Houston
Eun Heui Kim, California State University, Long Beach

AMS Special Session on Commutative Algebra and Algebraic Geometry, IV

1:00 PM - 4:10 PM
Organizers: Paul C. Roberts, University of Utah
Anurag K. Singh, University of Utah

1:00 PM
> (572) C.Y. Jean Chan*, Purdue University, and Jung-Chen Liu, National Taiwan Normal University (973-13-1196)

1:30 PM
Intersection Theory for Cohen-Macaulay Schemes.
> (573) Izuru Mori, Purdue University (973-14-696)

2:00 PM
On a Conjecture of Kurano and Roberts. Preliminary report.
> (574) Sean M Sather-Wagstaff, University of Illinois (973-13-741)

2:30 PM
A vanishing criterion for local cohomology modules in characteristic p0.
> (575) Gennady Lyubeznik, University of Minnesota (973-13-1108)

3:00 PM
On Modules of Finite Projective Dimension over Complete Intersections.
> (576) Sankar P. Dutta, University of Illinois at Urbana-Champaign (973-13-739)

3:25 PM
Remarks on the Cohomology of Chow Varieties.
> (577) E. Javier Elizondo*, Instituto de Matematicas, and Vasudevan Srinivas, TATA Institute for Fundamental Research (973-14-928)

3:50 PM
Restricting syzygies to linear subspaces. Preliminary report.
> (578) David Eisenbud, UC Berkeley and MSRI, Mark Green, UCLA, Klaus Hulek, Universitaet Hannover, Germany, and Sorin Popescu*, SUNY at Stony Brook (973-14-1148)
AMS Special Session on Low Dimensional Topology, IV

1:00 PM - 4:10 PM

Organizer: Tim D. Cochran, Rice University

Organizer: Tim D. Cochran, Rice University

1:00 PM
Patrick Bahls* and Michael L Mihalik, Vanderbilt University, Department of Mathematics (973-20-1089)

1:30 PM
Decompositions of 4-manifolds into 2-handlebodies.
Frank Quinn, Virginia Tech (973-57-666)

2:00 PM
An Intrinsic Geometric Characterization of the sec invariant.
Gregory S Clark, Rice University (973-57-368)

2:30 PM
Preliminary report.
Paul Frank Baum, Penn State University (973-19-1237)

3:00 PM
Surgery and involutions on 4-manifolds.
Vyacheslav S Krushkal, University of Virginia (973-57-1093)

3:30 PM
Codimension two PL embeddings of spheres with nonstandard regular neighborhoods. Preliminary report.
Dusan Repovs, University of Ljubljana (973-57-41)

4:00 PM
2-Complexes at a Non-Minimal Level. Preliminary report.
Jacqueline A Jensen, University of Oregon, Eugene (973-55-801)

MAA Minicourse #12: Part A

1:00 PM - 3:00 PM

Introduction to mathematical card tricks.
Organizers: Colm K. Mulcahy, Spelman College
Jeffrey A. Ehme, Spelman College

MAA Minicourse #8: Part A

1:00 PM - 3:00 PM

Real-world problem solving using technology and student projects.
Organizers: Bruce Pollack-Johnson, Villanova University
Audrey Borchard, Villanova University

AMS Session on Real and Complex Analysis

1:00 PM - 3:55 PM

1:00 PM
Cantor and a Few Good Numbers.
Ioana Mihaila, Coastal Carolina University (973-26-330)

1:15 PM
On a paper of Carleson.
Melnika A Brakalova*, Hotchkiss School, and James A Jenkins, Washington University (973-30-1149)

1:30 PM
Generalizations of some new inverse type Hilbert integral inequalities.
Chang-Jian Zhao and Lokenath Debnath*, University of Texas-Pan American (973-26-922)

1:45 PM
Nowhere Weakly Symmetric Functions.
Kandasamy Muthuvel, University of Wisconsin-Oshkosh (973-13-111)

2:00 PM
Convergence rate of averages over balls in Sobolev Spaces.
Javad Namazi, Fairleigh Dickinson University (973-28-82)

AMS Session on Combinatorics and Graph Theory, I

1:00 PM - 4:10 PM

1:00 PM
Tiling Rectangles with Trominoes.
J Marshall Ash*, DePaul University, and Solomon W Golomb, University of Southern California (973-05-759)

1:15 PM
Multidecompositions of the complete graph.
Atif Abueida*, University of Dayton, and Mike Daven, Mount Saint Mary College (973-05-263)

1:30 PM
Multidesigns for graph-pairs of order 4 and 5.
Atif A Abueida*, University of Dayton, and Mike Daven*, Mount Saint Mary College (973-05-257)

1:45 PM
Independent sums of arithmetic progressions in $k_m$-free graphs.
Neil Hindman*, Howard University, and Dona Strauss, University of Hull (973-05-315)

2:00 PM
A lower bound for the domination number of complete grid graphs.
David R. Guichard*, Whitman College, and David C. Fisher, Denver, Colorado (973-05-652)

2:15 PM
k-Ordered Hamiltonicity of Iterated Line Graphs.
Kathleen A Ponto, University of Notre Dame (973-05-653)

2:30 PM
Paths as m-step competition graphs.
Geir T Helleloid, University of Wisconsin - Madison (973-05-680)

2:45 PM
Number of Labeled Spanning Trees in a Cycle-Removed Complete Graph.
Jovan Hadzic, University of Wisconsin - Madison (973-05-680)

3:00 PM
Homeomorphs and Amallamorphs of the Petersen Graph.
Hossein Shahmohamad*, Rochester Institute of Technology, and Earl G Whitehead, Jr., university of Pittsburgh (973-05-707)
AMS Contributed Session on Many Lives of Lattice Theory and the Theory of Ordered Sets with Connections to Combinatorics

1:00 PM - 4:10 PM

1:00 PM A symmetric chain decomposition of Young's lattice, \((L, \leq, n)\), when \(n\) is odd.
Derek A Smith, Lafayette College (973-06-90)

1:15 PM Linear inequalities for the flag Whitney numbers of geometric lattices. Preliminary report.
Kathryn L Nyman, Texas A&M University (973-06-766)

1:30 PM Discrete Morse functions and partitions of a multiset.
Eric K Babson, University of Washington, and Patricia L Hersh*, University of Michigan (973-05-914)

1:45 PM Sperner's theorem and its generalizations. Preliminary report.
Matthias Beck*, Xueqin Wang and Thomas Zaslavsky, SUNY Binghamton (973-05-191)

2:00 PM Lattice of Commuting Boolean Subalgebras.
Catherine H Yan, Texas A&M University (973-06-121)

2:15 PM Order Dimension, Strong Bruhat Order and Lattice Properties for Posets.
Nathan Reading, University of Minnesota (973-06-117)

2:30 PM Path Independent Choice Theory, LLD lattices and their Construction.
Mark R Johnson*, Texas Christian University, and Richard A Dean, California Institute of Technology (973-06-356)

2:45 PM The automorphism problem for ordered sets.
Bernd S.W. Schroeder', Louisiana Tech University (973-06-28)

Jonathan D Farley, University of Oxford (973-06-1322)

3:15 PM Projective posets and unique colourability of graphs.
Benoit Larose, Concordia University (973-06-273)

Amit Agarwa1, Department of Computer Science & Engineering, Pennsylvania State University - University Park, Matt Insall, Department of Mathematics & Statistics, University of Missouri - Rolla, and Donald C Wunsch, Department of Electrical & Computer Engineering, University of Missouri - Rolla (973-06-186)

3:45 PM Recent Developments in Noncommutative Lattices.
Jonathan E Leech, Westmont College Santa Barbara, CA (973-06-146)

4:00 PM Epidemiology: A natural application for order theory. Preliminary report.
Jonathan E Leech, Westmont College Santa Barbara, CA (973-06-146)

MAA Session on History of Mathematics in the Second Millennium, III

1:00 PM - 3:35 PM

Organizers: Janet L. Beery, University of Redlands C. Edward Sandifer, Western Connecticut State University

1:00 PM Mistakes, Fallacies, and Misconceptions in the History of Mathematics. Preliminary report.
Mark S. Burgin, UCLA (973-A1-837)

1:20 PM Who created the decimal fractions for the first time in the world? Mohammad Moazzam, Salisbury University (973-A1-297)

1:40 PM Fundamental Theorem of Calculus — from Archimedes to Cauchy.
Po-Hung Liu, Chiny Institute of Technology, Taiwan (973-A1-251)

2:00 PM Cinemat: Mathematics on the Silver Screen.
Charlie L Smith, Park University (973-A1-80)

Martin E Flashman, Humboldt State University (973-A1-512)

2:40 PM Using Architecture to Teach the History of Mathematics. Preliminary report.
Maria R Zack, Point Loma Nazarene University (973-A1-405)

3:00 PM Video Group Projects to Learn about the History of Mathematics of the Second Millennium CE.
Agnes Tuska, California State University, Fresno (973-A1-509)

3:20 PM Resolving Kemeny's Conjecture: A Peek into the Third Millennium?

MAA Session on Initiating and Sustaining Undergraduate Research Projects and Programs, II

1:00 PM - 4:00 PM

Organizers: John R. Swallow, Davidson College Suzanne M. Lenhart, University of Tennessee Daniel J. Schaal, South Dakota State University

1:00 PM Establishing a Long Term Undergraduate Research Program in Mathematics. Preliminary report.
Michael J. Bardzell, Salisbury University (973-E1-525)

Kelly Black* and John B Geddes, University of New Hampshire (973-E1-91)
### Program of the Sessions - San Diego, CA, Monday, January 7 (cont’d.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>1:35PM</td>
<td>Ideas for Persuading Undergraduates to Become Involved in Mathematical Projects. Deborah A Sherman-Denver, Marshall University (973-E1-333)</td>
</tr>
<tr>
<td>1:50PM</td>
<td>Integrating research in undergraduate courses and studies. Aliakbar Montazer-Haghighi, Benedict College (973-E1-118)</td>
</tr>
<tr>
<td>2:05PM</td>
<td>Providing Real Research Opportunities to Undergraduates. Catherine A Roberts, College of the Holy Cross (973-E1-188)</td>
</tr>
<tr>
<td>2:25PM</td>
<td>Break.</td>
</tr>
<tr>
<td>2:40PM</td>
<td>Mathematical Biology REU at Jacksonville University. Preliminary report. Sanjay Rai* and Michael Nancarrow, Jacksonville University (973-E1-381)</td>
</tr>
<tr>
<td>3:00PM</td>
<td>Problem Solving Groups as Research. Preliminary report. Dave Feil, Carroll College (973-E1-406)</td>
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<tr>
<td>3:15PM</td>
<td>Experience is a teacher - Some thoughts for the pool. Timothy J Pennings, Hope College (973-E1-69)</td>
</tr>
<tr>
<td>3:30PM</td>
<td>Experiences with an Undergraduate Research Program Exploring Dynamical Systems with MAPLE. Preliminary report. Malcolm R Adams, University of Georgia (973-E1-555)</td>
</tr>
<tr>
<td>3:45PM</td>
<td>Lessons Learned about Applying for NSF Funding for an REU. Daniel J Schaal, South Dakota State University (973-E1-538)</td>
</tr>
</tbody>
</table>

### MAA Session on Computational Mathematics in Linear Algebra and Differential Equations, II

**1:00 PM - 3:35 PM**

Organizers: Richard J. Marchand, SUNY at Fredonia, Elias Y. Deeba, University of Houston-Downtown, Timothy J. McDevitt, Millersville University

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>1:00PM</td>
<td>The SVD and QSVQD in signals processing and signal separation. Preliminary report. Douglas R Hundleb, Whitman College (973-H1-602)</td>
</tr>
<tr>
<td>1:40PM</td>
<td>Linear Algebra and Technology. Dipa Choudhury* and George Mackiw, Loyola College in Maryland (973-H1-590)</td>
</tr>
<tr>
<td>2:00PM</td>
<td>Finding Unpredictable Behavior in a Simple Ordinary Differential Equation. Lisa D Humphreys, Rhode Island College (973-H1-331)</td>
</tr>
<tr>
<td>2:20PM</td>
<td>Investigation of fluid resistance to enhance student understanding of parameter variation in ODE's. John M McArthur, University of Southern Colorado (973-H1-484)</td>
</tr>
</tbody>
</table>

### MAA Invited Paper Session on Probability and Combinatorics in Analytic Number Theory, I

**1:00 PM - 3:55 PM**

Organizer: Andrew J. Granville, University of Georgia

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>1:00PM</td>
<td>Sums of powers of Kloosterman sums. Preliminary report. Ron J Evans* and Timothy Choi, University of California at San Diego (973-U1-1062)</td>
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<tr>
<td>Time</td>
<td>Event</td>
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<tr>
<td>1:30PM</td>
<td>Totally real number fields with large class number.</td>
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<tr>
<td>2:00PM</td>
<td>Some singular measures which have applications to Number Theory.</td>
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<tr>
<td>2:30PM</td>
<td>Fixed Points for Discrete Logarithms. Preliminary report.</td>
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<tr>
<td>3:00PM</td>
<td>A proof of a partition conjecture of Bateman and Erdos.</td>
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<tr>
<td>3:30PM</td>
<td>On the Additive Structure of Prime Numbers.</td>
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<tr>
<td>2:00PM</td>
<td>SIAM Minisymposium on Mathematical Models for Image Analysis and Computer Vision</td>
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<td>2:00PM</td>
<td>Navier-Stokes, Fluid Dynamics, and Image and Video Inpainting.</td>
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<tr>
<td>2:00PM</td>
<td>Partial Differential Equations on Implicit Surfaces.</td>
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<tr>
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<td>Navier-Stokes, Fluid Dynamics, and Image and Video Inpainting.</td>
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<tr>
<td>2:30PM</td>
<td>Characterization and visualization of unorganized data points using the distance function.</td>
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<tr>
<td>2:50PM</td>
<td>Break.</td>
</tr>
<tr>
<td>2:55PM</td>
<td>Local Inpainting of Images on Implicit Surfaces.</td>
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<tr>
<td>3:00PM</td>
<td>Characterization and visualization of unorganized data points using the distance function.</td>
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<tr>
<td>3:00PM</td>
<td>Numerical methods for p-harmonic flows and applications to image processing. Preliminary report.</td>
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<tr>
<td>3:20PM</td>
<td>Characterization and visualization of unorganized data points using the distance function.</td>
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</tbody>
</table>

AMS-MMA Committee on Teaching Assistants and Part-Time Instructors Panel Discussion

1:00 PM - 2:30 PM
Research on TAs: Background, beliefs, attitude, and practice.
Organizer: Bruce Reznick, University of Illinois at Urbana-Champaign

AMS Special Presentation

1:00 PM - 2:00 PM
Using the AMSREFS package for LaTeX bibliographies.
Presenter: Michael J. Downes, AMS

MAA CUPM Subcommittee on Calculus Reform and the First Two Years-MAA Task Force on the First College Level Mathematics Course Panel Discussion

1:00 PM - 2:30 PM
Rethinking the preparation for calculus.
Organizers: Sheldon P. Gordon, SUNY at Farmingdale
Nancy Baxter Hastings, Dickinson College
Moderator: Jack Y. Narayan, SUNY at Oswego
Panelists: Steven R. Dunbar, University of Nebraska
Nancy Baxter Hastings
Sheldon P. Gordon

MAA CUPM Subcommittee on Undergraduate Research Panel Discussion

1:00 PM - 2:30 PM
Providing and promoting opportunities for undergraduates: A win-win situation.
Organizer: Sandra O. Paur, North Carolina State University
Presenters: Colin C. Adams, Williams College
Paul D. Humke, Budapest Seminars
Sergei Tabachnikov, Pennsylvania State University

SIAM Minisymposium on Undergraduate Programs and Research Projects in Applied and Computational Mathematics

2:15 PM - 4:10 PM
Organizer: Terry L. Herdman, Virginia Polytechnic Institute and State University

2:15PM Research Experiences in Applied Math at the University of Tennessee.
Suzanne Lenhart, University of Tennessee (973-92-539) |
2:45PM The Applied and Computational Mathematical Sciences Program at the University of Washington.
James V. Burke, University of Washington (973-35-679) |
3:15PM Undergraduate Research Projects Course.
Charles R MacCluer, Michigan State University (973-97-454) |
Program of the Sessions – San Diego, CA, Monday, January 7 (cont’d.)

<table>
<thead>
<tr>
<th>Time</th>
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<th>Details</th>
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<tbody>
<tr>
<td>3:45PM</td>
<td>Preparing Undergraduate Students for Research.</td>
<td>Kelly J Black* and John B Geddes, University of New Hampshire (973-97-694)</td>
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<td><strong>MAA Project NExT Panel Discussion</strong></td>
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<tr>
<td>2:15PM</td>
<td>Successful programs that integrate mathematics with other disciplines.</td>
<td>Organizers: Timothy D. Comar, Benedictine University, Michael J. Dorff, Brigham Young University, Mary Garner, Kennesaw State University, Joan Ferrini-Mundy, Michigan State University, Agnes M. Rash, St. Joseph’s University, John L. Scharf, Carroll College.</td>
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<td><strong>MAA Special Presentation</strong></td>
<td>Mathematics preparation of doctorates in mathematics education.</td>
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<td>2:45PM</td>
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<td>Organizer: Robert E. Reys, University of Missouri, Columbia</td>
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<td>Presenters: Glenda Lappan, Michigan State University, Jeremy Kilpatrick, University of Georgia, Jim Lewis, University of Nebraska.</td>
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<td></td>
<td><strong>MAA CUPM Subcommittee on Calculus Reform and the First Two Years Panel Discussion</strong></td>
<td>Integrating statistics/data analysis through the core curriculum.</td>
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<td>2:45PM</td>
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<td>Organizer: Donald B. Small, U. S. Military Academy</td>
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<td>Moderator: Gary H. Krahn, U. S. Military Academy</td>
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<td>Panelists: George W. Cobb, Mount Holyoke College, Steve W. Horton, U. S. Military Academy, Roxy Peck, California Polytechnic State University at San Luis Obispo, Alan J. Rossman, Dickinson College</td>
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<td></td>
<td><strong>SUMMA-MAA Committee on Minority Participation in Mathematics Panel Discussion</strong></td>
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<td>2:45PM</td>
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<td>Organizer: William A. Hawkins, Jr., MAA and the University of the District of Columbia</td>
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<td>Panelists: Eda Davis-Butts, Oregon State University, Daniel J. Madden, University of Arizona at Tucson, David L. Pagni, California State University at Fullerton.</td>
</tr>
</tbody>
</table>

**AMS Invited Address**

3:20 PM – 4:10 PM

(715) Computational problems in topology: The complexity of unknotting.
Jeffrey C. Lagarias, AT&T Laboratories Research (973-57-08)

**Joint Prize Session and Reception**

4:25 PM – 6:00 PM

**Two-Year College Reception**

5:45 PM – 7:00 PM

**Annual Reunion of University of Wisconsin-Madison**

5:45 PM – 7:00 PM

**Purdue Mathematics Department Alumni Reception**

6:00 PM – 7:30 PM

**MER Banquet**

6:30 PM – 9:30 PM

**Knitting Network**

8:15 PM – 9:45 PM

Organizers: Sarah-Marie Belcastro, Bowdoin College, Carolyn Yackel, Indiana University

**Tuesday, January 8**

**Joint Pi Mu Epsilon and MAA Student Chapter Advisors’ Breakfast**

7:00 AM – 8:00 AM

**Joint Meetings Registration**

7:30 AM – 4:00 PM

**AMS Special Session on The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, I**

7:30 AM – 10:50 AM

Organizers: Jonathan D. Farley, University of Oxford and Vanderbilt University, Stefan E. Schmidt, New Mexico State University

7:30 AM | Ordered sets connected with semigroups.                                                                 |
|        | Preliminary report. Boris M. Schein, University of Arkansas (973-06-132)                             |

8:00 AM | Lattice Decompositions of Multivariate Functions.                                                  |
|        | Preliminary report. Juan K Lin, Rutgers University, Department of Statistics (973-06-157)        |

8:30 AM | Scaled Boolean Algebras.                                                                          |
|        | (718) Michael J Hardy, Massachusetts Institute of Technology (973-06-113)                       |
9:00 AM - 10:50 AM

Organizers: Martin J. Bohner, University of Missouri, Rolla
Billur Kaymakcalan, Georgia Southern University

AMS Special Session on Dynamic Equations on Time Scales, II

8:00 AM - 10:50 AM

Organizers: Martin J. Bohner, University of Missouri, Rolla
Billur Kaymakcalan, Georgia Southern University

AMS Special Session on Probabilistic Methods in Combinatorics and the Internet, I

8:00 AM - 10:50 AM

Organizers: Fan Chung Graham, University of California San Diego
Van Vu, University of California San Diego

AMS Special Session on Algebras, Forms, and Algebraic Groups, III

8:00 AM - 10:50 AM

Organizers: R. Skip Garibaldi, University of California Los Angeles
Program of the Sessions - San Diego, CA, Tuesday, January 8 (cont'd.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</table>
| 8:00AM | Level Set and PDE based methods in inverse problems, image processing, computer vision and graphics. Preliminary report.  
Stanley J Osher, University of California, Los Angeles (973-65-691) |
| 9:00AM | Undercompressive Shocks in Driven Film Flow.  
Andrea L Bertozzi, Duke University (973-35-649) |
| 9:30AM | Image Inpainting: Models, Theory, and Applications.  
Guillermo R. Sapiro, University of Minnesota (973-35-640) |
| 10:00AM | Computations of Multiphase Flows.  
Smadar Karni, University of Michigan (973-65-997) |
| 10:30AM | An Existence Result on Positive Solutions for a Class of Semilinear Elliptic Systems.  
D. D Hai and R. Shivaji*, Mississippi State University (973-35-1058) |

AMS Special Session on The Theory and Applications of Symmetric Functions, I

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</table>
| 8:00 AM - 10:50 AM | Organizers: Adriano Garsia, University of California San Diego  
Jeffrey B. Remmel, University of California San Diego  
John W. Neuberger, University of North Texas  
Stanley J. Osher, University of California, Los Angeles  
Thomas M. Langley*, Rose-Hulman Institute of Technology, and Jeffrey B. Remmel, University of California, San Diego (973-05-1251) |
| 8:00 AM  | Reduced Words Revisited.  
Adriano Garsia, UCSD (973-05-1390) |
| 8:30 AM  | Combinatorics of the Lascoux-Schützenberger Tree.  
David P Little, UCSD (973-05-1406) |
| 9:00 AM  | q-Analogs of symmetric functions.  
Michael A Zabrocki* and Geanina Tudose, York University (973-05-866) |
| 9:30 AM  | The plethysm of two Schur functions at hook and near-hook shapes.  
Thomas M Langley*, Rose-Hulman Institute of Technology, and Jeffrey B Remmel, UCSD (973-05-1251) |
| 10:00 AM | Trace Cocharacters and the Kronecker products of Schur Functions.  
Joaquín O Carbonara*, Buffalo State College, Luisa Carini, Universita di Palermo, and Jeffrey Remmel, UCSD (973-05-1110) |
| 10:30 AM | Counting Tableaux and Subtableaux.  
Herbert S Wilf, University of Pennsylvania (973-05-1242) |

AMS Special Session on Topology and Its Applications, I

<table>
<thead>
<tr>
<th>Time</th>
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</table>
| 8:00 AM - 10:50 AM | Organizers: Alexander Arhangelskii, Ohio University  
Melvin Henriksen, Harvey Mudd College  
James E. Keesling, University of Florida  
Ralph D. Kopperman, City College of CUNY  
John C. Mayer, University of Alabama at Birmingham  
W. W. Comfort*, Wesleyan University, and Jorge Galindo, Universitat Jaume I (973-22-1000)  
John W. Neuberger, University of North Texas  
Stanley J Osher, University of California, Los Angeles  
Thomas M Langley*, Rose-Hulman Institute of Technology, and Jeffrey B Remmel, University of California, San Diego (973-05-1251) |
| 8:00 AM  | Extremal Pseudocompact Topological Groups.  
W. W. Comfort*, Wesleyan University, and Jorge Galindo, Universitat Jaume I (973-22-1000) |
| 8:30 AM  | Tychonoff Expansions.  
Wanjun Hu, Wesleyan University CT (973-54-342) |
MAA Minicourse #13: Part A
8:00 AM - 10:00 AM
Getting students involved in undergraduate research.
Organizers: Aparna W. Higgins, University of Dayton
Joseph A. Gallian, University of Minnesota, Duluth
Stephen G. Hartke, Rutgers University

MAA Minicourse #3: Part A
8:00 AM - 10:00 AM
Optimal use of technology in teaching geometry at the college-university level.
Organizers: Subhash C. Saxena, Coastal Carolina University
Nick Jackiw, Key Curriculum Press

MAA Minicourse #9: Part A
8:00 AM - 10:00 AM
The Fibonacci and Catalan numbers.
Organizer: Ralph P. Grimaldi, Rose-Hulman Institute of Technology

AMS Session on Algebraic Topology and K-Theory
8:00 AM - 10:55 AM
8:00AM Prime Filtration in the Category of Noetherian Unstable Modules and Consequences (preliminary report). Preliminary report. Mara D Neusel, University of Notre Dame (973-55-45)
8:30AM Nielsen numbers as bordism invariants. Preliminary report. Peter Saveliev, Allegheny College (973-55-576)
8:45AM Immersing 2-Torsion Lens Spaces. Preliminary report. Thomas A Shinkus, Lehigh University (973-55-642)
9:00AM A Generalization of the Browning Invariant to Infinite Groups. Preliminary report. Katherine S Byler, University of Oregon (973-55-907)

AMS Session on Combinatorics and Graph Theory, II
8:00 AM - 10:55 AM
8:00AM Non-Unit examples of (n, i, f) tube orders. Preliminary report. Barry A Balof* and Kenneth P Bogart, Dartmouth College (973-05-871)
8:15AM Graphs with Cycle Lengths in a Certain Modularity Preliminary report. Stephen E Shauger, Coastal Carolina University (973-05-885)
8:30AM Critical Vertices in Dot-Critical Graphs. Preliminary report. Tamara A Burton*, Armstrong Atlantic State University, and David Sumner, The University of South Carolina (973-05-965)
8:45AM On the Edge Geodetic Number of a Graph. Mustafa Atici, Western Kentucky University (973-05-972)
9:00AM Bipartite Rainbow Ramsey Numbers. Linda L Eroh*, University of Wisconsin Oshkosh, and Ortrud Oellermann, University of Winnipeg (973-05-1011)
9:15AM Rado numbers for the equation \( \sum_{i=1}^{m-1} x_i = x_m \), for negative values of c. Wojciech K Kosek* and Daniel Schaal, South Dakota State University (973-05-1013)
9:30AM Domination parameters and \( \alpha \)-domination in digraphs and tournaments. Preliminary report. Larry J Langley*, Sarah K Merz, University of the Pacific, Dustin Stewart, University of Colorado, Denver, and Coburn Ward, University of the Pacific (973-05-1050)
9:45AM Some Results on k-insulated Sets. Elena Grigorescu, Bard College (973-05-1080)
10:00AM Tree-Tolerance Representations for Trees. Preliminary report. Mary Ann Saadi, Fitchburg State College (973-05-1092)
Program of the Sessions – San Diego, CA, Tuesday, January 8 (cont’d.)

10:30AM Pebling the n-path. Preliminary report.
   ► (792) Michael Jablonski, University of Tennessee at Knoxville (973-05-1124)
   ► (793) Cody Patterson*, Texas A&M University, and Collin Raymond, Arizona State University (973-05-1125)

MAA Session on Best Practices in Undergraduate Statistics Education

8:00 AM – 10:55 AM

Organizers: Mary M. Sullivan, Rhode Island College
   Carolyn M. Cuff, Westminster College

8:00AM Does the price of chocolate chip cookies affect the quality? Preliminary report.
   ► (794) Ann E Moskol, Rhode Island College (973-jl-1387)
8:20AM Using Census Data to Make Comparisons Between Cities.
   ► (795) Laura A McSweeney, Fairfield University (973-jl-656)
8:40AM Inferential Statistics by Example: The Search for the Three Nicked Dice.
   ► (796) Kenneth D Dutch, Centre College (973-jl-385)
9:00AM Developing Understanding Among Statistical Representations. Preliminary report.
   ► (797) Mary M Sullivan, Rhode Island College (973-jl-376)
   ► (798) Robin H Lock, St. Lawrence University (973-jl-636)
9:40AM Activities in Experimental Design.
   ► (799) Daniel J. Teague, NC School of Science & Mathematics (973-jl-437)
10:00AM Angle of Repose.
   ► (800) Stuart F Boersma*, Central Washington University, and Michele Huchy, Alfred University (973-jl-190)
   ► (801) Scott J Seipel and Ginger Holmes Rowell*, Middle Tennessee State University (973-jl-585)
10:40AM Scenarios for Statistics: some animations of real data analysis with Macromedia Flash 5.
   ► (802) Susan P Holmes, Stanford University (973-jl-373)

MAA Session on Redefining What a Modern “College Algebra” Experience Means, I

8:00 AM – 10:55 AM

Organizers: Sheldon P. Gordon, SUNY at Farmingdale
   Florence S. Gordon, New York Institute of Technology
   Arlene H. Kleinstein, SUNY at Farmingdale
   Mary Robinson, University of New Mexico, Valencia Campus
   Linda H. Boyd, Georgia Perimeter College
   Caren Diefenderfer, Hollins University

8:00AM A Contextual Definition of Functions for the College Algebra Course.
   ► (803) Scott R Herrick, Maharishi University of Management (973-K1-427)
8:20AM Why Can’t a Turkey Fly: The Power of Power Functions.
   ► (804) Florence S Gordon, New York Institute of Technology (973-K1-1117)

8:40AM College Algebra Reform Through Interdisciplinary Applications.
   ► (805) William P Fox* and Richard D West, Francis Marion University (973-K1-299)
9:00AM The impact of an interdisciplinary algebra/science course on students’ problem solving skills, critical thinking skills, and attitudes towards mathematics.
   ► (806) Karla J Otts*, University of Southern Colorado, and Brett M Elliott, Southeastern Oklahoma State University (973-K1-390)
   ► (807) Ronald J Harshbarger*, Univ. of South Carolina-Beaufort, and Lisa S Yocco, Georgia Southern Univ. (973-K1-201)
9:40AM College Algebra Reform in a Traditional Department.
   ► (808) Linda Martin, Albuquerque Technical Vocational Institute (973-K1-264)
10:00AM Preparing for Calculus Using Mathematica: A Laboratory Approach.
   ► (809) Barry Cherkas, Hunter College (CUNY) (973-K1-307)
10:15AM Using Compound Interest to Motivate the Study of Exponential Functions in College Algebra.
   ► (810) Michael J Cullinane, Keene State College (973-K1-244)
10:30AM The Probability of Factorable Quadratics:
   ► (811) Motivation for Completing the Square and the Quadratic Formula. Preliminary report.
   ► (812) Michael J. Bosse*, Indiana University of Pennsylvania, and N. R. Nandakumar, Delaware State University (973-K1-500)
10:45AM Project Enhanced College Algebra at Framingham State College.
   ► (813) Sarah L Mabrouk, Framingham State College (973-K1-647)

MAA Session on Strategies for Increasing the Diversity of Students in Mathematics

8:00 AM – 10:35 AM

Organizers: William Yslas Velez, University of Arizona, Tucson
   Marjorie Enneking, Portland State University
   William A. Hawkins, SUMMA
   Michael B. Freeman, University of Kentucky
   Robert E. Megginson, University of Michigan
   Wade Ellis, West Valley College

8:00AM Apache Math Camp - A summer program at the University of Arizona.
   ► (813) Daniel J Madden, University of Arizona (973-L1-840)
8:20AM Reflections on Efforts to Increase Female Participation in Mathematics.
   ► (814) Harvey B Keynes* and Andrea M Olson, University of Minnesota (973-L1-662)
8:40AM Increasing Retention in the Mathematical Sciences through Creation of Communities at the University of the Virgin Islands. Preliminary report.
   ► (815) Camille A McKayle, University of the Virgin Islands (973-L1-630)
San Diego, CA, Tuesday, January 8 – Program of the Sessions

8:00 AM - 10:35 AM

MAA Session on Using Examples from Sports to Enhance the Teaching of Mathematics, I

Organizers: Robert E. Lewand, Goucher College
Howard L. Penn, U.S. Naval Academy

8:00 AM
Home Run Hitting.
► (821) Howard L Penn, United States Naval Academy
(973-M1-308)

8:20 AM
Exceedances in Sports. Preliminary report.
► (822) Farzad D Noubary, Penn State University Schreyer
Honors College (973-M1-20)

8:40 AM
How Far Does a Marathoner Really Run? Preliminary report.
► (823) Robert N Talbert, Franklin College (973-M1-341)

9:00 AM
The Michael Jordan Problem: Solving a system of linear inequalities for lattice points.
Daniel J. Teague, NC School of Science & Mathematics (973-M1-436)

9:20 AM
What the Shortstop Sees.
► (825) Elton Graves, Rose-Hulman Institute of Technology
(973-M1-185)

9:40 AM
An Analysis of Scoring Algorithms in Boxing.
► (826) Robert E Lewand, Goucher College (973-M1-793)

10:00 AM
Elementary Modeling and the Olympics.
► (827) Jeffrey W Clark, Elon University (973-M1-228)

10:20 AM
Applications of College Algebra in Exercise and Sports Science.
Scott R Herriott* and Ken Dale, Maharishi University of Management (973-M1-489)

SIGMAA on Research on Undergraduate Mathematics Education, I

8:00 AM - 10:55 AM

Organizer: Julie Morrissett Clark, Hollins University

8:00 AM
A comparative investigation in college algebra of student appeals to authority in written mathematical justification.
Shandy Hauk*, University of Northern Colorado, and Matthew Isom, Arizona State University (973-M1-671)

AMS Session on Field Theory and Linear Algebra

8:15 AM - 10:55 AM

8:15 AM
Symmetrizing sets and multiaffine polynomials.
► (838) Preliminary report.
Micah J Smukler* and Weiqing Gu, Harvey Mudd College (973-15-1432)

8:30 AM
A bivariate analogue to the composed product of polynomials.
► (839) Preliminary report.
Kent M Neuerburg*, Southeastern Louisiana University, and Donald Mills, U.S. Military Academy (973-12-588)

9:00 AM
Uncountable Subfields of the Reals.
► (841) Ronald E Rietz, Gustavus Adolphus College (973-12-330)

9:15 AM
Twin Irreducible Polynomials over Finite Fields - Theoretical Results.
Gove W Effinger*, Skidmore College, Kenneth H Hicks, Ohio University, and Gary L Mullen, Penn State University (973-12-824)
9:30AM Twin Irreducible Polynomials over Finite Fields - Numerical Results.
Gove W Effinger, Skidmore College, Kenneth H Hicks*, Ohio University, and Gary L Mullen, Penn State University (973-12-851)

Preliminary report.
Ján Mináč, University of Western Ontario, and John Swallow*, Davidson College (973-12-1091)

10:00AM Isomorphism Classes of Hyperelliptic Function Fields. Preliminary report.
Mark J Motley, University of Kentucky (973-12-1381)

Kenneth R Driessel, University of Wyoming, Laramie, WY, Irvin R Hentzel, Iowa State University, Ames, IA, and Wasin So*, San Jose State University, San Jose, CA (973-15-261)

10:30AM Geometrical representation of $M$ and inverse $M$ matrices.
Yoshimitsu Iwasaki, Okayama University of Science (973-15-823)

10:45AM $P_0$ matrices and related completion problems.
Preliminary report.
Luz M DeAlba, Drake University (973-15-896)

AMS Special Session on Computational Topology, 1
8:30 AM - 10:50 AM
Organizers: Jeffrey C. Lagarias, AT&T Research Laboratories
William H. Jaco, Oklahoma State University

8:30AM New bounds for Betti numbers of semi-algebraic sets and algorithms for computing them.
Saugata Basu, Georgia Institute of Technology. (973-54-1289)

9:00AM Optimal geometry in topology. Preliminary report.
John M Sullivan, Univ. of Illinois (973-53-1228)

9:30AM Recognizing planar graphs in NP. Preliminary report.
Marcus Schaefer, Eric Sedgwick*, DePaul University, and Daniel Stefankovic, University of Chicago (973-68-1170)

10:00AM On the Andrews-Curtis conjecture and Algorithms from Topology.
Siddhartha Gadgil, SUNY at Stony Brook (973-20-868)

10:30AM A special case of the weak hyperbolization conjecture. Preliminary report.
Murray J Elder*, Jonathon P McCammond, Texas A&M University, and John Meier, Lafayette College (973-57-1046)

AMS Invited Address
9:00 AM - 9:50 AM
The role of rotation numbers in dynamical systems.
Preliminary report.
John M. Franks, Northwestern University (973-37-077)

ASL Invited Address
9:00 AM - 9:50 AM
Some applications of inner models.
Martin Zeman, University of California Irvine

MAA Special Presentation
9:00 AM - 10:30 AM
The Global Classroom: Live e-learning over the web.
Organizers: Marcelle Bessman, Jacksonville University
Douglas A. Quinney, Keele University, UK

Project NExT Panel Discussion
9:00 AM - 10:15 AM
Time for your first sabbatical...Now what?
Organizers: Cheri L. Boyd, Nazareth College
Mark R. Parker, Carroll College
Panelists: David L. Allen, Eastern Oregon University
Thomas H. Barr, Rhodes College
Christine L. Kinsey, Canisius College
William H. Marion, Valparaiso University
Cynthia J. Woodburn, Pittsburgh State University

MAA Special Presentation
9:00 AM - 10:30 AM
Grant-writing workshop for proposals to the NSF Division of Undergraduate Education.
Organizers: Dennis E. Davenport, NSF/Division of Undergraduate Education
James H. Lightbourne, NSF/Division of Undergraduate Education
Elizabeth J. Teles, NSF/Division of Undergraduate Education
Lee L. Zia, NSF/Division of Undergraduate Education

MAA Panel Discussion
9:00 AM - 10:30 AM
Mathematics in a postmodern age.
Organizers: Russell W. Howell, Westmont College, Santa Barbara
W. James Bradley, Calvin College
Moderator: Russell W. Howell
Panelists: W. James Bradley
Calvin Jongsm, Dordt College

MAA Committee on the Participation of Women-Women and Mathematics Network Special Presentation
9:00 AM - 10:30 AM
Successful mathematics outreach programs for women and girls.
Organizers: Elizabeth G. Yanik, Emporia State University
Book Sales and Exhibits
9:30 AM - 5:30 PM

AMS Committee on Meetings and Conferences Panel Discussion
9:45 AM - 10:45 AM
New directions at the NSF.
Moderator: Tony F. Chan, UCLA
Panelists: Douglas N. Arnold, Institute for Mathematics & Applications
David Eisenbud, Mathematical Sciences Research Institute
Mark L. Green, Institute for Pure and Applied Mathematics
Michael F. Singer, Mathematical Sciences Research Institute
Philippe Tondeur, NSF Division of Mathematical Sciences

AMS Special Presentation
10:00 AM - 10:55 AM
Who wants to be a mathematician?
Organizers: Michael A. Breen, AMS
Annette W. Emerson, AMS
William T. Butterworth, Barat College

AMS Invited Address
10:05 AM - 10:55 AM
(856) Meromorphic continuation of L-functions.
Richard Lawrence Taylor, Harvard University (973-11-06)

ASL Contributed Talks
10:10 AM - 11:00 AM

AMS-MAA Invited Address
11:10 AM - NOON
(857) Harmonic numbers and the ABC-conjecture.
Hendrik W. Lenstra, Jr., University of California Berkeley (973-11-16)

AMS Colloquium Lectures: Lecture III
1:00 PM - 2:00 PM
Lawrence Craig Evans, University of California Berkeley (973-35-05)

ASL Invited Address
1:00 PM - 1:50 PM
(859) Expressing graph and topological connectivity over the reals.
Leonid Libkin, University of Toronto

AMS-MAA Special Session on History of Mathematics, II
1:00 PM - 4:20 PM
Organizers: Thomas Archibald, Acadia University
David E. Zitarelli, Temple University

> (860) Nineteenth-Century Mathematics in Britain through the Pages of Its Scientific Journals.
Sloan E Despeaux, University of Virginia (973-01-820)

> (861) 'Spreading the Gospel': Gertrude M. Cox and the ISI Education Committee. Preliminary report.
Patti W Hunter, Westmont College (973-01-730)

> (862) More to the Story.
Karen H Parshall, University of Virginia

Eisso J Atzema, University of Maine (973-01-819)

Amy E Shell, United States Military Academy (973-01-50)

> (865) Oswald Veblen, Elizabeth Wilson and the Mathematics of the First World War.
David Alan Grier, George Washington University (973-01-75)

> (866) The role of manifolds in the history of topology and analysis.
Erwin O Kreyzig, Carleton University (973-01-733)

AMS Special Session on Dynamic Equations on Time Scales, III
1:00 PM - 5:20 PM
Organizers: Martin J. Bohner, University of Missouri, Rolla
Billur Kaymakcalan, Georgia Southern University

> (867) Preliminary report.
Billur Kaymakcalan, Georgia Southern University (973-34-1259)

> (868) Some function space inequalities and their application to oscillation problems in differential equations.
Richard Brown, University of Missouri-Rolla, and Don Hinton, University of Tennessee (973-34-1039)

> (869) Preliminary report.
Nickolai Kosmatov* and Eric R Kaufmann, University of Arkansas at Little Rock (973-35-77)

> (870) Search for solutions to a basic PDE on time scales.
Richard Archibald, Acadia University (973-35-77)

> (871) Preliminary report.
Eric R Kaufmann* and Nickolai Kosmatov, University of Arkansas at Little Rock (973-35-77)

> (872) Preliminary report.
Nickolai Kosmatov* and Eric R Kaufmann, University of Arkansas at Little Rock (973-45-78)
AMS Special Session on Computational Commutative Algebra and Algebraic Geometry, I
1:00 PM - 5:50 PM
Organizers: Elizabeth Arnold, Texas A&M University
   Amelia Taylor, Rutgers University

1:00 PM
Common transversals and tangents in $\mathbb{P}^3$.
(874) Gabor Megyesi, UMIST, Manchester, England, Frank Sottile*, University of Massachusetts, Amherst, and Thorsten Theobald, Technical University, Munich (973-14-999)

1:30 PM
The Hilbert function points in $\mathbb{P}^n \times \cdots \times \mathbb{P}^n$.
(875) Adam Van Tuyl, Lakehead University (973-13-1031)

2:00 PM
Properties of square-free monomial ideals.
(876) Preliminary report.
   Sara Faridi, George Washington University (973-13-1287)

2:30 PM
Parallel implementation of Buchberger's algorithm.
(877) Preliminary report.
   Symbolic and numeric implicitization of families of polynomials.
   James A. van Gils, Colorado State University (973-13-1362)

3:00 PM
Computing Gröbner bases on supercomputers.
(878) Preliminary report.
   Edward C. Mosteig, Tulane University (973-13-1219)

3:30 PM
Self-intersections of bicubic surfaces.
(879) Preliminary report.
   Michael Stillman*, Cornell University, and Andre Galligo, University of Nice (973-13-1362)

4:00 PM
Explicit inversion formulas for a model in diffuse tomography.
(880) Preliminary report.
   F. Alberto Grunbaum and Laura F. Matussevich, UC Berkeley (973-92-677)

5:00 PM
Polygon recognition and symmetry detection.
(882) Preliminary report.
   Mireille Boutin, Brown University (973-53-1122)

5:30 PM
Symbolic and numeric implicitization of families of curves, surfaces, and hypersurfaces.
(883) Ilias S. Kotsireas, Ontario Research Centre for Computer Algebra (973-14-1252)

AMS Special Session on Algebraic Coding Theory, III
1:00 PM - 5:45 PM
Organizers: Marcus Greferath, San Diego State University
   Michael E. O’Sullivan, San Diego State University
   Roxana N. Smarandache, San Diego State University

1:00 PM
Algebraic temptations in the theory of codes on graphs.
(884) Robert Michael Tanner, University of California, Santa Cruz (973-94-827)

2:00 PM
Codes, graphs, expanders and girth.
(885) Ian F. Blake, University of Toronto (973-94-845)

2:30 PM
On the Derivation of LDPC and Turbo Codes from Graphs with Large Girth.
(886) Preliminary report.
   Pascal O Vontobel*, Department of Information Technology and Electrical Engineering, ETH Zurich, Switzerland, and Joachim Rosenthal, Notre Dame University (973-94-1292)

3:00 PM
Algebra of Low Density Parity Check Codes.
(887) Emelina Soljanina*, Bell Labs, Lucent, and Elke Offer, Munich University of Technology (973-94-1272)

3:30 PM
An alternative point-counting algorithm for elliptic curves.
(888) Preliminary report.
   Kristin E Lauter* and Peter Montgomery, Microsoft Research (973-11-1361)

4:00 PM
New watermarking schemes from coding theory.
(889) Preliminary report.
   Nigel Boston, University of Illinois, Urbana-Champaign (973-94-1355)

4:30 PM
A class of near optimal polynomial codes.
(890) Preliminary report.
   Nuh Aydin* and Dijen K. Ray-Chaudhuri, The Ohio State University (973-05-227)

5:00 PM
Self-dual codes and zeta functions.
(891) Iwan Duursma, U of Illinois at U-C (973-11-1202)

AMS Special Session on Computational Topology, II
1:00 PM - 5:20 PM
Organizers: Jeffrey C. Lagarias, AT&T Research Laboratories
   William H. Jaco, Oklahoma State University

1:00 PM
The Complexity of Knot Genus.
(892) Joel Hass*, University of California, Davis, Ian Agol, Univ. of Illinois, Chicago, and William P Thurston, University of California, Davis (973-57-773)

1:30 PM
New algorithms from normal surfaces theory.
(893) Ben Burton, William Jaco*, David Letscher, Oklahoma State University, and J. Hyam Rubinstein, University of Melbourne (973-57-1472)

2:00 PM
Normal Surface Theory and Minimal Triangulations.
(894) Preliminary report.
   Alexander C Barchechat, UC Davis (973-54-765)

2:30 PM
Comparing Triangulations of 3-Manifolds.
(895) David M Letscher, Oklahoma State University (973-57-1132)

3:00 PM
Tabulation of classical links - the state of the game.
(896) Preliminary report.
   Morwen B Thistlethwaite, University of Tennessee (973-57-1065)

3:30 PM
Polynomial time complexity algorithm for computing coefficients of the Jones-Conway (Homflypt) and Kauffman polynomials of links.
(897) Preliminary report.
   Jozef H Przytycki, George Washington University (973-57-1066)

4:00 PM
Constraints on Vassiliev invariants and their complexity.
(898) Preliminary report.
   Oliver T Dasbach*, Oklahoma State University, and Xiao-Song Lin, UC Riverside (973-57-882)

4:30 PM
Dehn filling on outside torus of 3-bridge knot exterior.
(899) Preliminary report.
   Ying-Qing Wu, University of Iowa (973-57-1157)

5:00 PM
Discussion

AMS Special Session on Hybrid Systems, I
1:00 PM - 5:50 PM
Organizers: Elena Litsyn, Ben-Gurion University
### AMS Special Session on The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, II

**1:00 PM - 5:50 PM**

**Organizers:** Jonathan D. Farley, University of Oxford and Vanderbilt University  
Stefan E. Schmidt, New Mexico State University

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1:00PM</td>
<td><strong>Stability Properties of Hybrid Fuzzy Differential Equations, Preliminary report</strong></td>
<td>M Sambandham, Morehouse College (973-34-401)</td>
</tr>
<tr>
<td>1:30PM</td>
<td>A Neurocomputing Approach to Solving Partial Differential Equations.</td>
<td>Laurene V Faussett, Georgia Southern University (973-35-397)</td>
</tr>
<tr>
<td>2:00PM</td>
<td>Qualitative theory of Hybrid Systems and impulse effects.</td>
<td>Seenaith Sivasundaram, Embry-Riddle Aeronautical University (973-34-678)</td>
</tr>
<tr>
<td>3:00PM</td>
<td>On Partial Stability and Boundedness of Discontinuous Dynamical Systems.</td>
<td>Anthony N Michel*, University of Notre Dame, Alexander P Molchanov, Institute of Control Sciences, and Ye Sun, University of Notre Dame (973-93-805)</td>
</tr>
<tr>
<td>3:30PM</td>
<td>Universal Contingent Claims and Multiplicative Measures.</td>
<td>Valery A Kholodenyi, TXU Energy Trading (973-90-992)</td>
</tr>
<tr>
<td>4:00PM</td>
<td>Hybrid Control via Finsler Spaces and Connections. Preliminary report.</td>
<td>Anil Nerode*, Cornell University, and Wolf Kohn, Hyrnomics Corporation (973-93-1055)</td>
</tr>
<tr>
<td>4:30PM</td>
<td>Fundamental Theory of Control of Systems Involving a Kronecker Product of Matrices.</td>
<td>Kanuri N Murty* and Donald W Faussett, Georgia Southern University (973-34-1071)</td>
</tr>
<tr>
<td>5:00PM</td>
<td>Variational Lyapunov Method for Difference Equations.</td>
<td>Satyanarayana Dontha, Florida Institute of Technology (973-00-1151)</td>
</tr>
<tr>
<td>5:30PM</td>
<td>Quasilinearization for the Periodic Boundary Value Problem for Hybrid Impulsive Differential Equations.</td>
<td>Snezana G. Hristova* and Aghalaya S. Vatsala, University of Louisiana at Lafayette (973-34-852)</td>
</tr>
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</table>

### AMS Special Session on Partial Differential Equations and Their Applications, II

**1:00 PM - 5:50 PM**

**Organizers:** Reza Malek-Madani, United States Naval Academy  
Peter A. McCoy, United States Naval Academy  
John W. Neuberger, University of North Texas

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<td>1:00PM</td>
<td><strong>Interval Orders through Trapezoid Orders and Beyond.</strong></td>
<td>Kenneth P Bogart, Dartmouth College (973-06-147)</td>
</tr>
<tr>
<td>1:30PM</td>
<td>Interval Orders, Graph Coloring, Hamiltonian Paths and k-Sequences: Part I. Preliminary report.</td>
<td>William T Trotter, Arizona State University (973-06-1444)</td>
</tr>
<tr>
<td>2:00PM</td>
<td>The Linear and Weak Discrepancy of an Ordered Set.</td>
<td>Peter C Fishburn, AT&amp;T Shannon Laboratory, Paul J Tanenbaum, U.S. Army Research Laboratory, and Ann N Trenk*, Wellesley College (973-06-1408)</td>
</tr>
<tr>
<td>2:30PM</td>
<td>Lattice Theory in Economics.</td>
<td>Chris Shannon, University of California, Berkeley (973-06-153)</td>
</tr>
<tr>
<td>3:00PM</td>
<td>Some Applications of Vector Lattices to Economics and Finance. Preliminary report.</td>
<td>Charalampos D Aliprantis, Purdue University (973-06-418)</td>
</tr>
<tr>
<td>3:30PM</td>
<td>Lattice Properties of Equilibrium Solutions in Mathematical Economics.</td>
<td>Neil E. Gretsky, University of California, Riverside (973-90-790)</td>
</tr>
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**AMS Special Session on The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, II**

**1:00 PM - 5:50 PM**

**Organizers:** Jonathan D. Farley, University of Oxford and Vanderbilt University  
Stefan E. Schmidt, New Mexico State University

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<td>1:00PM</td>
<td><strong>A quasiorder representation for set systems and its application to consensus theory.</strong> Preliminary report.</td>
<td>Melvin F Janowitz*, DIMACS, and Gary D Crown, Wichita, KS (973-06-762)</td>
</tr>
<tr>
<td>1:30PM</td>
<td>Database Security and Concentrating Sums of Vectors.</td>
<td>Jerrold R Griggs, University of South Carolina (973-06-835)</td>
</tr>
<tr>
<td>2:00PM</td>
<td>A way to protect complex hierarchical information.</td>
<td>Marcus Grefeath, San Diego State University, and Stefan E Schmidt*, New Mexico State University (973-94-115)</td>
</tr>
<tr>
<td>2:30PM</td>
<td>Type-I and linear lattices. Preliminary report.</td>
<td>Mark D Haiman, U.C. Berkeley (973-06-770)</td>
</tr>
</tbody>
</table>

**AMS Special Session on Partial Differential Equations and Their Applications, II**

**1:00 PM - 5:50 PM**

**Organizers:** Reza Malek-Madani, United States Naval Academy  
Peter A. McCoy, United States Naval Academy  
John W. Neuberger, University of North Texas

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<td>New Perspectives on Atmosphere/Ocean Science Through Modern Applied Mathematics.</td>
<td>Andrew J Majda, Courant Institute of Mathematical Sciences (973-00-210)</td>
</tr>
</tbody>
</table>
| 2:00PM| Partial Differential Equations for Fluid Flow and Computer Graphics. | Ronald Fedkiw, Stanford University (973-76-969)  
**KdV-type equations and Boussinesq systems.** Preliminary report. | Min Chen, University of Central Florida (973-65-865) |
| 3:00PM| Visualization of Multiple Solutions of Semilinear Elliptic Equations. | Geong Chen, Texas A&M Univ. (973-35-1019)  
**Numerical Calculation of Critical Points of the Ginzburg- Landau Functional.** | John W Neuberger and Robert J Renka*, University of North Texas (973-35-354) |
| 4:00PM| Global well-posedness for the Camassa-Holm equation in the energy norm. Preliminary report. | Milena O Stanislavova* and Atanas G Stefanov, University of Massachusetts-Amherst (973-35-1038) |
| 4:30PM| Optimal design of a functionally graded elastic strip subjected to transient loading. Preliminary report. | Ani P Velo*, Army Research Laboratory, Aberdeen Proving Ground, MD U.S. Military Academy, West Point, NY, George A Gazonas and Michael J Scheidler, Army Research Laboratory, Aberdeen Proving Ground, MD (973-35-950) |
AMS Special Session on Research in Mathematics by Undergraduates, I

1:00 PM - 5:50 PM

Organizers: Carl V. Lutzer, Rochester Institute of Technology
Darren A. Narayan, Rochester Institute of Technology

1:00PM The Shilov Boundary of Operator Spaces.
- (929) Kay L Kirkpatrick, Montana State University (973-47-249)

1:30PM A Probabilistic Aspect of a Continuous
- (930) Nowhere-Differentiable Function.
- (931) Jer-Chin L Chuang, Furman University (973-26-217)

2:00PM Random Graphical Sequences. Preliminary report.
- (931) Megan T Smith*, Lawrence University, and Gabe Zimmer, East Tennessee State University (973-05-915)

2:30PM An exposition of elementary matroid theory.
- (932) Jonath D Blasiak, Princeton University, Jennifer M Rowe, Belmont University, Oded Yacobi*, Cornell University, and Lorenzo Traldi, Lafayette College (973-05-416)

3:00PM Algebra and Matrix Normed Spaces.
- (933) Seth M Hain, University of Nebraska - Lincoln (973-46-619)

3:30PM Continuity of the norm of a composition operator.
- (934) David B Pokorny*, UC Berkeley, Daniel McGinn, Carleton College (973-30-616)

4:00PM Approximate Statistical Moment Method for
- (936) Stephen G Penny, James Madison University (973-49-667)

4:30PM Common eigenvectors for matrices $X_1, \ldots, X_m$ when $X_i X_j$ is scalar for $i \leq j$. Preliminary report.
- (937) Adam H Berliner, Carleton College (973-15-853)

5:00PM Convergence of a family of random walks on the $d$-dimensional torus. Preliminary report.
- (938) Timothy M Prescott* and Francis E Su, Harvey Mudd College (973-60-1192)

5:30PM On two consecutive blocks with equal sums in a
- (939) Z-coloring of the integers. Preliminary report.
- (940) John B Gonzalez, Massachusetts Institute of Technology (973-11-1424)

AMS Special Session on Stochastic Processes and Functional Analysis (in honor of M. M. Rao), I

1:00 PM - 5:50 PM

Organizers: Alan C. Krinik, California State Polytechnic University Pomona
Randall J. Swift, California State Polytechnic University Pomona

1:00PM Reflections on M.M. Rao.
- (939) J. J. Uhl, University of Illinois at Urbana-Champaign (973-00-898)

1:15PM Stochastic analysis and function spaces.
- (940) M.M. Rao, Univ. of California, Riverside (973-60-883)

AMS Special Session on Topology and Its Applications, II

1:00 PM - 5:50 PM

Organizers: Alexander Arhangelskii, Ohio University
Melvin Henriksen, Harvey Mudd College
James E. Keesling, University of Florida
Ralph D. Kopperman, City College of New York
John C. Mayer, University of Alabama at Birmingham

1:00PM Indecomposable continua in dynamics. Preliminary report.
- (949) John C Mayer, University of Alabama at Birmingham (973-54-1338)

1:30PM A Semilinear Model for the Complex Exponential Map. Preliminary report.
- (950) Robert L Devaney, Boston University, and Mónica Moreno Rocha*, Boston University, Boston, MA (973-37-574)

2:00PM Conspicuous and the Structure of Periodic Orbits for Interval Maps.
- (951) David J Ryden, Tulane University (973-54-1240)

2:30PM Homological Rotation Vectors and Lyapunov Functions. Preliminary report.
- (952) John M. Alongi, California Polytechnic State University San Luis Obispo (973-37-785)
AMS Session on Ring Theory and Homological Algebra

1:00 PM - 5:25 PM

1:00 PM Valuative Spectra, Factorization, and Local Geometry. Preliminary report.
Yasuyuki Kachi* and Shashikant B Mulay, University of Tennessee (973-13-116)

1:15 PM Weakly Prime ideals.
Eric E Smith, University of Northern Iowa (973-13-445)

1:30 PM Formal Power Series and Composition.
Xiao-Xiong Gan, Morgan State University (973-13-693)

1:45 PM Multiplicative Invariants of Subgroups of Reflection Groups. Preliminary report.
Marc S Renault, Temple University (973-13-1090)

2:00 PM Cohen Macaulay Rings Of Invariants.
Jawahar H Pathak, Temple University (973-13-1142)

2:15 PM Power Series and the Preservation of Flat Covers.
David W. Dempsey, Jacksonville State University (973-13-1310)

2:30 PM Burnsides and Kurosh problems.
Lakhdar Hammoudi, Miami University (973-16-15)

2:45 PM Hopf Algebras Generated by a Coalgebra.
Charles B. Ragozzine, SUNY Oneonta (973-16-204)

3:00 PM When is the Universal Enveloping Algebra of a Lie Color Algebra Entire? Preliminary report.
Kenneth L Price, UW Oshkosh (973-16-523)

3:15 PM Semiprime crossed products over copointed Hopf algebras.
Declan Quinn and Serban Raianu*, Syracuse University (973-16-780)

AMS Session on Calculus of Variations

1:00 PM - 2:55 PM

1:00 PM Solution of Variational Problems via Hybrid of Piecewise Constant and Continuous Orthogonal Functions.
Mojtaba Haji, Mississippi State University (973-49-222)

1:15 PM Optimal Control of an HIV Immunology Model.
Hem R Joshi, University of Tennessee (973-49-804)

1:30 PM The Minimum Surface Problem Solved by Equivalent Problems.
Donald R Snow, Brigham Young University (973-49-948)

Reza R Ahangar*, University of Central Arkansas, and Stavros Belbas, University of Alabama (973-49-1083)
<table>
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<tr>
<td>4:15PM</td>
<td>Four-dimensional regular algebras mapping onto the 2-Veronese ring of a 3-dimensional regular algebra with generators of weights (1, 1, 2).</td>
<td>Darin R Stephenson, Hope College (973-16-1112)</td>
</tr>
<tr>
<td>4:30PM</td>
<td>(+) Admissible Sequences and the Preprojective Component. Preliminary report.</td>
<td>Helene R Tyler, Syracuse University (973-16-1184)</td>
</tr>
<tr>
<td>4:45PM</td>
<td>Binomial Rings. Preliminary report.</td>
<td>Jessica K Sklar, Pacific Lutheran University (973-16-1328)</td>
</tr>
<tr>
<td>5:00PM</td>
<td>Derived functors of Hom relative to flat covers. Preliminary report.</td>
<td>Stephen T Aldrich*, Saint Mary’s University of MN, Edgar E Enochs, University of Kentucky, and Juan A Lopes Ramos, University of Almeria (973-18-1173)</td>
</tr>
<tr>
<td>5:45PM</td>
<td>Unit and Proper Tube Orders and Graphs.</td>
<td>Lowell W Beineke*, Indiana University - Purdue University Fort Wayne, Jean E Dunbar, Converse College, and Marietje Frick, University of South Africa (973-05-1210)</td>
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<td>6:00PM</td>
<td>Some New Concepts on Edge Deleted Graphs.</td>
<td>Kelli R Carlson, Texas A&amp;M University (973-05-1283)</td>
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<td>6:30PM</td>
<td>Complementary Graphs and the Chromatic Number. Preliminary report.</td>
<td>William C Calhoun*, Kevin Ferland, Lisa Lister and John Polhill, Bloomsburg University (973-05-1303)</td>
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<td>6:45PM</td>
<td>Colorings of Graphs Defined by Conditions on Sets of Vertices. Preliminary report.</td>
<td>Gary Chartrand, Western Michigan University, Farrokh Saba*, Ebrahim Salehi, University of Nevada Las Vegas, and Ping Zhang, Western Michigan University (973-05-1306)</td>
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<td>7:00PM</td>
<td>Tightening Turyn’s bound in Hadamard difference sets.</td>
<td>Ji Young Choi, Iowa State University (973-05-1380)</td>
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<td>7:15PM</td>
<td>Least common multiples of cubes.</td>
<td>Preliminary report.</td>
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<td>7:45PM</td>
<td>Matroids derived from cycle spaces of graphs and linear transformations. Preliminary report.</td>
<td>Daniel C Silitay, Wright State University (973-05-1167)</td>
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<tr>
<td>8:00PM</td>
<td>Resistance Distance in Graphs and Cyclicity Measure.</td>
<td>Douglas J. Klein, Texas A&amp;M University - Galveston (973-05-1172)</td>
</tr>
<tr>
<td>8:15PM</td>
<td>Counting minimal paths in n-dimensional digital space.</td>
<td>Kwang Ik Kim, Pohang University of Science and Technology, Pohang, Republic of Korea (973-05-1199)</td>
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AMS Session on Combinatorics and Graph Theory, III

1:00 PM - 5:55 PM

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<td>1:00PM</td>
<td>Search for Group-Invariant Weighing Matrices W(60, 25). Preliminary report.</td>
<td>Paul E Becker, Penn State University - Erie (973-05-111)</td>
</tr>
<tr>
<td>1:15PM</td>
<td>The Number of Tableaux which Contain a Given Subtableau.</td>
<td>Aaron D. Jaggard, University of Pennsylvania (973-05-134)</td>
</tr>
<tr>
<td>1:30PM</td>
<td>Inequalities for Polynomials.</td>
<td>Richard Ehrenborg, University of Kentucky (973-05-470)</td>
</tr>
<tr>
<td>1:45PM</td>
<td>A Stirling Number Identity in a Generalized Context.</td>
<td>Theresa L Friedman, Willamette University, and Paul Klingsberg*, St. Joseph’s University (973-05-836)</td>
</tr>
<tr>
<td>2:00PM</td>
<td>Tightening Tuyrn’s bound in Hadamard difference sets.</td>
<td>Ken W Smith, Central Michigan University (973-05-1327)</td>
</tr>
<tr>
<td>2:15PM</td>
<td>Least common multiples of cubes.</td>
<td>Peter Adams, Darryn Bryant, University of Queensland, Saad El-Zanati, Illinois State University, Barbara Maenhaut, The Open University, and Charles Vanden Eynden*, Illinois State University (973-05-1129)</td>
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<tr>
<td>2:45PM</td>
<td>Matroids derived from cycle spaces of graphs and linear transformations. Preliminary report.</td>
<td>Daniel C Silitay, Wright State University (973-05-1167)</td>
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<td>3:00PM</td>
<td>Resistance Distance in Graphs and Cyclicity Measure.</td>
<td>Douglas J. Klein, Texas A&amp;M University - Galveston (973-05-1172)</td>
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<td>A Tree Labelling Problem of Leech.</td>
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MAA Session on Deep Understanding of School Mathematics Needed by Teachers, II

1:00 PM - 2:55 PM

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<td>Teachers’ mathematical understanding and reasoning about the design of calculus courses (preliminary report). Preliminary report.</td>
<td>Dara L Sandow, Michigan State University (973-11-504)</td>
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<tr>
<td>1:20PM</td>
<td>Algebra and Calculus Concepts for Preservice Teachers' mathematical understanding and reasoning about the design of calculus courses (preliminary report). Preliminary report.</td>
<td>Becky J Krakowski, University of Dayton (973-11-361)</td>
</tr>
<tr>
<td>1:40PM</td>
<td>Deepening Understandings of Functions In Grades 5–8 Through Dynamic Visualization. Preliminary report.</td>
<td>Barbara J Pence, San Jose State Univ (973-11-318)</td>
</tr>
<tr>
<td>2:00PM</td>
<td>Rich Mathematical Problems at SUNY Potsdam. Preliminary report.</td>
<td>Victoria Klawitter and Blair F Madore*, SUNY Potsdam (973-11-441)</td>
</tr>
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</table>
San Diego, CA, Tuesday, January 8 - Program of the Sessions

MAA Session on Classroom Demonstrations and Course Projects That Make a Difference, I

1:00 PM - 3:10 PM
Organizers: David R. Hill, Temple University, Sarah L. Mabrouk, Framingham State College, Lila F. Roberts, Georgia Southern University

1:00PM A Few Good Animated Demonstrations for Multivariable Calculus. John F. Putz, Alma College (973-N1-327)

1:15PM Balanced Lines: Mathematics of Microphones. Mako E. Haruta*, University of Hartford, and Steven Bellamy, McGill University (973-N1-550)

1:30PM Mathematics in the News: A Course Project that Shows Students Mathematics is Alive and Well. Troy D. Riggs, Union University (973-N1-198)

1:45PM Mathematics, Simple Coding, and Invertible Matrix. Catherine A. Gorini, Maharishi University of Management (973-N1-531)

2:15PM It's Not Fair!: A Coin-Testing Project. Carl V. Lutzer, Rochester Institute of Technology (973-N1-610)

2:30PM Using Trigonometric Functions for Temperature Models. Cathy M Frey, Norwich University (973-N1-281)

2:45PM Curvature in the Calculus Curriculum. Jerry M Lodder, New Mexico State University (973-N1-286)

3:00PM Motivational Projects for Multivariable Calculus. Carol J. Browning, Drury University (973-N1-349)

MAA Session on Environmental Mathematics in the Classroom, I

1:00 PM - 2:55 PM
Organizers: Ben Fusaro, Florida State University, Marty E. Walter, University of Colorado

1:00PM Optimizing Benefits for Fish and Fishermen. Rosalie A Dance*, University of the Virgin Islands, and James T. Sandefur, Georgetown University (973-P1-382)

1:20PM A statistical F test for the natural attenuation of contaminants in groundwater. Aristeo M Pelayo, WI Dept. of Natural Resources, and Fe S Evangelista*, Univ. of Wisconsin - Whitewater (973-P1-347)


2:00PM A Liberal Arts Course - Environmental Mathematics. B. A. Fusaro, Florida State University (973-P1-625)

2:20PM Web-Based Environmental Projects for Algebra Through Calculus. Christopher Schaufele*, Dineh College, and Nancy Zumoff, Kennesaw State University (973-P1-409)

2:40PM A Few Good Animated demonstrations for general contributions. Mako E. Haruta*, University of Hartford, and Steven Bellamy, McGill University (973-N1-550)

MAA Session on General Contributed Papers, IV

1:00 PM - 3:10 PM
Organizers: Shawnee L. McMurran, California State University, San Bernardino, Laura Wallace, California State University, San Bernardino, Sarah L. Mabrouk, Framingham State College

1:00PM Finding the area of tiles with fractal boundaries. Judith A. Palagallo, University of Akron (973-T1-276)

1:15PM Fractal Tilings with Radial Symmetry. Preliminary report. Thomas E. Price*, University of Akron, and Adam E. Roberts, Bowling Green State Univ (973-T1-461)

1:30PM Break.

1:45PM On the sum of a series by Euler and an associated integral of Dirichlet. T S Nanjundiah, University of Mysore, India (Retd), and Mysore S Jagadish*, Barry University (973-T1-573)

2:00PM Various Notions of Distance. Michael J. Cullinane, Keene State College (973-T1-245)

2:15PM Break.

2:30PM Factoring Polynomials with Matrices. Preliminary report. William P. Wardlaw, U. S. Naval Academy (973-T1-595)

2:45PM Black Holes and Black Loops-Connecting the Medium and the Message. T S Nanjundiah, University of Mysore, India, and Mysore S Jagadish*, Barry University (973-T1-573)

3:00PM Pythagoras, Beyond Sierpinski and the Triplet. Donald A. Sokol, Lisle, IL (Retired) (973-T1-272)

NAM Granville-Browne Session of Presentations by Recent Doctoral Recipients in the Mathematical Sciences

1:00 PM - 5:00 PM
Moderator: William A. Massey, Lucent Technologies

MAA Committee on the Teaching of Undergraduate Mathematics Panel Discussion

1:00 PM - 3:00 PM
The medium and the message: Practical suggestions on student reading and course efficiency using a structured conversation format. Organizers: Mary Ellen Foley, Louisiana State University-Shreveport, Sandra A. Gokey, Greenfield Community College, Tom J. Linton, Central College
Program of the Sessions - San Diego, CA, Tuesday, January 8 (cont’d.)

Kirk E. Weller, Bethel College

MAA Panel Discussion

1:00 PM - 2:30 PM

BIG Math: Projects in business, industry, and government.
Organizer: Philip E. Gustafson, Mesa State College

MAA CUPM Subcommittee on Calculus Reform and the First Two Years Panel Discussion

1:00 PM - 2:30 PM

Discrete mathematics in the first two years.
Organizers: Donald D. Mills, U. S. Military Academy
Donald B. Small, U. S. Military Academy
Kathleen Snook, U. S. Military Academy
Panelists: D. Chris Arney, College of Saint Rose
Diana M. Thomas, Montclair State University
Marie M. Vanisko, Carroll College

MAA Special Presentation

1:00 PM - 3:15 PM

Mathematical experiences for students outside the classroom.
Organizers: Richard L. Poss, St. Norbert College
Tom Kelley, Henry Ford Community College

MAA Special Presentation

1:00 PM - 2:30 PM

The Mathematical Education of Teachers.
Organizer: Ronald C. Rosier, CBMS
Presenters: James Lewis, University of Nebraska
Alan C. Tucker, SUNY at Stony Brook
Glenda Lappan, Michigan State University

MAA Poster Session

1:00 PM - 3:00 PM

Projects supported by the NSF Division of Undergraduate Education.
Organizer: Jon W. Scott, Montgomery Community College

ASL Invited Address

2:00 PM - 2:50 PM

(1033) Model Theory of Strings and Trees.
Michael Benedikt, Lucent Technology/Bell Labs

MAA Invited Address

2:15 PM - 3:05 PM

(1034) From shuffling cards to the roots of randomness.
Persi W. Diaconis, Stanford University

RMMC Board of Directors

2:15 PM - 4:10 PM

AMS Committee on Science Policy Presentation

2:30 PM - 4:00 PM

ASL Invited Address

3:10 PM - 4:00 PM

(1035) Classifying Borel Automorphisms.
John D. Clemens, California Institute of Technology

MAA Minicourse #5: Part A

3:15 PM - 5:15 PM

Using physical and computerized puzzles as models of permutation groups in teaching abstract algebra.
Organizer: John R. Kiltinen, Northern Michigan University

MAA Session on MAA Invited Paper Session on Probability and Combinatorics in Analytic Number Theory, II

3:25 PM - 5:00 PM

Organizer: Andrew J. Granville, University of Georgia

Brian Conrey, American Institute of Mathematics
(973-U1-917)

3:25 PM - 4:00 PM

The Bateman-Horn Conjecture for Number Fields.
(1037) Preliminary report.
Keith Conrad, UC San Diego (973-U1-1233)

4:00 PM - 4:30 PM

Moments of Short Divisor Sums and Gaps Between Primes.
(1038) Daniel A. Goldston, San Jose State University
(973-U1-779)

MAA Presentations by Teaching Award Recipients

3:30 PM - 5:00 PM

(1039) Pharmacokinetics.
Edward L. Spitznagel, Jr., Washington University
(St. Louis)

(1040) Teaching up and down the mathematical ladder.
Paul J. Sally, Jr., University of Chicago

(1041) Polymath teaching.
Dennis DeTurck, University of Pennsylvania

MAA Undergraduate Student Poster Session

4:00 PM - 6:30 PM

Organizer: Mario U. Martelli, Claremont McKenna College

AMS Committee on Science Policy-MAA Science Policy Committee Government Speaker

4:20 PM - 5:10 PM

(1042) Mathematics at the National Security Agency.
James R. Schatz, National Security Agency
ASL Contributed Talks
4:30 PM - 6:00 PM

Association for Research on Undergraduate Mathematics Education SIGMAA Business Meeting, Lecture, and Reception
5:00 PM - 7:00 PM
Organizer: Julie M. Clark, Hollins University
(1043) How can mathematical concepts be learned? Synthesizing APOS theory and mathematical formalism to get one possible answer.
Ed Dubinsky, Cincinatti, OH (973-51-1491)

MAA Informal Session
5:00 PM - 7:00 PM
Actuarial education.
Organizer: Krzysztof M. Ostaszewski, Illinois State University

Welcome Reception for Mathematicians in Business, Industry, and Government
5:00 PM - 6:00 PM
Organizer: Philip E. Gustafson, Mesa State College

Reception for Gay, Lesbian, Bisexual, and Transgendered Mathematicians
5:00 PM - 7:00 PM

University of Illinois Reception
5:00 PM - 7:00 PM

MAA-Young Mathematicians Network Panel Discussion
5:30 PM - 7:00 PM
Closing the deal: The campus interview and beyond.
Organizers: Chawne M. Kimber, Lafayette College
David T. Kung, St. Mary’s College of Maryland
Panelists: Carl C. Cowen, Purdue University
Gwen Fisher, California Polytechnic State University (San Luis Obispo)
Thomas J. Pfaff, Ithaca College
Carol S. Wood, Wesleyan University

MAA Special Presentation
5:30 PM - 7:00 PM
Carroll College Project InterMath Workshop reunion.
Organizer: Marie M. Vanisko, Carroll College

NAM Reception, Banquet, and Cox-Talbot Address
6:00 PM - 9:00 PM
(1044) Title to be announced.
Gloria C. Hewitt, University of Montana

MAA Project NExT-Young Mathematicians Network Special Presentation
6:00 PM - 7:00 PM
Planning ahead for the tenure/promotion process.
Organizers: Karrolyne Fogel, California Lutheran University
J. Lyn Miller, Western Kentucky University

SIGMAA on Statistics Education, 2002 Business Meeting, and Lecture
6:00 PM - 8:00 PM
Organizer: Dexter C. Whittinghill, Rowan University
Presenter: Roxy Peck, California Polytechnic State University, San Luis Obispo

Mathematical Reviews Reception
6:00 PM - 7:00 PM

MAA Student Lecture
7:30 PM - 8:20 PM
Finding and fixing systems’ weaknesses: The art and science of engineering risk analysis.
M. Elisabeth Pate-Cornell, Stanford University (973-AO-49)

MAA Project NExT Reception
8:30 PM - 10:30 PM
Organizer: T. Christine Stevens, St. Louis University

Wednesday, January 9

MAA Liaison Breakfast
7:00 AM - 8:30 AM

Joint Meetings Registration
7:30 AM - 2:00 PM

ASL Invited Address
8:00 AM - 8:50 AM
Computable Numberings and Constructive Models.
Sergey Goncharov, Novosibirsk State University

AMS Special Session on Probabilistic Methods in Combinatorics and the Internet, II
8:00 AM - 10:50 AM
Organizers: Fan Chung Graham, University of California San Diego
Van Vu, University of California San Diego

Optimal paths related to transport problems.
Preliminary report.
Qinglan Xia, Rice University (973-49-1439)
Program of the Sessions - San Diego, CA, Wednesday, January 9 (cont’d.)

8:30AM Guessing secrets with inner product questions.
(1048) Fan Chung, Ronald Graham and Linhuyan Lu*, UCSD (973-05-1351)
9:00AM Simulated Tempering: Fast or Slow?
(1049) Claire Kenyon, Universite de Paris Sud, and Dana Randall*, Georgia Tech (973-60-1397)
9:30AM Approximating the domatic number.
(1050) Uri Feige, Weizmann Institute, Israel, Magnus M Haldorsson, Science Inst., University of Iceland, Guy Kortsarz, Open University, Israel, and Aravind Srinivasan*, University of Maryland (973-05-846)
10:00AM The diameter of scale-free random graphs.
(1051) Bela Bollobas*, University of Memphis, TN and University of Cambridge, England, and Oliver M Riordan, University of Cambridge, England (973-05-166)
> (1052) Ioana Dumitriu, MIT, Prasad Tetali, Georgia Tech (973-60-154)

AMS Special Session on Computational Commutative Algebra and Algebraic Geometry, II

8:00 AM – 10:50 AM

Organizers: Elizabeth Arnold, Texas A&M University
Amelia Taylor, Rutgers University

8:00AM On Normal Monomial Ideals.
(1053) Les Reid, Southwest Missouri State University, Leslie G Roberts, Queen’s University, and Marie A Vitulli*, University of Oregon (973-13-1021)
(1054) Abdul Salam M Jarrah, New Mexico State University (973-13-46)
9:00AM Reverse Search for Monomial and Toric Ideals. Preliminary report.
(1055) Dave Bayer*, Barnard College, and Amelia Taylor, Rutgers University (973-13-1255)
9:30AM An Algorithm For The Computation Of The Adjoint Of A Monomial Ideal. Mark J Rhodes, Colgate University (973-13-1299)
10:00AM Multi-graded regularity. Preliminary report.
(1057) Gregory G Smith, Barnard College, Columbia University (973-13-1128)
10:30AM Towards the (dis)connectedness of the toric Hilbert scheme. Preliminary report.
(1058) Diane Maclagan, Stanford University (973-13-1409)

AMS Special Session on Algebraic Combinatorics, I

8:00 AM – 10:50 AM

Organizers: Rosa C. Orellana, Dartmouth College
Michael Zabrocki, York University

8:00AM Symmetric functions, bi-brick permutations, and Lyndon words. Preliminary report.
(1059) Andrius Kulikauskas, Minciu Sodas Dabar, and Jeffrey B Remmel*, University of California at San Diego (973-05-1047)
8:30AM A New Combinatorial Homotopy Theory for Graphs and Simplicial Complexes. Preliminary report.

AMS Special Session on Recent Developments in Analysis and Numerics

8:00 AM – 10:50 AM

Organizers: Jie Shen, Pennsylvania State University and University of Central Florida
Shouhong Wang, Indiana University
Xiaoming Wang, Iowa State University

9:00AM Lagrangian averages, transient vortex events and the initial value problem for turbulence. Preliminary report.
(1065) Darryl D Holm, Los Alamos National Lab (973-76-1147)
8:30AM Critical Dissipative Quasi-geostrophic Equations.
(1066) Jiahong Wu, Oklahoma State University (973-76-1488)
9:00AM Boundary layer for the Navier-Stokes-alpha model of fluid turbulence.
Alexey P Cheskidov, Indiana University (973-76-1037)
9:30AM On the Connection Between the Viscous Camassa-Holm Equation(Navier-Stokes-alpha model) and Turbulence Theory.
Ciprian Foias, Indiana University and Texas A & M, Darryl Holm, Los Alamos National Laboratory, and Edriss S Titi*, University of California – Irvine (973-76-963)
10:00AM Differential Inequalities for Physical Quantities in 2-D Turbulence.
Ciprian Foias, Texas A&M / Indiana Univ., and Michael S Jolly*, Indiana University (973-35-1389)
10:30AM Weakly dissipative KdV equation.
(1070) Olivier J Goubet, LAMFA, Amiens, France (973-35-1113)

AMS Special Session on Hybrid Systems, II

8:00 AM – 10:50 AM

Organizers: Elena Litsyn, Ben-Gurion University
A. S. Vatsala, University of Louisiana at Lafayette

8:00AM Qualitative theory of hybrid systems. Preliminary report.
(1071) Stanislav N Vassiliev* and Ravil I Kozlov, Institute of System Dynamics and Control Theory, Irkutsk (973-93-1267)
AMS Special Session on The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, III

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<td>The many faces of a complex related to geometric lattices. Preliminary report.</td>
<td>Manoj K Chari, Louisiana State University (973-06-122)</td>
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<td>Graph Pebbling and the Multiset Lattice.</td>
<td>Aiarat Bekmetjev, Arizona State University, Graham Brightwell, London School of Economics, Andrzej Czgrinow and Glenn H Hurlbert*, Arizona State University (973-06-163)</td>
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<td>Constructions of 3-chromatic Graph Cores.</td>
<td>Karen L Collins* and Benjamin shammer, Wesleyan University (973-06-151)</td>
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<td>Characterizing lattices by numerical invariants.</td>
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<td>Andreas R Blass, University of Michigan (973-06-110)</td>
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<td>Lattice Theory, Enumerative Combinatorics and Topology. Preliminary report.</td>
<td>Lynne M. Butler, Haverford College (973-06-161)</td>
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AMS Special Session on Partial Differential Equations and Their Applications, III

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<td>Interpolation and Attractors.</td>
<td>Ciprian Foias*, Texas A&amp;M/Indiana Univ., Michael S Jolly, Indiana University, Igor Kukavica, Univ. Southern California, and Wing-Suet Li, Virginia Tech/Georgia Tech (973-35-1179)</td>
</tr>
<tr>
<td>9:00AM</td>
<td>Results within the Ginzburg-Landau Theory of Superconductivity.</td>
<td>Peter J Sternberg, Indiana University, Bloomington (973-35-71)</td>
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AMS Special Session on Stochastic Processes and Functional Analysis (in honor of M. M. Rao), II

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<td>Computation for nonsquare constants of Orlicz spaces.</td>
<td>Z. D. Ren, Suzhou University (973-46-939)</td>
</tr>
<tr>
<td>9:00AM</td>
<td>Fractals and Distributions on the N-torus.</td>
<td>Victor Shapiro, University of California, Riverside (973-46-897)</td>
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AMS Special Session on Research in Mathematics by Undergraduates, II

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<td>On robustness of discontinuous feedback in optimal control and differential games.</td>
<td>Yuri S Ledyaeva, Western Michigan University (973-06-132)</td>
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9:30 AM  Statistical Considerations in Financial Optimization.  
(1095) Svetlozar Rachev, University of California, Santa Barbara (973-62-899)

10:00 AM  Applications of Sinkhorn balancing: low-cost approximations for hard problems.  
(1096) Francis E Sullivan*, IDA Center for Computing Sciences, and Isabel M Beichl, NIST (973-60-669)

10:30 AM  Problems.  
(1097) Alan Krinic*, California State Polytechnic University, Pomona, Gerardo Rubino, INRIA, Hassan Kasfy, Holly Lam and Carrie Mortensen, California State Polytechnic University, Pomona (973-60-1024)

AMS Special Session on The Theory and Applications of Symmetric Functions, II

8:00 AM - 10:50 AM

Organizers: Adriano Garsia, University of California San Diego  
Jeffrey B. Remmel, University of California San Diego

8:00 AM  From n! to \((n+1)!n-1\).  
(1098) Mark D Haiman, U.C. Berkeley (973-05-769)

8:30 AM  Macdonald Polynomials and the q,t-Catalan Numbers. Preliminary report.  
(1099) Jim B Haglund, Univ. of Pennsylvania (973-05-913)

9:00 AM  k-Schur functions and Macdonald polynomials.  
(1100) Jennifer L Morse*, University of Pennsylvania, and Luc F Lapointe, University of McGill (973-05-1043)

9:30 AM  Quotients of the ring of quasi-symmetric polynomials. Preliminary report.  
(1101) Francois Bergeron, University of Quebec in Montreal (973-05-1073)

10:00 AM  Non-commutative analog of Macdonald Symmetric Functions.  
(1102) Nantel Bergeron* and Mike Zabrocki, York University (973-05-844)

10:30 AM  Power Content Polynomials and Shift-Symmetric Polynomials.  
(1103) Alain Goupil, Universite du Quebec a Montreal (973-05-1459)

MAA Minicourse #11: Part A

8:00 AM - 10:00 AM

Incorporating discrete mathematics in the preparation of K-12 mathematics teachers.  
Organizer: Loaina Alvarez, New Mexico State University

MAA Minicourse #15: Part A

8:00 AM - 10:00 AM

Mathematical finance.  
Organizer: Walter R. Stromquist, Berwyn, PA

MAA Minicourse #6: Part A

8:00 AM - 10:00 AM

WebWork, an Internet-based system for generating and delivering homework problems to students.  
Organizers: Arnold K. Pizer, University of Rochester  
Michael E. Gage, University of Rochester

Vicki Roth, University of Rochester

AMS Session on Geometry and Differential Geometry

8:00 AM - 10:55 AM

8:00 AM  Tidbits in finite planes and Boolean algebra.  
(1104) Preliminary report.  
Raymond Killgrove, Ramona, California (Retired) (973-51-202)

8:15 AM  Steiner Symmetrization and Petty's Projection Body  
(1105) Preliminary report.  
Noah S Brannen, Sonoma State University (973-52-358)

8:30 AM  Polygons Whose Vertex Triangles Have Equal Area.  
(1106) Guershon Harel and Jeffrey M Rabin*, U.C.S.D. (973-51-720)

8:45 AM  Symmetric Almost r-Paracontact Connections.  
(1107) Andrew J. Buckli, Oklahoma School of Science and Mathematics (973-53-1515)

9:00 AM  Riemannian obstructions to minimal isometric immersions in Euclidean spaces.  
(1108) Bogdan Suceava, Michigan State University (973-53-76)

Iva Stavrov, University of Oregon (973-53-283)

9:30 AM  The Jordan normal form of Osserman algebraic curvature tensors.  
(1110) Raina B Ivanova, University of Oregon (973-53-284)

9:45 AM  Determining factors from products, with applications to the curvature of hypersurfaces.  
(1111) Preliminary report.  
Michael J Cowen, University at Buffalo (973-05-745)

10:00 AM  Minimal graphs in \(R^3\) over convex domains.  
(1112) Michael J Dorff, Brigham Young University (973-53-1040)

Marius I Munteanu, University of Oklahoma (973-53-1260)

10:30 AM  Spaces of area minimizing foliations of cones, and \(S^1\) products, of compact surfaces. Preliminary report.  
Simon P Morgan, Rice University (973-53-323)

Mikhail B Korotiaev, University of Alaska Fairbanks (973-58-1102)

AMS Session on Combinatorics and Graph Theory, IV

8:00 AM - 10:55 AM

8:00 AM  Codas, Designs and Graphs from the Janko Groups \(J_1\) and \(J_2\).  
(1116) Jamshid Moori*, University of Natal, South Africa, and Jenny D Key, Clemson University (973-05-682)

8:15 AM  Local permutation polynomials for m-circulant \(J_1\). Preliminary report.  
Wiebke S Diestelkamp, University of Dayton (973-05-1134)

Dawn M Jones, SUNY Brockport (973-05-1374)

8:45 AM  Disjunctive Rado Numbers.  
(1118) Daniel Schaal* and Brenda Johnson, South Dakota State University (973-05-1377)

9:00 AM  Break.
San Diego, CA, Wednesday, January 9 - Program of the Sessions

MAA Session on Redefining What a Modern "College Algebra" Experience Means, II
8:00 AM - 10:55 AM
Organizers: Sheldon P. Gordon, SUNY at Farmingdale, Carolyn M. Cuff, Westminster College

8:00 AM Mathematics 101: An Introduction to Mathematical Thought. Preliminary report.
Jacqueline Anderson Hall, Longwood College (973-K1-600)

8:20 AM A Classroom-Based Assessment of A College Algebra Course Using Projects. Preliminary report.
Regina D Aragon, Eastern New Mexico University (973-K1-438)

8:40 AM Connections Between College Algebra and Composition Courses.
Morteza Shafii-Mousavi*, Janet B Hall, Indiana University South Bend, Richard Cook, Indiana University, Kenneth A Smith, Rebecca Brittenham, Phyllis C Moore-White, Indiana University South Bend, Connie Ruhl-Smith, Bowling Green State University, Jay A Showalter and Karen L White, Indiana University South Bend (973-K1-53)

9:00 AM Rethinking the Preparation for Calculus: The Implications for College Algebra.
Sheldon P Gordon, SUNY at Farmingdale (973-K1-1118)

9:20 AM College Algebra Defined for General Education.
Jo Ann B Royster, Univ. of Central Arkansas (973-K1-530)

10:00 AM Journaling Through College Algebra. Preliminary report.
Sarah V Cook, Washburn University (973-K1-735)

10:25 AM Discussant: Joan Garfield, University of Minnesota.

Mohammad H Ahmadi, University of Wisconsin (973-K1-351)

MAA Session on Innovative Outcome Assessment in Statistics Education
8:00 AM - 10:55 AM
Organizers: Robert del Mas, University of Minnesota, Minneapolis
Carolyn M. Cuff, Westminster College

8:00 AM Welcome.

Richard J Cleary, Bentley College (973-Q1-260)

Olcay Akman, Coastal Carolina University (973-Q1-644)

8:45 AM Enhancing the Educational Experience: Statistical Laboary Activities.
Olcan Akman, Coastal Carolina University (973-Q1-644)

9:05 AM Assessing General Education Goals in an Introductory Statistics Course.
Julie A Belock, Salem State College (973-Q1-476)

9:25 AM Assessment as a Means of Instruction. Preliminary report.
Robert del Mas*, Joan Garfield, University of Minnesota, and Beth Chance, California Polytechnic State University (973-Q1-763)

Ann R Cannon and Jim Freeman*, Cornell College (973-Q1-800)

John D McKenzie, Jr.* and George Reck, Babson College (973-Q1-959)

10:25 AM Discussant: Joan Garfield, University of Minnesota.

MAA Session on SIGMAA on Research on Undergraduate Mathematics Education, III
8:00 AM - 10:55 AM
Organizer: Julie Morrissitt Clark, Hollins University

8:00 AM Self Contained Capsules for Introductory Statistics. Preliminary report.
Olcay Akman, Coastal Carolina University (973-Q1-644)

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John D McKenzie, Jr.* and George Reck, Babson College (973-Q1-959)

10:25 AM Discussant: Joan Garfield, University of Minnesota.
Program of the Sessions - San Diego, CA, Wednesday, January 9 (cont’d.)

8:00AM - 8:15AM  Assessing Understanding in Calculus. Preliminary report.
Melvin A Nyman*, Alma College, and John Berry, University of Plymouth (973-S1-37)

8:20AM - 8:40AM  Small-class Teaching of Calculus in Classes of 200.
Eleftherios C Zachmanoglou, Purdue University (973-S1-303)

8:45AM - 9:00AM  Resolving Conflicts Between Teachers’ and Students’ Beliefs About Mathematics. Preliminary report.
Gideon L Weinstein*, Montclair State University, and Kathi G Snook, US Military Academy (973-S1-38)

9:05AM - 9:20AM  The Role of Metaphor in Student Acquisition of New Concepts.
Carol E Seaman, University of Wisconsin Oshkosh (973-S1-378)

Hamide Dogan, University of Texas at El Paso (973-S1-496)

9:45AM - 10:00AM  Integrating Mathematics and Pedagogy: A large scale research study of an intervention designed to change prospective teachers’ beliefs about mathematics in order to maximize their mathematics learning Preliminary report.
Rebecca CA Ambrose*, San Diego State University, School of Teacher Education, Jennifer Chauvot, San Diego State University, Department of Mathematical Sciences, Lisa Clement and Randy Philipp, San Diego State University, School of Teacher Education (973-S1-614)

10:05AM - 10:20AM  A Grounded Theory Investigation of Learning in Interactive Technological Environments. Preliminary report.
Jack Bookman* and David Malone, Duke University (973-S1-498)

10:25AM - 10:40AM  Adaptation and extension of the framework of reducing abstraction to explain students’ construction of solution to differential equations. Preliminary report.
Debashree Raychaudhuri, Simon Fraser University (973-S1-622)

10:45AM - 11:00AM  The Development of Mathematical Norms in an Undergraduate Number Theory Course. Preliminary report.
Jennifer C Smith, University of Arizona (973-S1-700)

AMS Session on Series and Fourier Analysis
8:15 AM - 10:55 AM

Nasser Dastrange, Buena Vista University (973-26-889)

8:30AM  Absolute inclusion theorems for triangles. Preliminary report.
B. E. Rhodes*, Indiana University, and Ekrem Savas, Yuzuncu University (973-40-343)

8:45AM  Closed Forms for Certain Infinite Series. Preliminary report.
William Staub*, Frank Dangello and Lenny Jones, Shippensburg University (973-40-935)

9:00AM  An Extension of Bertrand’s Tests. Preliminary report.
Michael J Khoury, Denison University (973-40-1187)

Richard C Gayle*, Black Hills State University, and Jerry M Wolfe, University of Oregon (973-41-457)

9:30AM - 9:45AM  Optimal location with polyhedral constraints. Preliminary report.
Michael P Prophet*, University of Northern Iowa, Robert Huotari, Glendale Community College, and Jason Ribando, University of Northern Iowa (973-41-479)

9:50AM - 10:05AM  Restriction and decay for flat curves and hypersurfaces. Preliminary report.
Anthony P Carbery, University of Edinburgh, Scotland, and Sarah H Ziesler*, Dominican University, River Forest, IL (973-42-505)

Richard C Gayle*, Black Hills State University, and Jerry M Wolfe, University of Oregon (973-41-457)

MMA Session on Using Examples from Sports to Enhance the Teaching of Mathematics, II
8:20 AM - 10:35 AM

8:20AM - 8:35AM  Organizers: Robert E. Lewand, Goucher College and Howard L. Penn, U.S. Naval Academy

8:30AM - 8:45AM  0 for April, or, Are Batting Slumps Inevitable? Preliminary report.
E L May, Salisbury University (973-M1-537)

David H Carhart* and Karen J Schroeder, Bentley College (973-M1-545)

Wendy M Eaton, Northern Kentucky University (973-M1-612)

Owen D Byer, Eastern Mennonite University (973-M1-511)

Roland Minton, Roanoke College (973-M1-352)

10:00AM - 10:15AM  Dominance Matrices and Team Rankings. Preliminary report.
Thomas W Polaski, Winthrop University (973-M1-372)

10:20AM - 10:35AM  Sports and Mathematics are Inseparable. Preliminary report.
Montie G. Monzingo, Southern Methodist University (973-M1-491)

AWM Workshop
8:20 AM - 4:40 PM

This session consists of several parts listed separately throughout this program. All meeting participants are invited to attend all presentations. 
Organizers: Gail D. L. Ratcliff, University of Missouri-St. Louis and Sue Geller, Texas A&M University
AMS-MAA Special Session on History of Mathematics, III

8:30 AM - 10:50 AM

Organizers: Thomas Archibald, Acadia University
David E. Zitarelli, Temple University

9:00 AM
Priority, Propriety and Polemic: The Euler-d'Alembert Correspondence.
Robert E. Bradley, Adelphi University (973-01-183)

9:30 AM
Craig G Fraser, Lehman College, CUNY (973-01-833)

10:00 AM
Thomas Drucker, University of Wisconsin-Whitewater (973-01-650)

10:30 AM
Joseph W Dauben, Lehman College, CUNY (973-01-838)

AMS Session on Low Dimensional Topology

8:30 AM - 10:55 AM

8:30 AM
Knitting the Klein Bottle in Mathematically Meaningful Ways. Preliminary report.
Sarah-Marie Belcastro, Bowdoin College / Univ. of Northern Iowa (973-57-1353)

8:45 AM
Homotopy types of the components of the space of 3-manifolds. Preliminary report.
Nadja Shirokova, University of Illinois at Urbana-Champaign (973-57-1454)

9:00 AM
A link invariant based on the entanglement (linking) of components. Preliminary report.
Fernando Souza*, University of Waterloo, and Wim van Dam, University of California at Berkeley (973-57-1358)

9:15 AM
Using geometry to bound homotopy types in 2-orbifolds with isolated singularities. Preliminary report.
Elizabeth A. Stanhope, Dartmouth College (973-53-1340)

9:30 AM
Contact Transformations for ODEs and Holonomic Knot Isotopies. Preliminary report.
Edgar J Fuller, Duke University (973-53-1269)

9:45 AM
Jonathan P Naton, NYC Tech College, CUNY (973-57-1097)

10:00 AM
Logical distinction between diagrammatic and Cohern-Lyndon asphericity.
Igor Biskup, Bucknell University (973-20-1079)

10:15 AM
Uniqueness of graph products of torsion groups.
David G Radcliffe, St. Paul, MN (973-20-1056)

10:30 AM
Seiberg-Witten invariants, orbifolds, and circle actions. Preliminary report.
Scott J Baldridge, Indiana University (973-57-808)

10:45 AM
Strict Minimality of Alternating Knots in a Surface Cross an Interval. Preliminary report.
Thomas R Fleming*, University of California San Diego, and Colin C Adams, Williams College (973-57-129)

AWM Workshop: Presentations by Recent Women Ph.D.s, I

8:30 AM - 10:20 AM

8:30 AM
Simplicial Complexes in Commutative Algebra.
Sarah Faridi, George Washington University (973-01-183)

9:00 AM
Tight closure and linkage.
Adela Vraciu, University of Kansas (973-01-183)

9:30 AM
Algorithms of resolution of singularities: Recent results.
Ana Bravo, University of Michigan (973-01-183)

10:00 AM
From Groups to Hopf Algebras.
Yevgenia Kashina, Syracuse University (973-01-183)

AMS Committee on Education Presentation

8:30 AM - 10:00 AM

A conversation with the NCTM President: Facing the challenges of U.S. mathematics education together.
Presenter: Lee V. Stiff, NCTM

MAA Invited Address

9:00 AM - 9:50 AM

9:15 AM
Reforms in mathematics education: Best practices and malpractices.
Manuel P. Berriozabal, University of Texas at San Antonio

ASL Invited Address

9:00 AM - 9:50 AM

Moshe Vardi, Rice University

MAA Session on Classroom Demonstrations and Course Projects That Make a Difference, II

9:00 AM - 9:55 AM

Organizers: David R. Hill, Temple University
Sarah L. Mabrouk, Framingham State College
Lila F. Roberts, Georgia Southern University

9:00 AM
How to Ask a Sensitive Question: Demonstrating Randomized Response in the Classroom.
Patti Frazer Lock, St. Lawrence University (973-N1-360)

9:15 AM
How Monitored Projects Can Convince Non-Science Majors That Mathematics Is Applicable to Everyday Experiences.
Helen C Christensen, Loyola College in Maryland (973-N1-596)

9:30 AM
Developing Transferable Skills In Undergraduate Mathematics Students Via Collaborative Projects.
Melvin A Nyman*, Alma College, and John Berry, University of Plymouth (973-N1-36)
9:45AM Modeling and Simulating the Double Pendulum.
(1196) Mike O'Leary*, Towson University, and Shiva Azadegan, Department of Computer and Information Sciences, Towson University
(973-N1-577)

AMS-MAA Joint Panel Discussion
9:00 AM - 10:30 AM
Professors for the Future programs.
Organizers: Samuel M. Rankin, III, AMS
Thomas W. Rishel, MAA

MAA Panel Discussion
9:00 AM - 10:30 AM
Outreach programs for women: Assessment issues.
Organizer: Carolyn C. Connell, Westminster
College of Salt Lake City
Moderator: Susan L. Forman, Bronx Community
College
Panelists: Carole B. Lacampagne, RAND
Charlene Morrow, Mount Holyoke
College
Florence Fasanelli, The College Board

MAA Workshop
9:00 AM - 10:30 AM
Want to coach a math modeling team? Where to start and how to finish.
Organizers: Ben Fusaro, Florida State University
Mark R. Parker, Carroll College
Presenters: John E. August, Mount Saint Mary's
College
Robert A. Beezer, University of Puget
Sound
Thomas O'Neil, California Polytechnic
State University, San Luis Obispo
Holly Zullo, Carroll College
Ben Fusaro
Mark R. Parker

NAM Panel Discussion
9:00 AM - 9:50 AM
Distance learning.
Panelists: James C. Turner, Florida State
University

Employment Center
9:00 AM - 1:00 PM
Interview center.

Book Sales and Exhibits
9:00 AM - NOON

NAM Business Meeting
10:00 AM - 10:50 AM

MAA Retiring Presidential Address
10:05 AM - 10:55 AM
(1197) The down side of the trapezoid: An Immediate Past
President surveys the Internet.
Thomas F. Banchoff, Brown University

ASL Contributed Talks
10:10 AM - 11:00 AM

AWM Workshop: Women Graduate Students Poster Session
10:30 AM - 11:00 AM

Light refreshments will be available.

Entropy and Equivalence of Random Walks on Random Sceneries.
Karen Ball, University of Maryland, College Park

A New 2-parameter Variation of the Quantum
Yang-Baxter Equation.
Robin Endelman, University of Cincinnati

Hyperbolicity in the Complex Hénon Family.
Suzanne Lynch Hruska, Cornell University

Norms and the Bieri-Neumann-Strebel Invariant.
Reva S. Kasman, University of Illinois at Chicago

Summable processes.
Oana Mocioalca, University of Florida

The Modified Tunneling Approach to Solving a
Nonlinear Optimization Problem Applied to
Groundwater Remediation Design.
Karen Ricciardi, University of Vermont

Function Spaces with Matrix Weights, and
Applications to Wavelets.
Svetlana Roudenko, Michigan State University

The Castelnuovo-Mumford regularity of subspace
arrangements.
Jessica Sidman, University of Michigan

Filament Dynamics of Non-Newtonian Fluids.
Linda B. Smolka, Pennsylvania State University

Sand and Sea: Analysis of a Model of Coastal
Sandbar Formation.
Katherine Socha, University of Texas at Austin

Generalized coset codes and lattices.
Sarah A. Spence, Cornell University

Using Geometry to Bound Homotopy Types in
2-orbifolds with Isolated Singularities.
Elizabeth A. Stanhope, Dartmouth College

MAA Business Meeting
11:10 AM - 11:40 AM

AMS Business Meeting
11:45 AM - 12:15 PM

NAM William W.S. Claytor Lecture
1:00 PM - 1:50 PM

Title to be announced.
Katherine Okikiolu, University of California San
Diego
San Diego, CA, Wednesday, January 9 - Program of the Sessions

ASL Invited Address
1:00 PM - 1:50 PM
(1211) Learning in Finite Models.
Martin Grohe, University of Freiburg

AMS-MAA Special Session on History of Mathematics, IV
1:00 PM - 3:50 PM
Organizers: Thomas Archibald, Acadia University
David E. Zitarelli, Temple University

AMS Special Session on Probabilistic Methods in Combinatorics and the Internet, III
1:00 PM - 5:50 PM
Organizers: Fan Chung Graham, University of California San Diego
Van Vu, University of California San Diego

AMS Special Session on Computational Commutative Algebra and Algebraic Geometry, III
1:00 PM - 5:50 PM
Organizers: Elizabeth Arnold, Texas A&M University
Amelia Taylor, Rutgers University

AMS Special Session on Algebraic Combinatorics, II
1:00 PM - 5:50 PM
Organizers: Rosa C. Orellana, Dartmouth College
Michael Zabrocki, York University

4:00PM Failure Detection in Networks.
(1224) Jon M Kleinberg, Cornell University (973-05-220)
(1225) Monika R Henzinger, Google Inc. (973-68-353)
(1226) Internet. Preliminary report.
Ronald L. Graham, University of California, San Diego (973-05-1334)

5:30PM Discussion

NOTICES OF THE AMS 161
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>2:00PM</td>
<td>A combinatorial model for Weyl character formulas.</td>
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<td>Frederick Goodman*, University of Iowa, and Jacqui Ramage, University</td>
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<td>of Newcastle (973-05-1146)</td>
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<tr>
<td>2:30PM</td>
<td>The Stanley-Reisner simplicial complex of the slope variety. Preliminary report.</td>
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<td>Jeremy L Martin, University of California, San Diego (973-05-850)</td>
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<tr>
<td>3:00PM</td>
<td>Radon Transforms and the Finite General Linear Groups.</td>
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<td>Michael E Orrison, Harvey Mudd College (973-20-641)</td>
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<tr>
<td>3:30PM</td>
<td>A probabilistic approach to the descent statistic.</td>
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<td>Richard Ehrenborg, University of Kentucky, Michael Levin, Harvard</td>
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<td>University, and Margaret A Readyt*, University of Kentucky (973-05-767)</td>
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<tr>
<td>4:00PM</td>
<td>Restricted Permutations, Fibonacci Numbers, and k-Generalized Fibonacci</td>
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<td>Numbers.</td>
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<td>Eric S Egge, Gettysburg College (973-05-334)</td>
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<td>4:30PM</td>
<td>Sturmian Words and the Permutation that Orders the Fractional Parts</td>
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<td>[a], [2a], ..., [na].</td>
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<td>Kevin O'Bryant, University of Illinois at Urbana-Champaign (973-05-74)</td>
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<tr>
<td>5:00PM</td>
<td>Cyclotomic Hecke algebras and multipartitions.</td>
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<td>Monica J Vazirani, UC Berkeley (973-05-956)</td>
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<td>5:30PM</td>
<td>Reciprocity theorems for enumeration of perfect matchings.</td>
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<td>James G Propp, University of Wisconsin (973-05-732)</td>
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</tbody>
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AMS Special Session on Recent Developments in Analysis and Fluid Problems (in memory of Jacques-Louis Lions), III

1:00 PM - 5:50 PM

Organizers: Jie Shen, Pennsylvania State University and University of Central Florida
            Shouhong Wang, Indiana University
            Xiaoming Wang, Iowa State University
            Jerry L Bona, University of Illinois at Chicago (973-76-787)
            Roger Temam, Indiana University, and Xiaoming Wang* (973-76-1305)
            Shouhong Wang, Indiana University (973-76-657)
            Hans E Johnston, University of Michigan (973-76-881)
            John S Lowengrub, University of Minnesota (973-76-1471)
            John S Lowengrub, University of Minnesota (973-76-1471)
            Macromolecular fluids: modeling and simulation. Preliminary report.
            Wang Qj, Florida State University (973-76-1025)
            Multiple Scale Models in Complex fluids. Preliminary report.
            Chun Liu, Penn State University (973-76-670)
            The predictability problems in numerical weather and climate prediction. Preliminary report.
            Mu Mu* and Wansuo Duan, Institute of Atmospheric Physics, Chinese Academy of Sciences (973-76-731)

5:00PM Spectral Dynamics of Velocity Gradient Field in Restricted Flows
      Haifang Lui* and Eitan Tadmor, UCLA (973-35-1479)

5:30PM Statistical Solutions of the Navier-Stokes Equations with Applications to the Conventional Theory of Turbulence.
      Ricardo M Rosa, Universidade Federal do Rio de Janeiro (973-35-1281)

AMS Special Session on The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, IV

1:00 PM - 5:50 PM

Organizers: Jonathan D. Farley, University of Oxford and Vanderbilt University
            Stefan E. Schmidt, New Mexico State University
            Two applications of the tensor product of lattices. Preliminary report.
            Robert W Quackenbush, University of Manitoba (973-06-148)
            Congruence forcings in lattices. Preliminary report.
            George Grätzer, University of Manitoba, Matthew Greenberg*, McGill University, and Tamás E. Schmidt, Budapest University of Technology and Economics (973-06-702)
            Partial order, specification and refinement. Preliminary report.
            David Greenberg*, McGill University (973-06-148)
            Crossed products of lattice-ordered groupoids. Preliminary report.
            Huahao Wang, Iowa State University (973-06-1268)
            Radu Negulescu, Department of Electrical and Computer Engineering, McGill University (973-06-139)
            Dual Preorders: Operational Semantics & Applications.
            John S Davis II, IBM T.J. Watson Research Center (973-06-136)
            Partial order specification and refinement.
            Michael W Mislove, Tulane University (973-06-158)
            Retracts of Directed Complete Posets.
            Jimmie D Lawson, Louisiana State University (973-06-130)
            Retracts and Connections.
            Henry Crapo, CAMS, EHESS, Paris, France (973-06-1268)
            Constructing finite projective planes. Preliminary report.
            James B Nation, University of Hawaii (973-06-164)
            Q-universal varieties of bounded lattices. Preliminary report.
            M. E Adams*, State University of New York at New Paltz, and W. Dziobiak, University of Puerto Rico (973-06-143)

AMS Special Session on Research in Mathematics by Undergraduates, III

1:00 PM - 5:50 PM

Organizers: Carl V. Lutzer, Rochester Institute of Technology
            Darren A. Narayan, Rochester Institute of Technology
            Andy C Schultz, Davidson College (973-05-1433)
<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>1:30PM</td>
<td>Color-Consistent Automorphisms of Cayley Graphs.</td>
<td>Preliminary report.</td>
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<td>1:30PM</td>
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<td>Melanie Albert*, Davidson College, Jaren Smith, Bard College, and Elizabeth W McMahon, Lafayette College (973-05-414)</td>
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<tr>
<td>2:00PM</td>
<td>Permutations Avoiding the Patterns 1234 and</td>
<td>Preliminary report.</td>
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<td>2:00PM</td>
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<td>Corinne B Dallas, Gettysburg College (973-05-425)</td>
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<tr>
<td>2:30PM</td>
<td>RSK Insertion and Characters of Complex Reflection Groups and Cyclotomic Hecke Algebras.</td>
<td>Andy G Cantrell, Macalester College (973-05-225)</td>
</tr>
<tr>
<td>3:00PM</td>
<td>Constructing Excellent Unique Factorization</td>
<td>John Bryk, Williams College, Sonja Mapes*, University of Notre Dame, Charles Samuels, Williams College, and Grace Wang, University of California, Berkeley (973-13-250)</td>
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<tr>
<td>3:30PM</td>
<td>A measure that is both dyadic doubling and triadic doubling is not necessarily doubling.</td>
<td>Preliminary report.</td>
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<td>3:30PM</td>
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<td>Daniel M. Boylan, Harvey Mudd College (973-42-231)</td>
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<tr>
<td>4:00PM</td>
<td>Lotteries and Poisson approximation.</td>
<td>Preliminary report.</td>
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<td>4:00PM</td>
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<td>Ana Pavasovic*, Hillsdale College, and Chaliss Kinnucan*, Bates College (973-60-870)</td>
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<td>4:30PM</td>
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<td>Joanna A Bieri*, Northern Arizona University, and Catherine A Roberts, College of the Holy Cross (973-68-293)</td>
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<tr>
<td>5:00PM</td>
<td>Never Cry Wolf: Changing Population Dynamics in Yellowstone.</td>
<td>Clay E Cressler, Hope College (973-92-72)</td>
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AMS Special Session on Topological and Its Applications, III

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<tbody>
<tr>
<td>1:00PM</td>
<td>Organizers: Adriano Garsia, University of California San Diego</td>
<td>Edward E Allen, Wake Forest University (973-05-1339)</td>
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<tr>
<td>1:00PM</td>
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<td>John Shreshian, Washington University, and Michelle L Wachs*, University of Miami (973-05-1452)</td>
</tr>
<tr>
<td>1:30PM</td>
<td>Symmetric functions, homomorphisms, and permutation statistics.</td>
<td>Jeffrey B Remmel, University of California at San Diego (973-05-1049)</td>
</tr>
<tr>
<td>2:00PM</td>
<td>Applications of Symmetric Functions to the Study of Wreath Products Between Cyclic and Symmetric</td>
<td>Jennifer D Wagner, University of Illinois at Chicago (973-05-798)</td>
</tr>
<tr>
<td>3:30PM</td>
<td>Characters of the partition algebras.</td>
<td>Thomas Halverson, Macalester College (973-05-1138)</td>
</tr>
<tr>
<td>4:00PM</td>
<td>Descent Monomials and Garsia-Haiman Modules.</td>
<td>Edward E Allen, Wake Forest University (973-05-1339)</td>
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<tr>
<td>4:30PM</td>
<td>Symmetric functions and two-stack-sortable permutations.</td>
<td>Masato Okado, Osaka University, Anne Schilling, University of California, Davis, and Mark M Shimozono*, Virginia Polytechnic Institute and State University (973-05-1315)</td>
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AMS Special Session on Stochastic Processes and Functional Analysis (in honor of M. M. Rao), III

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<td>Organizers: Alan C. Kriknik, California State Polytechnic University Pomona</td>
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<td>John Shareshian, Washington University, and Michelle L Wachs*, University of Miami (973-05-1452)</td>
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<td>1:30PM</td>
<td>Stochastic Integral of processes with finite variation.</td>
<td>Nicolae Dinculeanu, University of Florida (973-60-904)</td>
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<td>Michael L Green, University (973-60-884)</td>
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<td>2:00PM</td>
<td>Stochastic Doubly Stochastic Operators.</td>
<td>Sheila King and Ray Shiflett*, California State Polytechnic University, Pomona (973-60-957)</td>
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<td>2:30PM</td>
<td>Filtering with Ornstein-Uhlenbeck Process as Noise.</td>
<td>Abhay G Bhatt, University of Tennessee at Knoxville (973-60-888)</td>
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<td>3:00PM</td>
<td>Itô formula for free stochastic integrals.</td>
<td>Michael Anschelevich, University of California, Berkeley (973-60-1400)</td>
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<td>3:30PM</td>
<td>Tightness of Brownian Flow and Lévy Flow.</td>
<td>Hong Zhang*, University of Wisconsin Oshkosh, and D Kannan*, University of Georgia (973-60-1221)</td>
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<td>4:00PM</td>
<td>Hedging of Options When the Price Process Has Jumps Whose Arrival Rate Depends on the Price History.</td>
<td>Kiseop Lee, Dept. of Statistics, Purdue Univ (973-60-17)</td>
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<td>4:30PM</td>
<td>Extended Distributions and Hyperfunctional.</td>
<td>Preliminary report.</td>
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<td>Mark Burgin, University of California, Los Angeles (973-46-900)</td>
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<td>5:00PM</td>
<td>A Problem from Hamiltonian Mechanics with Small Jumps Whose Arrival Rate Depends on the Price History.</td>
<td>Preliminary report.</td>
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<td>Natella V O'Bryant, University of Illinois at Urbana-Champaign (973-60-81)</td>
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<td>5:30PM</td>
<td>Approximating Scale Mixtures.</td>
<td>Hasan Hamdan* and John Nolan, James Madison University (973-60-905)</td>
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### Program of the Sessions - San Diego, CA, Wednesday, January 9 (cont’d.)

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<tr>
<td>1:00PM</td>
<td><strong>John C. Mayer</strong>, University of Alabama at Birmingham</td>
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<tr>
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<td>1:00PM Forcing and convergence properties in compact spaces. Preliminary report.</td>
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<td>Alan S Dow, University of North Carolina Charlotte (973-54-1274)</td>
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<tr>
<td>1:30PM</td>
<td>Perfect images of meta-Lindelöf spaces. Preliminary report.</td>
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<td>Oleg I Pavlov, Mercer University (973-54-1412)</td>
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<tr>
<td>2:00PM</td>
<td>A Generalization of Weak Bases.</td>
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<td>Chuan Liu, Ohio State University-Newark (973-54-1336)</td>
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<tr>
<td>2:30PM</td>
<td>An α-normal non-β-normal Moore Space.</td>
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<td>Preliminary report.</td>
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<td>John E Porter, Murray State University (973-54-144)</td>
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<tr>
<td>3:00PM</td>
<td>Base-cover paracompactness and GO-spaces.</td>
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<td>Strashimir G. Popvassilev, Auburn University, AL, and Institute of Mathematics, Sofia, Bulgaria (973-54-255)</td>
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<tr>
<td>3:30PM</td>
<td>Metrizability of trees.</td>
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<td>Akira Iwasa, University of South Carolina Salkehatchie (973-54-1035)</td>
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<tr>
<td>4:00PM</td>
<td>On some relative properties.</td>
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<td>Mikhail V Matveev, Irvine, CA (973-54-803)</td>
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<tr>
<td>4:30PM</td>
<td>A Survey of the Theory of Non-Metrizable Manifolds.</td>
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<td>Preliminary report.</td>
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<td>Abdul Adheem Mowatt Mohamad, University of Auckland and University of Pittsburgh (973-54-1224)</td>
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<tr>
<td>5:00PM</td>
<td>Nicely Fréchet spaces and Fréchetness of products.</td>
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<td>Francis Jordan and Frederic Mynard*, University of Mississippi (973-54-946)</td>
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<tr>
<td>5:30PM</td>
<td>The Category of Long Exact Sequences and the Homotopy Exact Sequence of Modules.</td>
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<td>C. Joanna Su, Providence College (973-55-740)</td>
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</tbody>
</table>

#### MAA Minicourse #12: Part A

1:00PM - 3:00PM

Introduction to mathematical card tricks.

Organizers: Colm K. Mulcahy, Spelman College
            Jeffrey A. Ehme, Spelman College

#### MAA Minicourse #7: Part A

1:00PM - 3:00PM

Creating and exporting computer animations to the Web.

Organizers: William D. Emerson, Metropolitan State College of Denver
            Louis A. Talman, Metropolitan State College of Denver
            Bradford Kline, Metropolitan State College of Denver

#### AMS Session on Functional Analysis and Operator Theory

1:00PM - 5:55PM

1:00PM Convex set and polygons. Preliminary report.
   Ji Gao, Community College of Philadelphia (973-46-24)

1:15PM Approximation by chaotic operators. Preliminary report.
   Juan P Bes*, Trinity College, and Kit C Chan, Bowling Green State University (973-46-142)

1:30PM Some extremal properties of section spaces of Banach bundles and their duals.
   D A Robbins, Trinity College (973-46-246)

1:45PM Some Convergent Properties of Mann and Ishikawa Iteration Schemes in Hilbert Spaces. Preliminary report.
   Jinlu Li, Shawnee State University (973-46-400)

2:00PM Riemann-Lebesgue properties of Banach spaces associated with subsets of a discrete abelian group. Preliminary report.
   Patrick N Dowling, Miami University (973-46-863)

   Dawn R Slavens*, Midwestern State University, and Elizabeth M Bator, University of North Texas (973-46-1082)

2:30PM Complemented subspaces of bounded linear operators from $C(H,E)$ to $F$. Preliminary report.
   Elizabeth M Bator, University of North Texas (973-46-1238)

2:45PM A separating property for operators on Banach lattices related to function space representations. Preliminary report.
   William A. Feldman, University of Arkansas (973-47-155)

3:00PM Orbits under a class of isometries of $L^1[0,1]$. Preliminary report.
   Terje Hoim, Trinity College, Hartford, CT (973-47-205)

   Lisa A Oberbroeckling, University of Oregon (973-47-810)

3:30PM Separating the shift-like and backward shift-like parts of a Hilbert space operator. Preliminary report.
   George R Exner*, Bucknell University, and Bernard Chevreau, University of Bordeaux I (973-47-857)

3:45PM Rank Preserving Maps on CSL Algebra. Preliminary report.
   Jaedeok Kim, University of Alabama (973-47-958)

4:00PM Composition and Toeplitz Operators in Lorentz Ideals.
   Raimundo M Kovac, Rhode Island College (973-47-1029)

   Michael W Raney, University of Oregon (973-47-1059)

4:30PM On the Existence of Non Outer Conjugate $Z_2$-Kernels on a Free Group Factor with the Same Obstruction to Lifting.
   Maria Grazia Viola, University of Iowa (973-47-1440)

4:45PM Cauchy-Kowalewski Theorem for Extended Distributions. Preliminary report.
   Mark Burgin and James Ralston*, UCLA (973-35-744)

5:00PM Extending the Kantrovich inequalities to Normal Operators and pairs of elements of closed Normal Subalgebras.
   Morteza Seddighin, Indiana University East (973-47-21)

5:15PM Ternary Rings of Operators and their Linking $C^*$-algebras.
   Zhong-Jin Ruan and Manmohan Kaur*, University of Illinois (973-46-1468)
AMS Session on Mathematics Education

1:00 PM - 2:55 PM

1:00 PM
Building Job Skills in a Number Theory Course.
John W Jones*, Arizona State University, and Jeffrey J Holt, University of Virginia (973-97-26)

1:15 PM
Wayne F Mackey, University of Arkansas, Fayetteville (973-97-332)

1:45 PM
The Effects of Hand-Held CAS in Multivariable Calculus.
Mary Ann Connors, Westfield State College, and William L Fehlm an II*, United States Military Academy (973-97-515)

2:00 PM
Richard O Hill* and Thomas A Parker, Michigan State University (973-97-1198)

2:30 PM
Improving Undergraduate Mathematics Education: Benefits of the Undergraduate Teaching Assistant Program at the University of Arizona.
Christopher D Goff* and Brigitte Lahme, University of Arizona (973-97-1423)

2:45 PM
Brigitte Lahme* and Maria K Robinson, University of Arizona (973-97-1429)

AMS Session on Partial Differential Equations

1:00 PM - 5:55 PM

1:00 PM
Generation and Metastability of Patterns for a Class of Nonlinear Evolution Equations.
Zhenbu Zhang, Tulane University (973-35-44)

1:15 PM
Complete Blow-Up For A Degenerate Semilinear Parabolic Problem With An Insulated Boundary Condition.
Nadejda E Dyakevitch, University of Louisiana at Lafayette (973-35-150)

1:30 PM
Decay of KaV Solitons.
Hieu D Nguyen, Rowan University (973-35-187)

1:45 PM
The existence and large time behavior of solutions of a parabolic boundary value problem with interface condition. Preliminary report.
Chi-Kan Chen, University of Central Arkansas (973-35-273)

2:00 PM
On Explicit Radial Entire and Non-Entire Solutions.
Philip W Schaefer*, University of Tennessee, and Vinod Goyal, Tuskegee University (973-35-1466)

2:15 PM
Break.

2:30 PM
An nth order Darboux transformation for the one-dimensional time dependent Schrodinger equation.
Danny Arrigo* and Fred Hickling, University of Central Arkansas (973-35-1001)

MAA Session on Classroom Demonstrations and Course Projects That Make a Difference, III

1:00 PM - 4:55 PM

Organizers: David R. Hill, Temple University
Sarah L. Mabrouk, Framingham State College
Lila F. Roberts, Georgia Southern University

1:00 PM
Students on Track - Designing a Train Track.
Gerald Kobyliski, William K Farmer*, United States Military Academy, and Ethan Berkove, Lafayette University (973-81-533)
### Program of the Sessions - San Diego, CA, Wednesday, January 9 (cont’d.)

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<tr>
<th>Time</th>
<th>Session</th>
<th>Presenters</th>
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<tbody>
<tr>
<td>1:15PM</td>
<td>Teaching Vectors in Context: Kennedy Space</td>
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<td><strong>(1351)</strong> Center’s Doppler Radar Wind Profiler Project.</td>
<td><strong>(1351)</strong> DENNIS C EBERSOLE, Northampton Community College (973-N1-412)</td>
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<td>1:30PM</td>
<td><strong>(1352)</strong> Calculus Demonstration</td>
<td><strong>(1352)</strong> JAMES T SANDEFUR, Georgetown University (973-N1-452)</td>
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<td>1:45PM</td>
<td><strong>(1353)</strong> Demos with Positive Impact: A Project to Connect</td>
<td><strong>(1353)</strong></td>
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<td>Mathematics Instructors with Effective Teaching Tools.</td>
<td><strong>(1353)</strong></td>
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<td>Kelly Black* and John B Geddes, University of New Hampshire</td>
<td><strong>(1353)</strong></td>
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<td><strong>(1354)</strong> Using Consulting Problems to Reinvigorate a Liberal</td>
<td><strong>(1354)</strong></td>
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<td>Arts Mathematics Course. Preliminary report.</td>
<td><strong>(1354)</strong></td>
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<td>Carol A Simmons, North Georgia College &amp; State University</td>
<td><strong>(1354)</strong></td>
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<td>2:15PM</td>
<td><strong>(1355)</strong> Modeling Projects in a Beginning Applied Calculus course.</td>
<td><strong>(1355)</strong></td>
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<td>Sharon L Brown, Humboldt State University</td>
<td><strong>(1355)</strong></td>
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<td>2:30PM</td>
<td><strong>(1356)</strong> The Force Table in the Mathematics Classroom.</td>
<td><strong>(1356)</strong></td>
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<td>Kelly Black* and John B Geddes, University of New Hampshire</td>
<td><strong>(1356)</strong></td>
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<td>2:45PM</td>
<td><strong>(1357)</strong> ILAPS to the Rescue.</td>
<td><strong>(1357)</strong></td>
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<td>William P Fox* and Richard D West, Francis Marion University</td>
<td><strong>(1357)</strong></td>
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<tr>
<td>3:00PM</td>
<td><strong>(1358)</strong> A Foot By Any Other Name - A Paradox for Calculus Students.</td>
<td><strong>(1358)</strong></td>
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<td>Tracy D Hamilton, California State University</td>
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<td></td>
<td>Stanislaus (973-N1-526)</td>
<td><strong>(1358)</strong></td>
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<td>3:15PM</td>
<td><strong>(1359)</strong> Projects for Pre-Service Teachers in an Upper-Level</td>
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<td>Modern Geometry Class.</td>
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<td>Timothy D Comar, Benedictine University</td>
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<td>(973-N1-478)</td>
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<td>3:30PM</td>
<td><strong>(1360)</strong> Spreading the Word: Classroom Simulations for</td>
<td><strong>(1360)</strong></td>
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<td>Modeling Logistic Growth.</td>
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<td>Penelope Dunham, Muhlenberg College</td>
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<td>(973-N1-544)</td>
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<td>3:45PM</td>
<td><strong>(1361)</strong> A Trip to the Circus - From General Mathematics to</td>
<td><strong>(1361)</strong></td>
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<td>Multivariate Calculus.</td>
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<td>Sarah L Mabrouk, Framingham State College</td>
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<td>(973-N1-697)</td>
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<td>4:00PM</td>
<td><strong>(1362)</strong> Was Malthus Correct? The Problem of Rice in India.</td>
<td><strong>(1362)</strong></td>
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<td>David H Carhart* and Karen J Schroeder, Bentley College</td>
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<td>(973-N1-554)</td>
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<td>4:15PM</td>
<td><strong>(1363)</strong> Models To Improve Visualization of Volumes.</td>
<td><strong>(1363)</strong></td>
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<td>Laurene V Faussett, Georgia Southern University</td>
<td><strong>(1363)</strong></td>
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<td>(973-N1-395)</td>
<td><strong>(1363)</strong></td>
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<td>4:30PM</td>
<td><strong>(1364)</strong> Do Math and History Mix?</td>
<td><strong>(1364)</strong></td>
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<td>Joanne V Peeples, El Paso Community College</td>
<td><strong>(1364)</strong></td>
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<td>(973-N1-574)</td>
<td><strong>(1364)</strong></td>
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<td>4:45PM</td>
<td><strong>(1365)</strong> Applications of Logic and Truth Tables in a General</td>
<td><strong>(1365)</strong></td>
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<td>Education Mathematics Course.</td>
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<td>Chris Oehrlein* and Jay Malmstrom, Oklahoma City Community College</td>
<td><strong>(1365)</strong></td>
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<td>(973-N1-578)</td>
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### MAA Session on Environmental Mathematics in the Classroom, II

**1:00 PM - 2:55 PM**

Organizers: **Ben Fusaro**, Florida State University

**Marty E. Walter**, University of Colorado

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<thead>
<tr>
<th>Time</th>
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<td>1:00PM</td>
<td>Mathematics for Environmental Analysis - two courses.</td>
<td><strong>(1366)</strong> Mic Jackson, Earlham College (973-P1-434)</td>
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<td>1:20PM</td>
<td><strong>(1367)</strong> Mathematics for Human Survival.</td>
<td><strong>(1367)</strong></td>
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<td>Patricia Clark Kenschaft, Montclair State University</td>
<td><strong>(1367)</strong></td>
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<td>1:40PM</td>
<td><strong>(1368)</strong> Classroom Ready Environmental Mathematics Resources.</td>
<td><strong>(1368)</strong></td>
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<td>Greg A Langkamp* and Joseph M Hull, Seattle Central Community College</td>
<td><strong>(1368)</strong></td>
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<tr>
<td>2:00PM</td>
<td><strong>(1369)</strong> Calculus and Environmental Modeling.</td>
<td><strong>(1369)</strong></td>
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<td>James A Walsh, Oberlin College</td>
<td><strong>(1369)</strong></td>
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<td>2:20PM</td>
<td><strong>(1370)</strong> Some Important Topics You Most Likely Will Not</td>
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<td>Encounter in an Economics Class. Preliminary report.</td>
<td><strong>(1370)</strong></td>
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<td>Martin E. Walter, University of Colorado</td>
<td><strong>(1370)</strong></td>
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<td>2:40PM</td>
<td><strong>(1371)</strong> Environmental Modeling: A general education course in an</td>
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<td>environmentally focused curriculum.</td>
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<td>Jim Wright, Green Mountain College</td>
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### MAA Session on Who Needs Algebra? Alternative Introductory Mathematics Courses

**1:00 PM - 4:55 PM**

Organizers: **Judy E. Ackerman**, Montgomery College

**Susan L. Forman**, Bronx Community College

**Kathie A. Yoder**, L. A. Pierce College

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<th>Time</th>
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<td>1:00PM</td>
<td><strong>(1372)</strong> Math in the First Year Studies Program: An Integrated</td>
<td><strong>(1372)</strong></td>
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<td>Approach to Collegiate Studies and Mathematical Thinking.</td>
<td><strong>(1372)</strong></td>
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<td>Theresa D Magnus, Rivier College</td>
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<td>(973-R1-547)</td>
<td><strong>(1372)</strong></td>
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<td>1:20PM</td>
<td><strong>(1373)</strong> Quantitative Reasoning and informed Citizenship:</td>
<td><strong>(1373)</strong></td>
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<td>An activity-based course for non-majors.</td>
<td><strong>(1373)</strong></td>
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<td>Alicia Sevilla* and Kay B Somers, Moravian College</td>
<td><strong>(1373)</strong></td>
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<td>(973-R1-529)</td>
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<td>1:40PM</td>
<td><strong>(1374)</strong> Quantitative Literacy as an Alternative to College Algebra.</td>
<td><strong>(1374)</strong></td>
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<td>Holly P Hirst* and Sarah J Greenwald, Appalachian State University</td>
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<td>(973-R1-398)</td>
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<td>2:00PM</td>
<td><strong>(1375)</strong> Graduating from college without college algebra. Preliminary report.</td>
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<td>John T Zerger, Catawba College</td>
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<td>(973-R1-466)</td>
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<td>2:20PM</td>
<td><strong>(1376)</strong> Logic in the Media, or Fallacies for Fun and Profit.</td>
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<td>Margaret Cibes, Hillyer College of the University of Hartford</td>
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<td>(973-R1-119)</td>
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<td>2:40PM</td>
<td><strong>(1377)</strong> Introduction to Mathematical Modeling.</td>
<td><strong>(1377)</strong></td>
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<td>Steven M Hettzler, Salisbury University</td>
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<td>(973-R1-568)</td>
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<td>3:00PM</td>
<td><strong>(1378)</strong> Mathematics in Action: A Holistic Approach to Teaching a</td>
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<td>First-year Mathematics Course.</td>
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<td>Morteza Shafii-Mousavi* and Paul Kochanowski, Indiana University North</td>
<td><strong>(1378)</strong></td>
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<td>Bend (973-R1-101)</td>
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<td>course for the five minute university.</td>
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<td>Dan Kalman, American University</td>
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<td>(973-R1-265)</td>
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<td>3:40PM</td>
<td><strong>(1380)</strong> What I did in High-School Mathematics and Why.</td>
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<td>George T Rublein, College of William and Mary</td>
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<td>(973-R1-567)</td>
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<td>4:00PM</td>
<td><strong>(1381)</strong> Taking Algebra Alternatives from the Community College to</td>
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<td>the High School.</td>
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<td>Chris Oehrlein, Oklahoma City Community College</td>
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<td>(973-R1-591)</td>
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<td>4:20PM</td>
<td><strong>(1382)</strong> Offering a Range of Algebra Alternatives. Preliminary report.</td>
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<td>Bonnie Gold, Monmouth University</td>
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<td>(973-R1-570)</td>
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SIGMAA on Research on Undergraduate Mathematics Education, III

1:00 PM - 2:35 PM
Organizer: Julie Morrisett Clark, Hollins University

1:00PM Exploring Changes in Elementary Education
(1384) Students' Mathematical Beliefs.
Stephen D Szydlik* and Jennifer E Szydlik, University of Wisconsin Oshkosh (973-S1-403)

1:20PM How Much Logic is Used in Transition Course Proofs and How Do Students Know It?
(1385) Annie Selden*, Tennessee Technological University, John Selden, Mathematics Education Resources Company, and Scott Baker, Tennessee Technological University (973-S1-556)

1:40PM Instructional Implications of Attending to Students' Spontaneous Reasoning. Preliminary report.
(1386) Michael C Furnish Oehrtman, The University of Texas at Austin (973-S1-162)

2:00PM Transformational Reasoning as a Tool for Defining, Conjecture and Proof. Preliminary report.
(1387) Michelle J Zandieh*, Mark Burth and Denise Nunley, Arizona State University (973-S1-608)

(1388) Eric S Hsu, San Francisco State University (973-S1-565)

MAA Panel Discussion

1:00 PM - 2:30 PM
The mathematics community and public support.
Organizer: Christopher C. Leary, SUNY at Geneseo
Panelists: Herbert Clemens, University of Utah
Daniel L. Goroff, Harvard University
Joseph Malkevitch, York College, City University of New York
Michael A. Green, AMS
Daniel N. Rockmore, Dartmouth College

MAA Special Presentation

1:00 PM - 2:30 PM
How to successfully publish a textbook.
Organizer: Michael R. Lennie, San Diego, CA
Presenters: Michael R. Lennie
Robert Christopherson, American River College

MAA CUPM Subcommittee on Calculus Reform and the First Two Years Panel Discussion

1:00 PM - 2:30 PM
Reflections on the West Point Summary Conference for the CRAFTY Curriculum Foundations Workshops.
Organizer: Donald B. Small, U. S. Military Academy
Moderator: Kathleen Snook, U. S. Military Academy

Panelists: William H. Barker, Bowdoin College
William G. McCallum, University of Arizona, Tucson
Harriet S. Pollatsek, Mount Holyoke College
Donald B. Small

AWM Workshop: Panel Discussion

1:00 PM - 2:30 PM
Launching a career in mathematics.
Moderator: Jodie Novak, University of Northern Colorado
Panelists: Cathy Kriloff, Idaho State University
Kristin Lauter, Microsoft Research
Judy Walker, University of Nebraska, Lincoln
Nancy J. Wyshinski, Trinity College

ASL Invited Address

2:00 PM - 2:50 PM
On Certain Epimorphisms.
Philipp S. Rothmaler, Ohio State University at Lima

AMS Invited Address

2:15 PM - 3:05 PM
Analytical and topological issues concerning Sobolev mappings.
Fanghua Lin, Courant Institute, New York University (973-58-11)

AWM Workshop: Presentations by Recent Women Ph.D.s, II

2:30 PM - 4:20 PM
Hecke Algebras and Homflypt Skein Modules.
(1391) Jianyuan Kathy Zhong, Louisiana Tech University
3:00PM An algorithmic approach to the invariant
(1392) approximation of differential invariants.
Mireille (Mimi) Boutin, Brown University
3:30PM Location and type of singularities of generic nonlinear differential systems.
(1393) Rodica D. Costin, Rutgers University
4:00PM Regularization of nonlinear unstable operator equations by secant-type method.
Alexandra Smirnova, Georgia State University

MAA Panel Discussion

2:45 PM - 4:15 PM
Enhance undergraduate mathematics courses using globally interactive, live dynamic mathematics on the Web.
Organizer: Joan Bookbinder, Arlington Heights, IL

MAA Workshop

2:45 PM - 4:15 PM
Reforming college algebra.
Organizer: Donald B. Small, U. S. Military Academy
Moderator: Donald B. Small
Program of Sessions

Panelists: Steven R. Dunbar, University of Nebraska
Mercedes A. McGowen, William Rainey Harper College

ASL Contributed Talks
3:10 PM - 5:00 PM

MAA Minicourse #8: Part A
3:15 PM - 5:15 PM
Real-world problem solving using technology and student projects.
Organizers: Bruce Pollack-Johnson, Villanova University
Audrey Borchardt, Villanova University

AMS Banquet
6:30 PM - 10:00 PM

John L. Bryant
AMS Associate Secretary
Tallahassee, Florida
James J. Tattersall
MAA Associate Secretary
Providence, Rhode Island

Mathematical Moments

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General Information Regarding Meetings & Conferences of the AMS

Speakers and Organizers: The Council has decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

Although an individual may present only one ten-minute contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once. An author can speak by invitation in more than one Special Session at the same meeting.

Special Sessions: The number of Special Sessions at an Annual Meeting is limited. Special Sessions at Annual Meetings are held under the supervision of the Program Committee for National Meetings and, for Sectional Meetings, under the supervision of each Section Program Committee. They are administered by the Associate Secretary in charge of that meeting with staff assistance from the Meetings and Conferences Department in Providence. (See the list of Associate Secretaries on the last page of this issue.)

Each person selected to give an Invited Address is also invited to generate a Special Session, either by personally organizing one or by having it organized by others. Proposals to organize a Special Session are sometimes solicited either by a program committee or by the Associate Secretary. Other proposals should be submitted to the Associate Secretary in charge of that meeting (who is an ex officio member of the program committee) at the address listed below. These proposals must be in the hands of the Associate Secretary at least seven months prior to the meeting at which the Special Session is to be held in order that the committee may consider all the proposals for Special Sessions simultaneously. Special Sessions must be announced in the Notices in a timely fashion so that any Society member who so wishes may submit an abstract for consideration for presentation in the Special Session.

Talks in Special Sessions are usually limited to twenty minutes; however, organizers who wish to allocate more time to individual speakers may do so within certain limits. A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is submitted to the AMS prior to the special early deadline for consideration. Contributors should know that there is a limit to the size of a single Special Session, so sometimes all places are filled by invitation. Papers submitted for consideration for inclusion in Special Sessions but not accepted will receive consideration for a contributed paper session, unless specific instructions to the contrary are given.

The Society reserves the right of first refusal for the publication of proceedings of any Special Session. If published by the AMS, these proceedings appear in the book series Contemporary Mathematics. For more detailed information on organizing a Special Session, see www.ams.org/meetings/specialsessionmanual.html.

Contributed Papers: The Society also accepts abstracts for ten-minute contributed papers. These abstracts will be grouped by related Mathematical Reviews subject classifications into sessions insofar as possible. The title and author of each paper accepted and the time of presentation will be listed in the program of the meeting.

Other Sessions: In accordance with policy established by the AMS Committee on Meetings and Conferences, mathematicians interested in organizing a session at an annual or sectional meeting on employment opportunities inside or outside academia for young mathematicians should contact the Associate Secretary for the meeting with a proposal by the stated deadline. Also, potential organizers for poster sessions on a topic of choice should contact the Associate Secretary before the deadline.

Abstracts: Abstracts for all papers must be received by the meeting coordinator in Providence by the stated deadline. Unfortunately, late papers cannot be accommodated.

Electronic submission procedures: Send a message to abs-submit@ams.org and type help as the subject to review your options, or visit the meetings and conferences home page on the Web at http://www.ams.org/committee/meetings/. Completed electronic abstracts must be submitted to abs-submit@ams.org, typing submission as the subject.

Submission by U. S. mail: AMS abstract forms may be requested by contacting the Meeting Coordinator, AMS Meetings and Conferences Department, P. O. Box 6887, Providence, RI 02940; telephone: 401-455-4146; e-mail: meet@ams.org. Your completed abstract should be sent to the same address by the stated deadline. N. B. there is a $20 processing fee for paper abstracts. There is no charge for abstracts submitted electronically.

See the inside front cover of Abstracts of Papers Presented to the American Mathematical Society for information on abstracts published by title and not presented at a meeting.

Site Selection for Sectional Meetings

Sectional meeting sites are recommended by the Associate Secretary for the section and approved by the Secretariat. Recommendations are usually made eighteen to twenty-four months in advance. Host departments supply local information, ten to fifteen rooms with overhead projectors for contributed paper sessions and Special Sessions, an auditorium with twin overhead projectors for Invited Addresses, and registration clerks. The Society partially reimburses for the rental of facilities and equipment and for staffing the registration desk. Most host departments volunteer; to do so, or for more information, contact the Associate Secretary for the section.
Meetings and Conferences of the AMS

Associate Secretaries of the AMS

Western Section: Bernard Russo, Department of Mathematics, University of California Irvine, CA 92697; e-mail: brusso@math.uci.edu; telephone: 949-824-5505.

Central Section: Susan J. Friedlander, Department of Mathematics, University of Illinois at Chicago, 851 S. Morgan (M/C 249), Chicago, IL 60607-7045; e-mail: susan@math.nwu.edu; telephone: 312-996-3041.

Eastern Section: Lesley M. Sibner, Department of Mathematics, Polytechnic University, Brooklyn, NY 11201-2990; e-mail: lsibner@duke.poly.edu; telephone: 718-260-3505.

Southeastern Section: John L. Bryant, Department of Mathematics, Florida State University, Tallahassee, FL 32306-4510; e-mail: bryant@math.fsu.edu; telephone: 850-644-5805.

The Meetings and Conferences section of the Notices gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. Information in this issue may be dated. Up-to-date meeting and conference information at www.ams.org/meetings/.

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2002

January 6-9 San Diego, California p. 93
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March 1-3 Ann Arbor, Michigan p. 95
March 8-10 Atlanta, Georgia p. 97
May 3-5 Montréal, Québec, Canada p. 100
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June 20-22 Portland, Oregon p. 102
October 5-6 Boston, Massachusetts p. 103
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2003

January 15-18 Baltimore, Maryland p. 104
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2005

January 5-8 Atlanta, Georgia p. 105
Annual Meeting

Important Information regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 175 in the January 2002 issue of the Notices for general information regarding participation in AMS meetings and conferences.

Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of $\LaTeX$ is necessary to submit an electronic form, although those who use $\LaTeX$ may submit abstracts with such coding. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html, or send mail to abs-submit@ams.org, typing help as the subject line; descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed abstracts should be sent to abs-submit@ams.org, typing submission as the subject line. Questions about abstracts may be sent to abs-info@ams.org.

Paper abstract forms may be sent to Meetings & Conferences Department, AMS, P.O. Box 6887, Providence, RI 02940. There is a $20 processing fee for each paper abstract. There is no charge for electronic abstracts. Note that all abstract deadlines are strictly enforced. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

Conferences: (See http://www.ams.org/meetings/ for the most up-to-date information on these conferences.)

February 14-19, 2002: Annual Meeting of the American Association for the Advancement of Science (AAAS), Boston, MA.

May 20-25, 2002: 6th International Conference on Clifford Algebras and Their Applications to Mathematical Physics, Cookeville, TN.


June 7-August 1, 2002: Joint Summer Research Conferences in the Mathematical Sciences, Mount Holyoke College, South Hadley, MA. See pages 1289-1291, November 2001 issue, for details.
From previous discussions, you recall that we defined the maps \( e \) and \( \delta \), as well as the vertical momentum of the reduced system. Now let us call \( \mathbf{p}_e = (p_e, \mathbf{p}_b) \). We want to find an equation for the evolution of \( p_e \). We have

\[
\frac{dp_e}{dt} = \left( \frac{D}{Dt} \mathbf{p}_b \right) + \left( \mathbf{p}_b \frac{D}{Dt} \mathbf{b} \right).
\]

Using the vertical Lagrange-Poincaré equation, we immediately obtain

\[
\left( \frac{D}{Dt} \mathbf{p}_b \right) + \left( \mathbf{p}_b \frac{D}{Dt} \mathbf{b} \right) = \frac{\partial \Phi}{\partial \mathbf{p}_b}.
\]

We previously learned how to calculate the covariant derivative of \( \mathbf{p}_e \) in \( \mathbf{q}(\mathbf{t}) \).


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formalism which pervades some parts of algebra.”

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