Iterations of the Landen Map (see page 317)
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**SIAM Turns Fifty**

In this very special year for the Society for Industrial and Applied Mathematics (SIAM)—the year of our fiftieth anniversary—we are pleased to share with you some reflections on our past and visions for our future.

SIAM was founded in 1951 in Philadelphia—not coincidentally the city in which the first programmable digital computer, the ENIAC, was built and tested. Close ties to computing and computational science have complemented deep interests across the spectrum of applied mathematics throughout the fifty years of SIAM’s existence. As these fields have grown and evolved over the past half century, so has SIAM.

Many of those associated with the development of the ENIAC became prominent SIAM leaders. ENIAC developer John Mauchly served on the first SIAM Board of Trustees and later became the fourth president of SIAM. John von Neumann, while never an officer of SIAM, lends his name to one of our most prestigious prizes: the John von Neumann Lecture. Grace Hopper, a member of Howard Aiken’s Mark I team and later a researcher at the Eckert-Mauchly Corporation, was elected SIAM vice president for planning at a 1952 organizational meeting.

The region around Philadelphia was an early center for the computer industry, as reflected by early lists of SIAM’s corporate members. The Burroughs Corporation, IBM, Sperry Rand’s Remington Rand Division (a successor of Eckert-Mauchly), and RCA were among our first corporate members. Also well represented among our early corporate sponsors were oil companies, including Standard Oil of California and Socony-Mobil. With the launch of Sputnik came strong representation from the aerospace sector, including Boeing Airplane Company, Hughes Aircraft Company, Lockheed Aircraft Corporation, and the Martin Company. Consistently among our corporate sponsors over the years has been Bell Labs.

Parallel to SIAM’s strong ties to industry, with an emphasis on digital computing, were deep roots in applied mathematics and the academic community, through membership and especially through the SIAM journals. The first volume of the *Journal of the Society for Industrial and Applied Mathematics* appeared in 1953 under the leadership of editors I. Edward Block, Philip Davis, Robert Jackson, and Russell Remage. In the early issues, the acquisition and shaping of every paper seemed to be a story in itself. By the early 1960s, though, the journal was on solid enough footing to spin off two specialty journals—on control (1962) and on numerical analysis (1964).

The blend of computing and applied mathematics that has been a consistent hallmark of SIAM can be seen in our leadership over the years. Alston Householder (president, 1963–64), J. Wallace Givens (president, 1966–67), and George Forsythe (trustee, 1970–72) were all important pioneers in numerical analysis and scientific computing. During the same period, Harold Kuhn lent his wisdom and prestige to SIAM as an early president (1954–55); other prominent applied mathematicians elected to leadership positions include Garrett Birkhoff (president, 1965–66) and Joseph LaSalle (president, 1962–63, and a driving force in establishing control as an important SIAM interest). This dual tradition continues today and contributes to the vitality of our community.

From its origins, with just a few hundred members and a single journal, SIAM has grown into an organization with nearly 9,000 members and eleven journals in areas that range from applied mathematics to control, optimization, and scientific computing. Today, SIAM holds eight to ten conferences a year in various areas of applied mathematics and computing and supports twelve activity groups. The activity groups are always a good indication of new emphases within SIAM, from the first (in linear algebra, founded in the early 1980s) to the three newest groups—in life sciences, imaging science, and computational science and engineering—all begun in the past two years. Like much of applied mathematics today, the areas covered by our activity groups are highly interdisciplinary, with exciting new research topics emerging from the intersection of mathematics, computing, and application areas.

The SIAM membership itself is quite interdisciplinary. Only about half of SIAM members, according to a 1995 survey, received their highest degrees from mathematics departments, with another 11 percent from applied mathematics departments. The remainder held degrees in a variety of disciplines, including computer science, engineering, and physics. Roughly two thirds of regular SIAM members work in academia, with the other third divided fairly evenly between industry and government, including a strong representation from national labs.

We believe that the future holds great promise for applied mathematics and computing—and for SIAM. Interdisciplinary mathematics has always played an important role in science and technology, on which the economy is increasingly dependent. New and exciting applications are continually emerging.

Biotechnology, imaging science, and information technology are some of the fields whose recent growth has been driven, in part, by remarkable advances in computational capabilities. As our computational tools have grown in power, mathematics has become even more important. A good case can be made that improvements in our ability to model complex phenomena can be attributed at least as much to advances in algorithms as to advances in hardware. For the coming years, we see applied and computational mathematics continuing to grow with computational technologies.

Traditional areas of applied mathematics—fluid dynamics being one important example—continue to thrive, driven by new problems. At the same time, the emergence of exciting new application areas—large data sets and financial mathematics among them—is driving the development of whole new areas of applied mathematics.

SIAM will celebrate its anniversary at the 2002 SIAM Fiftieth Anniversary and Annual Meeting in Philadelphia this summer (July 8–12). We are planning a special program, one that reflects our roots in both applied mathematics and computing but that is oriented very definitely toward the future. We invite you all to come and celebrate with us. See http://www.siam.org/meetings/SIAM50/ for details about the conference and related special events.

—Tom Manteuffel, SIAM President
—Jim Crowley, SIAM Executive Director
Digital Millennium Copyright Act

The Digital Millennium Copyright Act (DMCA), promoted by the music and motion picture industries under the banner of protecting intellectual property rights, was passed into law in July 1998. Section 1201(b)(1)(A) of the DMCA prohibits trafficking in "any technology...that is primarily designed or produced for the purpose of circumventing [copyright] protection." Unfortunately, the DMCA is being used to discourage scientific research related to encryption. With no stretch of the imagination, mathematics will be directly and adversely affected, as the fields of computer security and data encryption already are.

The names of Edward Felten and Dmitry Sklyarov are associated with events of interest to mathematicians. As part of a public challenge issued by the Secure Digital Music Initiative (SDMI), Felten's team broke several "watermarking" technologies for digital music, then rejected a monetary prize in favor of publication. The SDMI and the Recording Industry Association of America (RIAA) warned Felten that publication would "subject [Felten's] team to enforcement actions under the DMCA and possibly other federal laws." After negotiating with the recording industry, Felten's team presented its results at the Tenth Annual USENIX Security Symposium, but the wording of subsequent public announcements by the SDMI and RIAA leads us to believe that the recording industry's seeming acquiescence represents merely their perception of current public opinion.

The second case concerns a Russian software developer and cryptography student named Dmitry Sklyarov. As an employee of the Russian software firm ElcomSoft, Sklyarov authored a commercial program to circumvent password protection on Adobe eBook files. This software is legal outside the United States and has legitimate applications that are not provided by Adobe's own software. Sklyarov was also an invited speaker at the Def Con security conference held in Las Vegas in July 2001. Acting on a motion filed by Adobe Software, the FBI arrested Sklyarov on July 16, charging him with violating Section 1201(b)(1)(A) of the DMCA. In response to strong negative public reaction, Adobe dropped its complaint, but the Department of Justice is pursuing the case. On August 30, Sklyarov was charged with five counts, each carrying a maximum penalty of five years imprisonment and a fine of $500,000.

Sklyarov's case is relevant to academics because he was in the United States as a conference participant, not as a representative of ElcomSoft. However, all such cases are important to research mathematicians: Many commercial "content protection technologies" are currently at the level of Rot-13 (an involution of the Roman alphabet), Fermat's little theorem, and mod 2 linear algebra, relying on public ignorance for their effectiveness. To criminalize publication of work that could be used to thwart such measures is misguided. A mathematician whose work has cryptographic applications could run afoul of the DMCA. We do not believe criminal charges would be upheld in such a case, but find it unacceptable that the DMCA contains provisions for raising these charges at all.

The chilling effect of the DMCA on academic research has not been emphasized in media accounts, but it is extant and will only get worse as the entertainment industry pushes for more enforcement of the DMCA. In July, Alan Cox (the maintainer of the stable Linux kernel) stated that he would boycott conferences held in the United States and urged others to do the same. In August, Dutch cryptographer Neils Ferguson (a co-designer of the Twofish encryption algorithm) announced that he had broken the encryption used in Intel's High-bandwidth Digital Content Protection (HDCP). Because he visits the United States regularly, Ferguson has declined to discuss the details of his findings, even with Intel, since that could constitute "trafficking" under the DMCA.

Readers can find up-to-date information on legal aspects of the Sklyarov and Felten cases at the Electronic Frontier Foundation: http://www.eff.org/.

Technical and practical aspects of encryption are engagingly discussed at David Touretzky's Carnegie-Mellon University site. His gallery of DVD descramblers pointedly illustrates the fact that source code—a form of mathematical expression—is speech that should be protected by the First Amendment. See http://www.cs.cmu.edu/~dstl.

Two undergraduates broke the weak encryption used by Mattel's Cyber Patrol 4 Internet blocking software. Information about this case and subsequent events can be found at: http://www.ansuz.sooke.bc.ca/cpbfaq.html.

—George S. Avrunin
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College of the Holy Cross
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(Received November 9, 2001)
The Evaluation of Integrals: A Personal Story

Victor H. Moll

The fall semester of 1992 was a promising one for me. I had just returned from an extended sabbatical at the University of Utah, I was going to be considered for tenure, and I would be teaching the beginning graduate course in analysis. This article tells the story of how this promise was fulfilled, but in very unexpected ways.

One of the analysis students (George Boros), older than the rest and for many years a part-time instructor in the area, had finally decided to pursue a Ph.D. in mathematics. He was well known in New Orleans mathematical circles as "the person who can compute any integral." Having spent my graduate-student years at Courant Institute, I was comfortably unaware of integrals and did not think that this could be serious mathematics. I was wrong.

At the end of the academic year this student asked me to be his adviser. I agreed but cautioned: "George, nobody is going to give you a doctorate in mathematics for computing integrals." His response was that he was aware of this and if I was willing to suggest a general topic for the qualifiers, he would accept my choice. At that time Henry McKean and I were in the process of writing the book [6], so I suggested that George read the manuscript and that his qualifiers be related to elliptic curves. After a successful exam it came time for a thesis problem, and when I started to suggest some possibilities, he interrupted me with: "I have my own problems." This was a surprise. It was even more of a surprise to discover that new things can still be said today about the mundane subject of integration of rational functions of a single variable and that this subject has connections with branches of contemporary mathematics as diverse as combinatorics, special functions, elliptic curves, and dynamical systems.

A Formula for the Quartic

In order to satisfy my curiosity, George told me that

\[ \int_0^{\infty} \frac{dx}{(x^4 + 6x^2 + 1)^3} = \frac{219\pi}{2048\sqrt{2}}. \]

My response was clear: "George, there are symbolic languages that can do these things; you should not waste your time." Indeed, Mathematica yields the answer

\[ \frac{3\pi}{8192} \left( -31\sqrt{6} - 4\sqrt{2} + 42\sqrt{3} - 2\sqrt{2} 
\] 
\[ + 42\sqrt{3} + 2\sqrt{2} + 31\sqrt{6} + 4\sqrt{2} \right), \]

and George's evaluation can be obtained by using the FullSimplify command. Similarly,

\[ \frac{1}{\pi} \int_0^{\infty} \frac{dx}{(x^4 + 6x^2 + 1)^{31}} \]
\[ = \frac{3^2 \cdot 13^2 \cdot 17 \cdot 53 \cdot 59 \cdot 61 \cdot 67 \cdot N_1 \cdot N_2 \cdot N_3 \cdot N_4}{2^{249}\sqrt{2}}, \]

where \( N_1, N_2, N_3, \) and \( N_4 \) are the prime numbers

\[ 91297, \quad 1518533, \quad 4436895293, \]
\[ \text{and} \quad 10220677829087302935117744959039145564109. \]

The problem of integration of rational functions \( R(x) = P(x)/Q(x) \) was considered by J. Bernoulli in the eighteenth century. He completed the original...
attempt by Leibniz to find a general partial fraction decomposition of \( R(x) \). The main difficulty associated with this procedure is to obtain a complete factorization over the real numbers of the denominator \( Q(x) \). Once this is known, the partial fraction decomposition of \( R(x) \) can be computed. The fact is that the primitive of a rational function is always elementary: it consists of a rational part (a new rational function) and a transcendental part (the logarithm of a second rational function). In his classic monograph [5], G. H. Hardy states: "The solution of the problem (of definite integration) in the case of rational functions may therefore be said to be complete; for the difficulty with regard to the explicit solution of algebraical equations is one not of inadequate knowledge but of proved impossibility." He goes on to add: "It appears from the preceding paragraphs that we can always find the rational part of the integral, and can find the complete integral if we can find the roots of \( Q(x) = 0 \)."

But knowing that a problem admits a solution in principle is not the same as being able to compute the solution. The symbolic evaluations of integrals may take considerable time. The second example above took around seventeen minutes to compute. The Mathematica manual states that "definite integrals that involve no singularities are mostly done by taking limits of the indefinite integrals. Details can be found in [1]. I became intrigued about George's methods, which were based upon the following result.

**Theorem.** Let \( a > -1 \) and let \( m \) be a natural number. Then the integral

\[
N(a; m) := \int_0^\infty \frac{dx}{(\chi^4 + 2ax^2 + 1)^{m+1}}
\]

is given by

\[
\frac{\pi 2^{-m-3/2}}{(a+1)^{m+1/2}} \sum_{j=0}^{m} \binom{2m+1}{2j} (a+1)^j \\
\times \sum_{k=0}^{m-j} \binom{m-j}{k} \binom{2k+2j}{k+j} 2^{-3(k+j)} (a-1)^k.
\]

The proof is elementary and employs Wallis's integral formula

\[
\int_0^{\pi/2} \cos^n \phi \, d\phi = \left(\frac{2n}{n}\right) \pi / 2^{n+1}.
\]

The reader is invited to compare the expression given in the theorem with the expression obtained by residues.

The structure of \( N(a; m) \) now became clear. In particular

\[
P_m(a) := \frac{2^{m+3/2} (a+1)^{m+1/2}}{\pi} N(a; m)
\]

is a polynomial in \( a \) of degree \( m \). The theorem implies that the coefficient \( d_1(m) \) of the term \( a^m \) in the polynomial \( P_m(a) \) is a triply indexed sum of expressions that are products of binomial coefficients, powers of 1/2, and plus or minus signs. The first few polynomials are

\[
P_0(a) = 1, \\
P_1(a) = \frac{1}{2} (2a + 3), \\
P_2(a) = \frac{3}{8} (4a^2 + 10a + 7), \\
P_3(a) = \frac{1}{16} (40a^3 + 140a^2 + 172a + 77), \\
P_4(a) = \frac{5}{128} (112a^4 + 504a^3 + 876a^2 + 708a + 231).
\]

The fear of reinventing the wheel now appeared. It was quite possible that the polynomials \( P_m(a) \) were well known. We 1 wondered if there is a simple expression for the polynomials \( P_m(a) \) and whether all their coefficients are positive. Colleagues told us that the \( P_m(a) \) must be expressible in terms of hypergeometric functions, but an initial search in standard integral tables did not find our quartic integral. Responding to an inquiry about the coefficients \( d_1(m) \), Doron Zeilberger replied: "...the triple sum that you have does not seem to have a closed form in both \( m \) and \( l \). For a fixed \( m - l = p \), it does, but as \( p \) gets bigger, the 'closed form' gets uglier." Encouraged by this, we searched for a proof that \( d_1(m) > 0 \).

**Ramanujan, Double Square Root, and Positivity**

The proof of positivity appeared from a most unexpected place. It turns out that there is a connection between the Taylor series of \( h(c) := \sqrt{a + \sqrt{1 + c}} \) at \( c = 0 \) and the polynomial \( P_m(a) \). This and a theorem of Ramanujan yield a simple formula for the coefficients \( d_1(m) \).

The evaluation of the quartic integral described in the previous section gives, in particular,

\[
\int_0^\infty \frac{dx}{bx^4 + 2ax^2 + 1} = \frac{\pi}{2} \frac{1}{\sqrt{a} + \sqrt{b}}.
\]

While playing around with the parameters, we noticed that the derivatives of \( h(c) \) at \( c = 0 \) can be evaluated in terms of the quartic integrals. The fact is

\[1\text{By now it was we.}\]
The integrals $N(a; k)$ are essentially the coefficients of the Taylor expansion of the double square root $h(c)$ at $c = 0$.

**Theorem.** The Taylor series expansion of $h(c) = \sqrt{a + \sqrt{1 + c}}$, for $c$ in a neighborhood of the origin, is given by

$$h(c) = \sqrt{a + 1} + \frac{1}{\pi\sqrt{2}} \sum_{k=1}^{\infty} \frac{(-1)^{k-1}}{k} N(a; k-1) c^k.$$ 

This expansion appears in several classical analysis texts in the particular cases $a = 1$ and $c = a^2$.

The next piece of the puzzle appeared from Ramanujan's work. In particular, Ramanujan's Master Theorem connects the coefficients of a Taylor expansion

$$F(c) = \sum_{n=0}^{\infty} \frac{(-1)^n}{n!} \varphi(n)c^n$$

with the moments

$$M_n = \int_0^\infty c^{n-1} F(c) \, dc$$

of the function $F$ via $M_n = (n-1)! \varphi(-n)$. Observe that the application of the theorem requires extending the Taylor coefficients $\varphi(n)$ from $n \geq 0$ to $n < 0$. Details of this theorem can be found in Berndt's first volume on Ramanujan's Notebooks [3]. We can apply the theorem to an appropriate derivative of $h(c)$ to establish a relation between the original quartic integral $N(a; m)$ and a new family of integrals

$$B_m(a) := \int_0^\infty \frac{x^{m-1} dx}{(a + \sqrt{1 + x})^{2m+1/2}}.$$ 

Indeed, Ramanujan's Master Theorem yields

$$B_m(a) = \frac{2^{6m+3/2}}{\pi} \left[ m \left( \frac{4m}{2m} \right) \left( \frac{2m}{m} \right) \right]^{-1} N(a; m),$$

so we now need to evaluate $B_m(a)$. A simple change of variables shows that an evaluation of $B_m(a)$ follows from one for the derivatives of the function $u(u^2 - 1)^{m-1}$ at $u = 1$. To establish the values of these derivatives, we need the following identity for binomial coefficients:

$$\sum_{j=0}^{\infty} (-1)^j \binom{m-1}{j} \binom{2m-2j-1}{k+m-1} = 2^{m-k-1}(k+m)\binom{m}{k}.$$ 

This identity can be verified by using the powerful WZ-method described in [7]. We conclude that

$$P_m(a) = 2^{-2m} \sum_{k=0}^{m} 2^k \binom{2m-2k}{m-k} \binom{m+k}{m} (a+1)^k,$$

so now the coefficients $d_l(m)$, given by the expression

$$d_l(m) = 2^{-2m} \sum_{k=1}^{m} 2^k \binom{2m-2k}{m-k} \binom{m+k}{m} \binom{k}{l},$$

are clearly positive.

The expression (3) provides an efficient evaluation of $d_l(m)$ if $l$ is close to $m$. The natural question of formulas that work well when $l$ is small produced an unexpected and interesting problem. An elementary calculation yields the existence of polynomials $\alpha_l$ and $\beta_l$ of degrees $l$ and $l-1$, respectively, such that $d_l(m)!m!2^{m+1}$ can be written in the form

$$\alpha_l(m) \prod_{k=1}^{m} (4k-1) - \beta_l(m) \prod_{k=1}^{m} (4k+1).$$

We have conjectured that both families of polynomials have all their zeros on the line where $\text{Re } m = -1/2$.

The graphs of the zeros of $P_m(a)$ suggest some questions about their location. Figure 1 shows the zeros of $P_{75}(a)$ and Figure 2 shows the zeros of all the polynomials $P_m(a)$ from $m = 1$ to $m = 50$. 

---

Figure 1: Zeros of the polynomial $P_{75}$.

Figure 2: Zeros of the polynomials $P_m, 1 \leq m \leq 50$. 

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MARCH 2002
NOTICES OF THE AMS
The Hypergeometric Connection

At this point it was clear to us that we should provide a proof of the formula (2) for $P_m(a)$ based on the theory of special functions. A more careful examination of standard integral tables yielded the formula

$$
\int_0^{\infty} \frac{z^{\nu-1} \, dz}{(z^2 + 2az + 1)^{\mu+1/2}} = 2^{2\mu}(1+\mu)B(-\nu+2\mu+1, \nu)P^{-\mu}_m(a),
$$

[4, 3.252.11], where $B$ is the classical beta integral and $P^\mu_n(z)$ is the associated Legendre function. Using the hypergeometric representation of the latter, we can rewrite the right-hand side as

$$
\left(\frac{2}{a+1}\right)^\mu B(2\mu+1-\nu, \nu)
\times \, _2F_1 \left[ -\nu, 1+\mu - \nu; 1+\mu; \frac{1-a}{2} \right].
$$

The expression (2) now follows directly but with an extra bonus: the polynomials $P_m(a)$ are part of the Jacobi family

$$
P_m^{(\alpha, \beta)}(a) = \sum_{k=0}^{m} (-1)^{m-k} \binom{m+\beta}{m-k} \binom{m+\alpha+\beta}{k} \left(\frac{a+1}{2}\right)^k
$$
corresponding to the parameter values $\alpha = m+1/2$ and $\beta = -(m+1/2)$.

It is safe to say that we would never have found the connection between the quartic integrals and the Taylor expansion of the double square root had we known the most basic results in hypergeometric functions. Ignorance is bliss.

Wallis's Formula and Landen Transformations

Wallis's integral formula (1) is completely elementary and is usually proved by showing that

$$
J_n := \int_0^{\pi/2} \cos^n \varphi \, d\varphi
$$
satisfies the recurrence $J_n = \frac{2}{n+1} J_{n-1}$. The recurrence can be used to generate values of $J_n$ for small $n$ from which one can guess a general formula. The proof of Wallis's formula is thus reduced to checking the guessed formula in the recurrence.

We stumbled upon a different proof while trying to compute the integral of a rational function. First observe that

$$
J_n = \int_0^{\pi/2} \left(\frac{1+\cos 2\varphi}{2}\right)^n \, d\varphi.
$$

Now introduce $\psi = 2\varphi$, expand the power, and simplify the result by observing that the odd powers of cosine integrate to zero. Hence

$$
J_n = 2^{-n} \sum_{k=0}^{\lfloor n/2 \rfloor} \binom{n}{2k} J_k.
$$

As before one can use this expression to generate values of $J_n$ and guess the formula

$$
J_n = \left(\frac{2n}{n}\right) \pi/2^{2n+1}.
$$

The critical point of an inductive proof is the identity

$$
\sum_{k=0}^{\lfloor n/2 \rfloor} 2^{-2k} \binom{n}{2k} \binom{2k}{k} = 2^{-n} \binom{2n}{n}.
$$

Now comes the WZ-method to the rescue, for the identity (4) is precisely the first example used in [7, p. 113] to explain that procedure. Wilf and Zeilberger informed me that they do not recall why they chose this example.

The method of proof described above (double the angle, expand, and use the vanishing of odd powers) yielded an unexpected transformation when applied to integrals of higher degree. This requires a little bit of background. The Landen transformation $a \rightarrow (a+b)/2$ and $b \rightarrow \sqrt{ab}$ leaves the elliptic integral

$$
\int_0^{\pi/2} \frac{d\theta}{\sqrt{a^2 \cos^2 \theta + b^2 \sin^2 \theta}}
$$
invariant, and iteration of this transformation produces, in the limit, the celebrated arithmetic-geometric mean $AGM(a, b)$. It turns out that we can find an analogous transformation to help evaluate integrals of rational functions that are even. Here is an example of such a transformation in the case of degree 6. Let

$$
U = \int_0^{\infty} b_0 x^4 + b_1 x^2 + b_2 \frac{dx}{x^6 + a_1 x^4 + a_2 x^2 + 1}.
$$

Then the transformation

$$
\begin{align*}
a_1 & \rightarrow 9 + 5a_1 + 5a_2 + a_1 a_2, \\
b_0 & \rightarrow \frac{a_1 + a_2 + 6}{(a_1 + a_2 + 2)^{2/3}}, \\
b_1 & \rightarrow \frac{b_0 (a_2 + 3) + 2b_1 + b_2(a_1 + 3)}{a_1 + a_2 + 2}, \\
b_2 & \rightarrow \frac{b_0 + b_2}{(a_1 + a_2 + 2)^{1/3}}.
\end{align*}
$$

preserves the integral $U$. Moreover, the sequence $(a_1^n, a_2^n)$ defined by iteration of (5) converges to $(3, 3)$, and there is a value $L$ such that the sequence $(b_0^n, b_1^n, b_2^n)$ converges to $(L, 2L, L)$ precisely when the initial integral converges. The invariance of $U$ shows that $U = L \pi/2$.  

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One can produce formulas analogous to (5) for rational functions of any even degree, but very soon these expressions become unmanageable. The geometric fact is that these Landen transformations convert an even rational function into its direct image by the Newton map associated to the equation $z^2 + 1 = 0$. This interpretation yields a proof of convergence of the process. The fact is that the iterates of the rational Landen transformation converge precisely when the initial data produce a convergent integral.

In the example of degree 6, the determining quantity is the resolvent

$$R(a_1, a_2) = 4a_1^3 + 4a_2^3 - 18a_1a_2 - a_1^2a_2^2 + 27.$$ 

The locus of $R(a_1, a_2) = 0$ consists of two connected components $R_{\pm}$. The curve $R_{-}$ is in the first quadrant and contains the limiting point $(3,3)$. The integral $U$ is finite precisely when $R_{-}(a_1, a_2) > 0$. There is also a dynamical interpretation. The first two equations in (5) form a planar dynamical system that has three fixed points, two of them on the resolvent curve. The point $(3,3)$ is an attractor, explaining in part the convergence of the iterates. The second critical point is a saddle point, and the curve $R_{+}(a_1, a_2) = 0$ is its stable manifold. The dynamics below this curve are quite complicated. Figure 3 shows the first 5,000 iterates starting in this region.

A treatment of the elliptic Landen transformation appears in [6], so my original advice for George's qualifiers paid off.

**The Integration of a General Rational Function**

The previous section gave some information about how to integrate the even rational functions. Our unsuccessful attempt to extend these methods to the general case produced an interesting map on the space of rational functions.

Consider the splitting of $R(x)$ into its even and odd parts

$$R_e(x) = \frac{R(x) + R(-x)}{2} \quad \text{and} \quad R_o(x) = \frac{R(x) - R(-x)}{2}.$$ 

Ignore the issue of convergence and integrate to produce

$$\int_0^\infty R(x) \, dx = \int_0^\infty R_e(x) \, dx + \int_0^\infty R_o(x) \, dx.$$ 

The integral of the even part can be analyzed, at least partially, by the methods already described. The integral of the odd part can be transformed to

$$\int_0^\infty R_o(x) \, dx = \frac{1}{2} \int_0^\infty R_o(\sqrt{x}) \, \frac{dx}{\sqrt{x}}.$$ 

via $x \to \sqrt{x}$. The new integrand is again rational, and so we have produced a map $\mathcal{S}$ on the space of rational functions,

$$\mathcal{S}(R(x)) = \frac{R(\sqrt{x}) - R(-\sqrt{x})}{2\sqrt{x}},$$ 

with the property

$$\int_0^\infty R(x) \, dx = \int_0^\infty R_e(x) \, dx + \frac{1}{2} \int_0^\infty \mathcal{S}(R(x)) \, dx.$$ 

Observe that even though replacing $x$ by $\sqrt{x}$ decreases the degree of a function, the map $\mathcal{S}$ itself does not necessarily decrease the degree. The question of explicit integration of a rational function can be separated into two parts:

- explicit integration of even rational functions,
- properties of $\mathcal{S}$ related to integration.

The map $\mathcal{S}$ itself is an object worthy of study. In particular, the orbit \{ $\mathcal{S}^{j}(R)$ : $j = 0, 1, 2, \ldots$ \}, starting at an arbitrary rational function $R$, is interesting. In order to keep the coefficients of the orbit under some control, we were led to study the orbit of a rational function with all its poles of modulus 1. The simplest case is the function $x^j/(x^{a_1} - 1)$, where $a_1$ is an odd integer. A simple calculation shows that

$$\mathcal{S}\left(\frac{x^j}{x^{a_1} - 1}\right) = \frac{x^{\alpha_1(j)}}{x^{a_1} - 1},$$ 

where

$$\alpha_1(j) = \begin{cases} \frac{(a_1 - 1 + j)}{2} & \text{if } j \text{ is even,} \\ \frac{(j - 1)}{2} & \text{if } j \text{ is odd.} \end{cases}$$ 

In this case the study of the map $\mathcal{S}$ reduces to that of $\alpha_1 : \mathbb{Z} \to \mathbb{Z}$. The dynamics of $\alpha_1$ are quite interesting: for any initial $j \in \mathbb{Z}$, the iterates $\alpha_1^n(j)$,
This has amusing number theoretical consequences: if \( a_1 \) is prime, then all orbits of \( \mathcal{G} \) starting in the invariant set have the same length. Moreover, there is a single orbit if and only if 2 is a primitive root modulo \( a_1 \), that is, 2 is a generator of the group \( \{1, 2, \ldots, a_1 - 1\} \) under multiplication modulo \( a_1 \).

More generally, suppose \( a_1, \ldots, a_m \) are odd integers, and define

\[
T_m(x) := \prod_{k=1}^{m} (x^{a_k} - 1)
\]

and

\[
S_{m,j}(x) := \frac{x^j}{T_m(x)}.
\]

An elementary calculation shows that there are polynomials \( V_{p,j}(x) \) such that the iterates of \( \mathcal{G} \) applied to \( S_{m,j} \) have the form

\[
\mathcal{G}^j(S_{m,j})(x) = \frac{V_{p,j}(x)}{T_m(x)}.
\]

In the summer of 2001, Roopa Nalam, an undergraduate at Tulane on her way to medical school, proposed the following result, which remains open.

**Conjecture.** Assume \( \gcd(a_1, a_2, \ldots, a_m) = 1 \), and let \( LC(P) \) denote the leading coefficient of a polynomial \( P \). Then

\[
\lim_{p \to \infty} \frac{V_{p,j}(x)}{LC(V_{p,j}(x))} \times \frac{(x - 1)^m}{T_m(x)} = A_{m-1}(x) / x,
\]

where \( A_m(x) \) is the Eulerian polynomial defined by the generating function

\[
1 - x \exp[\lambda(1 - x)] = \sum_{m=0}^{\infty} A_m(x) \frac{\lambda^m}{m!}.\]

The situation in which \( \gcd(a_1, \ldots, a_m) \neq 1 \) seems more complicated.

Many other aspects of \( \mathcal{G} \) are quite interesting. For instance, every fixed point of \( \mathcal{G} \) is a linear combination of functions of the form \( x^{a_j - 1} / (1 - x^{a_j}) \), where the \( a_j \) are odd integers. On the other hand, for each positive integer \( n \), the rational functions of the form

\[
\sum_{k=1}^{n} x^{2k-1} R_k(x^{2k}),
\]

where \( R_1, \ldots, R_n \) are arbitrary rational functions, vanish after precisely \( n \) iterations of \( \mathcal{G} \).

### Unimodality and Logconcavity

The symbolic study of the coefficients \( d_j(m) \), and in particular of their graph, suggested that these coefficients are unimodal. A finite sequence of real numbers \( \{d_0, d_1, \ldots, d_m\} \) is said to be unimodal if there is an index \( m^* \), called the mode of the sequence, such that \( d_j \) increases up to \( j = m^* \) and decreases from then on. Our first proof of the unimodality of \( d_j(m) \) was elementary but long. Soon after, we were able to give a very simple criterion for unimodality:

If \( P(x) \) is a polynomial with positive nondecreasing coefficients, then \( P(x + 1) \) is unimodal with mode \( \lfloor m/2 \rfloor \). With the speed of electronic publishing, our simpler proof appeared before the original one.

A property stronger than unimodality is that of logarithmic concavity (or logconcavity for short), meaning that \( d_j+1d_{j-1} \leq d_j^2 \). We have conjectured that \( \{d_j(m) : 0 \leq j \leq m\} \) is logconcave, but much more seems to be true. Define the operator

\[
\mathcal{L}(\{d_j\}) := \{d_j^2 - d_j^2d_{j-1}\},
\]

so that logconcave sequences are those positive sequences \( \{d_j\} \) for which \( \mathcal{L}(\{d_j\}) \) is also positive. We say that \( \{d_j\} \) is infinitely logconcave if \( \mathcal{L}(\{d_j\}) \) is a positive sequence for every natural number \( p \).

The conjecture is that \( \{d_j(m)\} \) is infinitely logconcave. The prototype sequence in issues of unimodality and logconcavity is the sequence of binomial coefficients. A reasonable first step would be to prove that \( \{\binom{m}{k} : 0 \leq k \leq n\} \) is infinitely logconcave.

### SACNAS, SIMU, Puerto Rico, and Convergence of Landen

The 1999 annual meeting of the Society for the Advancement of Chicanos and Native Americans (SACNAS) took place in Portland, Oregon. My colleague Ricardo Cortez has been involved with this association since his days as a graduate student. That year he had organized a special session for which he asked me to give a presentation.

At the end of my talk, two participants at the conference, Ivelisse Rubio and Herbert Medina, wanted to know if I would be interested in their REU (Research Experiences for Undergraduates) Program SIMU (Summer Institute in Mathematics for Undergraduates). They told me that the program has as a mission "to increase the number of Chicanos/Latinos and Native Americans earning Master and Ph.D. degrees and pursuing research careers in the mathematical sciences." They invited me to direct a group of twelve students during the summer of 2000 at the University of Puerto Rico at Humacao. The idea sounded very interesting, so I agreed to do it. They warned me that "it is a lot of work." They were right. The program is structured so that there are lectures during the first three weeks, and students work on research projects for
three and one-half weeks. The students were fantastic, and the following generalization of the unimodality criterion \[2\] came out of one of their projects:

If \( P(x) \) is a polynomial with positive nondecreasing coefficients, and \( n \) is a natural number, then \( P(x+n) \) is unimodal with mode \( \left\lfloor \frac{m}{2} \right\rfloor \). In the discussion of this problem, we proved that unimodality of a sequence plus negative second derivative, that is, \( d_{j+1} - 2d_j + d_{j-1} \leq 0 \), implies logconcavity.

Every Friday SIMU has an invited speaker, and the next day there is a field trip. That summer, one of the speakers was John Hubbard from Cornell University. During a trip to Arecibo’s observatory, John asked me about the projects for the students. I remember saying, “I won’t tell you; I would like the students to solve them.” He then asked me about my area of work. My standard response used to be “classical analysis,” but I simply told him: “I compute integrals for a living.” The geometric interpretation of the rational Landen transformations came out of my argument to convince him that not everything was done in the subject.

Acknowledgments
The author thanks G. Boros for many suggestions and the editor for considerably improving an original version of this work. The author acknowledges the partial support of NSF-DMS 0070567, Project number 540623.

References
All Questions Answered

Donald Knuth

On October 5, 2001, at the Technische Universität München, Donald Knuth presented a lecture entitled “All Questions Answered”. The lecture drew an audience of around 350 people. This article contains the text of the lecture, edited by Notices senior writer and deputy editor Allyn Jackson.

Originally trained as a mathematician, Donald Knuth is renowned for his research in computer science, especially the analysis of algorithms. He is a prolific author, with 160 entries in MathSciNet. Among his many books is the three-volume series The Art of Computer Programming [TAOCP], for which he received the AMS Steele Prize for Exposition in 1986. The citation for the prize stated that TAOCP “has made as great a contribution to the teaching of mathematics for the present generation of students as any book in mathematics proper in recent decades.” The long awaited fourth volume is in preparation and some parts are available through Knuth’s website, http://www-cs-faculty.stanford.edu/~knuth/.

Knuth is the creator of the TeX and METAFONT languages for computer typesetting, which have revolutionized the preparation and distribution of technical documents in many fields, including mathematics. In 1978 he presented the AMS Gibbs Lecture entitled “Mathematical Typography”. The lecture was subsequently published in the Bulletin of the AMS [MT].

Knuth earned his Ph.D. in mathematics in 1963 from the California Institute of Technology under the direction of Marshall Hall. He has received the Turing Award from the Association for Computing Machinery (1974), the National Medal of Science (1979), the Adelskölöld Medal from the Royal Swedish Academy of Sciences (1994), the Harvey Prize from the Technion of Israel (1995), the John von Neumann Medal from the Institute of Electrical and Electronics Engineers (1995), and the Kyoto Prize from the Inamori Foundation (1996). Since 1968 Knuth has been on the faculty of Stanford University, where he currently holds the title of Professor Emeritus of The Art of Computer Programming.

—Allyn Jackson

Knuth: In every class that I taught at Stanford, the last day was devoted to “all questions answered”. The students didn’t have to come to class if they didn’t want to, but if they did, they could ask any question on any subject except religion or politics or the final exam. I got the idea from Richard Feynman, who did the same thing in his classes at Caltech, and it was always interesting to see what the students really wanted to know. Today I’ll answer any question on any subject. Do we allow religion or politics? I don’t know. But there is no final exam to worry about. I’ll try to answer without taking too much time so that we can get a lot of questions in.

So, who wants to ask the first question?... Well, if there are no questions...[Knuth makes as if to leave.]

Question: There was a special report to the American president, the PITAC report [PITAC], containing some recommendations. I am wondering whether you would be willing to comment on the priorities outlined in these recommendations: better software engineering, building a teraflop
The individual bricks are what make it work, and not the milestones. That's what really advances the field. From my experience writing *The Art of Computer Programming*, if you asked me any year what was the most important thing that happened in computer science that year, I probably would have no answer for the question, but over five years' time the whole field changes. Computer science is a tremendous collaboration of people from all over the world adding little bricks to a massive wall. The individual bricks are what make it work, and not the milestones.

**Question:** Mathematicians say that God has the "Book of Proofs", where all the most aesthetic proofs are written. Can you recommend some algorithms for the "Book of Algorithms"?

**Knuth:** That's a nice question. It was Paul Erdős who promulgated the idea that God has a book containing the best mathematical proofs, and I guess my friend Günter Ziegler in Berlin has recently written about it [PFB].

I remember that mathematicians were telling me in the 1960s that they would recognize computer science as a mature discipline when it had 1,000 deep algorithms. I think we've probably reached 500. There are certainly lots of algorithms that I think have to be considered absolutely beautiful and immortal, in some sense. Two examples are the Euclid algorithm and a corresponding one that works in binary notation and that may have been developed independently in China, almost as early as Euclid's algorithm was invented in Greece. In my books I am mostly concerned with the algorithms that are classical and that have been around for a long time. But still, every year we find brand new ideas that I think are going to remain forever.

**Question:** Do you have thoughts on quantum computing?

**Knuth:** Yes, but I don't know a great deal about it. It's quite a different paradigm from what I'm used to. It has lots of things in common with the kind of computing I know, but it's also quite mysterious in that you have to get all the answers at the end; you don't make a test and then have that determine what you do next. A lot of you have seen the movie *Lola rennt* (called *Run Lola Run* in the U.S.), in which the plot is played out three different times, with the outcome taking three different branches. Quantum computing is something like that: The world goes into many different branches, and we're interested in the one where the outcome is the nicest.

I'm good at nonquantum computing myself, so it's quite possible that if quantum computing takes over, I won't be able to do the new stuff. My life's work is with computers not because I'm interested so much in computation, but because I happen to be good at this kind of computing. Fortunately for me, I found that the thing I could do well was interesting to other people. I didn't develop an ability to think about algorithms because I wanted to help people solve problems. Somehow, by the time I was a teenager, I had a peculiar way of thinking that made me good at programming. But I might not be good at quantum programming. It seems to be a different world from my own.

I'll take a question from the back.

**Question:** I am working in theorem proving, and one of the most important papers is your paper "Simple word problems in universal algebra" [KB] from 1970, written with P. B. Bendix. I have two questions. The first is, do you still follow this area and what do you think of it? And the second is, who is and what became of P. B. Bendix?

**Knuth:** This work was published in 1970, but I actually did it in 1967 while I was at Caltech. It was a simple idea, but fortunately it's turned out to be very widely applicable. The idea is to take a set of mathematical axioms and find all the implications of those axioms. If I have a certain set of axioms and you have a possible theorem, you ask, does this theorem follow from those axioms or not? I called my paper "Simple word problems in universal algebra", and I said a problem was "simple" if my method could handle it. Now people have extended the method quite a lot, so that a lot more problems are "simple". I think their work is beautiful.

The year 1967 was the most dramatic year of my life by far. I had no time for research. I had two children less than two years old; I had been scheduled to be a lecturer for ACM (Association for Computing Machinery) for three weeks; I had...
to give lectures in a NATO summer school in Copenhagen; I had to speak in a conference at Oxford; and so on. And I was getting the page proofs for *The Art of Computer Programming*, of which the first volume was being published in 1968. All of this was in addition to the classes I was teaching, and an attack of ulcers that put me in the hospital, and being an editor for twelve journals. That year I thought of two little ideas. One has become known as the Knuth-Bendix algorithm; the other one is known as attribute grammars [AG]. That was the most creative year of my life, and it was also the most hectic.

You asked about Peter Bendix. He was a sophomore in a class I taught at Caltech, "Introduction to Algebra". Every student was supposed to do a class project, and Peter did his term paper on the implementation of the algorithm. He was a physics major. This was the time of the Vietnam War, and he became an objector. He went to Canada and worked as a high school teacher for about five years and later got a degree in physics. I found he was living near Stanford a couple of years ago, so I called him up and found out that he has had a fairly happy life in recent years.

In the 1960s, if I wrote a joint paper with my advisor Marshall Hall, it meant that he did the theory and I did the programming. But if I wrote a paper with anybody else, it meant that I did the theory and the other person did the programming. So Pete Bendix was a good programmer who implemented the method.

Question: It seems to me it's easier to revise a book than the huge software programs we see day to day. How can we apply theory to improve software?

Knuth: Certainly errors in software are more difficult to fix than errors in books. In fact, my main conclusion after spending ten years of my life working on the \TeX project is that software is hard. It's harder than anything else I've ever had to do. While I was working on the \TeX program, I was unable to do full-time teaching. Although I love teaching, I had to take a year off from it because there was just too much to keep in my head at one time. Writing a book is a little more difficult than writing a technical paper, but writing software is a lot more difficult than writing a book.

In my books I offer rewards for the first person who finds any particular error, and I must say that I've written more checks to people in Germany than in any other country in the world. I get letters from all over, but my German readers are the best nitpickers that I've ever had! In software I similarly pay for errors in the \TeX and METAfont programs. The reward was doubling every year: It started out at $2.56, then it went to $5.12, and so on, until it reached $327.68, at which time I stopped doubling. There has been no error reported in \TeX since 1994 or 1995, although there is a rumor that somebody has recently found one. I'm going to have to look at it again in a year or two. I do everything in batch mode, by the way. I am going to look again at possible errors in \TeX in, say, the year 2003.

I think letting users know that you welcome reports of errors is one important technique that could be used in the software industry. I think Microsoft should say, "You'll get a check from Bill Gates every time you find an error."

Question: What importance do you give to the design of efficient algorithms, and what emphasis do you suggest giving this area in the future?

Knuth: I think the design of efficient algorithms is somehow the core of computer science. It's at the center of our field. Computers are incredibly fast now compared to what they were before, so for many problems there is no need to have an efficient algorithm. I can write programs that are in some sense extremely inefficient, but if it's only going to take one second to get the answer, who cares? Still, some things we have to do millions or billions of times, and just knowing that the number of times is finite doesn't tell us that we can handle it. So the number of problems that are in need of efficient algorithms is huge. For example, many problems are NP complete, and NP complete is just a small level of complexity. Therefore I see an almost infinite horizon for the need for efficient algorithms. And that makes me happy because those are the kinds of problems I like the best.
Question: You have a big interest in puzzles, including the "Tower of Hanoi" puzzle on more than 3 pegs. I won't ask a harder question—what is the shortest solution?—because I am not sure everyone knows this puzzle. But I will ask a more philosophical question: Is it possible to show this can never be solved?

Knuth: Do people know the "Tower of Hanoi" problem? You have 3 pegs, and you have disks of different sizes. You're supposed to transfer the disks from one peg to another, and the disks have to be sorted on each peg so that the biggest is always on the bottom. You can move only one disk at a time. Henry Dudeney invented the idea of generalizing this puzzle to more than 3 pegs, and the task of finding the shortest solution to the 4-peg problem has been an open question for more than a hundred years. The 3-peg problem is very simple; we teach it to freshmen.

But take another, more famous problem, the Goldbach conjecture in mathematics: Every even integer is the sum of two odd primes. Now, I think that's a problem that's never going to be solved. I think it might not even have a proof. It might be one of the unprovable theorems that Gödel showed exist. In fact, we now know that in some sense almost all correct statements about mathematics are unprovable. Goldbach's conjecture is just, sort of, true because it can't be false. There are so many ways to represent an even number as the sum of two odd numbers, that as the numbers grow the number of representations grows bigger and bigger. Take a $10^{10^9}$-digit even number, and imagine how many ways there are to write that as the sum of two odd integers. For an n-bit odd number, the chances are proportional to $1/n$ that it's prime. How are all of those pairs of odd numbers going to be nonprime? It just can't happen. But it doesn't follow that you'll find a proof, because the definition of primality is multiplicative, while Goldbach's conjecture pertains to an additive property. So it might very well be that the conjecture happens to be true, but there is no rigorous way to prove it.

In the case of the 4-peg "Tower of Hanoi", there are many, many ways to achieve what we think is the minimum number of moves, but we have no good way to characterize all those solutions. So that's why I personally came to the conclusion that I was never going to be able to solve it, and I stopped working on it in 1972. But I spent a solid week working on it pretty hard.

Question: What are the five most important problems in computer science?

Knuth: I don't like this "top ten" business. It's the bottom ten that I like. I think you've got to go for the little things, the stones that make up the wall.

Question: You spent a lot of time on computer typesetting. What are your reflections on the impact of this work?

Knuth: I am extremely happy that my work was in the public domain and made it possible for people on all platforms to communicate with each other via the Internet. Especially now I'm thrilled by some recent projects. Two weeks ago I heard a great lecture by Bernd Wegner from the Technical University of Berlin about the plans for online journals by the European Mathematical Society. Such things would simply have been impossible without the open source software that came out of my work. So I'm extremely delighted this is helping to advance science.

I'm happy to see many books that look pretty good. Before I started my work, books on mathematics were looking worse and worse from year to year. It took a lot of skilled handwork to do it in the old system. The people who could do that were dying out, and high priority did not go to mathematical books. I never expected that TeX would take over the entire world of publishing. I'm not a very competitive person, and I did not want to take jobs away from anybody who was doing another way of printing. But I found that nobody wanted to do mathematical publishing well, so math was something I could improve without getting anybody upset about me being an upstart.

The downside is that I'm too sensitive to things now. I can't go to a restaurant and order food...
because I keep looking at the fonts on the menu. Five minutes later I realize that it's also talking about food. If I had never thought about computer typesetting, I might have had a happier life in some ways.

Question: Can you give us an outline for computer science, some milestones for the next ten or twenty years?

Knuth: You're asking for milestones again. There is a lot of interest in applications to biology because so many things have opened up in that domain, with chances to cure diseases. The fact that human beings are based on a discrete code means that people like you and me, who are good at discrete problems, are able to do relevant work for this area. The problems are very difficult and challenging, and that's why I foresee an important future there.

But in all aspects of our field, I really don't see any slowing down. Every time I think I've discovered something interesting, I look on the Internet and find that somebody else has done it too. So we have a field that at the moment still seems to be like a boiling kettle, where you can't keep the lid on.

In the field of biology, I think we can confidently predict that it's going to have rich problems to solve for at least 500 years. I can't make that claim for computer science.

Question: What is the connection between mathematics and computer programming viewed as an art?

Knuth: Art is Kunst. The American movie Artificial Intelligence is called Kunstlicher Intelligenz in Germany—that is, artificial as well as artistic. I think of programming with beauty in mind, as being something elegant, something that you can be proud of for the way it fits together. Mathematics in the same way has elegance. Both fields, computing and mathematics, are different from other sciences because they are artificial; they are not in nature. They're totally under our own control. We make up the axioms, and when we solve a problem, we can prove that we've solved it. No astronomer will ever know whether his theories of astronomy are correct. You can't go up to the sun and measure it.

So these are my first thoughts on that connection. But there is a difference between mathematics and computer programming, and sometimes I can feel when I'm putting on one hat or the other. Some parts of me like mathematics, and some parts of me like emacs hacking. I think they go together okay, but I don't see that they're the same paradigm.

Question: What is the relationship between God and computers?

Knuth: In one of my books, 3:16 Bible Texts Illuminated [BTI], I used random sampling to study sixty different verses of the Bible and what people from all different religious persuasions and different centuries have said about those verses. I did the study at first on my own, and then I found it was interesting enough that I ought to make a book about it. I got sixty of the best artists in the world to illustrate the book, many of them in Germany. The artwork was exhibited twice in Germany, and in other countries around the world. It was also shown in the National Cathedral in Washington, DC. In that book I used methodology that computer scientists often use for understanding a complicated subject, to see if that method would give some insight into the Bible, which is a complicated subject. In the book, I don't give answers. I just say I think it's good that life should be an ongoing search. The journey is more important than the destination.

Question: Do you know whether "P equals NP" has been proved? I heard a rumor that it has.

Knuth: Which rumor did you hear?

Question: One from Russia.

Knuth: From Russia? That's new to me. Well, I don't think anybody has proved that P equals NP yet. But I know that Andy Yao has retired and hopes to solve the problem in the next five to ten years. He is inspired by Andrew Wiles, who...
devoted several years to proving Fermat's Last Theorem. They're both Princeton people. Andy can do it if anybody can.

Three or four years ago, there was a paper in a Chinese journal of computer science and technology by a professor who claimed he could solve an NP-hard problem in polynomial time. The problem was about cliques, and he had a very clever way to represent cliques. The method was supposedly polynomial time, but it actually took something like $n^{12}$ steps, so you couldn't even check it when $n$ equals 5. So it was very hard to see the bug in his proof. I went to Stanford and sat down with our graduate students, and we needed a couple of hours before we found the flaw. I wrote the author a letter pointing out the error, and he wrote back a couple of months later, saying, "No, no, there is no error." I decided not to pursue it any further. I had done my part. But I don't believe it's been solved. That's the most mind-boggling problem facing theoretical computer science, and maybe all of science at the moment.

**Question:** What do you think of research in cryptographic algorithms? And what do you think of efforts by politicians today to put limits on cryptography research?

**Knuth:** Certainly the whole area of cryptographic algorithms has been one of the most active and exciting areas in computer science for the past ten years, and many of the results are spectacular and beautiful. I can't claim that I'm good at that particular subject, though, because I can't think of sneaky attacks myself. But the key problem is, what about the abuse of secure methods of communication? I don't want criminals to use these methods to become better criminals.

I'm a religious person, and I think that God knows all my secrets, so I always feel that whatever I'm thinking is public knowledge in some way. I come from this kind of background. I don't feel I have to encrypt everything I do. On the other hand, I would certainly feel quite differently if somebody started to use such openness against me, by stealing my bank accounts or whatever. So I am supportive of a high level of secrecy. But whether it should be impossible for the authorities to decode things even in criminal investigations, in extreme cases—there I tend to come down on the side of wanting to have some way to break some keys sometimes.

**Question:** Will we have intelligent machines sometime in the future? Should we have them?

**Knuth:** There have always been inflated estimates as to how soon we are going to have a machine that's intelligent. I still see no signs of getting around the central problem of understanding what is cognition, what it means to think. Neurologists are making better measurements than they ever have before, but we are still so far from finding an answer that I can't yet rank neuroscience as one of the most active fields of current work. Biology has been getting answers, with DNA and stem cells and so on. But with cognition we are still looking for the secret.

Some very thought-provoking books came out a year or two ago, one by Hans Moravec [Mo], and one by Ray Kurzweil [Ku]. Both of them are saying that in twenty or thirty years we are going to have machines smarter than humans. Some people were worried about that. My attitude is, if that's true, more power to them. If they are smarter than us, so what? Then we can learn from them. But I see no signs that there are any breakthroughs around the corner.

Two weeks ago in Greece I was at the inauguration of a new book by Christos Papadimitriou, who is chairman of computer science at Berkeley. He published a novel in the Greek language called *The Smile of Turing* [Pa]. I don't want to give away the story, but when it gets published in German or English, you'll find that it has a very nice discussion of artificial intelligence and the Turing test for intelligence.

The most promising model of how the brain works that I've seen says that the brain is a dynamic genetic algorithm that operates all the time. As I
am talking to you now, your brains have a lot of competing theories about what I'm going to say. It's the survival of the fittest, a continual battle among the competing theories. Some come to the surface and actually enter your consciousness, but the others are all there. Some kind of mating of concepts might be going on in our heads all the time. This model seems to have the right properties to account for how we can do what we do with the relatively slow response time that our neurons have. But I am by no means an expert on this.

**Question:** What is your thinking about software patents? There is a big discussion going on in Europe right now about whether software should be patentable.

**Knuth:** I'm against patents on things that any student should be expected to discover. There have been an awful lot of software patents in the U.S. for ideas that are completely trivial, and that bothers me a lot. There is an organization that has worked for many years to make patents on all the remaining trivial ideas and then make these available to everyone. The way patenting had been going was threatening to make the software industry stand still.

Algorithms are inherently mathematical things that should be as unpatentable as the value of \( \pi \). But for something nontrivial, something like the interior point method for linear programming, there's more justification for somebody getting a right to license the method for a short time, instead of keeping it a trade secret. That's the whole idea of patents; the word Patent means "to make public".

I was trained in the culture of mathematics, so I'm not used to charging people a penny every time they use a theorem I proved. But I charge somebody for the time I spend telling them which theorem to apply. It's okay to charge for services and customization and improvement, but don't make the algorithms themselves proprietary.

There's an interesting issue, though. Could you possibly have a patent on a positive integer? It is not inconceivable that if we took a million of the greatest supercomputers today and set them going, they could compute a certain 300-digit constant that would solve any NP-hard problem by taking the GCD of this constant with an input number, or by some other funny combination. This integer would require massive amounts of computation time to find, and if you knew that integer, then you could do all kinds of useful things. Now, is that integer really discovered by man? Or is it something that is God given? When we start thinking of complexity issues, we have to change our viewpoint as to what is in nature and what is invented.

**Question:** You have been writing checks to people who point out errors in your books. I have never heard of anyone cashing these checks. Do you know how much money you would be out of, if everyone suddenly cashed the checks?

**Knuth:** There's one man who lives near Frankfurt who would probably have more than $1,000 if he cashed all the checks I've sent him. There's a man in Los Gatos, California, whom I've never met, who cashes a check for $2.56 about once a month, and that's been going on for some years now. Altogether I've written more than 2,000 checks over the years, and the average amount exceeds $8.00 per check. Even if everybody cashed their checks, it would still be more than worth it to me to know that my books are getting better.

**References**


Photographs used in this article are courtesy of Andreas Jung, Technische Universität München.
Triangle of Thoughts
Reviewed by Yuri I. Manin

Triangle of Thoughts
A. Connes, A. Lichnerowicz, M. P. Schützenberger
American Mathematical Society, 2001
179 pages, $30.00

The literary form of philosophic dialogue inherited from Plato and revived during the Renaissance almost fell into oblivion in the last century, precisely when reflections on the implicit dialogical character of all human culture became the focus of the moral and cultural studies of Martin Buber and Mikhail Bakhtin. In fact, voices of most philosophers, before and after Plato, were authoritative and authoritarian, without a pretense of seeking truth in the clash of contrasting intellectual attitudes and varying viewpoints.

The central figure of a philosophic dialogue is a wise man, whereas modernity generally and systematically replaces wisdom by training. Wisdom seems to be an inborn faculty slowly ripened by life experience; as such it is rarely met and even more rarely put to any use. Training is a democratic surrogate for wisdom which, in spite of all of its (mainly aesthetic) drawbacks, is superior in one respect: it produces professionals.

This delightful book was conceived and written (told?) by wise professionals, mathematicians with a strong penchant for theoretical physics, the history of culture, and epistemology. It ought to be read slowly, perhaps no more than one dialogue at a time, and re-read in order to follow, say, a thread of argument that vanishes and reappears in a different context a dozen pages later. It is a difficult book, as its complete understanding requires a high level of professional training from the reader as well.

The participants discuss different images of the world, created by physicists. The core content of these images is expressed, and can only be expressed, in the language of mathematics, as we have known since the time of Galileo. But mathematics itself is not exclusively, or even predominantly, a language, and insofar as it is one, the semantics of this language does not reduce to any single physical interpretation, although it has its roots in the physical world.

As Alain Connes, professor at the Collège de France and a 1982 Fields Medalist, puts it in his opening statement, "without seeking to reduce every science to its object, it is simple for a physicist, chemist, geologist, or astronomer to define the object of his work: it consists of studying, on various levels, the structure and organization of matter. ...Things are different in mathematics." And he proceeds: "To launch the debate, I would like to present right away two diametrically opposed points of view on mathematical activity:
the viewpoint of the 'Platonists', who see themselves as the explorers of a 'mathematical world' about whose existence they have absolutely no doubt, and whose structure they uncover; and the 'formalists', who take refuge behind a sceptical attitude, considering mathematics as no more than a series of logical deductions in a formal system or, in a sense, as a sort of purified language.

Much of the first three dialogues (“Logic and reality”, “The nature of mathematical objects”, “Physics and mathematics: the double-edged sword”) is an elaboration of this statement and the participants' positions towards it.

To summarize: Alain Connes believes in a "primordial reality" of mathematical objects and views the axiomatic method as a tool for studying this reality (cf. his other book of dialogues [ChCo]). André Lichnerowicz (who died in Paris in 1998) reveals a reserved stance towards formalist philosophy but uses this opportunity in order to learn more about arguments of formalists (not surprisingly, heavily relying upon Gödel's incompleteness theorem). Marcel Paul Schützenberger (who died in 1996) is more of a gadfly, haphazardly venturing outrageous statements to enliven the atmosphere, as in the following excerpt:

M. P. S. — It is very presumptuous on my part to speak after you two. Some days, I support Alain's Leninist thesis. On other days, I would tend to support André's Stalinist thesis.

A. L. — Why Stalinist?

M. P. S. — Stalinism is opposed to Leninism by the massive injection of the free will lacking in Lenin, who had a mechanistic view of history. It does not take into account free will.

Structurally, these first three chapters serve not only to introduce some basic themes, but also the masks, the personae of the actors, even if they are real people and not invented persons. (The book ends with two short biographical notes: one about Lichnerowicz, written by Connes, and one about Schützenberger, written by Moshe Flato. An attentive reader will compare portraits of these two remarkable men with her or his own impressions.)

The remaining chapters are dominated by physics. What distinguishes them from many other books written for the general public is the implicit awareness of the distance between the physical world and the means we can use to grasp it, the distance that our technological advances can bridge but not do away with.

A revealing remark made by Lichnerowicz is pertinent here: "...if we compare what was called 'physics' or 'mathematics' in the nineteenth century with today's physics, what would surprise us would not be all the equations we write, but rather the pseudo-rational entities we make up to give them meaning. What has changed is the discourse, not the form of the equations."

Concerning equations, this is not literally true: with the advent of general relativity and quanta, the twentieth century added a lot of new equations to the classical arsenal. However, it is a fact that "new physics" brought with it new modes of discourse, in particular, by generating in the natural language numerous expressions referring directly to the mathematical descriptions of reality rather than to reality itself, understood in whatever sense we are prepared to concede to this much abused word.

As an example, consider the "probability amplitude" and the "superposition principle", two central notions in quantum mechanics. Richard Feynman in his beautiful lectures made a heroic attempt to explain their physical meaning to the general public, bypassing their mathematical content, because he could not count upon understanding of √−1, much less of Euler's formula for e^{iπ} and of the notion of complex linear space. In my opinion, he failed, but he could not have done better.

For examples from classical physics, see quotations from Maxwell on page 65 (about "proper names" for the p's and q's in analytical mechanics), and consider the mentions of this or that Lagrangian that continually pop up. (A whole history of theoretical physics could be written by focusing on the evolution of this remarkable abstraction.)

A further complication is that even a full mastery of the Euler formula, the Schrödinger equation, and, say, electron microscopy, does not help one to formulate a convincing epistemology, but only brings a troubled feeling that most interesting things cannot be expressed in words, or in words alone.

We have to accept this, with a sigh, as a professional risk for everybody trying to write about science, the author of this review included (cf. [Ma]). What is marvelous about this book is how many interesting things it manages to convey in words.

Here is a discussion on fire:

M. P. S. — ...I could take fire as an example of emergence. Fire is totally impossible to explain. The conjunction of specific factors in fire...

A. L. — ...I am convinced that fire, in the history of the human mind, is without parallel...

M. P. S. — That is one way of putting it. It is a unique phenomenon in nature, and there will be others. But what I want
to emphasize is that there is no fire that is not on a human scale. You cannot make a fire that is one tenth of a millimeter.

A. L. — Conversely, the Sun is not a ball of fire.

M. P. S. — Conversely, as soon as you make a fire too big, it is no longer a fire, it is a firestorm. That is what the Allies produced in Hamburg, and what they repeated in Dresden.... The phenomenon is quite rare. It sometimes happens in forest fires. Instead of being 600 or 700°, the temperature goes up 1200 or 1300°. This is why the number of victims was so high in Hamburg and Dresden. The English high command deliberately wanted to set off a firestorm.

And here is a discussion about how well general relativity is confirmed by recent observations of binary pulsars and what exactly this confirmation means:

M. P. S. — If I understand correctly, the first Fourier coefficients, in fact the first seven, are sufficient to determine the physical parameters of the system. Once these parameters are known, the theory predicts the other Fourier coefficients and may therefore be refuted each time one of them is observed, making it possible to test the theory’s validity.

A. C. — Exactly — since the 5 Keplerian parameters are measured directly, they can be forgotten. Then, as soon as we measure $n$ post-Keplerian parameters (such as the precession of the periastron, the time dilatations, and the secular variation of the orbital period), we have $n$ equations with 2 unknowns which are the two masses, whence we have $n - 2$ possible refutations of the relativistic theory of gravitation.

For example, for the binary pulsar 1913+16 we measure 3 post-Keplerian parameters, and so we have $3 - 2 = 1$ test of general relativity. For another binary pulsar, 1534 + 12, we measure 5 post-Keplerian parameters, thus we have $5 - 2 = 3$ new tests of general relativity.

On language, music, multiculturalism, and quantum computing:

M. P. S. — language begins with poetry rather than with grammar; euphony plays a big role here.

A. C. — Your point of view coincides with my own, since I sincerely believe that music is at its very beginnings, like language when it was at the stage of euphony. I think we might succeed in this way to educate the human mind to deal with polyphonic situations in which several voices coexist, in which several states coexist, whereas our ordinary logic allows room for only one.

Finally, we come back to the problem of adaptation which has to be resolved in order for us to understand quantum correlation and interrelation which we discussed earlier, and which are fundamentally schizoid in nature. It is clear that logic will evolve in parallel with the development of quantum computers, just as it evolved with computer science. This will no doubt enable us to cross new borders and to better integrate the mathematical formalism of the quantum world into our metaphysical system.

This is the concluding paragraph of the last chapter, “Reflections on Time”, and the whole chapter is fascinating and frustrating.

This book can play an important role, if it helps the general intellectual public to avoid “the lure of unreason”, invoked by John Weightman ([W]) in his fine and sensible review of Sokal’s and Bricmont’s critical contribution [SoBr] to the socio-philosophical controversies in which some leading minds of France and the USA got hopelessly entangled.

Basically, the authors celebrate the happy cohabitation of common sense with its most sophisticated refinements, developed in mathematics and physics, rather than that “strange blend of post-modernism with the ancient cult of the charismatic leader” ([W]).

This is the wisdom of professionals.

References


Radical Equations: Math Literacy and Civil Rights

Reviewed by Neal Koblitz

Radical Equations: Math Literacy and Civil Rights
Robert P. Moses and Charles E. Cobb Jr.
Beacon Press, 2001
ISBN 0-8070-3126-7
240 pages, $21.00

In this book, Robert Moses (assisted by journalist Charles Cobb Jr.) tells the story of two arduous campaigns in which he has played a leadership role: the voter registration drive in Mississippi in the 1960s and the efforts to increase success rates in math among black children. Early in the book, Moses explains the link between the two:

In today's world, economic access and full citizenship depend crucially on math and science literacy. I believe that the absence of math literacy in urban and rural communities throughout this country is an issue as urgent as the lack of registered black voters in Mississippi was in 1961...[M]ath literacy—and algebra in particular—is the key to the future of disenfranchised communities. (p. 5)

The book is divided into two parts. Part I gives a vivid picture of the civil rights movement in Mississippi in the years 1961-1964. Moses not only conveys the drama of impoverished black Mississippians confronting the violence of whites determined to prevent them from voting, but also candidly and convincingly describes the difficult strategic and tactical decisions of organizers such as himself who were trying to transform these rural black communities into an effective political force.

In Part II Moses describes the Algebra Project, which grew out of his efforts to improve the teaching of math in his own children's middle school in Cambridge, Massachusetts, in the early 1980s. Alarmed that his oldest child would not be adequately prepared for the college-prep track in high school, Moses volunteered to teach beginning algebra to her and several of her more advanced classmates. He later expanded the program to include other schools in Cambridge and Boston. As word spread of the success of the Algebra Project, Moses was able to start similar programs in Chicago, Milwaukee, Oakland, San Francisco, Atlanta, and elsewhere. In 1992 he returned to his old battleground, Mississippi, and from there launched the "Southern Initiative", directed by David Dennis, a
friend of his from the civil rights movement. At its peak in the mid-1990s, the Algebra Project served almost ten thousand middle-schoolers.

As Moses explains, "Our aim is to change the situation that currently exists, where large percentages of minority students who get through a high school and get admitted to a college have to take remedial math in order to get to the place where they can even get college credit mathematics courses" (p. 16). To achieve this objective, Moses believes that one has to start at the middle-school level and help the children over certain conceptual obstacles so that they are ready for the abstraction and symbol manipulation of an algebra course. One such barrier is negative numbers. Moses discovered that most middle-schoolers found operations with negative numbers to be confusing and unrelated to the real world. In order to convince them of the practicality of negative numbers, Moses takes the kids on a subway ride. Interpreting the number of stops traveled inbound as a positive integer and the number of stops outbound as a negative integer, he shows how addition and subtraction of signed numbers have meaning for their subway trip.

Moses' program has had some impressive results. According to a study by Frank Davis and Mary West of Lesley University, 92 percent of Algebra Project graduates in Cambridge enrolled in upper-level courses in ninth grade—twice the rate of students not in the project. Davis and West found similar comparative data in San Francisco, and in West Tallahatchie, one of the poorest communities in Mississippi, Algebra Project students scored well above the district mean on the state's algebra test.

But Radical Equations does not emphasize such statistics. It is not intended as a scholarly treatise; in the words of the authors, it is a "very personal book" (p. 22). Moses describes his struggle for the Algebra Project as eloquently as he describes the civil rights campaigns of his youth. Some readers might be put off by Moses' angry and impassioned tone when writing about the failure of schools in minority communities:

Math illiteracy is not unique to blacks the way the denial of the right to vote in Mississippi was. But it affects black and other minorities much, much more intensely, making them the designated serfs of the information age just as the people that we worked with in the 1960s on the plantations were Mississippi's serfs then...In our time, across the country, it is black, Latino, and poor white students who are trapped at the bottom with prisons as their plantations. (pp. 11-12)

But I do not think that Moses' words are too strong. Many other writers with first-hand knowledge of inner-city and rural schools have used similar language to describe the educational deprivation there (see, for example, [4]).

Some readers might also find Moses' analogy between the voter registration movement and the math literacy movement to be a little strained. But here again I think that Moses is expressing a deep truth that frequently goes unrecognized in discussions of math education: social aspects are often more important than anything else. The best lesson plans and the best textbooks in the world will not do much good if students do not respect their teachers, if their peer group is constantly telling them that studying math is "uncool", if teachers are burnt out and demoralized, if parents and local community leaders are uninvolved in the schools, and if national political leaders approach educational issues irresponsibly and demagogically.

Many pages of the Notices and other journals have been devoted to the fierce debates between "reformers" and "traditionalists" (see Allyn Jackson's excellent, evenhanded report on the "math wars" [3]). But to many of us who spend time in math classrooms these debates seem largely irrelevant—orthogonal to the reality of the public schools.

For the past eight years I have been teaching a rather unconventional math course for our majors who plan to become middle and high school teachers. The five-credit course includes a "lab" consisting of visits to an inner-city school in Seattle. Each week we present math enrichment material to several sixth or seventh grade classes. The topics range from cryptography to graph theory to arithmetic games to a proof-without-words of the Pythagorean Theorem. After one of us briefly explains the topic, we pass out worksheets and circulate among the kids, helping them individually or in small groups.

Like Robert Moses, I believe that the middle school years are critical for interventions of this type. This is the age when many minority students (and also girls) turn off to mathematics, develop negative attitudes, and start falling badly behind. The kids we work with (about 75 percent of whom are black) see a side of mathematics that is more interesting than their usual schoolwork, get more personal attention than their teachers could possibly give them, and in many cases start to look up to the university students as role models. In addition, my teacher-prep students get to experience a real-world classroom environment.

I, as well as my students, have learned a lot from these school visits. The central lesson has been that in math education, social issues are often more important than purely curricular ones. Thus, to me it is not so surprising to see the former civil
rights activist and community organizer Robert Moses, rather than a mathematician or a professor of education, as a leader in math education reform.

When I began visiting schools in the early 1990s, what I found most unexpected and disorienting were the frequent interruptions that teachers have to put up with during a fifty-minute math class: announcements over the public address system, telephone calls to the teacher during class, messengers with notes from the main office. Someone interrupts class to pick up attendance sheets. Someone else interrupts to bring in a late student or pull a student out of class for some reason. It is no wonder that “attention deficit” has reached epidemic proportions among American middle-schoolers. When the school administration shows little respect for the integrity of the class hour, the children inevitably get the message that the academic content of the lesson is not very important.

One incident stands out in my memory as a sad and poignant illustration of the lack of common sense in our schools. One day a boy named Jamaal was wanted in the main office. Jamaal looked alarmed, and his classmates all stared at him. Had he done something terrible? What was in store for him? Jamaal was escorted out and fifteen minutes later was brought back to the class. His return caused even more commotion among the sixth graders than had his departure. His friends, burning with curiosity, had lost all interest in the math lesson. Jamaal had tears in his eyes and was trying hard not to cry in front of the others. I later learned from the teacher that Jamaal had been pulled out of class to be told that his grandmother had just died.

Writing a decade ago, educational researchers Stigler and Stevenson [9] compared math classes they had observed in Asia and in the U.S.:

American lessons are often disrupted by irrelevant interruptions. These serve to break the continuity of the lesson and add to children’s difficulty in perceiving the lesson as a coherent whole. In our American observations, the teacher interrupted the flow of the lesson with an interlude of irrelevant comments or the class was interrupted by someone else ... 47% of all fifth-grade lessons ... In fact, no interruptions of either type were recorded during the eighty hours of observation in Beijing fifth-grade classrooms. The mathematics lesson in one of the American classrooms we visited was interrupted every morning by a woman from the cafeteria who polled the children about their lunch plans and collected money from those who planned to eat the hot lunch.

Interruptions, as well as inefficient transitions from one activity to another, make it difficult to sustain a coherent lesson throughout the class period.

Part II of the book under review is most interesting and convincing when it treats the social aspects of math education. Moses has great insight into ways to motivate young people. Like Uri Treisman at the university level [10], he highlights the crucial role of peer influence and peer group interaction. Particularly inspiring is Moses’ account of the steady stream of Algebra Project graduates who return as “math literacy workers” (in conscious analogy with the voter registration workers of the 1960s). Less than a decade older than their students, they can speak to the middle-schoolers in the language of youth culture and convince them that studying math is “cool”. They can also help them form small groups to explain the math to one another.

Another social factor that Moses is acutely aware of is teachers’ attitudes. The Algebra Project has become most firmly established in those school districts such as Cambridge, Massachusetts, and Weldon, North Carolina, where the teachers not only have agreed to the plan, but have become active lobbyists for it. Moreover, in some cases they have helped design or modify the lessons so as to fit in with their particular students. Moses comments that the process of working out the details of the curriculum “gave participating teachers greater appreciation for the kind of self-reliant education efforts the project was trying to encourage in students. Teachers also gained a deeper sense of their own authority” (p. 118). Elsewhere Moses speaks of teachers feeling a sense of “ownership” of the material. This idea of involving teachers directly in curriculum development is close in spirit to the “lesson study” approach that the Japanese use with great success (see [8]).

Moses stresses the need to draw in the family and the community—again, by analogy with the civil rights movement. He gives a wonderful example of how this can be done:

With the help of Southern Echo, a community organization founded by [civil rights movement] veteran Hollis Watkins, a math games league had been developed in Indianola [Mississippi]. At tournaments students competed in games built around factoring numbers, writing equations, and other calculations. Parents participated as scorekeepers. In August the league was told by the superintendent of schools that it could no longer use the middle school without his permission. Letters were written and ignored. But when parents
got the backing of the local steelworkers union, the superintendent backed down. Recognizing their power, parents now pressed him on why science labs were not available at the middle school. (p. 146)

Moses comments that "the only ones who can really demand the kind of education they need and the kind of changes needed to get it are the students, their parents, and their community, which largely remains silent on issues like this." (p. 151). Thus, it is the job of a math literacy campaigner to organize these groups. And it is precisely in the South, where Moses and David Dennis had had the most experience tapping into the rich community structures, that the Algebra Project has had the most sustained impact.

Despite my admiration for what Robert Moses has accomplished, some parts of the book bothered me. The treatment of pedagogy is disappointing. A belabored and tedious discussion of how addition and subtraction of negative numbers can be taught using direction along with distance on a trip occupies fully twenty-one pages of the appendix.

Moreover, Moses is impatient with anyone who does not immediately embrace his five-step method of experiential learning. His respect for teachers' autonomy does not appear to extend to those who do not buy into his approach. If a teacher wants to cover arithmetic operations with negative numbers in a traditional manner, without taking the class on a field trip and without extensive class discussion, that is unacceptable. In Warren County, North Carolina, David Dennis decided to terminate the Algebra Project after encountering teacher resistance to the materials that Moses had developed. "I really think the program is fine," the teacher told him [Charles Cobb], "but with the kind of pressure we have on us, my classes and my students need more structure and discipline. We just can't have all that back and forth in here and get anything done." And 'I have seen some success with the traditional way, so I'm going to stay on this traditional path and maybe I'll see some more'" (p. 159). Instead of respecting and trying to accommodate such teachers, Moses and Dennis speak regretfully of the scarcity of teachers that causes the district to be stuck with the recalcitrant ones: "...the teachers refused to do the project although the school district had embraced the project. The school district was confronted with the choice of either strongly reprimanding or firing the teachers. But if they fired the teachers, or the teachers quit in anger, the district would not have had any teachers to replace them. This is a problem throughout rural areas, where it is always difficult to find and keep teachers" (p. 158–9).

Visiting middle schools over the years, I have seen some dedicated and effective teachers who, like the Warren County teachers, prefer traditional curricula. I have also encountered excellent teachers who use innovative materials, based on the 1989 NCTM Standards [3] and similar in spirit to the Algebra Project curriculum. And I know some teachers who like to combine both, some days using a lecture-and-drill approach and some days using a loosely structured, constructivist, self-discovery method. Why does one have to choose a single pedagogical philosophy and condemn everyone who does not adopt it?

Moses seems to believe that his curriculum provides the only way to motivate minority students. This is not true. Some teachers have had success with other types of Standards-based textbooks, and some even manage to get good results while defying NCTM recommendations. The most famous example of the latter type of teacher is Jaime Escalante, the hero of the movie Stand and Deliver, who took his mostly Latino students in East Los Angeles all the way from pre-algebra through the advanced placement calculus exam.

Moses' dogmatic insistence that teachers use a single set of curricular material is hard to understand. When he started teaching in the Martin Luther King School in Cambridge in 1984–1985, he used a textbook by John Saxon, an ardent traditionalist and fierce critic of the NCTM (see [7]):

I settled on Saxon's Algebra I because I liked the way it reviewed concepts and processes through questions at the end of each chapter. The questions always included problems introduced in previous lessons. This helped ease my worries about how to get at fundamental concepts from the material. (p. 96)

If Moses himself was successful with a traditional textbook before he developed the Algebra Project material, why is he now unwilling to work with teachers who prefer the older approach? Like many converts to constructivist pedagogy, Moses is intolerant toward those who prefer other methods.

A few years ago I learned about a program that also used Saxon's books and had an objective very similar to that of Moses' Algebra Project. Called the Garfield Challenge Program, it was created by the two calculus teachers, Virginia Burton and Jack Babani, at Garfield High School in Seattle. In the early 1990s, disturbed by the small number of minority students in the advanced track, they started an intensive six-week summer workshop for promising minority ninth graders. Their purpose was to boost the youngsters' mathematical knowledge so that they could jump into the higher track.

The Garfield Challenge Program was very successful. During the few years of its existence, several dozen minority students moved into the
advanced math sequence. The project got favorable coverage in the local press, and some of us at the University of Washington were particularly interested in the program's potential to enlarge the pool of highly qualified minority applicants to the university.

But unfortunately, the program was a victim of the vicissitudes of funding. It is easier to get "seed money" for a new project's first few years than it is to get continuing funding for a program with a proven record of success. And money is more readily available for curricular experimentation than for programs that use traditional methods and older materials. Most likely that is why the Garfield Challenge Program, despite its documented success in getting minority students into the advanced track, died for lack of funding.

Just because a program is widely acclaimed, it does not follow that it will be able to get long-term support. In recent years the influence of Robert Moses' Algebra Project in Northern cities has been on the wane [2, 11]. Moses' explanation is that there is more competition from other programs in those cities, whereas in the South the Algebra Project is usually the only game in town. He also says that in the major urban school systems "the basic idea is that the math reform should be driven by people who are credentialed through the universities" [2], and the Algebra Project's leaders are not based in the universities. In addition, it seems to me that Moses might have had more success in Northern cities if he had been a little more flexible and had been willing to work with teachers and administrators who wanted to use curricular materials other than the ones that Moses developed. Whatever the reason, it is unfortunate that Moses' math literacy campaign has taken root in relatively few school districts.

This is a difficult time for math education. Politicians of both political parties have decided on an education policy centered around annual high-stakes standardized exams. Teachers are increasingly being pressured to teach to the test and neglect good pedagogy. Since little is being done to improve working conditions for teachers, the teacher shortage, especially in math, is bound to get worse. Now more than ever it is important that rational voices be heard and that we listen to people like Robert Moses who have concrete programs that grapple with the educational crisis in this country.

References
Conversations about Mathematics

Rob Kirby

Over the past few years Robert Osserman has hosted a series of public events called "Conversations", in which he talks with prominent playwrights and other cultural figures who have used mathematics in their work. Osserman, who is the Special Projects Director at the Mathematical Sciences Research Institute in Berkeley, held conversations with Tom Stoppard about Stoppard's play Arcadia; and with G.V. Coyne, director of the Vatican Observatory, and Michael Winters, who played Galileo in The Life of Galileo, a new English version by David Hare of the play by Bertolt Brecht. Osserman's third and most recent conversation was held on November 29, 2001, in San Francisco, with David Auburn, author of the Pulitzer Prize- and Tony Award-winning play Proof.

It would be wrong to think of these conversations as interviews by Osserman of Auburn et al. Instead Osserman prepares at great length, looking not just into the history of the characters in the plays, but into interesting topics related to the plays. In my estimation (I've attended all three conversations), he brings even more to the conversations than do his interviewees, partly of course because he is a mathematician bringing up issues that may be closer to him than to his interviewees. The conversations have been extremely successful, and Osserman is due much praise for these marriages of the humanities and math.

Proof has already been reviewed twice in the Notices (by Dave Bayer, October 2000, pages 1082-4, and by Mark Saul, June/July 2001, pages 596-7).

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so rather than describe the play again, I must assume some familiarity on the part of the reader.

After asking Auburn about his background (Auburn was a University of Chicago student who began by writing Second City-style comedy sketches), Osserman raised three issues during his conversation with Auburn: drugs, women in math, and mental illness and mathematicians. Together they read an excerpt from Proof, in which the character Hal describes mathematicians at conferences taking amphetamines to keep themselves in high gear. Auburn—who has a great deadpan sense of humor and got more laughs from the audience while reading Hal's lines than did the actor in the actual play—offered Erdös as an example of a mathematician thought to have used amphetamines, but agreed that he was taking dramatic liberties here. Of course, to mathematicians, this suggestion of common drug use seems laughable.

Auburn did not start out with the idea of a woman finding a remarkable mathematical proof. Rather he had a vision of a woman sitting on a porch and an older man coming up to her and saying, "Can't sleep?" (the opening line in the play), and also of two sisters quarreling. Only later did math and proofs get added. But Auburn was certainly aware of the scarcity of great female mathematicians (Auburn went only as far as calculus but has read further about mathematicians), and he and Osserman went on to discuss Sophie Germain, Hypatia, and the plays Arcadia and The Five Hysterical Girls Theorem, a recent off-off-Broadway play by Rinne Groff.

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As for madness, Auburn cited John Nash as an obvious example and remarked, "Some very edgy personalities are drawn to it (math) as a way to find order in the world" (San Francisco Chronicle story on Auburn and Proof, November 25, 2001). But Osserman had done his homework and searched the literature for research on madness and professions. According to him, "More than one source reported a far higher incidence of mental instability among writers and poets than among natural scientists."

Auburn thought of us mathematicians as an "eccentric subculture," a somewhat "unusual guild, with a strong sense of belonging." Osserman responded that "we are different, but not differently different."

As with his other conversations, Osserman brought in many other issues and facts, e.g., Reuben Hersh's "Mathematical menopause" (Mathematical Intelligencer, vol. 23, no. 3, 2001) regarding math being a young person's game and other works of art including the play Breaking the Code about Alan Turing and the forthcoming movie on the same subject, Enigma.

Osserman's conversations are rich and fascinating, and it is unfortunate that he does not go on tour (with his interviewees) as the plays do. The conversation on Galileo can be found on tape at http://www.msri.org/calendar/events/galileo/, but the conversation with Auburn at the Curran Theater in San Francisco could not be videotaped due to union contracts and costs.

I'd like to finish with an illuminating comment by my colleague Beresford Parlett concerning the most important point of the play. Catherine has shown her trust in Hal by allowing him to find the manuscript of her proof of something amazing in number theory (an example that would fit is Goldbach's Conjecture that every even number is the sum of two primes). The proof is written in one of her father's notebooks, in handwriting similar to his, and presumably she is not advanced enough in mathematics to have done such work. Hal points this out, raising doubt that she rather than her father actually discovered the proof. When Hal wishes to take the manuscript to his peers so that they may examine the proof, she becomes very angry, arguing that she trusted him in letting him see the manuscript, but now he is not trusting her when he does not immediately believe that she wrote it (in the previous scene, they had become romantically involved for the first time). In other words, Hal wants to look over the manuscript primarily to sort through the math but also to see if it sheds light on who wrote it, whereas Catherine, who has trusted Hal emotionally by showing him the manuscript, wants to be trusted that she would not lie about authorship (she appears to have no doubt as to the correctness of her proof).

Hal returns a few days later saying that the proof is indeed remarkable and probably correct, and furthermore it uses newer material that her father (mentally ill for some ten years) is not likely to have known. But he finds Catherine disgusted with life and about to leave for another world with her sister. At the end of the play, Hal has cajoled Catherine into sitting down and explaining the proof, after admitting that he was wrong not to trust her.

Parlett's point is that Hal (i.e., Auburn) missed the chance to speak to Catherine like a mathematician. Hal might have said, "We mathematicians usually let the math speak. Let us read the manuscript and if it appears correct, then our saying so will mean much more than if I say I believe you due to my affection for you. And the manuscript may shed light on who wrote it, and again if the manuscript indicates that you wrote it, that will carry much more weight than belief due to affection. Let us appeal to the scientific method rather than to emotion."

On the other hand, this resolution may not be dramatically viable or even correct. Catherine and Hal, even though mathematicians, may (at this point in time) have been more intent on getting the romance straight than the mathematics, and an audience of nonmathematicians may well prefer the romance of Auburn's ending, rather than the rigor of Parlett's.

Note: Photograph courtesy of Robert Osserman/David Zetland.
What follows is a list of resources, annotated by Robert Osserman, that he used in preparing for the conversation with David Auburn.

**Mathematical Biographies:**

Alan Hodges, *Alan Turing, the Enigma*

As described (accurately) on the cover: “The extraordinary story of the brilliant scientist whose ‘enigma’ device broke Germany’s most secret WWII code, who pioneered the modern computer age and who finally fell victim to the cold-war world of military secrets and sexual scandal.”

This biography led to the play *Breaking the Code* in which actor Derek Jacobi played the part of Turing, first in London, then in New York, and then in a television version of the play which is available on video.

Sylvia Nasar, *A Beautiful Mind*

Biography of John Nash. Title used for film “based on incidents in the life of John Forbes Nash Jr.,” with Russell Crowe playing the part of the semifictionalized John Nash.

Tony Rothman, *Science à la Mode: Physical Fashions and Fictions*

Six essays, including one, “Genius and Biographers: The Fictionalization of Évariste Galois” that recounts the story of Galois’ life and some of the distortions in its retelling. (Another essay in the book has a fascinating account of “geodesic domes” and their history prior to their “invention” by Buckminster Fuller.)

Anita Burdman Feferman, *Politics, Logic, Love: The Life of Jean Van Heijenoort,* paperback issued under the title *From Trotsky to Gödel*

Jean van Heijenoort is one of the least known and most romantic figures in mathematics. He led a double and at times triple life in mathematics, politics, and the world of artistic and intellectual ferment at mid-century. This biography is a fascinating account of his life and includes an appendix by his friend and co-worker, Solomon Feferman, on van Heijenoort’s scholarly work.

**Novels about Mathematicians:**

Rebecca Goldstein, *The Mind-Body Problem*

With the great opening line: “I’m often asked what it’s like to be married to a genius,” Rebecca Goldstein’s brilliant first novel tackles the problem of the title literally and metaphorically. The disclaimer “no reference to any living person is intended or should be inferred” was apparently not enough to prevent at least one living person from contemplating a lawsuit, since the author was a graduate student at Princeton and describes the scene there in some detail.

Robert Harris, *Enigma*

A beautiful evocation of England during World War II and life in and around Bletchley Park, where teams of code breakers, one of them headed by Alan Turing, had a major influence on the course of the war by breaking some of the codes using the Enigma machine that the Germans thought was unbreakable. Made into a movie, coproduced by Mick Jagger, with a screenplay by Tom Stoppard.

**Books about Genius and Madness:**

Kay Redfield Jamison, *Touched with Fire: Manic-Depressive Illness and the Artistic Temperament*

The author writes, “The main purpose of this book is to make a literary, biographical, and scientific argument for a compelling association, not to say actual overlap, between two temperaments—the artistic and the manic-depressive....” Includes (Appendix B) lists of writers, artists, and composers with probable mental illness.

Daniel Nettle, *Strong Imagination: Madness, Creativity and Human Nature*

Describes different forms of “madness” and asks the question of why madness persists and is not wiped out as evolutionarily undesirable. Proposes the answer that it is linked to creativity. Cites various studies of eminent people and their incidence of mental disorders, broken down by profession. It appears that scientists are among the least affected, and creative writers among the most.

**Music, Mathematics, and the Brain:**

Edward Rothstein, *Emblems of Mind: The Inner Life of Music and Mathematics*

From the Prelude: “The Need for Metaphors”—“Math and music are both so abstract they can seem other-worldly, but both also have extraordinary this-worldly power—music in its effects on the listener, mathematics in its applications in the world.” Edward Rothstein was the chief music critic for the *New York Times* after having pursued mathematical studies to a considerably advanced level. This book is often hard going on both the musical and mathematical fronts but is very well written and has many interesting insights.

Robert Jourdain, *Music, the Brain, and Ecstasy*

A detailed account of the many different aspects of music, the specific parts of the brain connected to each, and speculations on the evolutionary reasons for those developments.
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Vadim Yu. Kaloshin and Brian R. Hunt, A stretched exponential bound on the rate of growth of the number of periodic points for prevalent diffeomorphisms I

Vadim Yu. Kaloshin and Brian R. Hunt, A stretched exponential bound on the rate of growth of the number of periodic points for prevalent diffeomorphisms II

V. Balaji, I. Biswas, and D. S. Nagaraj, Principal bundles with parabolic structure

Robert Lauter and Victor Nistor, On spectra of geometric operators on open manifolds and differentiable groupoids

Stephen Doty and Anthony Giaquinto, Generators and relations for Schur algebras

A. Yu. Ol'shanskii and M. V. Sapir, Non-amenable finitely presented torsion-by-cyclic groups

Pablo Pedregal, Fully explicit quasiconvexification of the mean-square deviation of the gradient of the state in optimal design


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Humboldt Foundation Awards

The Alexander von Humboldt Foundation of Germany has announced special awards for 2001.

Wolfgang Paul Award: Marc Levine

Fourteen researchers and scholars from outside of Germany have received Wolfgang Paul Awards of up to DM 4.5 million (about US$2 million) each to carry out research in Germany. Among the awardees is one mathematician, MARC LEVINE of Northeastern University.

Levine received his doctoral degree in 1979 from Brandeis University. He studies a mixture of algebraic geometry and topology. His work examines the relationships between motivic cohomology, singular cohomology, algebraic K-theory, and topological K-theory. He has worked with Fabien Morel to construct a version of the topological theory of complex cobordism in an algebra-geometric setting. Levine plans to use their construction to better understand the motivic cohomology of varieties. His host institution for the Wolfgang Paul Award will be the Gesamthochschule Essen.

Sofya Kovalevskaya Prize: Matilde Marcolli

Thirteen researchers have received sums of up to DM 2.25 million (about US$1 million) under the terms of the Sofya Kovalevskaya Prize. The funds will not only cover the prize-winners' cost of living from 2001 to 2003 but also enable them to set up their own groups of young researchers at research institutes of their choice in Germany. Among the winners of the Kovalevskaya Prize is one mathematician, MATILDE MARCOLLI of the Max-Planck-Institut für Mathematik in Bonn.

Aizenman Awarded Brouwer Prize

MICHAEL AIZENMAN of Princeton University has been awarded the 2002 L. E. J. Brouwer Prize of the Dutch Mathematical Society.

The Brouwer Prize is Netherland's most prestigious award in mathematics. It was established shortly after the death of the distinguished Dutch mathematician L. E. J. Brouwer and is awarded every three years. For each award the Society chooses an important field in mathematics; the 2002 award honors the field of mathematical physics. The recipient is awarded a gold medal and presents a lecture at the annual meeting of the Dutch Mathematical Society. The prize will be awarded at the annual meeting of the Society in April 2002.

Royal Society of Canada Elections

NANCY REID of the University of Toronto has been elected to the Royal Society of Canada. Reid has made many fundamental contributions to the mathematical theory of statistics. She was inducted into the Society in a ceremony in Ottawa, Ontario, in November 2001.
Mathematics People

Rhodes Scholarships Awarded

Four mathematics students are among the thirty-two American men and women chosen as Rhodes Scholars by the Rhodes Scholarship Trust. The Rhodes Scholars were chosen from 925 applicants who were endorsed by 319 colleges and universities in a nationwide competition. The names and brief biographical descriptions of the mathematics scholars follow.

ZACHARIAH R. MILLER of Stoneboro, Pennsylvania, is in his final year at the United States Military Academy, where he ranks second in his class. He won the top award in mathematics, served as company commander for cadet basic training, and served an internship in Azerbaijan. He also captains the Army rugby team. Miller intends to read philosophy, politics, and economics at Oxford University.

SALVATORE M. MALONE of Zebulon, North Carolina, is a senior at Duke University majoring in mathematics and economics. A Goldwater Scholar and National Science Foundation research fellow, he won first place in the international mathematical modeling contest, as well as national awards in mathematics. He is editor in chief of the Duke University journal on science and technology and editor in chief of the Duke Journal of Economics. He is involved with Amnesty International and has served as an elementary school tutor. Malone plans to study for the M.Phil. in economics.

WILLIAM B. ROPER Jr. of Rutledge, Georgia, received both his B.S. and M.S. in physics from the Georgia Institute of Technology, where he was the winner of the Siemens-Westinghouse Science and Technology Award. A Truman Scholar, Roper founded T-Train, a tutoring program at Georgia Tech, and directed a program for inner-city students. He is a Tae Kwon Do instructor and is a two-time state champion. He will study for the M.Sc. in mathematics and the foundations of computer science.

LILLIAN B. PIERCE of Fallbrook, California, is a senior mathematics major at Princeton University. A Goldwater Scholar ranked first in her class each year at Princeton, she has won many awards for academic excellence. She is co-concertmaster and co-president of the Princeton orchestra and founder and first violinist of the Nassau String Quartet, and she has given concert tours in Europe. Pierce was home schooled until the age of sixteen. She will do graduate research in mathematics at Oxford.

Rhodes Scholarships provide two or three years of study at the University of Oxford in England. The value of the Rhodes Scholarship varies depending on the academic field, the degree (B.A., master's, doctoral), and the Oxford college chosen. The Rhodes Trust pays all college and university fees and provides a stipend to cover students' necessary expenses while in residence in Oxford, as well as during vacations, and transportation to and from England. The total value averages approximately $28,000 per year.

—From a Rhodes Scholarship Trust announcement
Mathematics Opportunities

NSF Mathematics and Geosciences Program

The National Science Foundation (NSF) has announced a new program solicitation, Opportunities for Research Collaborations between the Mathematical Sciences and the Geosciences (CMG). The focus of the solicitation is on research that centers on problems dealing with multiscale phenomena. The full solicitation can be found at the following site: http://www.nsf.gov/cgi-bin/getpub?nsf02022.

—From an NSF announcement

NSF Program on Exploratory Research on Engineering the Service Sector

The National Science Foundation (NSF) has announced a focused solicitation for Exploratory Research on Engineering the Service Sector (ESS). The goal of this effort is to stimulate the development of a community of academic researchers in engineering and allied branches of the mathematical and social sciences and a corresponding body of research findings that address the service sector. Specifically, this effort will support research on application of the computational problem-solving techniques that define engineering to improving the quality, productivity, safety, reliability, and competitiveness of service operations.

Proposals are sought that explore novel lines of basic research that promise to extend the range of focused empirical, analytical, and computational techniques for design, planning, and control of service products, operations, and processes and/or advance policy insights with relevance to implementable solutions in service enterprises. Grants of up to $100,000 ($150,000 for investigator teams) are expected to be awarded, with durations of eighteen months.

Cognizant program officers in the Division of Mathematical Sciences are Deborah Lockhart, Tom Fogwell, and Marianthi Markatou. Their contact information, as well as the complete announcement, may be found at http://www.nsf.gov/cgi-bin/getpub?nsf02029. The deadline for proposals is March 5, 2002.

—From an NSF announcement

Women’s International Science Collaboration Program

The American Association for the Advancement of Science (AAAS) Directorate for International Programs, with support from the National Science Foundation (NSF), will sponsor the Women’s International Science Collaboration (WISC) Program for 2001–2003. This program aims to increase the participation of women in international scientific research by helping to establish new research partnerships with colleagues in central and eastern Europe, in the newly independent states of the former Soviet Union, in the Near East, the Middle East, the Pacific, Africa, the Americas, and Asia.

Small grants ($4,000–$5,000) will provide travel and living support for a U.S. scientist and, when appropriate, a coprincipal investigator to visit a partner country to develop a research program. Funds can also be used to support a second visit to the partner country or for a foreign partner to travel to the United States. Men and women scientists who have their Ph.D.s or equivalent research experience are eligible to apply. Applicants who have received their doctoral degrees within the past six years will receive special consideration, as will scientists applying to work with colleagues in less frequently represented countries and regions. Approximately forty
awards will be made. The deadline for applications is July 15, 2002.

For further application information and region-specific guidelines, see http://www.aaas.org/international/wiscnew.shtml, or contact WISC Travel Grant, American Association for the Advancement of Science, Directorate for International Programs, 1200 New York Avenue, NW, Washington, DC 20005.

—from an AAAS announcement

National Academies Internship Program

The Christine Mirzayan Internship Program of the National Academies is designed to engage graduate students in the analysis and creation of science and technology policy and to familiarize them with the interactions of science, technology, and government. As a result, students develop essential skills different from those attained in academia and make the transition from being a graduate student to being a professional.

During the program, interns work on studies and activities at the National Academies. Each intern is assigned to a senior staff member who acts as his or her mentor. The mentor provides guidance and ensures that the intern’s time is focused on substantive work and activities.

Applications for the internships are invited from graduate students through postdoctoral candidates in any physical, biological, or social science field or any field of engineering, medicine/health, or veterinary medicine as well as business and law students. For information on applying, visit the website http://www4.nationalacademies.org/pd/nrc-ip.nsf. The deadline is March 1, 2002, for the program that runs June 3 through August 9, 2002 (10 weeks).

The e-mail address is internship@nas.edu, the fax number is 202-334-1667, and the telephone number is 202-334-2455. The postal address is: National Academies Internship Program, 2101 Constitution Avenue, NW, Suite FO-2050, Washington, DC 20418.

—from a National Academies announcement

News from the IMA

The 2001–02 program at the Institute for Mathematics and its Applications (IMA) is “Mathematics in the Geosciences”. The dates, topics, and brief descriptions of the workshops follow.


For further information and registration forms for these workshops, consult http://ima.umn.edu/geoscience/

In addition to the geosciences theme, the IMA will also sponsor a three-day Minisymposium on Evolutionary Consequences of Invasions by Exotic Species on April 12–13, 2002.

The IMA summer program on Special Functions in the Digital Age will be held from July 22–August 2, 2002. Organizers are George Andrews, Richard Askey, Carl de Boor, Arieh Iserles, Daniel W. Lozier, Frank W. J. Olver, Peter Olver, and Peter Paule.

From August 5–14, 2002, the IMA will host FoCM’02, organized by the Society for Foundations of Computational Mathematics. There will be three-day workshops and plenary lectures (eighteen of each). For further information, see the conference home page at http://www.damtp.cam.ac.uk/user/na/FoCM/FoCM02/ or e-mail: focm@ima.umn.edu.


Details of these and all planned IMA programs may be found at http://www.ima.umn.edu/programs/annual/annual.html, or contact the Institute for Mathematics and its Applications, University of Minnesota, 400 Lind Hall, 207 Church Street, Minneapolis, MN 55455; telephone 612-624-6066; e-mail to Fred Dulles, Associate Program Director, at dulles@ima.umn.edu.

—from an IMA announcement

2002 Summer Program for Women in Mathematics

The George Washington University has announced the 2002 Summer Program for Women in Mathematics (SPWM 2002) to be held June 29–August 3, 2002, in Washington, DC. SPWM 2002 is an intensive five-week program for mathematically talented undergraduate women who are completing their junior years and may be contemplating graduate study in the mathematical sciences. The goals of this program are to communicate an enthusiasm for mathematics, to develop research skills, to cultivate mathematical self-confidence and independence, and to promote success in graduate school.

Sixteen women will be selected. Each will receive a travel allowance, campus room and board, and a stipend of $1,500. The application deadline is March 1, 2002. For further information, see the university’s website, http://www.gwu.edu/~math/spwm.html, or contact the codirectors, Murli M. Gupta (mmg@gwu.edu) or E. Arthur Robinson Jr. (robinson@gwu.edu), Department of
Mathematics Opportunities


—George Washington University announcement

Maria Mitchell Women in Science Award

The Maria Mitchell Association offers an annual award to recognize an individual, program, or organization that encourages the advancement of girls and women in studies and careers in science and technology. Maria Mitchell (1818-1889) was the first woman astronomer and first woman astronomy professor in the United States.

The award may be given in the natural and physical sciences, mathematics, engineering, computer science, or technology. The winner will be chosen by a national jury of distinguished educators and scientists and will receive a cash award of $10,000.

Funding for the award has been provided by an anonymous donor. Guidelines and nomination forms are available from the association’s website at http://www.mmo.org/, or contact the Maria Mitchell Women in Science Award Committee at the Maria Mitchell Association, 2 Vestal Street, Nantucket, MA 02554; telephone 508-228-9198. Deadline for nominations is April 30, 2002.

—From a Maria Mitchell Association announcement

ICM Travel Grants

The organizers of the 2002 International Congress of Mathematicians (ICM2002), to be held in Beijing August 20–28, 2002, have announced a new program of travel grants. The grants are intended for mathematicians from Eastern Europe, senior mathematicians from developing countries in Latin America and Africa, and senior mathematicians from developing countries in Asia. The grants are sponsored by the International Mathematical Union and the Chinese Mathematical Society.

Those who have already applied for grants for local costs of attending ICM2002 may also apply for the travel grants. The deadline is March 10, 2002. For further information, send e-mail to icm@bnu.edu.cn/, or visit the website http://www.icm2002.org.cn. Or write to: Shanzhen Lu or Yingbo Zhang, Department of Mathematics, Beijing Normal University, 100875 Beijing, People’s Republic of China; fax 66-10-62208280.

—From an ICM announcement
Inside the AMS

AMS Committee on Education Examines Issues

The AMS Committee on Education (CoE) held its annual meeting October 26–27, 2001, in Washington DC. Committee chair Roger Howe of Yale University chose as the theme for the meeting the involvement of professional mathematicians in K-12 education. About 45 people attended the meeting, including mathematics department chairs, congressional staff, and representatives from federal agencies and other mathematical organizations. Over the course of the two days, discussions ranged over the extent of AMS involvement in current mathematics education issues and initiatives.

Howe set the tone by noting that, as a result of recent CoE comments on the draft of the NAEP (National Assessment of Educational Progress) Mathematics Framework for 2004, presented by Herb Clemens of the University of Utah at a recent public session, the committee has been invited to write introductions to three of the five subject areas in the Framework. CoE is currently working on the drafts.

Representatives from publishers of K-12 mathematics textbooks were for the first time invited to CoE. Pat Brill (Harcourt School Publishers) and Rosi Marshall (Scott Foresman) described how they worked with mathematicians in their projects, the kind of input they found most valuable, and some of the difficulties encountered. CoE members learned about the constraints under which textbook publishers work and felt that the ensuing dialog was helpful. A particular problem faced by publishers is the lack of uniformity of the various state standards that must be met, and they would be very grateful for whatever mathematicians could do to promote national standards.

Carole Lacampagne of the U.S. Department of Education and Deborah Ball of the University of Michigan spoke on the progress of the Rand Mathematics Study Panel, whose draft report will soon be available on the Web. Howe has also been involved in this panel, which arose out of the department's concerns about the quality of research in education, and mathematics education in particular. Research is scattered, did not accumulate into a large research knowledge base, and, even when of high quality, did not translate into practice. What is proposed is a coordinated research agenda, focused on teaching and learning of algebra (broadly defined), identification and development of mathematical practices, the nature and uses of knowledge in mathematics teaching, and how such knowledge can be effectively deployed in practice. There was much discussion about this project, and CoE was asked to participate in refining the draft. Both CoE members and department chairs were asked to organize review groups to provide feedback.

CoE heard from George Walker about the Carnegie Project on the Doctorate, the largest ever engaged in by the Carnegie Foundation. In the first stage of the project, disciplines are being asked to define "stewardship" in a disciplinary context. Carnegie will then work with four to six departments in each discipline to implement innovative, multi-department programs. After examining the results of these experiments, Carnegie will work to facilitate broad adoption of successful models. Walker asked CoE, "What does stewardship entail for mathematics?" and "How do we structure a doctoral program to prepare stewards of the discipline?" Carnegie has commissioned essays from mathematicians (AMS President Hyman Bass has been asked to write one) and will organize discussion sessions at disciplinary society meetings and Carnegie-sponsored "convenings".

Jim Lewis of the University of Nebraska outlined the recent report "Mathematical Education of Teachers" (MET), the outcome of a project of the Conference Board on the Mathematical Sciences. The report has been distributed to all mathematics departments, colleges of education, deans, and professional organizations, and a national summit was held in November 2001. Naomi Fisher of the Mathematicians and Education Reform (MER) Forum reported that the AMS-MER Professional Master's Program project ended in November 2001, having conducted three workshops and

—Monica Foulkes, AMS Washington Office

Scholarship Fund to Assist Dependents of Victims of September 11 Attacks

Together with about 35 other scientific and engineering societies, the AMS is participating in an effort to create a scholarship fund to assist financially needy dependents of the victims of the September 11, 2001, terrorist attacks. The American Physical Society (APS) is leading the effort to establish the fund, called the Science and Engineering Scholarship Fund. It is part of the Families of Freedom Scholarship Fund, established by the Citizens' Scholarship Foundation of America (CSFA) and the Lumina Foundation for Education.

Eligible participants will be financially needy dependents, including children and spouses, of those persons who died or are permanently disabled as a direct result of the attacks or rescue activities. The CSFA will manage the fund and will work with the appropriate government agencies to compile a list of potentially eligible participants.

For further information about the scholarship fund, visit the website http://www.aps.org/sciencefund.html.

—Allyn Jackson

Deaths of AMS Members

Pierre Faurre, École Polytechnique, Palaiseau, France, died on February 6, 2001. Born on January 15, 1942, he was a member of the Society for 18 years.


Edgar J. Howard, professor, San Diego State University, CA, died on September 20, 2001. Born on March 4, 1932, he was a member of the Society for 36 years.

David B. Kirk, retired, of Yardley, PA, died on August 7, 2001. Born on November 18, 1921, he was a member of the Society for 57 years.

John G. Leschen, of Schenectady, NY, died on November 17, 2001. Born on December 3, 1918, he was a member of the Society for 29 years.

Helmut Simion, retired, Pädagogische Hochschule Ludwigsburg, Germany, died on August 4, 2001. Born on June 30, 1926, he was a member of the Society for 24 years.

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:

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

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

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

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

Upcoming Deadlines
March 5, 2002: Proposals for the NSF Program on Exploratory Research on Engineering the Service Sector (ESS). See “Mathematics Opportunities” in this issue.
March 31, 2002: Nominations for 2002 Prize for Achievement in Information-Based Complexity. Send nominations to Joseph Traub, traub@santafe.edu.
April 15, 2002: Applications for National Research Council Research Associateship Program. See http://www4.nationalacademies.org/pgalrap.nsf or contact the National Research Council, Associateship Programs (TJ 2114), 2101 Constitution

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 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 2002, p. 237
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 2002, p. 345
Program Officers for Federal Funding Agencies—October 2001, p. 1009 (DoD, DoE); November 2001, p. 1198 (NSF)
Reference and Book List

MPS Advisory Committee

Following are the names and affiliations of the members of the Advisory Committee for Mathematical and Physical Sciences (MPS) of the National Science Foundation. The date of the expiration of each member's term is given after his or her name. The website for the MPS directorate may be found at http://www.nsf.gov/home/mps/. The postal address is Directorate for the Mathematical and Physical Sciences, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230.

Thomas W. Appelquist (10/04)
Department of Physics
Yale University

Roger D. Blandford (10/04)
Division of Physics, Mathematics, and Astronomy
California Institute of Technology

Ronald Brisbois (10/02)
Chemistry Department
Macalester College

Arturo Bronson (10/02)
Materials Center for Synthesis and Processing
University of Texas, El Paso

Tony Chan (10/02)
Department of Mathematics
University of California, Los Angeles

Billy Joe Evans (10/02)
Department of Chemistry
University of Michigan, Ann Arbor

S. James Gates Jr. (10/03)
Physics Department
University of Maryland

Fiona Goodchild (10/03)
Materials Research Laboratory
University of California, Santa Barbara

Robert C. Hilborn (10/04)
Department of Physics
Amherst College

Lon Mathias (10/03)
Department of Polymer Science
University of Southern Mississippi

Willie Pearson Jr. (ex officio)
School of History, Technology, and Society
Georgia Institute of Technology

Jeanne E. Pemberton (10/04)
Department of Chemistry
University of Arizona

Julia Phillips (10/03)
Materials Science & Technologies
Sandia National Laboratories

William R. Pulleyblank (10/04)
Mathematical Sciences and Deep Computing Institute
IBM T. J. Watson Research Center

Joseph Salah (10/04)
Haystack Observatory
Massachusetts Institute of Technology

David Siegmund (10/03)
Department of Statistics
Stanford University

Neil deGrasse Tyson (10/03)
Hayden Planetarium
American Museum of Natural History

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...
Reference and Book List

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.


*Added to "Book List" since the list's last appearance.
Add this Cover Sheet to all of your Academic Job Applications

How to use this form

1. Using the facing page or a photocopy, (or visit the AMS web site for a choice of electronic versions at www.ams.org/coversheet/), fill in the answers which apply to all of your academic applications. Make photocopies.

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

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

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

Please direct all questions and comments to: emp-info@ams.org.
**AMS STANDARD COVER SHEET**

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

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

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*This form is provided courtesy of the American Mathematical Society.*

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

*Please print or type. Do not send this form to the AMS.*
2000
Mathematics
Subject
Classification

00 General
01 History and biography
03 Mathematical logic and foundations
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General algebraic systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra, matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 $K$-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
37 Dynamical systems and ergodic theory
39 Difference and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
49 Calculus of variations and optimal control, optimization
51 Geometry
52 Convex and discrete geometry
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
74 Mechanics of deformable solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum theory
82 Statistical mechanics, structure of matter
83 Relativity and gravitational theory
85 Astronomy and astrophysics
86 Geophysics
90 Operations research, mathematical programming
91 Game theory, economics, social and behavioral sciences
92 Biology and other natural sciences
93 Systems theory, control
94 Information and communication, circuits
97 Mathematics education
The selection committee for this prize requests nominations for consideration for the 2003 award. Further information about this prize can be found in the November 2001 Notices, pp. 1211-1223 (also available at http://www.ams.org/ams/prizes.html).

Three Leroy P. Steele Prizes are awarded each year in the following categories: (1) the Steele Prize for Lifetime Achievement: for the cumulative influence of the total mathematical work of the recipient, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through Ph.D. students; (2) the Steele Prize for Mathematical Exposition: for a book or substantial survey or expository-research paper; and (3) the Steele Prize for Seminal Contribution to Research: for a paper, whether recent or not, that has proved to be of fundamental or lasting importance in its field, or a model of important research. In 2003 the prize for Seminal Contribution to Research will be awarded for a paper in Logic.

Nominations with supporting information should be submitted to the Secretary, Robert J. Daverman, American Mathematical Society, 312D Ayres Hall, University of Tennessee, Knoxville, TN 37996-1330. Include a short description on the work that is the basis of the nomination, including complete biographic citations. A curriculum vitae should be included. The nominations will be forwarded by the Secretary to the prize selection committee, which will, as in the past, make final decisions on the awarding of prizes.

Deadline for nominations is March 31, 2002.
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**Random Graphs**
Second Edition
Béla Bollobás
This up-to-date and comprehensive account of random graph theory contains two new sections, numerous new results and 150 references. The theory estimates the number of graphs of a given degree that exhibit certain properties.

Cambridge Studies in Advanced Mathematics 73
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0-521-79722-5 Paperback $45.00

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S. Donaldson
This monograph gives a thorough exposition of Floer's seminal work during the 1980s from a contemporary viewpoint. The results form part of the area known as Donaldson theory. The author was awarded the Fields Medal for his contribution to this work.

Cambridge Tracts in Mathematics 147
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**Calendrical Tabulations, 1900-2200**
Edward M. Reingold and Nachum Dershowitz
Using the algorithms outlined in *Calendrical Calculations*, the authors have simultaneously displayed the date on thirteen different calendars over a 300-year period. Included are the Gregorian, ISO, Hebrew, Chinese, Coptic, Ethiopic, Persian, Hindu lunar, Hindu solar, and Islamic calendars.

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us.cambridge.org/mathematics
Mathematics Calendar

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

March 2002

*Post-Genome Knowledge Discovery, January-June 2002, Institute for Mathematical Sciences, National University of Singapore, Singapore, Republic of Singapore.

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

The program topics are: 1. Sequence and gene expression analysis (Jan.-Feb. 2002); 2. Population and statistical genetics (Mar.-Apr. 2002); 3. Protein interaction and clinical data analysis (May-June 2002).

Application and Information: The Institute invites applications for Membership for participation in the above program. Limited funds are available to cover travel and living expenses to young scientists. Application should be received at least (3) months before the commencement of membership. More information and application forms are available from: http://www.ias.nus.edu.sg or by writing to: Secretary, Institute for Mathematical Sciences, National University of Singapore, 3 Prince George’s Park, Singapore 118402, Republic of Singapore.


11-June 14 Large Scale Communications Networks, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, California. (Feb. 2002, p. 268)

15-17 SEAM XVIII (South Eastern Analysis Meeting XVIII), Univ. of North Carolina, Chapel Hill, North Carolina. (Nov. 2001, p. 1728)


*18-20 DIMACS Working Group on Data Compression in Networks and Applications, DIMACS Center, Rutgers University, Piscataway, New Jersey.

Short Description: This working group will explore the role of compression in all layers of data networks. What are the benefits and costs of doing data compression at the packet level versus the stream level? What are the issues in compressing massive data warehouses? What are the issues in compressing new data formats, such as html or XML or BioXML? How does one best compress heterogeneous data? What data compression problems are unique to applications such as email and the web? The working group will review a variety of applications and new compression methods and it is likely that subgroups will be formed to investigate more specialized aspects of the compression problem.

Sponsors: DIMACS Center.

Organizers: A. Buchsbaum, AT&T Labs-Research, S. Muthukrishnan, AT&T Labs-Research, S. C. Sahinalp, Case Western Reserve University.

Contacts: A. Buchsbaum, AT&T Labs-Research, alb@research.att.com.

Local Arrangements: J. Thiemann, DIMACS Center, jennifer@dimacs.rutgers.edu, 732-445-5928.

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

This section contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings and symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete list of meetings of the Society can be found on the last page of each issue.

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

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

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

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

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

March 2002

Notices of the AMS

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

21–23 Spring Topology and Dynamics Conference, Univ. of Texas, Austin, Texas. (Aug. 2001, p. 751)


*24–April 20 School on Geometry and String Theory, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK

Sponsors: Clay Mathematics Institute and Isaac Newton Institute for Mathematical Sciences.

Theme: The topics that will be covered include: Orbifolds and McKay correspondence, Calabi-Yau 3 folds and mirror symmetry, hyperKähler and other geometries based on special holonomy, and applications of these to the study of supersymmetric compactifications and brane configurations in string/M-theory.

Partial List of Lecturers: B. Acharya (Rutgers), E. Diaconescu (Rutgers), R. Dijkgraaf (Amsterdam), R. Donagi (Pennsylvania), S. Donaldson (Imperial College), N. Dorey (Swansea), M. Douglas (Rutgers/IES), G. Gibbons (Cambridge), M. Gross (Warwick), J.P. Gauntlett (London), N. Hitchin (Oxford), D. Joyce (Oxford), F. Kirwan (Oxford), M. Kontsevich (IHES), G. Moore (Rutgers), M. Reid (Warwick), S. Sethi (Chicago), C. Voisin (Paris).

Information, Program, and Application Form: http://www.newton.ac.uk/programs/MTH/mthw01.html or http://www.claymath.org/.


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

27–29 10emes Journées du Groupe MODE de la Smai (10th Meeting of the MODE Group of the Smai), Montpellier, France. (Feb. 2002, p. 269)


28–31 Geometry and Topology in Dimensions 3 and 4, Ohio State Univ., Columbus, Ohio. (Jan. 2002, p. 54)


April 2002


*5–6 The 28th Annual New York State Regional Graduate Mathematics Conference, Syracuse University, Syracuse, New York.

Description: Opening Address: "Coloring graphs embedded on surfaces—when does the embedding make coloring easier and harder?", Dr. Joan Hutchinson, Maceele College, 8 p.m., Friday, 4/5/2002.


Presentations: We are accepting submissions until March 26, 2002. http://math.syr.edu/mgo/conference/forms/present.html for a submission form.

Information: http://math.syr.edu/mgo/.

5–7 The 5th Riviere-Fabes Symposium on Analysis and PDE, Univ. of Minnesota, Minneapolis, Minnesota. (Jan. 2002, p. 55)


8–19 Invariant Theory, Queen’s Univ., Kingston, Ontario, Canada. (Aug. 2001, p. 751)


*17–20 Interface '02, the 34th Symposium on the Interface of Computing Science and Statistics, Montreal, Canada.

Program: The theme of Interface '02 is Geoscience and Remote Sensing.

Topics: Statistics, computing, graphics, data mining, computer vision, data visualization, bioinformatics, computer security, earth science.

Conference Chair/Co-chair: E. Wegman (George Mason Univ.), A. Braverman (Jet Propulsion Lab.).

Short Courses: Multiresolution visualization; pattern recognition.


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

May 2002


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

The program topics are: 1. Sequence and gene expression analysis (Jan.–Feb. 2002); 2. Population and statistical genetics (Mar.–Apr. 2002); 3. Protein interaction and clinical data analysis (May–June 2002).

Application and Information: The Institute invites applications for Membership for participation in the above program. Limited funds are available to cover travel and living expenses to young scientists. Application should be received at least (3) months before the commencement of membership. More information and application forms are available from: http://www.ism.nus.edu.sg or by writing to: Secretariat, Institute for Mathematical Science, National University of Singapore, 3 Prince George’s Park, Singapore 117432, Republic of Singapore.
**Mathematics Calendar**

**March 2002**


**27-June 10 Computation Lie Theory**, Centre de Recherches Mathematiques (CRM), Universite de Montreal, Montreal (Quebec), Canada. (Aug. 2001, p. 751)


**June 2002**


**3-8 Algebra Conference-Venezia 2002**, Venice International University, Island of San Servolo, Venice, Italy.

Topics: Abelian groups, algebras and their representations, commutative rings, module theory, ring theory, topological algebraic structures.

Main speakers: S. Bazzoni (Italy), A. Facchini (Italy), R. Farnsteiner (Germany), R. Gilmer (USA), R. Göbel (Germany), W. Heinzer (USA), H. Krause (Germany), K. Kunen (USA), J. Reiten (Norway), J. Trifaj (Czech Republic), C. Vinsonhaler (USA), R. Wiegand (USA).

**Plenary speakers**: R. Colpi (Italy), D. Herbera (Spain), S. Kasjan (Poland), B. Olerding (USA), D. Shakhmatov (Japan), L. Struengmann (Germany).

**Scientific Committee**: D. Dikranjan (Italy), A. Facchini (Italy), M. Fontana (Italy), L. Fuchs (USA), K. Fuller (USA), R. Göbel (Germany), W. Heinzer (USA), C. Ringel (Germany), D. Simson (Poland).

**Organizing Committee**: P. Barollo, S. Bazzoni, R. Colpi, S. Gabelli, E. Gregorio, C. Metelli, L. Salce, F. Stumbo, A. To a, P. Zanardo (Italy).

**Deadlines**: To register and submit abstracts, March 31, 2002.

**Proceedings**: To be published by Marcel Dekker Inc.

**Information**: http://dm.unife.it/venezia/ . Registration: see URL Program: see URL.

**3-9 BIOCOMP2002: Topics in Biomathematics and Related Computational Problems at the Beginning of the Third Millennium**, Vietri sul Mare (Amalfi Coast), Italy. (Feb. 2002, p. 269)

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


10–14 Théories d’Homologie, Représentations et Algèbres de Hopf, CIRM, Luminy, Marseille, France. (Jan. 2002, p. 56)

10–15 Algebraic Transformation Groups, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 732)


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


*15–17 CMS Summer Meeting 2002, Laval University, Quebec City, Quebec, Canada.

Sponsor: Department of Mathematics & Statistics, Laval University.

Plenary Speakers: D. Henderson (Cornell Univ.), N. Nikoloski (Univ. of Bordeaux), P. D. Seymour (Princeton Univ.), I. M. Singer (MIT), C. Reutenauer (Univ. du Québec à Montréal).


Symposia: Analysis, Org: T. Ransford (Laval); Arithmetic algebraic geometry, Org: K. Murty (Toronto); Category theory, Org: R. Pare (Dalhousie); Combinatorics, Org: P. Leroux (UQAM); Cryptography, Org: H. Williams (Calgary) and D. Stinson (Waterloo); Differential geometry, Org: J. Chen (UBC); Graph theory, Org: R. Alspach (SFU); Mathematical education, Org: F. Gourdeau (Laval) and B. Hodgson (Laval); Mathematics of finance, Org: H. Manouzi (Laval); Number theory, Org: A. Akbary (Lethbridge) and O. Kihel (Lethbridge); Probability theory, Org: D. Dawson (Carleton); Universal algebra, Org: J. Hyndman (UNBC) and S. Wismath (Lethbridge); Contributed papers, Org: N. Lacroix (Laval) and H. Edgar (San Jose, CA).

Meeting Director: C. Levesque (Laval).

Local Arrangements: J.-P. Carmichael (Laval).

Information: http://www.cms.math.ca/Events/summer02/.


16–23 Second Russian-German Geometry Meeting Dedicated to 90th Anniversary of A. D. Alexandrov, Euler International Mathematical Institute, St Petersburg, Russia. (Feb. 2002, p. 269)

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

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

*17–21 Stochastic Inequalities and their Applications: A EuroConference, Centre de Recerca Matemàtica, Bellaterra (Barcelona), Spain.

Topics: The topics to be covered in this Euroconference belong to different areas of probability, statistics and analysis, and therefore the conference will provide a unique opportunity for exchange of ideas occurring in different fields and for interdisciplinary contact and collaboration, that will hopefully lead to fruitful developments. Concentration and deviation inequalities for various types of processes using isoperimetry, differential inequalities, and information inequalities; other exponential and moment inequalities for sums of independent or weakly dependent random vectors and related variables; inequalities in Malliavin calculus; geometric inequalities for log-concave probability measures, particularly the Gaussian correlation inequality; martingale and decoupling inequalities.

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

18–22 The Barcelona Conference on Stochastic Inequalities and Their Applications (A EuroConference), Bellaterra (Barcelona). (Jan. 2002, p. 56)

19–21 The EUROMECH Colloquium 437: Identification and Updating Methods of Mechanical Structures, Prague, Czech Republic. (Jan. 2002, p. 56)


Topics/Theme of Conference: The three main scientific topics of the planned EuroConference, in parallel with the Newton Institute programme entitled Higher Dimensional Complex Geometry are: Minimal models, classification and birational geometry of 3-folds, resolution of 3-fold quotient singularities and the McKay correspondence, and Calabi-Yau 3-folds and mirror symmetry.


Further information and application forms: These are available from the WWW at http://www.newton.cam.ac.uk/programs/HDG/hdg02.html.


Description: An international conference on stochastic networks will be held June 24-29, 2002, on the Stanford campus. This week-long workshop continues a tradition of similar meetings held at irregular intervals over the last 15 years, starting with the one organized by Tom Kurtz in Madison in 1987, continuing with conferences in Minneapolis and Edinburgh during the 1990s, then returning to Madison in 2000. These meetings have brought together mathematicians and applied researchers who share an interest in stochastic network models.

Like its predecessors, the Stanford Stochastic Networks Conference will emphasize new model structures and new mathematical problems that are motivated by contemporary developments in business and technology, with particular emphasis on computer and wireless networks or data networks and electronic business. We expect to have talks on other application areas too, like manufacturing and supply chain management and on mathematical methods for stochastic network analysis.

Sponsors: Stanford Graduate School of Business and Stanford School of Engineering.


Information: For further information, including registration fees, registration procedures, housing arrangements and logistics, see http://www.stanford.edu/~fkkelly/snconf.html.


Information: ACA’2002 conference e-mail: aca2002@ath.gr; ACA’2002 conference website: http://www.orcca.on.ca/~ilias/
aca2002.html; ACA Conferences main web site: http://math.unm.edu/aca.html


July 2002


Program: The representation theory of Lie groups is the third program organized by the Institute for Mathematical Sciences (IMS), National University of Singapore. Three one-week tutorials for beginners and a one-week conference for researchers will be held during the program. Detailed information on the program can be found on the IMS official website at http://www.ins.nus.edu.sg/.

Topics: Representation of p-adic groups, unitary representation of real reductive groups, multiplicity-free actions and representations.


Participants: The complete list of participants who will be visiting the IMS is given on our website. Key participants include J. Adams, D. Barbasch, M. Cowling, B. H. Gross, G. Henniart, R. Howe, J. S. Huang, D. Jiang, T. Kobayashi, J.-S Li, G. Lusztig, A. Moy, K. Nishiyama, T. Oshima, T. Przebinda, S. Sahi, G. Savin, M. Tadic, P. Trapa, M.-F. Vigneras and D. Vogan.

Registration: Registration forms are available from the IMS official website at http://www.ins.nus.edu.sg/ and should be received at least one month before the commencement of each tutorial/workshop. The Institute would like to encourage aspiring mathematicians to participate in the program, in particular, in the tutorial sessions to be held on July 8-12, August 5-10, 2002, and January 6-10, 2003, and also the workshop/conference to be conducted on August 12-15, 2002. Registration is free.

Information: For general enquiries, please send e-mail to ins@nus.edu.sg; for enquiries on academic matters, please e-mail E.-C. Tan at mttanecnus.nus.edu.sg.

*1-5 28th Conference on Stochastic Processes and Their Applications, The University of Melbourne, Melbourne, Australia.

Program: The themes of the conference include: stochastic analysis, discrete random processes and randomised algorithms, topics in limit theorems, Markov chain Monte Carlo, Markov processes, random processes in random environments, point processes, as well as application areas such as: stochastic processes in finance and insurance, stochastic processes in physics, applications to telecommunications, time series, modelling in biology and medicine.

Deadlines: The deadline for submission of abstracts is May 3, 2002.


Speakers: A partial list of invited speakers is as follows: I. S. Borisov, P. Del Moral, P. Embrechts, O. Haggstrom, K. Johansson, Zhi-Ming Ma, M. Neuts, T. Ozaki, P. Protter and D. Siegmund.

Information and Registration: http://www.spa28.ms.unimelb.edu.au/

*1-5 Congrès de Mathématiques Appliquées à la Mémoire de Jacques-Louis Lions, Collège de France, Paris, France.


Honour Committee: H. Curien, H. Fujita, P. Lax, E. Magenes (Chair), G. Marchuk.

Patronages: International Mathematical Union and Académie des Sciences de Paris.

Supported and sponsored by: Ministère de la Recherche, CNRS, CNES, INRIA, Collège de France, Ecole Polytechnique, Université Pierre et Marie Curie (Paris VI), SMAI and SMF.

Registration: Registration to the conference is requested and free of charge. Please register directly on the website.

Contacts: Postal Address: Laboratoire d'analyse numérique, Université Pierre et Marie Curie, Boîte courrier 187, 75252 Paris cedex 05, France; fax +33 1 44 27 72 00; e-mail: congrès.jllions@amsu.jussieu.fr; http://aca.math.fr/congres-jllions/.

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


*3-5 Call for Papers: The Thirteenth Annual Symposium on Combinatorial Pattern Matching (CPM2002), Hotel Unimonakamichi, Fukuoka, Japan.

Topics: Papers in all areas related to combinatorial pattern matching and its applications will be considered, including, but not limited to: string algorithms, pattern recognition, applications in molecular biology, text searching, information retrieval, data mining, symbolic computing, natural language processing, coding and data compression, string processing in database. Both papers reporting on original research unpublished elsewhere and surveys of important results are welcome.

Proceedings will be published in the Springer-Verlag series, Lecture Notes in Computer Science.

Information: The conference web site is at http://www.i.kyushu-u.ac.jp/cpm2002/.

7-10 ISSAC 2002 International Symposium on Symbolic and Algebraic Computation, University of Lille I, France. (Feb. 2002, p. 269)

7-12 The 5th Americas Conference in Differential Equations and Nonlinear Dynamics, Univ. of Alberta, Edmonton, Canada. (Jan. 2002, p. 56)


8-12 14th International Conference on Formal Power Series and Algebraic Combinatorics, Univ. of Melbourne, Australia. (Jan. 2002, p. 56)

8-12 An International Conference on Boundary and Interior Layers—Computational & Asymptotic Methods, Univ. of Western Australia, Perth, Australia. (Dec. 2001, p. 1366)

8-12 Harmonic Maps, Minimal Surfaces and Geometric Flows, University of Bretagne Occidentale, Brest, France. (Feb. 2002, p. 270)


8-19 Biomathematics Euro Summer School: Dynamical Systems in Physiology and Medicine, Urbino, Italy. (Feb. 2002, p. 270)

8-19 SMS-NATO ASI: Normal Forms, Bifurcations, and Finiteness Problems in Differential Equations, Université de Montréal, Canada. (Dec. 2001, p. 1366)
Mathematics Calendar

8-26 School and Conference on Algebraic K-Theory and its Applications, The Abdus Salam International Centre for Theoretical Physics (ICTP), Strada Costiera 11, I-34014, Trieste, Italy.

Directors: M. Karoubi (Univ. de Paris VII, France), A. O. Kuku (ICTP), C. Pedrini (Univ. degli Studi di Genova, Italy).

Local organizer: A. O. Kuku.

Deadline: Deadline for requesting participation is February 28, 2002.

Information: Details available from http://www.ictp.trieste.it/cgi-bin/ICTPpear/mkhtml/zn2htmal.pl?sm1418/Announcement/.


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


16-22 7th International Spring School "Nonlinear Analysis, Function Spaces and Applications" (NAFSA 7), Prague, Czech Republic. (Jan. 2002, p. 57)


21-August 3 Summer School on Applications of Advanced Mathematical and Computational Methods to Atmospheric and Oceanic Problems, National Center for Atmospheric Research (NCAR), Boulder, Colorado. (Feb. 2002, p. 270)

22-25 Seventeenth Annual IEEE Symposium on Logic in Computer Science, Copenhagen, Denmark.

Description: The LICS Symposium is an annual international forum on theoretical and practical topics in computer science that relate to logic in a broad sense. LICS 2002 will be part of the 2002 Federated Logic Conference (FLoC 2002), to be held in Copenhagen, Denmark, July 20th - August 1st, 2002.

LICS 2002 will have a session of short (5-10 minutes) presentations. This session is intended for presentations of work in progress, new projects, and relevant research being published elsewhere; other brief communications may be acceptable. Submissions for these presentations, in the form of short abstracts (1 or 2 pages long), should be entered at the LICS submission site between March 25th and March 29th, 2002. Authors will be notified of acceptance or rejection by April 12th, 2002.

The symposium is sponsored by the IEEE Technical Committee on Mathematical Foundations of Computing in cooperation with the Association for Symbolic Logic, and the European Association for Theoretical Computer Science.

Kleene Award for Best Student Paper: An award in honor of the late S.C. Kleene will be given for the best student paper, as judged by the program committee. For a paper to be eligible the research presented must have been carried out while at least one of the authors was a full-time student. Multiple-authored papers are permitted. The exact circumstances, including allocation of credit, should be detailed in the submission letter, SIGNED BY ALL AUTHORS. The program committee may decline to make the award or may split it among several papers.

Invited Speakers: The following distinguished speakers have agreed to give invited talks at LICS 2002: S. Cook (Univ. of Toronto), G. Gottlob (TU Wien), J. Reynolds (Carnegie Mellon), N. Shankar (SRI); M. Lenzerini (Univ. di Roma "La Sapienza") will give an invited tutorial on Description Logics.

Information: http://lics02.lfcs.informatics.ed.ac.uk/.

22-26 Universal Algebra and Lattice Theory, University of Szeged, Szeged, Hungary. (Feb. 2002, p. 270)

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


*28-August 2 Institute of Mathematical Statistics Annual Meeting, Banff, Alberta, Canada.

Description: The meeting will be held in the Banff Centre Building of The Banff Centre for Conferences (http://www.banffcentre.ca/).

L. Breiman (Univ. of California, Berkeley) will be the Wald lecturer, and Wing Hung Wong (Harvard Univ.) will give the Neyman lecture. Special invited papers will be given by Maury Bramson (Univ. of Minnesota), Steven Evans (Univ. of California, Berkeley), Hans Künsch (ETH, Zurich), and Per Mykland (Univ. of Chicago). The Research Section of the Royal Statistical Society is planning to host an RSS Ordinary Meeting, and the Statistical Society of Canada will organize two invited paper sessions.

The program chair for this meeting is T. DiCiccio (Cornell Univ.: tjg@cornell.edu), and the local arrangements chair is S. Lele (Univ. of Alberta; slei@ualberta.ca).

Information: This meeting will be joint with an International Probability Symposium; see announcement for the meeting being held July 31-August 2. Please visit http://www.stat.cornell.edu/news/IMSMeeting/frontpage.htm for more information. Abstracts are due February 15, 2002.

29-August 3 Escuela Latinoamericana de Matematicas (ELAM), Cartagena de Indias, Colombia. (Jan. 2002, p. 57)

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


Description: In conjunction with the annual meeting of the Institute of Mathematical Statistics. The goal of the symposium is to present a broad view of recent developments in probability and important areas of application. The format of the Symposium will be similar to earlier symposia in this series with approximately 15 sessions of invited lectures. IMS Special Invited Papers in probability will also be presented as part of the Symposium.

Committee: The editorial boards of the Annals of Probability and the Annals of Applied Probability are serving as the program committee for the Symposium.

Information: For additional information (as it becomes available) including a tentative list of session topics, see http://www.math.uic.edu/annprob/banff/banff.htm.

August 2002

3-9 (NEW DATE) Logic Colloquium 2002 (ASL European Summer Meeting), Westfälische Wilhelms-Universität, Münster, Germany.
5-9 Conference on Ill-Posed and Inverse Problems, Sobolev Inst. of Mathematics, Novosibirsk, Russia. (Sept. 2001, p. 909)

5-10 6th Brazilian School of Probability, Praia das Toninhas, Ubatuba, São Paulo, Brazil. (Feb. 2002, p. 271)

5-14 Foundations of Computational Mathematics 2002 (FoCM'02), University of Minnesota, Minneapolis Campus, Minneapolis, Minnesota.

Description: Eighteen-day workshops and eighteen plenary lectures.

SFoCM Executive Committee: R. Devore and S. Brenner (Univ. of South Carolina), M. Todd (Cornell Univ.).

Information: http://www.damtp.cam.ac.uk/user/na/FoCM/FoCM02/. For questions, please contact: focomina.umn.edu.

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

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


11-17 The 7th International Conference on Difference Equations and Applications (7th ICDEA), Hunan Univ. at Changsha, China. (Jan. 2002, p. 58)

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

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


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

15-17 The Eighth Annual International Computing and Combinatorics Conference (COCOON'02), Singapore. (Jan. 2002, p. 58)


26-28 The Sixth Iranian International Statistics Conference (ISIC6), Tarbiat Modarres Univ., Tehran, Iran. (Dec. 2001, p. 1367)

26-September 1 Symmetry and Cosymmetry Applications in the Theory of Bifurcations and Phase Transitions, Big Sochi, Russia. Organizer: Department of Computational Mathematics and Institute of Physics of Rostov State University.

Program: Symmetry and cosymmetry in hydrodynamics; phase transitions in condensed matter; integratability and conservative chaos in classical mechanics; convection of homogeneous and inhomogeneous fluids—phase transitions, bifurcations, chaos, asymptotic models, influence of electromagnetic field; magnetodynamics problems.

Keynote Speakers: V. Yudovich (Russia), V. Pukhnachev (Russia), Yu. Gufan (Russia), E. Vinberg (Russia), G. Zaslavsky (USA), V. Vladimirov (United Kingdom), G. Iooss (France), G.-F. Sartory (Italy), J. Granovskii (Poland), B. Karasozan (Turkey).


Language: English.

Information: Further details on the organization of SCDS'2002 will be posted on this website as soon as they become available.

Enquiries can be directed to the organizing committee at the following address: e-mail: sadkov@ip.rsu.ru, fax: 7-8632-434044, tel: 7-8632-223998.


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

29-September 3 Stochastic Analysis, German Science Center, Beijing, China. (Feb. 2002, p. 271)

September 2002


1-9 8th International Congress on Algebraic Hyperstructures and Applications (AHA 2002), Democritus University of Thrace, Samothraki Island, Greece.

Topics: The congress will cover the following topics: hypergroups, semihypergroups hypergroupoids, hyperrings, hyperfields, hypervectorial spaces, H'-structures (H'-groups, semigroups, rings), nonassociative and F-closed associative hypergroupoids, join spaces, hyperstructures associated to geometric spaces, ordered hyperstructures, fuzzy hyperstructures, hypergraphs, generalizations and applications. There will be invited lecturers and special sessions for talks of twenty (20) minutes.

Dates: The second announcement will be sent to the interested researchers by the end of December 2001. Registration, March 31, 2002; abstracts, April 30, 2002; final announcement, June 15, 2002.

Information and Registration: aha2002@agro.duth.gr.

*2-7 VI International Workshop on Complex Structures, Vector Fields and Applications, St. Constantine, near Varna/Bulgaria.

Main Purpose: Bringing together specialists in complex analysis, potential theory, differential geometry, mathematical physics and applications for stimulating cross-disciplinary activities. Lectures: There will be two types of lectures. The first type of lectures will present the up-to-date state of the subject and could be considered as an introduction in large research domains. The second type of lectures will be authors' contributions.


Registration fee: US$150 including the price of the Proceedings volume. Accommodation and meals: no more than US$40 per day.

*4-6 The Fourth International Workshop on Automated Deduction in Geometry, RISC-Linz, Hagenberg, Austria.

Description: The fourth workshop ADG 2002 to be held in Hagenberg (near Linz), Austria, September 2002, will continue ADG's
emphasis on theory and algorithms, implementation, experiments, and applications to science, engineering and industry.

**Important Dates:** Deadline for extended abstract submission: June 3, 2002; notification of acceptance or rejection: July 3, 2002; workshop taking place: September 4-6, 2002; deadline for full paper submission: November 4, 2002.

**Topics:** Specific topics for ADG 2002 include (but are not limited to): polynomial algebra, invariant and coordinate-free methods, probabilistic, synthetic, and logic approaches, techniques for automated geometric reasoning from discrete mathematics, combinatorics, and numerics; symbolic and numeric methods for geometric computation, geometric constraint solving, automated generation/reasoning and manipulation with diagrams; design and implementation of geometry software, special-purpose tools, automated theorem provers, experimental studies; applications of ADG to mechanics, geometric modeling, CAGD/CAD, computer vision, robotics and education.

**Submission:** Potential participants of ADG 2002 are invited to submit an extended abstract of three or more pages or a full paper describing their work to be presented at ADG 2002. The submitted extended abstracts and full papers will be reviewed by members of the program committee (PC) for presentation at the workshop. Electronic submissions are preferred and should be sent to the editor. The editorial committee invites papers for this issue.

Information: For an up-to-date version of the cfp please check http://www.risc.uni-linz.ac.at/conferences/adg2002/.

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


**January 2003**


New Publications Offered by the AMS

Algebra and Algebraic Geometry

Groups and Combinatorics—in Memory of Michio Suzuki
Eiichi Bannai, Kyushu University, Fukuoka, Japan, Hiroshi Suzuki, International Christian University, Tokyo, Japan, Hiroyoshi Yamaki, Kumamoto University, Japan, and Tomoyuki Yoshida, Hokkaido University, Sapporo, Japan, Editors

A publication of the Mathematical Society of Japan.

In honor of Professor Michio Suzuki's 70th birthday, a conference was held at the International Christian University (Tokyo, Japan). This book presents the proceedings of that conference. Professor Suzuki had a profound influence on the development of group theory over the last 50 years. It's generally believed that his work in the 1950s ignited work on the classification of finite simple groups, and in the 1960s and 1970s, he was a leader in its development.

Just prior to his death in 1998, Professor Suzuki completed a 150-page manuscript containing his most recent contribution to group theory. This paper, "On the Prime Graph of a Finite Simple Group—an Application of the Method of Feit-Thompson-Bender-Glauberman", is included in this volume. Here, the editors have been meticulous in making minimal corrections to the work in order to honor the writing style and original flow of Professor Suzuki's thoughts. The book also includes contributions from the speakers at the conference, as well as papers from researchers who shared close ties with Professor Suzuki.

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

Contents: K. Harada, Michio Suzuki; M. Suzuki, On the prime graph of a finite simple group—an application of the method of Feit-Thompson-Bender-Glauberman; M. Aschbacher, a characterization of 2E6(2); E. Bannai, M. Koike, A. Munemasa, and J. Sekiguchi, Some results on modular forms—subgroups of the modular group whose ring of modular forms is a polynomial ring; H. Bender, Steiner systems and Mathieu groups revisited; E. C. Dade, Rationally determined group modules; W. Feit and M. A. Shahabi, On the lattice of all subgroups of a finite noncyclic simple group; P. Flavell, Generation theorems for finite groups; A. A. Ivanov, Non-abelian representations of geometries; M. Kitazume and M. Miyamoto, 3-transposition automorphism groups of VOA; T. Kondo, The calculation of the character of moonshine VOA; S. Koshitanai and N. Kunugi, A remark on the Loewy structure for the three dimensional projective special unitary groups in characteristic 3; J. McKay, The essentials of monstrous moonshine; T. Okuyama and K. Uno, On the vertices of modules in the Auslander-Reiten quiver III; T. Shoji, Finite Chevalley groups—representations of finite Chevalley groups; R. Solomon, The shape of the classification of finite the simple groups; G. Stroth, 2F-modules with quadratic offender for the finite simple groups; F. G. Timmesfeld, On the structure of special rank one groups; Y. Usami, Principal blocks with extra-special defect groups of order 27; J. Walter, Bases of chambers of linear Coxeter groups; A. Watanabe, The Isaacs character correspondence and isotypies between blocks of finite groups; H. Yamaki, Either 71 : 35 or L2(71) is a maximal subgroup of the monster; S. Yoshidara, Radical subgroups of the sporadic simple group of Suzuki; T. Yoshida, |Hom(A,G)| (II).

Advanced Studies in Pure Mathematics, Volume 32


Analysis

Cracktip is a Global Mumford-Shah Minimizer
Alexis Bonnet, Goldman Sachs, London, England, and Guy David, Université de Paris-Sud, Orsay, France

A publication of the Société Mathématique de France.

In this book, the authors show that the pair (u, K) given by K = (−∞, 0] ⊂ R² and u(r cos θ, r sin θ) = √2/π r r r sin θ, for r > 0 and −π < θ < π is a global Mumford-Shah minimizer. This means that if K is another closed set in the plane with locally finite Hausdorff measure, it is a function on R² \ K with a derivative in L²(R² \ K), and the pair (u, K) coincides with (u, K) outside some disk B, then H¹(K ∩ B + |∇u|² + H¹(K ∩ B + |∇u|², where H¹ denotes Hausdorff measure.

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The authors also show that every global Mumford-Shah minimizer \((u', K')\) that is sufficiently close to \((u, K)\) near infinity must be equivalent to it. This is the case, for instance, if some blow-up limit of \((u', K')\) equals \((u, K)\).

The proofs are based on a detailed study of the harmonic function \(v'\) conjugated to \(u'\), and its level sets. Also used are blow-up techniques and the monotonicity of an energy integral.

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMP, Maison de la SMF, 67, 13274 Marseille cedex 05, France. Members of the SMF receive a 30% discount from list.

Asterisque, Number 274

Appendix. Proof of basic estimates.

Illustrations for some results in chapters 1 and 2; \(L_n\) and \(I_n,1\) as semi-invariants of the first kind; \(V_n\) and \(J_n,1\) as semi-invariants of the second kind; The coefficients of transformed equations; Formulas that involve \(L_n(z)\) or \(I_n,1(z)\); Formulas that involve \(V_n(z)\) or \(J_n,1(z)\); Verification of \(I_n,1 = J_n,1\) and various observations; The local constructions of earlier research; Relations for \(G_{ij}, H_{ij}\) and \(L_i\) that yield equivalent formulas for basic relative invariants; Real-valued functions of a real variable; A constructive method for imposing conditions on Laguerre-Forsyth canonical forms; Additional formulas for \(K_{ij}, U_{ij}, A_{ij}, D_{ij}, \ldots\); Three canonical forms are now available; Interesting problems that require further study; Appendix A. Results needed for self-containment; Appendix B. Related studies for a class of nonlinear equations; Appendix C. Polynomials that are linear in a key variable; Appendix D. Rational semi-invariants and relative invariants; Appendix E. Generating additional relative invariants; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 156, Number 744


New Series!

Documents Mathématiques is published by the Société Mathématique de France and distributed in North America by the AMS. Books in this series include mathematical texts of historical interest. Published are new editions of seminar talks or books out of print, original correspondence, lectures, and complete works of well-known researchers.

Correspondance Grothendieck-Serre

Pierre Colmez and Jean-Pierre Serre, Editors

A publication of the Société Mathématique de France.

Alexandre Grothendieck and Jean-Pierre Serre are two dominant figures in the development of algebraic geometry in the middle of the twentieth century. Serre’s FAC and GAGA papers and Grothendieck’s use of schemes completely changed the way people did algebraic geometry.

This remarkable volume contains a large part of the mathematical correspondence between A. Grothendieck and J.-P. Serre. This correspondence forms a vivid introduction to the study of algebraic geometry during the years 1955–1965. For example, readers will discover the genesis of some of Grothendieck’s ideas on Sheaf cohomology, schemes, Riemann-Roch, the fundamental group, motives, and more. They also will get an idea of the mathematical atmosphere of this time (Bourbakis, seminars in Paris, Harvard, Princeton, war in Algeria, etc.). This is a remarkable book.

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

New Publications Offered by the AMS
The asymptotics of torsion forms of unit sphere bundles. The main formula generalizes the results of Lott-Rothenberg and Cheeger, MUller, Chern braids; 1-handle surgery on surface braids; Braid monodromy; Alexander polynomials. Braid techniques are extended to resource for researchers. For surface braids, various methods to describe them are introduced and developed: the motion picture method, the chart description, the braid monodromy, and the braid system. These tools are fundamental to understanding and computing invariants of surface braids and surface links. Included is a table of knotted surfaces with a computation of union and connected sum; Markov's theorem in dimension four are given. This book is the first to contain a complete proof of the generalized Markov theorem.

Surface links are studied via the motion picture method, and some important techniques of this method are studied. For surface braids, various methods to describe them are introduced and developed: the motion picture method, the chart description, the braid monodromy, and the braid system. These tools are fundamental to understanding and computing invariants of surface braids and surface links.

Included is a table of knotted surfaces with a computation of Alexander polynomials. Braid techniques are extended to represent link homotopy classes. The book is geared toward a wide audience, from graduate students to specialists. It would make a suitable text for a graduate course and a valuable resource for researchers.

Contents: Introduction; Flat superconnections and equivariant torsion forms; Rigidity of torsion forms and Chern normalizations; Analytic torsion forms; rigidity and the Chern character; The analytic torsion forms of a \( Z_2 \)-graded vector bundle; A family of Thom-Smale gradient vector fields; Fibration, Berezin integrals and Euler currents; Analytic torsion forms and Morse-Smale vector fields; A contour integral; A proof of the main result; Generalized metrics: a first proof of Theorem 9.8; Fibrewise nice functions: a second proof of Theorem 9.8; An asymptotic expansion for \( \text{Tr}_s(fgh') \) as \( T \to +\infty \); The asymptotics of \( \text{Tr}_s(fgh') \) as \( t \to 0 \); The asymptotics of \( \text{Tr}_s(fgh') \) as \( t \to 0 \); The asymptotics of \( \text{Tr}_s(fgh') \) as \( t \to 0 \); The analytic torsion forms of unit sphere bundles; Bibliography; Index.

Number 2
Mathematics Subject Classification: 11-XX, 14-XX, Individual member $50, List $55, Order code SMFDM/2N

Supplementary Reading

Braid and Knot Theory in Dimension Four
Seiichi Kamada, Osaka City University, Japan

Braid theory and knot theory are related via two famous results due to Alexander and Markov. Alexander's theorem states that any knot or link can be put into braid form. Markov's theorem gives necessary and sufficient conditions to conclude that two braids represent the same knot or link. Thus, one can use braid theory to study knot theory and vice versa.

In this book, the author generalizes braid theory to dimension four. He develops the theory of surface braids and applies it to study surface links. In particular, the generalized Alexander and Markov theorems in dimension four are given. This book is the first to contain a complete proof of the generalized Markov theorem.

Bundled 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: Correspondence; Notes; Références; Index.

Number 275
Mathematics Subject Classification: 37D15, 57R20, 58-XX, Individual member $69, List $77, Order code ASTM/275N

Geometry and Topology

Families Torsion and Morse Functions
Jean-Michel Bismut, Université Paris-Sud, Orsay, France, and Sebastian Goette, Universität Tübingen, Germany

A publication of the Société Mathématique de France.

To a flat vector bundle, one can associate odd real characteristic classes. Bismut and Lott have proved a Riemann-Roch-Grothendieck theorem for such classes, when taking the direct image of a flat vector bundle by a proper submersion. They have also constructed associated secondary invariants, the analytic torsion forms in de Rham theory. The component of degree 0 of these forms is the classical Ray-Singer torsion.

The present paper has five purposes:
1. To extend the theory of analytic torsion forms to the equivariant setting.
2. To give a proper normalization of these torsion forms.
3. To prove rigidity formulas, showing that in positive degree, and up to locally computable terms, these forms are rigid under deformation of the flat connection.
4. To evaluate the equivariant analytic torsion forms modulo coboundaries, under the assumption that there exists a fiberwise gradient vector field which verifies the Morse-Smale transversality conditions in every fiber.
5. To compute the equivariant analytic torsion forms of sphere bundles associated to vector bundles.

The main formula generalizes the results of Cheeger, Müller, Lott-Rothenberg and Bismut-Zhang on the relation of Ray-Singer torsion to Reidemeister torsion, and also computations by Bunke for sphere bundles.

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Contents: Introduction; Flat superconnections and equivariant torsion forms; Rigidity of torsion forms and their Chern normalizations; Analytic torsion forms; rigidity and the Chern character; The analytic torsion forms of a \( Z_2 \)-graded vector bundle; A family of Thom-Smale gradient vector fields; Fibration, Berezin integrals and Euler currents; Analytic torsion forms and Morse-Smale vector fields; A contour integral; A
Surface braids and surface links: Knot groups; Unknotted surface braids and surface links; Ribbon surface braids and surface links; 3-braid 2-knots; Unknotting surface braids and surface links; Seifert algorithm for surface braids; Basic symmetries in chart descriptions; Singular surface braids and surface links; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 95

Triangulations of Oriented Matroids
Francisco Santos, University of Cantabria, Santander, Spain

Contents: Introduction; Preliminaries on oriented matroids; Triangulations of oriented matroids; Duality between triangulations and extensions; Subdivisions of Lawrence polytopes; Lifting triangulations; Bibliography.

Memoirs of the American Mathematical Society, Volume 156, Number 741

Number Theory

New Series!

Documents Mathématiques is published by the Société Mathématique de France and distributed in North America by the AMS. Books in this series include mathematical texts of historical interest. Published are new editions of seminar talks or books out of print, original correspondence, lectures, and complete works of well-known researchers.

Exposés de Séminaires 1950–1999
Jean-Pierre Serre
A publication of the Société Mathématique de France.

Jean-Pierre Serre has made significant contributions to several areas of mathematics, in particular to topology, algebraic geometry, and number theory. He is also renowned for his remarkable expository skill. This volume gathers seminar talks he gave between 1950 and 1999 in various seminars: Bourbaki, Cartan, Chevalley, and Delange-Pisot-Poitou. The themes extend from algebraic topology to number theory, covering also Lie group theory, algebraic geometry and modular forms. It gives both a presentation of works by other mathematicians (Borel, Dwork, etc.) and personal works, such as his talk at the Chevalley seminar on algebraic fibre spaces, which inspired Grothendieck in his construction of étale cohomology. None of these texts is available in the four volumes of J.-P. Serre's Collected Papers.

This item will also be of interest to those working in geometry and topology, algebra and algebraic geometry, and general and interdisciplinary areas.

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: Extensions de groupes localement compacts; Applications algébriques de la cohomologie des groupes I; Applications algébriques de la cohomologie des groupes II; Théorie des algèbres simples; Fonctions automorphes d'une variable: application du théorème de Riemann-Roch; Deux théorèmes sur les applications complètement continues; Faisceaux analytiques sur l'espace projectif; Fonctions automorphes; Représentations linéaires et espaces homogènes kähleriens des groupes de Lie compacts; Les espaces K(H, m); Groupes d'homotopie des bouquets de sphères; Espaces fibrés algébriques; Morphismes universels et variétés d'Albanese; Morphismes universels et différentielles de troisième espèce; Rationalité des fonctions ζ des variétés algébriques; Représentations ramifiées du plan projectif; Groupes finis à cohomologie périodique; Dépendance d'exponentielles p-adiques; Groupes p-divisibles; Points rationnels des courbes modulaires X0(N); Sous-groupes finis des groupes de Lie; Notes.

Number 1

Spectral Decomposition of a Covering of GL(r): the Borel Case
Heng Sun, University of Toronto, ON, Canada

Contents: Introduction; Preliminaries; Local intertwining operators; Spectrum associated with the diagonal subgroup; Contour integration (after MW); Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 156, Number 743
Cohomology of Arithmetic Groups, L-Functions and Automorphic Forms

T.N. Venkataramana, Tata Institute of Fundamental Research, Mumbai, India

This collection of papers is based on lectures delivered at the Tata Institute of Fundamental Research (TIFR) as part of a special year on arithmetic groups, L-functions and automorphic forms. The volume opens with an article by Cogdell and Piatetski-Shapiro on Converse Theorems for GL_n and applications to liftings. It ends with some remarks on the Riemann Hypothesis by Ram Murty. Other talks cover topics such as Hecke theory for Jacobi forms, restriction maps and L-values, congruences for Hilbert modular forms, Whittaker models for p-adic GL(4), the Siegel formula, newforms for the Maaß-Spezialschar, an algebraic Chebotarev density theorem, a converse theorem for Dirichlet series with poles, Kirillov theory for GL_2(D), and the L^2 Euler characteristic of arithmetic quotients. The present volume is the latest in the Tata Institute’s tradition of recognized contributions to number theory.

Previously Announced Publications

q-Series with Applications to Combinatorics, Number Theory, and Physics

Bruce C. Berndt, University of Illinois, Urbana, and Ken Ono, University of Wisconsin, Madison, WI, 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 famous \( \psi \) 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.

Contributors include: B. C. Berndt and K. Ono.

Contemporary Mathematics, Volume 291


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 vanishing bundle isomorphism.

The book has two distinct parts. The first part 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 Chern-Wilson periodicit, 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 isomorphism and the vanishing bundle isomorphisms, a discussion about small cosimplicial algebras, and a comparison of different definitions of Borel's regulator.

CRM Monograph Series, Volume 15


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 group. 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 aims 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 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.


AMS/IP Studies in Advanced Mathematics, Volume 24


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 spectral sequence for the cohomology of the boundary of a Shimura variety S 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; and study the spectral sequence for the automorphic vector bundles and the toroidal boundary. They also extend the technique of a theorem of Beilinson's to this setting, and prove that the cohomology of both S and its toroidal boundary.

Contributors include: B. C. Berndt and K. Ono.

Contemporary Mathematics, Volume 291

**Entire Functions in Modern Analysis**

**Boris Levin Memorial Conference**


A *publication of the Bar-Ilan University.*

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.


**Israel Mathematical Conference Proceedings, Volume 15**

January 2002, 392 pages, Softcover, 2000 *Mathematics Subject Classification: 30Dxx* 30Fxx, 30H05, 42A75, Individual member $78, List $130, Institutional member $104, Order code IMCP/15RT203

**Taniguchi Conference on Mathematics Nara 1998**


**A publication of the Mathematical Society of Japan.**

In 1929, Mr. Toyoasaburo 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 of 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 1998, 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, and others.

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


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


**Proceedings on Moonshine and Related Topics**

John McKay, *Concordia University*, Montreal, PQ, Canada, and Abdellah Sebbar, *University of Ottawa*, ON, Canada, Editors

This volume contains the proceedings of the Moonshine workshop held at the Centre de Recherches Mathématiques (CRM) in Montréal. A glance at the contents will reveal that the range of topics presented, namely the Monster simple group and other finite groups, automorphic functions and forms and related congruence groups, and vertex algebras and their representations, is rather broad. However, Moonshine has proved to be a very fertile area, and it does not stretch the imagination to believe that many more threads will be drawn together before we understand what is really going on.

In this volume, all the classical Moonshine themes are presented, namely the Monster simple group and other finite groups, automorphic functions and forms and related congruence groups, and vertex algebras and their representations. These topics appear in either a pure or in a blend of algebraic geometry dealing with algebraic surfaces, Picard-Fuchs equations, and hypergeometric functions.


**CRM Proceedings & Lecture Notes, Volume 30**

Invariant Theory of Finite Groups
Mara D. Neusel, University of Notre Dame, IN, and
Larry Smith, Mathemtatisches Institut, Göttingen,
Germany
The questions that have been at the center of invariant theory since the 19th century have revolved around the following themes: finiteness, computation, 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.

Mathematical Surveys and Monographs, Volume 94

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 $\mathbb{Z}_p$-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 $\{p^{-1/(p-1)} < |x| < 1\}$ 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.

Mémoires de la Société Mathématique de France, Number 84
Popular Texts for Course Adoption

AMS textbooks continue to be a vital tool for classroom instruction. Below is just a sample of the many books that have been adopted for courses at universities nationwide, including University of Washington, Northwestern University, Georgia Tech, Cornell, University of California, Columbia, and many others. To learn more about these and other recommended textbooks available from the AMS, visit the AMS Bookstore at www.ams.org/bookstore.

Partial Differential Equations

Lawrence C. Evans, University of California, Berkeley

The ideas are clearly explained and the principal definitions and theorems are carefully stated. It is entirely possible that the Evans PDE text could eventually become the benchmark. It is a standard treatment with good notation. It is extremely well written, with a very attractive format.

—SIAM Review

Graduate Studies in Mathematics, Volume 19; 1998; ISBN 0-8218-0772-2; 562 pages; Hardcover; All AMS members $60, List $75, Order Code GSM/19CT203

Groups and Symmetry: A Guide to Discovering Mathematics

David W. Farmer, Bucknell University, Lewisburg, PA

Nicely produced and concentrates on the informal analysis of geometrical patterns with the emphasis on informality... could serve as a useful collection of activities to precede a formal course and would provide a range of intuitive experiences to which the more formal treatment could refer.

—The Mathematical Gazette

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

—Zentralblatt für Mathematik

Mathematical World, Volume 5; 1996; ISBN 0-8218-0450-2; 102 pages; Softcover; All AMS members $16, List $20, Order Code MAWRDL/5CT203

Introduction to Probability

Second Revised Edition

Charles M. Grinstead, Swarthmore College, PA, and J. Laurie Snell, Dartmouth College, Hanover, NH

The book is a beautiful introduction to probability theory at the beginning level. The book contains a lot of examples and an easy development of theory without any sacrifice of rigor, keeping the abstraction to a minimal level. It is indeed a valuable addition to the study of probability theory.

—Zentralblatt für Mathematik

1997; ISBN 0-8218-0749-6; 510 pages; Hardcover; All AMS members $41, List $51, Order Code IPROBCT203

How to Teach Mathematics, Second Edition

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

Since the first edition of How to Teach Mathematics the increasing maturity of both traditionalist and reform movements has given Krantz more insights into the teaching of mathematics. The book is intended primarily for the graduate student or novice instructor; however, the book is also valuable for others. Post-secondary instructors... Mathematics department heads... Teaching Development Centers... university administrators. In the appendices twelve other mathematics teachers comment in some way on Krantz's text and give some insight into other approaches to teaching. This book is a must read for instructors preparing their courses for next semester.

—MAA Online

1999; ISBN 0-8218-1398-6; 307 pages; Softcover; All AMS members $20, List $25, Order Code HTM/2CT203

Analysis

Second Edition

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

The essentials of modern analysis... are presented in a rigorous and pedagogical way... readers... are guided to a level where they can read the current literature with understanding... treatment of the subject is as direct as possible.

—Zentralblatt für Mathematik

Lieb and Loss offer a practical presentation of real and functional analysis at the beginning graduate level... could be used as a two-semester introduction to graduate analysis... not all of the topics covered are typical. The authors introduce the subject with a thorough presentation... an informative exposition.

—CHOICE

Graduate Studies in Mathematics, Volume 14; 2001; ISBN 0-8218-2793-9; 346 pages; Hardcover; All AMS members $31, List $39, Order Code GSM/14RCT203

Chaotic Elections! A Mathematician Looks at Voting

Donald G. Saari, University of California, Irvine

Saari has written an original, topical, and enjoyable book combining thoughtful social commentary with interesting and accessible mathematics. Read it and read it soon so that you can expand your mathematical horizons, upgrade your civic awareness, and sparkle at social events.

—MAA Online

2001; ISBN 0-8218-2847-8; 159 pages; Softcover; All AMS members $18, List $23, Order Code ELECTCT203
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2002 subscriptions available now from the American Mathematical Society

MOSCOW MATHEMATICAL JOURNAL

Published by the Independent University of Moscow

Editors: Yulij Ilyashenko and Michael Tsfasman

The AMS is pleased to distribute this new international quarterly published by the Independent University of Moscow. The Moscow Mathematical Journal (MMJ) presents high-quality research and research-expository papers in mathematics from all over the world. Its purpose is to bring together different branches of the science and to achieve the broadest possible outlook on mathematics, which is characteristic of the Moscow mathematical school in general and of the Independent University of Moscow in particular.

An important specific trait of the journal is that it particularly encourages research-expository papers that contain new important results and include detailed introductions. The papers place the achievements in the context of other studies and explain the motivation behind the research. The aim is to make the articles—at least the formulation of the main results and their significance—understandable to a wide mathematical audience rather than to a narrow class of specialists.

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Papers are welcome by email sent to mmj@mccme.ru.

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Assistant professor, tenure-track position. An earned Ph.D. in mathematics, statistics, or a related field is preferred, but other candidates will be considered. Teaching responsibilities will be 12 credit hours per semester, including calculus-based statistics; qualified candidate may also teach an operations research course for undergraduate mathematics and industrial engineering majors. Advising and committee assignments are expected. St. Ambrose is a private diocesan university. Candidates who are student centered, dedicated to excellence in teaching, and sensitive to the mission of a Catholic university are encouraged to apply. Review of applications will begin March 1st and will continue until the position is filled. Send cover letter, resume, and contact information for three professional references to Director of Human Resources, St. Ambrose University, 518 W. Locust St., Davenport, IA 52803. AA/EEO

TULANE UNIVERSITY
Mathematics Department

Computational Algebra or Geometry/Topology

Position Description:
The Mathematics Department invites applications for a regular, tenure-track position to begin in fall 2002. We are interested in applicants whose research interests are in computational algebra or in geometry/topology. The successful candidate will have demonstrated excellence both in teaching and in research, and there is a preference for research beyond the dissertation. The responsibilities of the position include participating in the research life of the department, teaching undergraduate and graduate courses, participating in departmental seminars, and contributing to the department and the university in service.

We also invite applications for two post-doctoral assistant professor positions, also to begin in fall 2002. Each is a two-year, non-tenure-track position carrying a teaching load of two courses per semester. Candidates will be expected to participate in the research life of the department and should have a research interest that is compatible with those represented within the department. More information about the faculty can be found at the department’s home page http://www.math.tulane.edu/.

Candidates for all of these positions should have a Ph.D. in mathematics or a related discipline and should provide evidence of strong research and teaching. Interested applicants should complete an AMS cover sheet and send it along with a CV, a description of their research interests, and a teaching statement to:

Hiring Committee
Department of Mathematics
Tulane University
New Orleans, LA 70118
Phone: +1 504 865-5727
Fax: +1 504 865-5063
e-mail: mmathtulane.edu

Applications will be accepted until the positions are filled. Tulane University is an Affirmative Action/Equal Opportunity Employer that is committed to increasing the diversity of its faculty. We therefore especially encourage applications from underrepresented groups.

More information about Tulane’s Mathematics Department can be found on our website, http://www.math.tulane.edu/.

Suggested uses: for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.
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Direct your students toward one of the applications. Applications are invited for a 3-year, non-tenure-track postdoctoral position starting in August 2002. Preference to applicants within three years of having received the Ph.D. who show strong research promise in one of the areas in which UNL's mathematics faculty is currently active. Excellence in teaching is also expected. Applicants should send a letter of application, a CV, statements addressing the candidate's research and teaching, and three letters of reference to: Postdoctoral Search Committee, Department of Mathematics and Statistics, University of Nebraska-Lincoln, Lincoln, NE 68588-0323. Use of the AMS application cover sheet is encouraged. For more information see the department's website at http://www.math.unl.edu/. The University of Nebraska is committed to a pluralistic campus community through Affirmative Action and Equal Opportunity and is responsive to the needs of dual career couples. We assure reasonable accommodation under the Americans with Disabilities Act. Contact Marilyn Johnson at (402) 472-3731.

The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, a UNESCO-IAEA organisation, located in the Adriatic Riviera in the middle of a larger research complex with 74 resident physicists and 13 resident mathematicians, is seeking to expand its activities in mathematics in the following directions:

- Algebraic and differential geometry; analysis; differential equations; probability theory; mathematical modelling; mathematics of economics; mathematics of computer science.

We are seeking well-qualified scientists active in research with significant publications record. Candidates from developing countries and women candidates are particularly welcome to apply. Outstanding candidates working in related areas are also encouraged to apply.

The ICTP has a worldwide reputation as a research centre that has as its mission the promotion and support of science in the developing world. The scientists we are looking for should therefore share our motivations and work actively for the dissemination of scientific knowledge. They should be prepared to collaborate in running the training activities of the Centre and be ready to assist and work with the scientific visitors. Every year, the Centre receives on the order of 4,000 visitors.

The positions presently available are United Nations professional positions at the P-4 level (two positions) and at the P-3 level (three positions). The net annual salary ranges are as follows:

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A full curriculum vitae to be accompanied by a complete list of publications.
Classified Advertisements

should be provided on UNESCO Form No. 250 which may be obtained from the Abdus Salam International Centre for Theoretical Physics, Personnel Office, Box 586, I-34100 Trieste, Italy; fax: +39 040 2240593; e-mail: staff@ictp.trieste.it, or electronically from the Web (http://www.ictp.trieste.it/). For the junior positions, candidates should arrange for three letters of recommendation to be sent directly to the ICTP Personnel Office at the above address. The closing date for applications is March 31, 2002.

PORTUGAL

CENTRO DE MATEMÁTICA DA UNIVERSIDADE DE COIMBRA - CMUC

Postdoctoral Posts

The Centro de Matemática da Universidade de Coimbra - CMUC (http://www.mat.uc.pt/~cmuc/) invites applications for a limited number of postdoctoral fellowships, tenable for up to 12 months from October 2002.

Applicants should have a research interest in one of the following areas:

- analysis
- algebra
- numerical analysis and optimization
- probability theory and statistics
- geometry/topology
- history of mathematics

Applications consisting of CV, list of publications, research plans, and two letters of recommendation should be sent to:

Director
Centro de Matemática da Universidade de Coimbra
Apartado 3008
3001-454 Coimbra, Portugal

not later than March 31, 2002. The monthly fellowship amount is around 1350 Euros (tax-free).

MARCH 2002

NOTICES OF THE AMS
New from de Gruyter Mathematics

Public-Key Cryptography and Computational Number Theory
Proceedings of the International Conference organized by the Stefan Banach International Mathematical Center, Warsaw, Poland, September 11–15, 2000

K. Alster · J. Urbanowicz · H. C. Williams, editors


This volume contains articles from leading experts in the world on cryptography and computational number theory, providing an account of the state of research in a wide variety of topics related to the conference theme. Topics covered include: Public-Key Cryptography concerned with efficiency and security of DL-cryptosystems, DL-cryptosystems based on elliptic curves, the Jacobian of a hyperelliptic curve, algebraic groups and class groups of imaginary and real quadratic orders, connections between cryptography and error correcting codes, new cryptosystems (NTRU and XTR) and other new ideas in cryptography.

The book will prove invaluable to anyone working in Cryptography (Public-Key Cryptography in particular) and Computational Number Theory.

de Gruyter Series in Logic and Its Applications

Volume 5
Inner Models and Large Cardinals
Martin Zeman


This volume is an introduction to inner model theory, an area of set theory that is concerned with fine structural inner models reflecting large cardinal properties of the set theoretic universe.

The monograph is informally divided into three parts. The first part contains a detailed presentation of general fine structure theory for acceptable $\mathcal{I}$-structures. The second part presents a modern approach to the construction of small core models, namely those containing at most one strong cardinal, together with some of their applications. The third part of the book is devoted to a new approach encompassing large inner models which admit overlapping extenders.

The exposition is self-contained and does not assume any special prerequisites, which should make the text comprehensible not only to specialists, but also to advanced students in mathematical logic and set theory.

Volume 4
Aspects of Complexity
Minicourses in Algorithmics, Complexity, and Computational Algebra, Mathematics Workshop, Kaikoura, January 7–15, 2000

Rod Downey · Denis Hirschfeldt, editors


The book contains 8 detailed expositions of the lectures given at the Kaikoura 2000 Workshop on Computability, Complexity, and Computational Algebra. Topics covered include basic models and questions of complexity theory, the Blum–Shub–Smale model of computation, probability theory applied to algorithmics (randomized algorithms), parametric complexity, Kolmogorov complexity of finite strings, computational group theory, counting problems, and canonical models of ZFC providing a solution to continuum hypothesis. The text addresses students in computer science or mathematics, and professionals in these areas who seek a complete, but gentle introduction to a wide range of techniques, concepts, and research horizons in the area of computational complexity in a broad sense.
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Introductory ordinary member rate applies to the first five consecutive years of ordinary membership. Eligibility begins with the first year of membership in any category other than student and nominee. Dues are $52.

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

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

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

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

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Multi-year membership ....................................................... $ for years

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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

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- Australian Mathematical Society
- Azerbaijani Mathematical Society
- Balkan Society of Geometers
- Berliner Mathematische Gesellschaft
- Calcutta Mathematical Society
- Comedan Mathematical Society
- Croatian Mathematical Society
- Cyprus Mathematical Society
- Danish Mathematical Society
- Deutsche Mathematiker-Vereinigung
- Edinburgh Mathematical Society
- Egyptian Mathematical Society
- European Mathematical Society
- Gesellschaft für Angewandte Mathematik und Mechanik
- Glasgow Mathematical Association
- Hellenic Mathematical Society
- Icelandic Mathematical Society
- Indian Mathematical Society
- Irish Mathematical Society
- Israel Mathematical Union
- János Bolyai Mathematical Society
- The Korean Mathematical Society
- London Mathematical Society
- Malaysian Mathematical Society
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- Mathematical Society of the Republic of China
- Mongolian Mathematical Society
- Nepal Mathematical Society
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- Sociedad Española de Matemática Aplicada
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- Sociedad Uruguaya de Matemática y Estadística
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- Société des Associations de Mathematiciens et Physiciens
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- Society of Mathematicians, Physicists, and Astronomers of Slovenia
- South African Mathematical Society
- Southeast Asian Mathematical Society
- Suomen Matemaattinen Yhdistys
- Svenska Matematikerföreningen
- Ukrainian Mathematical Society
- Union Mathematica Argentina
- Union of Bulgarian Mathematicians
- Union of Czech Mathematicians and Physicists
- Union of Slovak Mathematicians and Physicists
- Union of the Universities of South Asia
- Vijnana Parishad of India
- Wiskundig Genootschap

☐ ☐
Members of the Society

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

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

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

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

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- Complexes of Modules over Exceptional Lie Superalgebras E(3, 8) and E(5, 10), Victor G. Kac and Alexei Rudakov
- Generating Functions for Intersection Numbers on Moduli Spaces of Curves, Andrei Okounkov
- Homotopy Groups of Complements and Nonisolated Singularities, Anatoly Libgober and Mihai Tibar
- Hyperelliptic Curves in Characteristic 2, Jasper Scholten and Huju June Zhu
- Invariant Stein Domains in Stein Symmetric Spaces and a Nonlinear Complex Convexity Theorem, Simon Gindikin and Bernhard Krötz
- Multi-Parameter Deformations of the Module of Symbols of Differential Operators, B. Agerbaou, F. Ammar, P. Lecomte, and V. Ovsienko
- Nonfine Moduli Spaces of Sheaves on K3 Surfaces, Andrei Căldăraru
- Reduction of Structure Group of Principal Bundles over a Projective Manifold with Picard Number One, Indranil Biswas, Tomáš L. Gómez, and Yogesh I. Holla
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International Congress
of Mathematicians
Beijing, China
August 20–28, 2002

Second Announcement

The Organizing Committee is pleased to invite you to attend the International Congress of Mathematicians in Beijing, August 20–28, 2002.

Mr. Jiang Zemin, the President of the People’s Republic of China, has personally expressed a most cordial welcome to all participants.

The Congress will be held under the auspices of the International Mathematical Union and under the sponsorship of the Chinese Mathematical Society (CMS), the Ministry of Education, the Ministry of Science and Technology, Chinese Academy of Sciences and the National Natural Science Foundation of China.

This announcement describes the Congress and gives related information. It explains how to register and how to submit a short communication or a poster representation. It also contains the necessary forms for securing accommodation during the Congress.

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Mathematical traditions in Beijing can be traced back to ancient times. In the development of mathematics in modern China, Beijing has played an increasingly important role. In the early 1930’s, a group of outstanding Chinese mathematicians, including Hua Luo-keng and Chern Shing-Shen, were trained here and stepped on to the international stage of mathematics from here. Today, Beijing is one of China’s main centers for mathematical research and education. Three leading universities (Peking University, Tsinghua University, and Beijing Normal University) and four
research institutes of the Academy of Mathematics and System Sciences of the Chinese Academy of Sciences (Institute of Mathematics, Institute of Applied Mathematics, Institute of Systems Science, and Institute of Computational Mathematics and Scientific/Engineering Computing), as well as the Nankai Institute of Mathematics at Nankai University in the nearby city of Tianjin, conduct mathematics instruction on a broad front and carry out many state-of-the-art research projects in various fields. In recent years, special attention has been paid to attracting and training excellent young mathematicians, and international exchanges have greatly increased. Every year we receive numerous visitors from all over the world.

Beijing is the capital of the People's Republic of China. It is China's political, cultural, educational and research center. With a history of 3000 years, it has been the nation's capital for the last 800 years and thus has much to offer to visitors, such as the Great Wall, the Forbidden City, the Temple of Heaven, the Summer Palace, etc.

A.2 The Congress

The activities of the Congress are divided between two locations. The program of the first day, August 20, 2002, including the opening ceremony, will take place at the Great Hall of the People. As the Great Hall is located in the center of the city, transportation will be provided to delegates staying at the congress-assigned hotels. On all other days, the lectures, seminars and short communications will be held at the Beijing International Convention Center (BICC).

The address of the Congress is:

ICM2002
c/o Prof. Ya-xiang Yuan
Academy of Mathematics and System Sciences
Chinese Academy of Sciences
1A South 4th Street
Zhong Guan Cun, Beijing 100080
People's Republic of China

Phone: +86 10 6256-0649
Fax: +86 10 6261-8223
E-mail: icmsec@beijing.icm2002.org.cn
WWW: http://www.icm2002.org.cn

A.3 Deadlines

April 30, 2002  Early Registration at reduced rate
May 1, 2002  Submission of abstracts for
   • Plenary Lectures
   • Invited Lectures
   • Short Communications
   • Poster Sessions
May 15, 2002  Apartment reservation
June 15, 2002  Hotel reservation
June 15, 2002  Submission of manuscripts of
   • Invited Lectures for the Proceedings
   • Plenary Lectures for the Proceedings
July 15, 2002  Cancellation (with partial refund) of
   • registration

B. Scientific Program

The final program will be available electronically by June 1, 2002.
B.1 Opening and Closing Ceremonies

The opening ceremony will be held in the Great Hall of the People at 15:00 on Tuesday, August 20, 2002. As part of the program, the Fields medals and the Nevanlinna prize will be awarded. The Great Hall of the People seats up to 10000 people and allows a good view from all seats.

After the opening session, there will be addresses on the works of the Fields medalists and the Nevanlinna prize winner.

The closing ceremony, after the last two Plenary Lectures, is scheduled for Wednesday, August 28, at 16:00 in the main lecture hall of BICC.

B.2 Plenary Lectures

At the recommendation of the Program Committee, appointed by the International Mathematical Union (IMU), the Organizing Committee has invited 20 mathematicians to give one-hour Plenary Lectures. The names of the speakers, together with their affiliations and fields of research, are listed below. The Plenary Lectures will inform participants of major developments, problems, and trends in mathematics.

The IMU General Assembly, the Program Committee, and the Organizing Committee have emphasized that these lectures should be comprehensible to a wide spectrum of mathematicians. All plenary speakers have agreed to prepare addresses for a general mathematical audience.

Noga Alon (Tel Aviv Univ., Israel): Discrete Mathematics
Douglas N. Arnold (Univ. of Minnesota, USA): Numerical Analysis, Differential Equations, Mechanics, Computational Relativity
Luis Angel Caffarelli (Univ. of Texas at Austin, USA): Partial Differential Equations
Sun-Yung Alice Chang (Princeton Univ., USA): Geometric Analysis
David Leigh Donoho (Stanford Univ., USA): Statistics
Ludwig D. Faddeev (St. Petersburg Dept, Steklov Math. Inst., Russia): Mathematical Physics
Shafi Goldwasser (MIT, USA and Weizmann, Israel): Computer Science
Uffe Haagerup (Univ. of Southern Denmark, Denmark): Operator Algebras
Michael Jerome Hopkins (MIT, USA): Algebraic Topology
Victor G. Kac (MIT, USA): Algebra and Mathematical Physics
Harry Kesten (Cornell Univ., USA): Probability Theory
Frances Clare Kirwan (Univ. of Oxford, UK): Symplectic Geometry, Algebraic Geometry
Laurent Lafforgue (IHES, France): Arithmetic Algebraic Geometry and Automorphic Representations
David Mumford (Brown Univ., USA): Statistics, Applied Mathematics
Hiraku Nakajima (Kyoto Univ., Japan): Geometry, Representation Theory
Yum-Tong Siu (Harvard Univ., USA): Several Complex Variables, Differential Geometry, Algebraic Geometry
Richard Lawrence Taylor (Harvard Univ., USA): Number Theory
Gang Tian (MIT, USA): Geometry, Nonlinear Analysis

All the addresses will be given in Hall 1, the main lecture hall, of BICC, which has a capacity of 2500 seats. If necessary, the talks will also be shown in an adjoining lecture hall via closed-circuit television, so that another audience of more than 1000 people can be reached.

B.3 Invited Lectures

Also at the recommendation of the IMU Program Committee, 169 mathematicians have been invited to give 45-minute lectures in specified sections. These lectures are intended to be surveys
of significant topics in the respective area of research. The speakers have been asked to make their lectures comprehensible for the general mathematical community, and they agreed to do so.

The Invited Lectures will be given in several large lecture rooms at BICC. Usually there will be about six or seven lectures simultaneously.

The list of sections is as follows, where the number in parentheses indicates the expected number of presentations in that section.

1. Logic (5)
2. Algebra (9)
3. Number Theory (10)
4. Differential Geometry (14)
5. Topology (9)
6. Algebraic and Complex Geometry (8)
7. Lie Groups and Representation Theory (11)
8. Real and Complex Analysis (9)
10. Probability and Statistics (13)
11. Partial Differential Equations (12)
12. Ordinary Differential Equations and Dynamical Systems (11)
13. Mathematical Physics (12)
14. Combinatorics (8)
15. Mathematical Aspects of Computer Science (7)
17. Applications of Mathematics in the Sciences (12)
18. Mathematics Education and Popularization of Mathematics (3)
19. History of Mathematics (3)

In addition, 8 mathematicians have been invited to give talks in two panel discussion sessions of Section 18. Each panel discussion session lasts 90 minutes with 4 invited speakers.

B.4 Short Communications and Posters

All Ordinary Members (see I.1) of the Congress will have the opportunity to present their mathematical work in the form of a Short Communication or a Poster — provided that

- they have registered by May 1 and marked in the registration form, that they want to present their work,
- they have submitted an abstract by that date,
- their contribution has been accepted by the Local Scientific Committee.

Only one Short Communication or Poster (and thus only one abstract) is allowed for each member. Each Short Communication lasts 15 minutes including discussion. Short Communications are grouped into time slots of 45 minutes for three presentations. The rooms for Short Communications are equipped with an overhead projector. Each Poster Session lasts 105 minutes; during that period the authors should stand by their posters and be available for questions and discussion.

Authors presenting a poster are advised to bring the material of the Poster with them when they come to the Congress since no facilities for preparing posters are available on site. The size of the individual poster panels is as follows: width 100 cm, height 245 cm.

The abstract for a Short Communication or a Poster must include the appropriate section number (see B.3) and 2000 MS classification number (see N.) so that the Communications and Posters can be grouped in a coherent way for presentation. Abstracts may be submitted in English,
French, Russian or German. Abstracts of accepted Short Communications and Posters which are properly prepared and received by the deadline will be reproduced and distributed to all Ordinary Members when they pick up their registration package. The Local Scientific Committee will notify authors of acceptance/rejection of their contribution.

Instructions on how to prepare an abstract are in Section D.3. Abstracts which do not conform to the stipulated rules will be returned to the author for resubmission. Late papers will not be accepted. However, it is possible to present them in ad-hoc sessions that will be organized and announced during the Congress.

**B.5 Organized Sessions**

We invite Ordinary Members to organize sessions of Short Communications on their own initiative. Such sessions and their organizers will be included in the final program after a review and consent by the Local Scientific Committee. Ordinary Members who want to organize such a session should contact the Local Scientific Committee at scipcomm@beijing.icm2002.org.cn with their program and their request for time slots within the schedule of Short Communications.

All participants of these organized sessions have to submit an abstract for their Short Communication as indicated in Section D.3.

**B.6 Informal Seminars**

During the Congress it will also be possible to organize informal mathematical seminars on site.

Ordinary Members who wish to organize such spontaneous seminars are asked to make all arrangements among themselves, and to request a room either in advance (scipcomm@beijing.icm2002.org.cn), or during ICM2002 from the congress office. Such seminars may take place during the afternoons. If the congress office is notified before 15:00 the previous day, an announcement of the seminar can be included in the daily newsletter to be distributed to all participants on the following day.

**C. Other Events of Mathematical Interest**

**C.1 Events for the General Public**

A small number of lectures of non-technical nature will be arranged. These lectures are intended for the general public and they will highlight the important ways in which mathematics and mathematical ways of thinking are having an important impact on everyday life. The International Congress provides also other opportunities to inform the general public about some of the recent developments and future challenges of mathematics.

**C.2 Book Exhibitions**

Book, educational media, and computer software exhibits are located in the same building as the Congress, and are open to all Ordinary Members and accompanying persons during the Congress, from 8:00 to 18:00 on August 21 to 24 and 26-28, 2002.

**C.3 Other Mathematical Conferences**

Traditionally there are several smaller conferences scheduled at various places immediately before or after the Congress. On page 400, you can find a list of such satellite conferences (as of December 1, 2001), together with the addresses where further information may be obtained. You may also find further information at the website http://www.icm2002.org.cn. Please do not direct inquiries about these conferences to ICM2002.
D. Publications

The material described in sections D.1–D.4 will be included in the registration package that each Ordinary Member will receive at the registration counter.

D.1 Program

All Ordinary Members (see I.1) will receive copies of the official ICM2002 program. The program will show in detail the dates, times and locations of all Plenary and Invited Lectures. It will also contain a complete listing of all Short Communications and Poster presentations. See the ICM2002 WWW server http://www.icm2002.org.cn, after June 1, 2002.

D.2 List of Participants

A list of all participants who have registered by August 1, 2002 will be distributed to all Ordinary Members. A list of all ICM2002 members, including their mailing addresses, will be kept at the ICM2002 registration counter throughout the Congress. Ordinary Members are asked to check their own listing for accuracy while they are in Beijing, as this list will be used to prepare the official list of participants for inclusion in the Proceedings and to prepare mailing labels for shipment of the Proceedings.

D.3 Abstracts

Abstracts of Plenary and Invited Lectures, Short Communications and Posters will be reproduced and distributed in printed form to all Ordinary Members at the beginning of the Congress. These abstracts will also be available on the internet under the following addresses:

http://www.icm2002.org.cn/D/Abstract.htm (Short Communications and Posters)

Abstracts of Short Communications and Posters should be written in English, French, Russian or German and should have the following form (compare also the enclosed example):

- Section Number (see B.3)
- 2000 Mathematics Subject Classification number (see N.)
- Name and affiliation of author(s)
- Title
- Abstract text (no more than 120 words)
Section: 2
2000 MS Classification: 17, 18, 55

Loday, Jean-Louis, Université de Strasbourg, France:

**Leibniz algebras and their (co)homology.**

A *Leibniz algebra* is a vector space equipped with a product satisfying a variation of the Jacobi identity:

\[ [x, [y, z]] = [[x, y], z] - [[x, z], y]. \]

There is a dual notion in the sense of Koszul duality for operads. For any Leibniz algebra \( g \) there is a (co)homology theory \( HL(g) \), which satisfies various properties including the following: \( HL^*(g) \) is a dual Leibniz algebra.

Applications to non-commutative rational homotopy theory will be presented. Part of these results is joint work with T. Pirashvili.


Abstracts of Plenary Lectures and Invited Lectures should be written in the same way except that they should be written in English and the length of the body text should not exceed 600 words. All abstracts should be submitted electronically via the forms provided by one of the following WWW addresses:


or by e-mail using the subject “ICM2002 abstract” to one of the following e-mail addresses:

- icm2002@fudan.edu.cn (Plenary and Invited Lectures)
- editor@beijing.icm2002.org.cn (Short Communications and Posters)

**T** **e** **X** and html forms supporting electronic submission will be available under the above WWW address.

Submission is also possible by fax or by ordinary mail (preferably with the file in a 3.5-inch diskette) to

**Plenary and Invited Lectures:**

- ICM2002 Abstracts
c/o Prof. Li Ta-tsien
Department of Mathematics
Fudan University
220 Han Dan Road
Shanghai 200433, China
Fax: +86 21 6564-8274

**Short Communications and Posters:**

- ICM2002 Abstracts
c/o Prof. Ding Weiyue
Academy of Mathematics and System Sciences
1A South 4th Street
Zhong Guan Cun, Beijing 100080, China
Fax: +86 10 6261-8233

However, electronic submission at the WWW web server is strongly encouraged.
The deadline for submission of abstracts is May 1, 2002.
D.4 The Beijing Intelligencer

The Chinese Mathematical Society, Springer-Verlag Berlin/Heidelberg and Higher Education Press will together prepare, publish, and present to all participants a magazine called the "Beijing Intelligencer", which is meant to welcome you to Beijing and to the ICM2002, and to guide your visit to Beijing and to some of its manifold aspects and attractions.

D.5 Proceedings

All Plenary and Invited Lectures as well as the congress report will be published in the Proceedings of the International Congress of Mathematicians, Beijing, 2002. These Proceedings will be published by Higher Education Press.

A printed version of the proceedings will be distributed to all Ordinary Members and students of the Congress. There will also be an electronic version published in the International Math Arxiv at the website: http://front.math.ucdavis.edu/ICM2002/ or http://www.cgtp.duke.edu/ICM2002/.

D.6 Daily News

A newsletter containing program changes, announcements of informal seminars and information of general interest to ICM2002 participants will be available each day outside the meeting rooms in the BICC. Participants with announcements for the newsletter should be sure to submit them to the conference office no later than 15:00 the day before.

E. Social Program

E.1 Opening Reception

On August 20, an Opening Reception will be offered to all participants immediately after the Opening Session. The opening reception will be held at the Banquet Hall of the Great Hall of the People. It is free for all participants and registered accompanying persons.

E.2 ICM2002 Party

On the evening of August 27, an ICM2002 Party will take place for all participants and registered accompanying persons. If weather permits, it will be held in the open, on the lawn.

E.3 Beijing Opera

Beijing Opera is a purely Chinese operatic form with a history of over 200 years. It is a combination of singing, dancing, Kongfu, acrobatics, music, arts and literature.

On the evening of August 25, 2002, at 19:30, a show of Beijing Opera will be arranged at Chang'an Theater. The show contains three dramatic selections from the well-appreciated complete plays. For the time being, the three selections are The Crossroads, Stealing Magic Herbs, and Farewell My Concubine (The Death of Yu Ji). Those who are interested may make reservations with the registration form. Transportation will be provided to those staying in the congress-assigned hotels.

E.4 Tourist Program

As the heart of the nation from the height of China's dynastic splendor 600 years ago and home to 24 emperors who ruled China's vast territory, Beijing has been bequeathed with many historical sites of great aesthetic and cultural value. During the Congress, guided local tours will be organized to provide participants and accompanying persons an opportunity to appreciate the splendid culture of the Chinese nation. See Section K.2 for details.
E.5 Footloose Tours

Footloose tours will be offered as informal tours to special museums, parks and shopping streets. The tours are free of charge, except for possible entrance fees. These tours will be announced shortly before the Congress by means of Circular Letters from the ICM2002 e-mail service and posted on the WWW-server of ICM2002 http://www.icm2002.org.cn.

E.6 Activities for Accompanying Persons

Accompanying persons, whether registered or not, are welcome to participate in all activities of the social program. They are invited to take part in the informal Footloose Tours and the formal Local Tours. However, only registered accompanying persons can attend the Opening ceremony and the Opening Reception in the Great Hall of the People, and the ICM2002 Party.

F. Travel

F.1 Passports and Visas

Passports, valid for at least six months from the entry into China, and entry visas are required to visit China. Visas may not be required for visitors from certain countries, and Congress participants are advised to consult the nearest Chinese diplomatic mission for details. A single entry visa is valid for three months, and can be extended for an additional month at the Foreigners Section of the Beijing Public Security Bureau if necessary. Once in China, the Congress participants are advised to carry their passports on them at all times because the passports may be needed to check into hotels, book airline tickets, and change money. To apply for visas, Congress participants should first fill out and send in the registration form with the appropriate registration fee. The Congress Secretariat will then send a formal invitation via airmail with which the Congress participants can apply for a visa at the Chinese diplomatic mission indicated in the invitation. This application should be made preferably at least one month before departure for China to allow time for processing. Alternatively, Congress participants may ask their travel agents to arrange their travel to China and obtain a tourist visa irrespective of whether or not they have registered with the Congress Secretariat.

F.2 Congress Agent

China International Conference Center for Science and Technology (CICCST) has been appointed by the Organizing Committee to handle registration for the Congress, and reservation of accommodation and tours, etc. for the Congress participants. Please send all correspondence related to the scientific program of the Congress to the official congress address as indicated in A2, and that related to registration and reservation of hotels and tours to the CICCST at:

ICM2002 Secretariat
Attn. Mr. Liu Feng
CICCST
86 Xueyuan Nan Road
Beijing 100081, China
Tel: +86 10 6217-4952
Fax: +86 10 6218-0142
Email: icmagent@beijing.icm2002.org.cn

F.3 Arrival in Beijing

Beijing can be reached by air or by train. Capital International Airport is the only airport for civil flights. If you arrive by air, you should better first exchange some Chinese money at the Bank of
China Airport Service in the Terminal Building, so as to be able to pay for taxi and other minor costs. Then you may easily get a taxi at the taxi stand outside the airport terminal. Make sure that the taximeter is turned on and you get a receipt printed from the taximeter. The cost for a taxi from the airport to the Congress venue is roughly 100 yuan or 13 US dollars, including the highway toll fee. There are regular shuttle buses to town, but they do not pass your hotel or the Congress venue. Please be advised that you are not supposed to accept help of taxi service from anyone other than at the taxi stand.

The Organizing Committee will send some staff, with the sign of the Congress logo, to the airport on August 18, 19 and the morning of 20th to meet the arriving Congress participants and to direct them. In case you cannot get their help, the following message, written in Chinese, may help you get to the Beijing International Convention Center:

请送我到亚运村国际会议中心

The meaning of the above Chinese message is “please take me to Beijing International Convention Center in the Asian Games Village”. A sketch map of Beijing and that of the neighborhood of BICC are given in pages 406 and 407 respectively.

If you arrive by train, take the subway train to Anding Men, and then take Bus No. 406 or taxi to Ya Yun Cun (Beijing International Convention Center).

F.4 Local Transportation

Beijing has a perfect public bus network by which you can get almost anywhere, but taxi is the most convenient for foreign visitors.

The Organizing Committee has arranged transportation between the Congress venue and the designated hotels of Category B, C, D (see J.1) and student dormitories (see J.3). Each morning, buses will take you to the venue; in the late afternoon, they will take you back to your hotel.

G. Mail and Messages

G.1 Mail

All mail, telegrams, and faxes for persons attending the Congress should be addressed to:

Name of the Participant  
c/o ICM2002, Prof. Ya-xiang Yuan  
Academy of Mathematics and System Sciences  
Chinese Academy of Sciences  
1A South 4th Street, Zhong Guan Cun  
Beijing 100080, China  
Tel: +86 10 6256-0649  
Fax: +86 10 6261-8223

Incoming items will be posted at the conference office in the BICC.

G.2 Telephone Messages

For urgent messages to a participant, call

+86 10 6256-0649

or send a fax to
To avoid mistakes, only simple messages will be taken and will be put in the respective mailbox. Unless it is a very urgent matter, it will not be possible for our secretarial staff either to check the presence of a specific person or to check whether the message actually reaches the intended person.

Participants can make international telephone calls from their hotel rooms, or at a public telephone booth with a phone card, which is sold at the General Service Counter in the Beijing International Convention Center and in the post office.

G.3 Personal Messages
Participants wishing to exchange personal messages during ICM2002 should stick their message on the Message Board erected in the lobby of BICC.

G.4 Public E-Mail Service
During the congress days public e-mail service will be available to Ordinary Members of ICM2002. For this, a mail server and some client computers are offered in the BICC. Opening hours during the Congress are from 9:00 to 20:00.

H. Miscellaneous Information

H.1 Official Languages
English, French, Russian, and German are the official languages of the Congress. Announcements, correspondence, and all other business matters will be carried out in English.

H.2 Invitation Letter
An Official Invitation Letter will be sent by the Organizing Committee upon request (see the second page of the registration form). This personal invitation is intended only to facilitate participants’ travel and visa arrangements.

H.3 Climate and Clothing
Beijing is located in the temperate zone and enjoys a continental monsoon climate. Late August is still quite hot in the daytime but cool at night, with an average of 24.5 degrees Celsius or 76 degrees Fahrenheit; the high temperature in the day can reach 33 C or 91 F and the low could be 18 C or 65 F. There is not much rain during this time. So travel light to Beijing. A jacket will be sufficient for the cool rainy day, and an umbrella is necessary for both scorching sun and sudden rain if you are going out.

H.4 Electric Current
The electric current is 220 V (50 Hz). The hotels can provide 220v and 110v (shavers only) power outlets. Please note that adapters may be necessary.

H.5 Bank Services
RMB (Renminbi) is the only currency used in China. Money exchanges by cash or traveler’s cheques can be made at the branches of Bank of China at Beijing International Airport, hotels and tourist stores. There is also a bank in the basement of the BICC. Banks usually open at 8:00-9:00 in the morning and close at 17:00 in the afternoon everyday of the week. Conversion services are available for the following foreign currencies: US Dollar, Euro, British Pound Sterling,
Japanese Yen, Hong Kong Dollar, Australian Dollar, Canadian Dollar, Swiss Franc, Singapore Dollar, Danish Krone, Norwegian Krone, Swedish Krone, Malaysian Ringgit and Macau Pataca. But note that not all these currencies are accepted at some small money exchange outlets. In the basement of the BICC, the Congress venue, China Merchant Bank provides money exchange service for US Dollar, Euro, British Pound Sterling, Japanese Yen, Hong Kong Dollar, Australian Dollar, Canadian Dollar, Swiss Franc and Singapore Dollar. The opening hours are 8:30-18:30 every day of the week. In all star-rated hotels, there are also money exchange services.

**H.6 Credit Cards**

Credit cards such as American Express, Diners Club, JCB, Master and Visa are acceptable for payment at hotels or tourist stores. But it is difficult to draw cash with credit cards. It would be best to change money with internationally recognized traveler's checks, or foreign cash.

**H.7 Shopping Hours**

Opening hours are 8:30-21:00 for major department stores, every day of the week.

**H.8 First Aid, Health and Accident Insurances**

The congress fee does not include insurance for the participants against accidents, sickness, or loss of personal property. All participants are strongly advised to make necessary arrangements for short-term health and accident insurance in advance. In any case, the organizers refuse all liability to cover health or accident expenses of participants unless expenses are due to an act of negligence by ICM2002.

During the congress, First Aid will be available in the BICC. In case of emergency, please contact the registration counter, the congress office, or one of the lecture room attendees. In case of illness, you may go to the hospitals or clinics listed below.

- Beijing Union Hospital, Tel. 65296114
- International SOS Assistance, Tel. 64629112, 64629100, 14 Liangma He South Road
- Sino-Japanese Friendship Hospital, Tel. 64221122
- International Medical Center, Tel. 64651561/2/3, S106 Lufthansa Business Center
- AEA International, Tel. 64651384, S103 Lufthansa Business Center
- Hong Kong International Clinic, Tel. 65122288 ext. 2346, 3/F, Swiss Hotel

**I. Registration**

**I.1 Membership**

It has been a long tradition to call any person who has registered for ICM2002 an *Ordinary Member* of the Congress. Registration is required in order to be admitted to the scientific program of the Congress. Ordinary members will receive a registration package including a congress badge, the program, an abstract book, and other material at the registration counter as well as a copy of the Proceedings when published. Furthermore the registration fee includes the Opening Ceremony with the Opening Reception, coffee during coffee breaks, and the ICM2002 Party.

Please do wear your congress badge at all congress activities or whenever you want to be recognized as a congress member; in any case, be prepared to show the badge when asked to do so.

Students not having completed their PhD may register at the reduced student rate by supplying an official student certificate of their university. Student registration also includes the Proceedings volume, thanks to the supports from various ministries of the Chinese government.
1.2 Accompanying Persons

Only registered accompanying persons are entitled to attending the Opening Ceremony, Opening Reception after the Opening Session, the ICM2002 Party, and coffee breaks.

1.3 Registration

There are two possible ways for ICM2002 registration. You may register electronically at the following registration site on line: http://www.icm2002.org.cn/i/Register.htm. Alternatively, you may complete the registration form and return it to the CICCST with the address provided in F.2.

1.4 Registration Fees

<table>
<thead>
<tr>
<th>Registration</th>
<th>until April 30, 2002</th>
<th>after April 30, 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full registration fee</td>
<td>US$ 240,-</td>
<td>US$ 280,-</td>
</tr>
<tr>
<td>Students*</td>
<td>US$ 120,-</td>
<td>US$ 140,-</td>
</tr>
<tr>
<td>Accompanying Persons†</td>
<td>US$ 80,-</td>
<td>US$ 100,-</td>
</tr>
</tbody>
</table>

The full registration or student registration fee includes all the conference materials and the Proceedings of the Congress, the Opening Reception after the Opening Session, and the ICM2002 Party.

* Registration as a student requires an official certificate of the university to be attached.

† Registered accompanying persons are entitled to attend the Opening Session, Opening Reception after the Opening Session, the ICM2002 Party, and coffee breaks.

1.5 Methods of Payment

All fees must be paid in U.S. dollars, by bank transfer, bank draft or credit card. Currency exchange charges or bank service fees are the money sender’s responsibility. If these are not paid or have occurred during money transfer, they will be charged upon registration at the registration desk.

1. By bank transfer: Account No.: 00038018241014, Account Name: CICCST, Bank Name: Bank of China Head Office, 1 Fu Xing Men Nai Da Jie, Beijing 100818, China. A duplicate or photocopy of the remittance order from the bank should be sent with the Registration Form to the Congress Secretariat. The name of the participant as well as details of payment should be clearly marked.

2. By Bank Draft, made payable to CICCST/ICM2002, mail to Mr. Liu Feng, ICM2002, CICCST, 86 Xueyuan Nan Road, Beijing 100081, China.

3. By Credit Card: Fill out the appropriate place in the registration form and sign your name, or, if you register on-line, download a copy of the Payment Authorization Form from http://www.icm2002.org.cn/i/Registration.htm, and fill it out and fax it to Mr. Liu Feng, +86-10-6218 0142, or mail to him at the address given in section F.2.

Note that only American Express, Diners Club, JCB, Master and Visa are acceptable. And, as the payments are calculated in Chinese RMB, the amount charged to your account may vary slightly from the amount billed, due to fluctuations in exchange rates. On-site payment should be made in US dollars in cash or traveler’s checks or credit card.
I.6 Cancellations

All cancellations of registration, hotel reservation, social events and tours booking must be in written form. No refund of registration will be made after July 15, 2002 but substitute delegates are acceptable. For pre- or post-Congress tours, no refund will be made if the cancellation is received five days before the start of the tour. Refunds will be made from September 1, 2002 where applicable.

<table>
<thead>
<tr>
<th>Cancellation Received</th>
<th>Before July 15, 2002</th>
<th>From July 16, 2002</th>
<th>After August 10, 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delegate</td>
<td>US$150 refunded</td>
<td>No Refund</td>
<td>No Refund</td>
</tr>
<tr>
<td>Student</td>
<td>US$ 80 refunded</td>
<td>No Refund</td>
<td>No Refund</td>
</tr>
<tr>
<td>Accompanying Person</td>
<td>US$ 60 refunded</td>
<td>No Refund</td>
<td>No Refund</td>
</tr>
<tr>
<td>Hotel reservation</td>
<td>80% refunded</td>
<td>60% refunded</td>
<td>No Refund</td>
</tr>
<tr>
<td>Local tours, tickets for Social events</td>
<td>80% refunded</td>
<td>60% refunded</td>
<td>No Refund</td>
</tr>
<tr>
<td>Pre/Post Congress tours</td>
<td>90% refunded</td>
<td>60% refunded</td>
<td>see above</td>
</tr>
</tbody>
</table>

I.7 Registration Counter

The registration counter will be set up in the lobby of Beijing International Convention Center and open in the following hours:

- Monday  August 19, 2002  9:00-21:00
- Tuesday August 20, 2002  8:00-21:00
- Wednesday  August 21, 2002  8:00-18:00
- Thursday  August 22, 2002  8:30-18:00
- Friday  August 23, 2002  8:30-18:00
- Saturday  August 24, 2002  8:30-18:00
- Sunday  August 25, 2002  8:30-18:00
- Monday  August 26, 2002  8:30-18:00
- Tuesday  August 27, 2002  8:30-18:00
- Wednesday  August 28, 2002  8:30-12:00

If fees have been forwarded late and therefore not yet been credited to the account of CICCST on the day of arrival, a copy of the remittance order should be presented.

J. Accommodation

The CICCST has blocked as many as possible hotel rooms for intending participants around the Congress venue, BICC. Some of these hotels are only 15 to 20 minutes walk from the BICC. The others are only 20-30 minutes by shuttle bus, which will be provided by the CICCST. All these hotels are air-conditioned. If you wish to make hotel reservation for the Congress via CICCST, please use the registration form or the internet on-line registration. Reservation of rooms will be made in accordance with your first choice, or the second choice if the rooms of your first choice have been booked out. Once the requested reservation has been made, you will receive confirmation via email.

J.1 Hotels

A block of rooms will be reserved for Congress participants and accompanying persons in the hotel categories listed below at special rates for standard two-bed rooms per night. These hotels are all air-conditioned. Please note that hotel confirmations are subject to a deposit of US$100 (which will be deducted from your final hotel bill). Congress participants are requested to use the Registration Form or the on-line registration for the hotel reservation. They are advised to check at
the Congress registration website http:\/\www.icm2002.org.cn whether the rooms of their choice are still available before they make a reservation on-line. Reservation should be made before June 15, 2002. Reservation later than this date may not be guaranteed of a room of your choice.

Category A: US$55-90
Category B: US$45-55
Category C: US$35-45
Category D: US$25-35

A few of the hotels of Category A are located near the Congress venue, such as Beijing Continental Grand Hotel and CATIC Hotel.

J.2 Apartments
A block of apartment rooms will be reserved for Congress participants and accompanying persons. These apartments are located within a 10 minutes walk from the Congress venue. These apartments have two, three or four bedrooms, each with two or three beds. The occupants of the bedrooms will have to share common toilets in the apartment. Every apartment is furnished with basic furniture, a TV set, and a telephone for local calls. These apartments are very suitable for groups of several people. The cost is around US$13-16 per bed per night. In your reservation, indicate how many beds in how many rooms you want to reserve. To reserve the apartments, follow the procedure for the reservation for hotel rooms, but the balance due will be paid to the Congress Secretariat directly. The minimal reservation will be two beds in one room. The deadline for the reservation of apartments is May 15, 2002.

J.3 Student Dormitories
Student dormitories in universities might be available to participants during ICM2002. But no actual information can be obtained until March 1, 2002. Participants interested in reservation is requested to inquire or visit the Congress website for latest information after March 1, 2002.

J.4 Liability
In all cases the organizers of ICM2002 shall only act as an agent and shall not be liable for any losses, accidents, personal injury, or damage to property of any kind and origin whatsoever. The liability of the persons or companies instructed to provide the services shall not be affected. Amendments shall not be valid unless mutually agreed in writing and signed by the two contracting parties. The place of jurisdiction for fully qualified merchants, persons who do not have a general place of jurisdiction in China, and persons who have relocated their place of residence to a foreign country after the conclusion of the agreement shall be Beijing.
K. Social and Tourist Program

Overview

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Price in US$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tuesday August 20, 2002</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening Ceremony in the Great Hall of the People followed by a Opening Reception</td>
<td>15:00-20:30</td>
<td>free of charge*</td>
</tr>
<tr>
<td><strong>Wednesday August 21, 2002</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Great Wall at Juyong Pass and the Ming Tombs</td>
<td>8:30-17:00</td>
<td>38</td>
</tr>
<tr>
<td>The Forbidden City and the Temple of Heaven</td>
<td>8:30-17:00</td>
<td>32</td>
</tr>
<tr>
<td>Museum of Chinese History, the Zoo and the Silk Street</td>
<td>8:30-16:30</td>
<td>24</td>
</tr>
<tr>
<td><strong>Thursday August 22, 2002</strong></td>
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<tr>
<td>The Great Wall at Juyong Pass and the Ming Tombs</td>
<td>8:30-17:00</td>
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<tr>
<td>Summer Palace and the Lama Temple</td>
<td>8:30-16:30</td>
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<tr>
<td>Tiananmen Square, Beihai Park, and the Lane Tour</td>
<td>8:30-16:30</td>
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<tr>
<td><strong>Friday August 23, 2002</strong></td>
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<tr>
<td>The Great Wall at Juyong Pass and the Ming Tombs</td>
<td>8:30-17:00</td>
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<tr>
<td>Museum of Chinese History, the Zoo and the Silk Street</td>
<td>8:30-16:30</td>
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<tr>
<td><strong>Saturday August 24, 2002</strong></td>
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<tr>
<td>The Great Wall at Juyong Pass and the Ming Tombs</td>
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<tr>
<td>The Forbidden City and the Temple of Heaven</td>
<td>8:30-17:00</td>
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<tr>
<td>Tiananmen Square, Beihai Park, and the Lane Tour</td>
<td>8:30-16:30</td>
<td>26</td>
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<tr>
<td><strong>Sunday August 25, 2002</strong></td>
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<tr>
<td>The Forbidden City and the Temple of Heaven</td>
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<tr>
<td>Summer Palace and the Lama Temple</td>
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<tr>
<td>Museum of Chinese History, the Zoo and the Silk Street</td>
<td>8:30-16:30</td>
<td>24</td>
</tr>
<tr>
<td>Beijing Opera</td>
<td>19:30-20:45</td>
<td>10-24</td>
</tr>
<tr>
<td><strong>Monday August 26, 2002</strong></td>
<td></td>
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<tr>
<td>The Great Wall at Juyong Pass and the Ming Tombs</td>
<td>8:30-17:00</td>
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<tr>
<td>The Forbidden City and the Temple of Heaven</td>
<td>8:30-17:00</td>
<td>32</td>
</tr>
<tr>
<td>Tiananmen Square, Beihai Park, and the Lane Tour</td>
<td>8:30-16:30</td>
<td>26</td>
</tr>
<tr>
<td>ICM Party</td>
<td>19:00-21:00</td>
<td>free of charge†</td>
</tr>
<tr>
<td><strong>Tuesday August 27, 2002</strong></td>
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<tr>
<td>The Great Wall at Juyong Pass and the Ming Tombs</td>
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<tr>
<td>Summer Palace and the Lama Temple</td>
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<tr>
<td>Museum of Chinese History, the Zoo and the Silk Street</td>
<td>8:30-16:30</td>
<td>24</td>
</tr>
</tbody>
</table>

All bus tours start in front of the Beijing International Convention Center. Please note that the return times of the bus tours are approximate and depend on traffic conditions. Luncheons are included beverages. The program is subject to change. All tours are provided with English speaking guides.

* Only for participants and registered accompanying persons.
† For un-registered accompanying persons, each ticket costs $20.

K.1 Social Events

Opening Reception
Date: August 20, 2002
Time: 19:00 after the Opening Session
Place: The Great Hall of the People
Transportation: Provided by the CICCST, at 14:00 from the Congress-designated hotels

ICM2002 Party
Date: August 26, 2002
Time: 19:00
Place: The lawn in front of the BICC

Beijing Opera
Date: August 25, 2002
Time: 19:30
Place: Chang'an Theatre
Transportation: Provided by the CICCST. Buses start in front of the BICC.
Ticket Categories: First Category US$ 24, Second Category US$ 16, Third Category US$ 13, Fourth Category US$ 10. If tickets in the desired category are sold out, tickets in another category will be reserved. Following is a description of the three selections of the Opera.

1. The Crossroads: Jiao Zan, a senior officer of the Dong Dynasty, is being exiled under guard to Shamen Island because he has killed a treacherous court official. Marshal Yang orders Ren Tanghui to protect Jia in secret. Ren and Jiao put up for the night at the Crossroad Inn. The inn-keeper Liu Lihua believes that Ren intended to murder Jiao, so he steals into Ren's room and fight with him in the dark. Only when the inn-keeper's wife comes in with a candle do the three realize in the end that all has been the result of misunderstanding.

2. Stealing Magic Herbs: This is an episode of The Romance of the White Snake. On the day of Dragon Boat Festival, Xu Xian advises his wife, Bai Suzhen, for a drink of medicated wine. At her dead drunkenness, Bai shows herself in her true colors - a white snake. At the sight of this, Xu is scared to death. To save her husband, Bai goes to the forbidden mountains to steal magic herbs. There she fights with the guards - crane boys and deer boys, and gets the right herbs she wants.

3. Farewell My Concubine (The Death of Yu Ji): Liu Bang and Xiang Yu have agreed to a truce and drawn a demarcation line at Honggou. Liu's general makes a feign surrender to Xiang and then successfully lures Xiang and his troops into an ambush. Xiang and his troops are surrounded and cannot break through. When his soldiers hear their folk songs sung from the enemy, they take it for granted that their fellow soldiers have given up fighting, and their morale goes down. Xiang realizes that the game is as good as lost and indulges in his drinks in despair. He bids farewell to his lover, Yu Ji, who dances her last before killing herself with a sword.

K.2 Tourist Program
All tours, either local or pre- and post-Congress, are operated by China Travel Service Head Office.
To make reservations, fill out the section of Tours Reservation in the Registration Form.

Local Tours
As the ancient capital of five dynasties - the Liao, Jin, Yuan, Ming and Qing - Beijing boasts numerous relics and beautiful historical monuments such as the Great Wall, the magnificent imperial palace, different religious temples and imperial gardens. The local tours will introduce you to the old and new Beijing. All the local tours are one-day tours and start and end in front of the BICC.

LT-1: The Great Wall at Juyong Pass and the Ming Tombs
During this one-day tour, you will visit a section of the Great Wall at Juyong Pass and one of the Ming Tombs. The Great Wall stretches 6000 kilometers from East to West China, traversing five provinces and two autonomous regions. Built first in 221 B.C. and re-built several times in the following 1500 years, it has become a symbol of the ancient Chinese civilization. After the visit to the Wall and lunch, you will visit an emperor's tomb of the Ming Dynasty (1360-1644). This tomb is a mausoleum of the 13th Ming emperor and is the only one that has been excavated. And, the best part of the tomb area is the Spirit Way - giant stone carvings of human beings, animals and mythical monsters standing guard. US$ 38 per person, lunch included. Tour operated on

<table>
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<tr>
<th>Date</th>
<th>Time</th>
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<tr>
<td>Aug. 21</td>
<td>8:30-17:00</td>
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<td>Aug. 22</td>
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<tr>
<td>Aug. 24</td>
<td>8:30-17:00</td>
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</tbody>
</table>
LT-2: The Forbidden City and the Temple of Heaven
In this one-day tour you will see the imperial palace (officially called the Palace Museum) and the Temple of Heaven. The Forbidden City was constructed in 1406. It was the imperial palace of the Ming and Qing Dynasties from 1420 to 1911. An architectural masterpiece, it was China’s political center for 500 years. It is now converted into a museum with a large imperial collection of porcelain, goldware, bronzeware, jade ware, traditional paintings, and jewelry. After lunch, you will visit the Temple of Heaven. The Temple of Heaven was built 600 years ago. It served as a means of communication between the Emperor and the Heaven. The buildings are a masterpiece of ancient architecture. The focal points are the Hall of Prayer for Good Harvests (a completely wooden structure), the Imperial Vault of Heaven (with a circular Echo Wall with acoustic effects), and the Circular Mound Altar (designed with geometric ingenuity). US$ 32 per person, lunch included. Tour operated on:

Aug. 21 8:30-17:00
Aug. 24 8:30-17:00
Aug. 25 8:30-17:00
Aug. 26 8:30-17:00

LT-3: Summer Palace and the Lama Temple
In the morning, you will visit the Summer Palace, the largest and best preserved imperial garden. It used to be a retreat for emperors to escape the scorching summer heat in Beijing. The garden is so large that it is scarcely enough to see in one day all the halls, towers, pavilions, corridors, walkways and bridges that grace the hill slopes, lake shore and islets. In the afternoon, you will visit the Lama Temple. The temple is the most impressive and an active Buddhist temple in the city. One of the prominent features of the temple is the 23-meter-tall Maitreya Buddha, which was carved out of a whole trunk of white sandalwood tree from Tibet. US$ 26 per person, lunch included. Tour operated on:

Aug. 22 8:30-16:30
Aug. 23 8:30-16:30
Aug. 25 8:30-16:30
Aug. 27 8:30-16:30

LT-4: Tiananmen Square, Beihai Park, and the Lane Tour
In the morning you will visit the Tiananmen Square and Beihai Park. Tiananmen Square is located in the center of the city, to the south of the Forbidden City. It is the largest city square in the world. At the Square there are Mao’s Mausoleum, the Museum of Chinese History and the Great Hall of the People (parliament building). Beihai Park is to the northwest of the Forbidden City. It was built on the basis of a legend and used to be a royal garden. After lunch, you will visit the backyards of Beijing, on a pedicab, across the small zig-zag lanes. US$ 26 per person, lunch included. Tour operated on:

Aug. 22 8:30-16:30
Aug. 24 8:30-16:30
Aug. 26 8:30-16:30

LT-5: Museum of Chinese History, the Zoo and the Silk Street
In the morning you will visit the Museum of Chinese History where you will see various archaeological findings that illustrate the development of the Chinese nation. After lunch, you will visit the Beijing Zoo and see the Giant Panda, an endangered species of animal native to China. Then, you will have a walk around the Silk Alley, a shopping street (market) in the embassy area. US$ 24 per person, lunch included. Tour operated on:

Aug. 21 8:30-16:30
Aug. 23 8:30-16:30
Aug. 25 8:30-16:30
Aug. 27 8:30-16:30

Pre- and Post-Congress Tours
The pre- and post-Congress tours will show you the most beautiful parts of China. Reservation of a pre-Congress tour is subject to the payment of full cost by May 31, 2002, and reservation of a post-Congress tour is subject to a deposit of US$300 by May 31, 2002. Any one these tours
will take place when there are a minimum of ten participants for the tour. If there are insufficient bookings for a tour, full refund will be made for this tour.

The price includes domestic inter-city air or rail transportation, accommodation in three-star hotels or hotels of the same level, regular meals, admission tickets for the sites specified, and local transportation. It does not include airport tax, air-trip accident insurance, overweight of luggage, personal expenses, and tips.

For the detailed itinerary, please visit http://www.icm2002.org.cn.

**PRE-1: Beijing-Yichang-Chongqing-Beijing**
August 14-19, 2002
Twin Occupancy: US$666; Single Supplement (only in Beijing): US$25
This trip features an upstream boat cruise through the Three Gorges along the world's third longest river, the Yangtze River. You will first visit in Yichang the Chinese Sturgeon, an endangered species of fish, and the Gezhou Dam on the Yangtze. Then, you will get on the boat for the three-day cruise. The boat arrives at Chongqing, the capital city of China during the World War II, and you will fly back to Beijing from there.

**PRE-2: Beijing-Urumqi-Turpan-Dunhuang-Xi'an-Beijing**
August 11-19, 2002
Twin Occupancy: US$1099; Single Supplement: US$180
This Silk Road Tour will introduce you to the Northwestern China. You will first fly from Beijing to Urumqi, the capital city of Xinjiang and a scenic spot along the ancient Silk Road. Then you will visit several famous places along the road, like the Old City Between Two Rivers (Jiaohe Gucheng) in Turpan, Mogao Grottoes in Dunhuang, the underground army of Terra Cotta Warriors and Horses in Xian. Coach ride and overnight train ride will be used during the tour.

**PRE-3: Shanghai-Guilin-Xi'an-Beijing**
August 14-19, 2002
Twin Occupancy: US$630; Single Supplement: US$75
This tour is a combination of landscape beauty and archeological grandeur. When you arrive in Shanghai, China's industrial and financial center, you will take a tour to the Bund, and the Yu Garden. Then, you will fly to Guilin to have a half day boat cruise on the Li River and visit some sites of karst landscape and caverns, the most spectacular in China. From Guilin you will fly to Xian, which boats China's best archeological findings, to visit the underground army of Terra Cotta Warriors and Horses and Banpo Museum of remains of a settlement in the Neolithic age. The tour will end in Beijing.

**PRE-4: Kunming-Guilin-Xi'an-Beijing**
August 12-19, 2002
Twin Occupancy: US$640; Single Supplement: US$95
This tour is similar to PRE-3. Instead of Shanghai, you should arrive in Kunming, capital of the southwestern province Yunnan to meet the group. There you will have a day trip to the Stone Forest and Western Hills. The other sites in Guilin and Xian are the same as in PRE-3.

**PT-1: Beijing-Xi'an-Beijing**
August 29-30, 2002
Twin Occupancy: US$335; Single Supplement: US$15
This is a short two-day tour for those who do not have sufficient time to see more of China. During this trip you will visit the underground army of Terra Cotta Warriors and Horses, Banpo Museum of remains of a settlement in the Neolithic age, and the Provincial Museum of History.

**PT-2: Beijing-Xi'an-Guilin**
August 29-September 2, 2002
Twin Occupancy: US$455; Single Supplement: US$66
This tour is similar to the pre-Congress tour PRE-3, but without Shanghai. You will visit the underground army of Terra Cotta Warriors and Horses and Banpo Museum in Xian, and have a boat cruise along the Li River in Guilin. The tour will end in Guilin, and you can fly out to Hong Kong or other Chinese cities by your own arrangement.

**PT-3: Beijing-Xi'an-Chengdu-Kunming**
August 29-September 5, 2002
Twin Occupancy: US$560; Single Supplement: US$95
During this trip, you will first visit the underground army of Terra Cotta Warriors and Horses, Banpo Museum of remains of a settlement in the Neolithic age, and the Provincial Museum of History in Xian. Then you will fly to Chengdu, an important city in Southwestern China, to visit the Panda Research Center and Duijiang Dam, an ancient water conservancy project. In Kunming you will visit the Western Hills and take a day trip tour to the Stone Forest. The tour will end in Kunming, and you can fly out to Hong Kong or other Chinese cities by your own arrangement.

PT-4: Beijing-Xi’an-Chengdu-Lhasa-Beijing
August 29-September 5, 2002
Twin Occupancy: US$1030; Single Supplement: US$130
In this tour, in addition to the sites of Xian and Chengdu as listed in PT-3, you will visit Lhasa, the political and economic center of Tibet for the last 360 years. There you will be shown around to tour the Potala Palace, Drepang Temple and Norbu Linka. High-altitude reaction may be experienced during the tour in this city.

PT-5: Beijing-Chongqing-Yichang-Shanghai
August 29-September 5, 2002
Twin Occupancy: US$740; Single Supplement: US$85
This is a two-day downstream boat cruise through the Three Gorges along the world’s third longest river, the Yangtze. After the cruise, you will visit the Chinese Sturgeon, and the Gezhou Dam on the Yangtze in Yichang. Then you will fly to Shanghai, to tour the Bund, the Jade Buddha Temple and the Yu Garden. The tour will end in Shanghai.

PT-6: Beijing-Nanjing-Suzhou-Hangzhou-Shanghai
August 29-September 4, 2002
Twin Occupancy: US$330; Single Supplement: US$85
This trip will show you the eastern part of China, which is claimed to be the paradise on earth. You will first fly to Nanjing, capital of the Nationalist government before 1949. You will visit the Mausoleum of Dr. Sun Yat-sen, founder of the Republic, and the Yangtze River Bridge. Then you will have a coach ride to Suzhou to tour the typical Chinese-style gardens. Then the coach will drive you to Hangzhou to see the Lingyin Temple and West Lake. The coach tour will end in Shanghai, where you will visit the Bund, the Jade Buddha Temple and the Yu Garden. The tour will end in Shanghai.

L. Satellite Conferences
Listed in the sequence of the date when the proposal was received.

xgao@mmrc.iss.ac.cn; zliu@mmrc.iss.ac.cn. Website: http://www.mathsoftware.org/

chengde@OAinChina.org; hxlin@cartan.uoregon.edu. Website: http://www.OAinChina.org

Differential Geometry and Global Analysis. Tianjin. Aug. 17-18. Contact: 
weiping@sun.nankai.edu.cn

Mathematical Biology. Guilin. Aug. 15-18. Contact: gxnu@public.glptt.gx.cn; 
waiban@mailbox.gxnu.edu.cn. Website: http://math.la.asu.edu/~kuang/guilin.html

gszhao@scu.edu.cn. Website: http://www.scu.edu.cn

Ordinary Differential Equations. Lanzhou (Dunhuang). Aug. 30-Sept. 4. Contact: 
antianqing@21cn.com. Website: http://www.nwnu.edu.cn

cnzong@math.pku.edu.cn
Combinatorics. Shijiazhuang. Aug. 30-Sept. 3. Contact: qdkang@public.sj.he.cn; rendering@public.sj.he.cn. Website: http://math.hebtu.edu.cn


International Colloquium for the History of Mathematics. Xi'an. Aug. 15-18. Contact: hismath@nwu.edu.cn; qaj@sein.sxgb.com.cn

Mathematics Education. Lhasa. Aug. 12-17. Contact: xzsxh@utibet.edu.cn

New Directions in Dynamical Systems. Kyoto. Aug. 5-15. Contact: kokubu@kusm.kyoto-u.ac.jp. Website: http://ndds.math.h.kyoto-u.ac.jp/index.html

Matrix Theory and Its Application. Shanghai. Aug. 14-18. Contact: ejiang@fudan.edu.cn; chyu-k@online.sh.cn


Differential and Functional Differential Equations. Moscow. Aug. 11-17. Contact: k803@mail.ru

Control Theory and Optimization. Xi'an. Aug. 30-Sept. 1. Contact: quanpan@nwpu.edu.cn; tanggp@nwpu.ac.cn. Website: http://www.nwpu.edu.cn/ICM-2002-Xi'an

Algebra. Suzhou. Aug. 29 - Sept. 2. Contact: yysz@suda.edu.cn; zmtang@suda.edu.cn. Website: http://math.suda.edu.cn/icm/ALGEBRAIC/topics.html

Nonlinear Evolution Equations and Dynamical Systems. Huangshan. Aug. 29-Sept. 1. Contact: chengy@ustc.edu.cn

Computational Mathematics and Applications. Dalian. Aug. 30-Sept. 3. Contact: renhong@dlut.edu.cn; mateokl@polymail.hk; iscm02@dlut.edu.cn. Website: http://www.polymail.hk/math; http://www.dlut.edu.cn/dutn/index_pages/iscm02/index.htm

Geometric Function Theory in Several Complex Variables. Hefei. Aug. 30 - Sept. 2. Contact: lts@ustc.edu.cn. Website: http://www.ustc.edu.cn/ICM2002GFT

Nonlinear Partial Differential Equations-Theory and Approximation. Hong Kong. Aug. 29-Sept. 2. Contact: malam@cityu.edu.hk

Number Theory and Arithmetic Geometry. Weihai. Aug. 13-17. Contact: icm2002nt@sdu.edu.cn. Website: http://www.sdu.edu.cn

Nonlinear Partial Differential Equations in Mechanics and Physics. Harbin-Mudanjiang(Jingbo Lake). Aug. 29-Sept. 3. Contact: sxx_zr@hrbnu.edu.cn

Harmonic Analysis and its Applications. Hangzhou. Aug. 14-18. Contact: jchen@mail.hz.zj.cn

Backward Stochastic Differential Equations. Weihai and Beijing. Aug. 29-31. Contact: dice@math.sdu.edu.cn
International Conference on Mathematical Logic. Chongqing. Aug. 29-Sept. 2. Contact: yitang@swmu.edu.cn. Website: http://www.swmu.edu.cn


Geometric Topology. Xi’an. Aug. 12-16. Contact: xl@math.ucr.edu; wangsc@math.pku.edu.cn. Website: http://www.math.uiowa.edu/~wu/gtc/gtc.html

Game Theory and Applications. Qingdao. Aug. 14-17. Contact: gaosai@public.qd.sd.cn; spbuoasis7@peterlink.ru. Website: http://www.mathqdu.org; http://isdrgrus.apmath.spbu.ru

Combinatorics, Graph Theory and Applications. Hong Kong. Aug. 15-17. Contact: mabhchen@ust.hk. Website: http://www.math.ust.hk/conference

Infinite Dimensional Function Theory. Pohang. Aug. 12-16. Contact: mathchoi@euclid.postech.ac.kr

Several Complex Variables and Complex Geometry. Daejeon. Aug. 14-18. Contact: kimkt@postech.edu; kimkt@math.wustl.edu. Website: http://math.postech.ac.kr

International Conference in Algebras and Related Topics. Hong Kong. Aug. 14-17. Contact: KPShum@math.cuhk.edu.hk

Complex Analysis. Shanghai. Aug. 14-17. Contact: anfang@mail.sjtu.edu.cn; wangyf@math03.math.ae.cn

Electronic Information and Communication in Mathematics. Beijing. Aug. 29-31. Contact: icms@math.tsinghua.edu.cn; nsu@math.tsinghua.edu.cn. Website: http://icms.math.tsinghua.edu.cn

The 7th International Conference on Difference Equations and Applications. Changsha, Aug. 11-17. Contact: appimath@mail.hunu.edu.cn. Website: http://www.math.hunu.edu.cn

Algebraic Topology. Suzhou. Aug. 30-Sept. 3. Contact: yuy1@suda.edu.cn. Website: http://math.suda.edu.cn/icm/topology/atc.html

Bifurcation and Chaos. Kunming. Aug. 13-17. Contact: jibinli@hotmail.com; huifang@public.km.yn.en


Abstract and Applied Analysis. Hanoi. Aug. 13-17. Contact: nmchuong@thevinh.ncst.ac.vn; nhdien@thevinh.ncst.ac.vn; huongnga@thevinh.ncst.ac.vn

Stochastic Analysis. Beijing. Aug. 29-Sept. 3. Contact: Wang@uni-bonn.de; dayue@math.pku.edu.cn

Fractal Geometry and Applications. Nanjing. Aug. 30-Sept. 2. Contact: suqiu@netra.nju.edu.cn; wenzy@tsinghua.edu.cn

M. ICM2002 Sponsors

The ICM2002 Organizing Committee has maintained the tradition of setting a relatively low registration fee to attract as many mathematicians as possible. Nevertheless, there will still be many mathematicians for whom participation is economically unaffordable. To help at least some of them to attend, ICM2002 Organizing Committee has, in cooperation with the International Mathematical Union, set up a program to offer financial support for active young mathematicians as well as mature mathematicians from developing countries. Details can be found at the ICM2002 Web Server http://www.icm2002.org.cn. With all this, the registration fee only cannot cover all costs of ICM2002. The various ministries of the Chinese government has rendered strong support without which the success of ICM2002 cannot be guaranteed. The Organizing Committee of ICM2002 are very grateful to the following:

- Ministry of Finance of PRC
- Ministry of Science and Technology of PRC
- Ministry of Education of PRC
- Chinese Academy of Sciences
- National Natural Science Foundation of China
- Beijing Municipal Government
- China Association for Science and Technology

Finally we would like to thank Shanghai Municipal Government, who will sponsor the IMU General Assembly.

The IMU General Assembly will take place in Shanghai, China, on August 17-18, 2002.

N. 2000 Mathematics Subject Classification

00 General
01 History and biography
03 Mathematical logic and foundations
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General algebraic systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra; matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
19 K-theory
20 Group theory and generalizations
22 Topological groups, Lie groups
26 Real functions
28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
O. Organizing Committee

The Organizing Committee was set up in 1998 and has been growing since. At the moment of this writing the following people are involved:

CHAIRMAN
Ma, Zhi-Ming, Inst of Appl Math, AMSS, CAS, Beijing.

MEMBERS
Chang, Kung Ching, Peking University, Beijing;
Chen, Shuping, Zhejiang University, Hangzhou;
Ding, Weiyue, Inst of Math, AMSS, CAS, Beijing;
Feng, Keqin, Tsinghua University, Beijing;
Feng, Qi, Inst of Math, AMSS, CAS, Beijing;
Hou, Zixin, Nankai University, Tianjin;
Jiang, Boju, Peking University, Beijing;
Li, Daqian, Fudan University, Shanghai;
Li, Wenlin, Inst of Math, AMSS, CAS, Beijing;
Lin, Qun, Inst of Comp Math, AMSS, CAS, Beijing;
Lin, Fanghua, University of New York, New York;
Liu, Taiping, Stanford University, San Francisco;
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Ma, Zhi-Ming, Inst of Appl Math, AMSS, CAS, Beijing;
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Wang, Jianpan, Eastern China Normal University, Shanghai;
Wong, Roderick, City University of Hong Kong, Hong Kong;
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Yuan, Ya-xiang, Inst of Comp Math, AMSS, CAS, Beijing;
Zhang, Jiping, Peking University, Beijing;
Zhang, Xiangsun, Inst of Appl Math, AMSS, CAS, Beijing;
Zhou, Qing, Eastern China Normal University, Shanghai.
A Sketch Map of Beijing
REGISTRATION FORM

PERSONAL INFORMATION

Title:  ☐ Prof. ☐ Dr. ☐ Mr. ☐ Mrs. ☐ Ms.

Family Name: _____________________________ First Name and Initial: __________________________

Contact Address: (☐ Office  ☐ Home)
Position and Affiliation: __________________________

Street, Zip-Code and City: __________________________
Country: __________________________

E-mail: __________________________ Fax: __________________________

I hereby accept that my personal data as listed above will be passed to the organizer of the ICM2006, and used for information purposes in the Internet with respect to this congress.

Please mark:  ☐ Yes  ☐ No

Signature: __________________________ Date __________________________

NAME BADGE INFORMATION

Please state how your name/affiliation should be printed on the name badge (as few letters as possible):

Name: __________________________
Affiliation (abbreviated): __________________________
Country: __________________________

SECTIONS POSSIBLY TO ATTEND

<table>
<thead>
<tr>
<th>First Choice</th>
<th>No.</th>
<th>Second Choice</th>
<th>No.</th>
<th>Third Choice</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section Numbers:</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1. Logic</td>
<td>11. Partial Differential Equations</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5. Topology</td>
<td>15. Mathematical Aspects of Computer Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Lie Groups and Representation Theory</td>
<td>17. Applications of Mathematics in the Sciences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PAPER PRESENTATION AND INVITATION

☐ I plan to give a talk in Section ________  ☐ I plan to present a poster in Section ________

I need an invitation letter to facilitate my travel arrangement ☐
REGISTRATION FEES

<table>
<thead>
<tr>
<th>Category</th>
<th>Until April 30 2002</th>
<th>After May 1, 2002</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Member</td>
<td>US$ 240</td>
<td>US$ 280</td>
<td></td>
</tr>
<tr>
<td>Student*</td>
<td>US$ 120</td>
<td>US$ 140</td>
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<tr>
<td>Accompanying Person</td>
<td>US$ 80</td>
<td>US$ 100</td>
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</tr>
</tbody>
</table>

Section Total 1: US$

* Please provide proof of student status from university with the registration form.

HOTEL RESERVATION

Note. The rates are per night and include breakfast and service charge. If you share a room with another delegate, one reservation of a double room will be sufficient.

|----------------------|----------------------|----------------------|----------------------|

Apartment: US$13-16 per bed, minimal reservation is one room.
☐ I will book hotel accommodation by myself.
☐ Please arrange my hotel reservation as indicated below:
  Date of Arrival: ________________ Date of Departure: ________________
  Number of single rooms: __________ Number of double rooms: __________
  How many beds in how many rooms for reservation in apartments: ________________
  I prefer Category __________; alternatively, I would prefer category __________.
  Hotel deposit is US$100 per room __________ rooms = US$ __________.
  Special requests for hotel reservation: __________________________

Section Total 2: US$

SOCIAL EVENTS

August 25, 2002
Beijing Opera 19:30-21:00
  Category 1 24
  Category 2 16
  Category 3 13
  Category 4 10

August 26, 2002
ICM2002 Party 19:00-21:00 20

Section Total 3: US$

LOCAL TOURS

<table>
<thead>
<tr>
<th>Day/Tour</th>
<th>Time/hrs</th>
<th>Price US$</th>
<th>Person(s)</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday August 21, 2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT1 Great Wall &amp; Ming Tombs</td>
<td>08:30-17:30</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT2 Forbidden City &amp; Temple of Heaven</td>
<td>08:30-17:30</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT5 Zoo, Museum &amp; Silk Alley</td>
<td>08:30-17:30</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday August 22, 2002</td>
<td></td>
<td></td>
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<tr>
<td>LT1 Great Wall &amp; Ming Tombs 08:30-17:00 38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT3 Summer Palace &amp; Lama Temple 08:30-17:30 26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT4 Tiananmen Square &amp; Lane Tour 08:30-17:30 26</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Friday August 23, 2002</th>
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<tbody>
<tr>
<td>LT1 Great Wall &amp; Ming Tombs 08:30-17:00 38</td>
</tr>
<tr>
<td>LT3 Summer Palace &amp; Lama Temple 08:30-16:30 26</td>
</tr>
<tr>
<td>LT5 Zoo, Museum &amp; Silk Alley 08:30-17:30 24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Saturday August 24, 2002</th>
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</thead>
<tbody>
<tr>
<td>LT1 Great Wall &amp; Ming Tombs 08:30-17:00 38</td>
</tr>
<tr>
<td>LT2 Forbidden City &amp; Temple of Heaven 08:30-17:30 32</td>
</tr>
<tr>
<td>LT4 Tiananmen Square &amp; Lane Tour 08:30-17:30 26</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Sunday August 25, 2002</th>
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</thead>
<tbody>
<tr>
<td>LT2 Forbidden City &amp; Temple of Heaven 08:30-17:00 32</td>
</tr>
<tr>
<td>LT3 Summer Palace &amp; Lama Temple 08:00-16:30 26</td>
</tr>
<tr>
<td>LT5 Zoo, Museum &amp; Silk Alley 08:30-17:30 24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monday August 26, 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT1 Great Wall &amp; Ming Tombs 08:30-17:00 38</td>
</tr>
<tr>
<td>LT2 Forbidden City &amp; Temple of Heaven 08:30-17:30 32</td>
</tr>
<tr>
<td>LT4 Tiananmen Square &amp; Lane Tour 08:30-17:30 26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tuesday August 27, 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT1 Great Wall &amp; Ming Tombs 08:30-17:00 38</td>
</tr>
<tr>
<td>LT3 Summer Palace &amp; Lama Temple 08:30-16:30 26</td>
</tr>
<tr>
<td>LT5 Zoo, Museum &amp; Silk Alley 08:30-17:30 24</td>
</tr>
</tbody>
</table>

**Section Total 4: US$**

**PRE- AND POST-Congress Tours**

Note: For the pre-Congress tours full cost may be paid. For the post-Congress tours, at least a deposit of US$300 should be paid.

**PRE-1 Beijing-Yichang-Chongqing-Beijing August 14-19, 2002**

**PRE-2 Beijing-Urumqi-Turpan-Dunhuang-Xi'an-Beijing August 11-19, 2002**

**PRE-3 Shanghai-Guilin-Xi'an-Beijing August 14-19, 2002**

**PRE-4 Kunming-Guilin-Xi'an-Beijing August 12-19, 2002**

**PT-1 Beijing-Xi'an-Beijing August 29-30, 2002**

**PT-2 Beijing-Xi'an-Guilin August 29-September 2, 2002**

**PT-3 Beijing-Xi'an-Chengdu-Kunming August 29-September 5, 2002**

**PT-4 Beijing-Xi'an-Chengdu-Lhasa-Beijing August 29-September 5, 2002**

**PT-5 Beijing-Chongqing-Yichang-Shanghai August 29-September 5, 2002**

**PT-6 Beijing-Nanjing-Hangzhou-Shanghai August 29-September 4, 2002**
Tour Route (Code): _______ 
Number of Single Occupancy: ___ _ Number of Double Occupancy: ____ _
Total Cost/Deposit: ____________________

**Section Total 4: US$ ______**

**PASSPORT DATA FOR VISA INVITATION** (Participant and Accompanying Persons)

<table>
<thead>
<tr>
<th>City of Chinese diplomatic mission from which to get visa:</th>
<th>Full Name as in Passport</th>
<th>Nationality</th>
<th>Occupation</th>
<th>Passport Number</th>
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</tbody>
</table>

**PAYMENT**

I wish to pay a total amount of US$ ______________ (sum of section totals) by:

- [ ] Enclosing a bank draft in US dollars made payable to ICM2002/CICCST
- [ ] Bank transfer in US dollars to Banking Department, Bank of China Head Office, 1 Fuxingmen Nei Dajie, Beijing 100818, China, Account Name: CICCST, Account no. 00038018241014
  
  *Please indicate your name and "ICM2002" on all money transfers.*

- [ ] Credit Card
  
  I hereby authorize CICCST to debit the below mentioned credit card account with the total value of the items booked by me on this form.

  - [ ] VISA
  - [ ] Diners Club
  - [ ] MasterCard
  - [ ] American Express
  - [ ] JCB

Card Number

![Card Number] (Fill in your card number)

Expiry Date

![Expiry Date] (Fill in your expiry date)

Name of Card Holder

![Name of Card Holder] (Fill in your name)

Card Holder’s Signature: ________________________

*Note. It may sometimes happen that your bank refuses to pay. In this case, you will be contacted immediately.*
New version of MathSciNet released!

In 2001, the AMS released a new version of MathSciNet to subscribers. New features and enhancements include:

Reference lists
- Full reference lists from original items are now available in MathSciNet. Lists have been added initially from 65 leading math journals, covering material published since January 2000.

Reference citations
- Reference citations are now available in MathSciNet. If an item appears in a MathSciNet reference list, a Reference Citations link is displayed. This link will bring you to a Headline list of those MathSciNet items whose reference lists include the on-screen item.

Database expansion items
- The MR Database has been expanded to include items in the area of Applied Statistics. These database expansion items receive full author identification, journal linking, and original item linking (when available).

Improved search screens
- Modifications have been made to improve the MathSciNet search screens, making them more user-friendly.

See www.ams.org/msnhtml/whats_new.html for additional details.

MathSciNet Facts and Figures as of Fall 2001:

- 71,024 items added; 1,799 journals covered; links to over 186,000 original articles; 10,843 active reviewers; 366,945 authors indexed

MathSciNet Consortia Pricing

The AMS is pleased to offer consortia pricing for MathSciNet, your premier source for searching over 60 years of mathematical literature in the MR Database. The AMS’s goal is to increase MathSciNet access to the mathematical research community. Consortia arrangements can be very valuable for small- and mid-sized institutions that have relatively limited budgets.

As a result of AMS consortia pricing arrangements, there are over 90 Consortia worldwide that now enjoy access to MathSciNet. Participants include over 900 public and private colleges and universities, community colleges, satellite campuses, corporations, and more.

See www.ams.org/bookstore/mathsciprice#consortia for additional information.

Links from MathSciNet to Online Articles

Linking capabilities continue to expand. MathSciNet now provides over 186,000 links from reviews directly to original articles in over 220 journals from commercial, society, and independent publishers.
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.

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: Expired

Invited Addresses
Laszlo Babai, University of Chicago, Combinatorial models and algebraic questions in the theory of computing.
Alan W. Reid, University of Texas at Austin, Hyperbolic manifolds, discrete groups and quadratic forms.
Lihe Wang, University of Iowa, Hölder and $L^p$ estimates for $\Box_b$ operators on CR manifolds of arbitrary codimensions.

Thaleia Zariphopoulou, University of Texas, Austin, Pricing and risk management in incomplete markets.

Special Sessions
Algebraic Combinatorics, Patricia Hersh, University of Michigan, Ann Arbor, and Brian D. Taylor, Wayne State University.
Algebraic Topology, Robert Bruner, Wayne State University, and Igor Kriz, University of Michigan, Ann Arbor.
Biological Applications of Dynamical Systems, J. M. Cushing, University of Arizona, Shandelle M. Henson, Andrews University, and Anna M. Spagnuolo, Oakland University.
Commutative Algebra, Florian Enescu and Anurag K. Singh, University of Utah, and Karen E. Smith, University of Michigan, Ann Arbor.
Differential Geometry, Lizhen Ji, Krishnan Shankar, and Ralf Spatzier, University of Michigan, Ann Arbor.
Hyperbolic Manifolds and Discrete Groups, Richard D. Canary, University of Michigan, Ann Arbor, and Alan W. Reid, University of Texas, Austin.
Integrable Systems and Poisson Geometry, Anthony Bloch, University of Michigan, Philip Foth, University of Arizona, and Michael Gekhtman, University of Notre Dame.
Mapping Class Groups and Geometric Theory of Teichmüller Spaces, Benson Farb, University of Chicago, Nikolai Ivanov, Michigan State University, and Howard Masur, University of Illinois, Chicago.
Moduli Spaces, Angela Gibney, Gavril Farkas, Thomas Nevins, and Gilberto Bini, University of Michigan, Ann Arbor.
Numerical Analysis and Applications of Partial Differential Equations, Joan Remski and Jennifer Zhao, University of Michigan, Dearborn.

Partial Differential Equations, Qing Han, University of Notre Dame, and Lihe Wang, University of Iowa.

Quantum Topology in Dimension Three, Charles Frohman, University of Iowa, and Joanna Kania-Bartoszynska, Boise State University.

Stochastic Modeling in Financial Mathematics, Ronnie Sircar, Princeton University.

Topics in Geometric Function Theory, David A. Herron, University of Cincinnati, Nageswari Shanmugalingam, University of Texas, and Jeremy T. Tyson, SUNY at Stony Brook.

Atlanta, Georgia
Georgia Institute of Technology

March 8–10, 2002

Meeting #975
Meeting held in conjunction with the Mathematical Association of America.

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: Expired

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, Uniqueness implies existence for solutions of boundary value problems for dynamic equations on time scales.

Nigel J. Kalton, University of Missouri, Columbia, Banach space theory, sectorial operators and partial differential equations.

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

Special Sessions
Algebraic Combinatorics, Mihai A. Ciucu, Georgia Institute of Technology.

Automated Reasoning in Mathematics and Logic, Johan G. F. Belinfante, Georgia Institute of Technology.

Banach Spaces and Their Applications, Peter G. Casazza and N. J. Kalton, University of Missouri-Columbia.

Collaborative Learning Classroom Activities, Sabrina A. Hessinger, Armstrong Atlantic State University.

Combinatorics and Graph Theory, John M. Harris, Furman University.

Computation in the Mathematical Sciences, Sabrina A. Hessinger, Armstrong Atlantic State University, and Mark D. Cawood, Clemson University.

Dynamic Equations on Time Scales, Martin J. Bohner, Florida Institute of Technology, and Billur Kaymakcalan, Georgia Southern University.

Elementary Mathematical Modeling, Mary Ellen Davis, Georgia Perimeter College.

Frames, Wavelets, and Operator Theory, Christopher E. Heil and Yang Wang, Georgia Institute of Technology.

Graphs and Matroids, James G. Oxley and Bogdan Oporowski, Louisiana State University, and Robin Thomas, Georgia Institute of Technology.

Harmonic Analysis, Gerd Mockenhaupt and Michael T. Lacey, Georgia Institute of Technology, and Akos Magyar, University of Georgia.


Knot Theory, 3-Manifolds, 4-Manifolds, and Geometric Group Theory, Wolfgang H. Heil, Florida State University, and Jose Carlos Gomez-Larrañaga, CIMAT, Mexico.

Linear Algebra and Matrix Theory, Frank J. Hall and Zhongshan Li, Georgia State University.

Mathematical Models in Biology, Robert D. Fray, Furman University.

Number Theory, David Penniston, Furman University.

Numerical Linear Algebra and Its Applications, Michele Benzi, Emory University, Steven B. Damelin, Georgia Southern University, and James Nagy, Emory University.

Probability and Combinatorics, Russell D. Lyons and Prasad V. Tetali, Georgia Institute of Technology.

Quantum Structures, Alexander G. Wilce, Juniata College, Richard J. Greechie, Louisiana Technical University, and Franklin E. Schroeck, Florida Atlantic University.

Real World Applications of Mathematics, Mark C. Ginn, Appalachian State University.

Research on the Mathematical Education of Undergraduates, Joe Wimbish, Huntington College.

Symplectic and Contact Topology, Margaret Symington, Georgia Institute of Technology, and Gordana Matic, University of Georgia.

Technology and Distance Learning, Tom Morley, Georgia Institute of Technology, and Martha Abel, Georgia Southern University.

Three Bridges from “Applied” to “Mathematics”, Peter Mucha, John A. Pelesko, John E. McCuan, and Guillermo H. Goldsztein, Georgia Institute of Technology.
Montréal, Quebec Canada
Centre de Recherches Mathématiques, Université de Montréal
May 3–5, 2002

Meeting #976
Eastern Section
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: Expired
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.
Nicky 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 François Bergeron and Christophe Reutenauer, Université du Québec à Montréal.
Combinatorial and Geometric Group Theory (Code: AMS SS A1), Olga G. Kharlampovich, McGill University, Alexei Myasnikov and Vladimir Shpilrain, City College, New York, and Daniel Wise, McGill University.
Commutative Algebra and Algebraic Geometry (Code: AMS SS G1), Irena Peeva, Cornell University, and Hema Srinivasan, University of Missouri-Columbia.
Curvature and Topology (Code: AMS SS E1), Regina Rotman, Courant Institute, New York University, 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.

Accommodations
Participants should make their own arrangements directly with a hotel of their choice. The following are suggested for their convenience to the meeting site. The AMS is not responsible for rate changes or for the quality of the accommodations. Rates quoted do not include sales tax of $2/night plus 15%. Reservations should be made as early as possible as Montréal is a popular tourist destination in the spring. All rates quoted are in Canadian dollars (at the time of this printing CDN$1 = US$.63). Participants should state that they are attending a meeting on campus in order to get the best rate possible; rates are not guaranteed.
Terasse Royale Hotel, 5225 Cote-des-Neiges Street, Montréal (Québec), H3T 1Y1; 514-0739-6391, 514-342-2512 (fax); $85/single or $89/ double occupancy. This all-suites hotel (some with kitchenettes) is within walking distance to the meeting; indoor parking is $7/night. See http://www.terrasse-royale.com/.

These hotels are within a 20- to 30-minute ride by metro. The metro/bus fare is CDN$2.25.
Le Richebourg Hotel (Comfort Inn and Suites), 2170 Lincoln Street, Montréal (Québec), H3H 2N5; 800-678-6323, 514-935-9223, 514-935-5049 (fax); rates from $89 to $105/single or double. Suites have kitchens, located downtown, indoor pool, indoor parking is $12/night. See http://www.iber.com/richebourg/index.html.

Hotel Casa Bella, 264 West Sherbrooke Street, Montréal (Québec) H2X 1X9; 888-453-2777 (toll free), 514-849-3650 (fax). Rates range from $48 to $90/single or double, some with shared bath. This small hotel is located downtown. Complimentary continental breakfast is served, and parking is free. See http://www.hotelscabella.com/.

Hotel Versailles Park Plaza (Château Versailles), 1808 West Sherbrooke Street, Montréal (Québec), H3H 1E5; 514-933-3611, 514-933-7102 (fax), 888-933-8111 (toll-free in Canada and the U.S.); $110/single or double; room service available, located downtown. See http://www.versailleshotels.com/.

Renaissance Montréal Hotel, 3625 du Parc Avenue, Montréal (Québec), H2X 3P8 514-288-6666, 514-288-2469 (fax), 800-363-0735; $130/single or double; large hotel with lounge and restaurant, located downtown, accessible from campus by bus #129. See http://www.renaissancehotels.com/.
Food Service
Many eating establishments are located near the campus and within walking distance of the meeting site. A list of restaurants will be available at the registration desk. The university cafeteria will be open all day Friday, May 3, from 8:00 a.m. to 5:00 p.m. but will be closed on Saturday and Sunday, May 4 and 5.

Local Information
For local information please consult the website maintained by the Centre de Recherches Mathématiques (CRM) of the Université de Montréal at http://www.crm.umontreal.ca, the Université de Montréal website at http://www.umontreal.ca, and the Montréal Official Tourist Information website at http://www.tourism-montreal.org.

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
It is difficult to park on the streets surrounding the campus. For $9 on Friday and $7 on Saturday (it's free on Sunday), you may use campus parking lots.

Registration and Meeting Information
The locations of the registration desk and sessions will be announced in the next issue (or watch http://www.ams.org/amsmts/sectional.html for up-to-the-minute information). Registration will take place on site only from noon to 4:30 p.m. on Friday and from 7:30 a.m. to 4:30 p.m. on Saturday.

Fees are US$40 or CDN$63 for AMS or CMS members; US$60 or CDN$94 for nonmembers; and US$5 or CDN$8 for students/unemployed/emeritus, payable by cash, check or credit card. Registration fees paid by credit card will be processed in U.S. funds.

Travel
For U.S. citizens, proof of citizenship (either a valid or expired passport with a picture that accurately represents your appearance or an original birth certificate or a certified copy with photo ID) is required. Driver's license and/or voter registration card is not sufficient.

Montreal is served by one major airport (Dorval). The airport bus is the cheapest way to get downtown (CDN$11.50 from Dorval). We suggest that you get off at Terminus Berri.

From the Terminus Berri to the Université de Montréal campus, you can take a taxi (about CDN$15) or you can take the Metro (subway) for CDN$2.25 per ticket. You get on the Metro at the station Berri-UQAM, within the bus terminus, in the direction of Henri-Bourassa (orange line). At Jean-Talon, the sixth station from Berri-UQAM, you change to Snowdon (blue line). Then you get off at Université de Montréal. Take the moving ramp to the campus.

Car rental: Special rates have been negotiated with Avis Rent A Car for the period April 26 to May 12, 2002, beginning at CDN$33.99/day (about US$21.41) 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: Take the Decarie Expressway (Highway 15); exit at Chemin Queen Mary Road and travel east. After crossing Decelles Street (one street east of Chemin Cote-des-Neiges), enter the Université de Montréal campus. It is difficult to park on the streets surrounding the campus. For the price of $9 per day, you may use campus parking lots (not including special permit area).

Weather
The temperature in May averages between 43° and 61°F. See http://www.usatoday.com/weather/basemaps/canada/nw716270.htm for forecasts.

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: March, 2002
Program first available on AMS website: Not applicable
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For abstracts: March 15, 2002

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.
Meetings & Conferences

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

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

Sergiu 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 PDEs and Applications, Valentin Lychagin, New Jersey Institute of Technology, 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 Prabhatkaro 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 Volcic, University of Trieste.

Classification Theory and Topology of Algebraic Varieties, Fabrizio Catanese, University of Gottingen, 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 Guerrieri, University of L’Aquila, Claudia Polini, University of Oregon, and Bernd Ulrich, Michigan State University.

Commutative Rings and Integer-valued Polynomials, Stefania Gabelli, University of Roma III, and Thomas G. Lucas, University of North Carolina Charlotte.

Complex, Contact and Quaternionic Geometry, David E. Blair, Michigan State University, and Stefano Marchiafava, University of Roma, La Sapienza.

Contemporary Developments in Partial Differential Equations and in the Calculus of Variations, Irene Fonseca, Carnegie Mellon University, and Paolo Marcellini, University of Firenze.

Didattica della Dimostrazione, Ferdinando Arzarello, University of Torino, Guershon Harel, Purdue University, and Vinicio Villani, University of Pisa.

Dynamical Systems, Antonio Giorgilli, University of Milano-Bicocca, Stefano Marmi, Scuola Normale Superiore, Pisa, and John Norman Mather, Princeton University.

Elliptic Partial Differential Equations, Angelo Alvino, University of Napoli, Luis Caffarelli, University of Texas, Giorgio Talenti, University of Firenze, and Vladimir Oliker, Emory University.

Equazioni di Evoluzione Nonlineari, Alberto Tesei, University of Roma, La Sapienza, and Wei-Ming Ni, University of Minnesota, Minneapolis.

Free Boundary Problems, Ricardo Horacio Nochetto, University of Maryland, College Park, and Augusto Visintin, University of Trento.

Geometric Properties of Solutions to PDEs, Donatella Danielli, Purdue University, and Sandro Salsa, Politecnico di Milano.

Harmonic Analysis, Fulvio Ricci, Scuola Normale Superiore, Pisa, and Elias M. Stein, Princeton University.

Higher Dimensional Algebra, John Baez, University of California, Riverside, and Giuseppe Rosolini, University of Genova.

History of Mathematics, Piers Bursill-Hall, Cambridge University, Enrico Giusti, University of Firenze, and James J. Tattersall, Providence College.

Hyperbolic Equations, Sergiu Klainerman, Princeton University, and Sergio Spagnolo, University of Pisa.


Inverse Boundary Problems and Applications, Giovanni Alessandrini, University of Trieste, and Gunther Uhlmann, University of Washington.

Jump Processes in Option Pricing Theory, Claudio Albanese, University of Toronto, and Marco Isopi, University of Bari.

Kolmogorov Equations, Giuseppe Da Prato, Scuola Normale Superiore, Pisa, and Nicolai V. Krylov, University of Minnesota.

Logarithmic De Rham Cohomology and Dwork Cohomology, Alan Adolphson, Oklahoma State University, Stillwater, Francesco Baldassarri, University of Padova, Arthur Ogus, University of California Berkeley, and Steven Sperber, University of Minnesota, Minneapolis.

Mathematical Problems in Soft Matter Modelling, Eugene C. Gartland, Kent State University, and Epifanio Virga, University of Pavia.

Mathematical Problems in Transport Theory, Carlo Cercignani, Politecnico di Milano, and Irene Gamba, University of Texas.

Mathematical Schools: Italy and the United States at the Turn of the Twentieth Century, Umberto Bottazzini, University of Palermo, and Karen Hunger Parshall, University of Virginia.
Meetings & Conferences

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 Rabinoowitz, 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, Vieri Bend, University of Pisa, Haim Brezis, Rutgers University, and Paul Rabinowitz, University of Wisconsin.

Periodic Solutions of Differential and Difference Equations, Martelli, Massimo Furi, University of Firenze, and Mario Umberto Payne, University of Milano.


Poisson Geometry and Integrable Systems, Franco Magri, University of Milan, and Mario Umberto Martelli, Claremont McKenna College.

Optimization and Control, Roberto Triggiani, University of Virginia, and Tullio Zolezzi, University of Genova.

Quantum Cohomology and Moduli Spaces, Angelo Vistoli, University of Bologna, and Aaron Bertram, University of Utah.

Variational Analysis and Applications, Franco Giannessi, University of Pisa, Boris S. Mordukhovich, Wayne State University, Detroit, Biagio Ricceri, University of Catania, and R. Tyrrell Rockafellar, University of Washington.

Viscosity Methods in PDEs and Applications, Piermarco Cannarsa, University of 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.

Meeting Website
The following information is taken from the website for the meeting maintained by UMI. For more details see their website at http://www.dm.unipi.it/%7Emeet2002/english/index.html (English version). All sessions will take place at the Palazzo dei Congressi (Via Matteotti, 1) and the Aule Polo Fibonacci (Via Buonarroti, 2). Sessions begin at 10:00 a.m., Wednesday, June 12, and conclude on Sunday, June 16, with a closing speech at 11:30 a.m.

Abstract Submission
The deadline for submission of all abstracts is March 15. All speakers in Special Sessions should send their abstracts to one of the session organizers. Speakers who would like to be considered for a 10-minute talk in a contributed paper session should send an abstract to sbordone@unina.it with the subject line “contribution”. All abstracts must be sent according to the instructions in the file abstract.tex on the meeting website.

Accommodations
All accommodations are being handled through Touristic Consortium Pisa e. Blocks of rooms have been reserved in two-, three-, and four-star hotels, all of which have private baths, and are easily accessible from the meeting site. Current prices range from about $51/single and $69/double (two stars); $69/single and $92/double (three stars); and $97/single and $142/double (four stars); however, final rates for 2002 were not available at the time of this printing. Rates include breakfast and must be guaranteed with a credit card. Less expensive rooms without private baths are available on request. One night’s lodging will be charged to your credit card if you fail to appear. You should make a preliminary request for the type of room you prefer as soon as possible from the meeting website.

Registration
All registration fees will be collected in Euro (1 Euro=US$.8898 as of this printing). Advance registration fees until March 31 are 100 Euro/AMS or UMI members, and 120 Euro/nonmembers; fees from April 1 through May 31 are 150 Euro/AMS or UMI members, and 170 Euro/nonmembers. On-site fees are 180 Euro/AMS or UMI members, and 200 Euro/nonmembers. Payment in advance is accepted by bank transfer or credit card; please fill out the form on the meeting website. Payment onsite will be accepted in cash (Euro) only.

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Social Events
All participants are invited to these events:

Wednesday, June 12: Welcome cocktail reception hosted by the Mayor of Pisa.
Thursday, June 13: Dinner hosted by the University of Pisa.
Saturday, June 15: Evening concert in the church of Santo Stefano dei Cavalieri sponsored by the Scuola Normale Superiore di Pisa.

In addition, these tours are being offered at special prices; pricing may change depending upon how many people sign up (N.B. There are no scientific sessions on Friday or Sunday afternoons.) Reservations should be made as soon as possible, and no later than April 30.

Thursday, June 13: A day trip to the characteristic towns of Volterra and San Gimignano. Cost will be about $19 to $28. Because this excursion is opposite the scientific program, it is being offered only to those who accompany registered participants.

Friday, June 14: An afternoon excursion to Lungomonte Pisano, a pleasant trip by bus to the medieval town of Vicopisano and her fortress, then driving along the road that skirts the Pisan Hills to the charming baroque Certosa di Calci (16th century charterhouse) where dinner will be served. And if time permits, there will be a visit to a local pottery artisan. Cost will be about $50 to $60.

Sunday, June 16: A guided tour of the lesser known corners of Pisa and its most charming squares, streets, and churches recalling the past glory of Pisa as a Maritime Republic during the Middle Ages. Then a light supper close to the river, so you will not miss the Luminara di San Ranieri: All the buildings facing the river are lit up with candles at dusk. At 11:00 p.m., a truly remarkable fireworks display on the Arno River takes place. Cost will be about $12.

Travel
The closest airport is Galileo Galilei Pisa Airport. Travel by train to Pisa is pleasant and frequent from several cities throughout Italy. Detailed information is available on the meeting website maintained by the UMI.

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: Michel L. Lapidus
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

Joint Invited Addresses
Kenneth A. Ribet, University of California Berkeley, Title to be announced (AMS-MAA Invited Address).

AMS Invited Addresses
Richard W. Montgomery, University of California Santa Cruz, Title to be announced.
Edriss S. Titi, University of California Irvine, Title to be announced.
Michael Wolf, Rice University, Title to be announced.

AMS Special Sessions
Algebraic Geometry and Combinatorics (Code: AMS SS B1), Eric Babson and Rekha Thomas, University of Washington, and Sergey Yuzvinsky, University of Oregon.
Flat Structures, Moduli Spaces, and Minimal Surfaces (Code: AMS SS F1), Matthias Weber, Indiana University, and Michael Wolf, Rice University.
Low Dimensional Homotopy and Combinatorial Group Theory (Code: AMS SS H1), F. Rudolf Beyl and Paul Latiolais, Portland State University, William A. Bogley, Oregon State University, and Micheal N. Dyer, University of Oregon.
Matroid Theory (Code: AMS SS E1), Jennifer M. McNulty, University of Montana, and Nancy Ann Neudauer, Pacific University.
Quantum Topology (Code: AMS SS G1), Douglas G. Bullock, Joanna M. Kania-Bartoszynska, and Uwe Kaiser, Boise State University.
The Quintic Equation: Algebra and Geometry (Code: AMS SS C1), Jerry Shurman, Reed College, and Scott Crass, California State University, Long Beach.

Boston, Massachusetts
Northeastern University
October 5–6, 2002
Meeting #979
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 2002
Program first available on AMS website: August 22, 2002
Program issue of electronic Notices: December 2002
Issue of Abstracts: Volume 23, Issue 4

Deadlines
For organizers: March 6, 2002
For consideration of contributed papers in Special Sessions: June 18, 2002
For abstracts: August 13, 2002

Invited Addresses
Lou P. van den Dries, University of Illinois, Urbana-Champaign, Title to be announced.
Diane Henderson, Pennsylvania State University, Title to be announced.
Christopher K. King, Northeastern University, Title to be announced.
Xiaobo Liu, University of Notre Dame, Title to be announced.

Special Sessions

Meetings & Conferences

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

Issue of electronic Notices: December 2002
Issue of Abstracts: Volume 23, Issue 4

Deadlines
For organizers: March 12, 2002
For consideration of contributed papers in Special Sessions: June 25, 2002
For abstracts: August 20, 2002

Invited Addresses
Lawrence Ein, University of Illinois at Chicago, Title to be announced.
Eleny Ionel, University of Wisconsin, Title to be announced.
Mikhail Safonov, University of Minnesota, Title to be announced.
John Sullivan, University of Illinois, Urbana-Champaign, Title to be announced.

Special Sessions

Arithmetic Algebraic Geometry (Code: AMS SS A1), Ken Ono and Tonghai Yang, University of Wisconsin-Madison.
Arrangements of Hyperplanes (Code: AMS SS E1), Daniel C. Cohen, Louisiana State University, Peter Orlik, University of Wisconsin-Madison, and Anne Shepler, University of California Santa Cruz.

Biological Computation and Learning in Intelligent Systems (Code: AMS SS S1), Shun-ichi Amari, RIKEN, Amir Assadi, University of Wisconsin-Madison, and Tomaso Poggio, Massachusetts Institute of Technology.
Characters and Representations of Finite Groups (Code: AMS SS U1), Martin Isaacs, University of Wisconsin, Madison, and Mark Lewis, Kent State University.
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.

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.
Meetings & Conferences

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

New York, New York
Courant Institute

April 12–13, 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: September 12, 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 abstracts: To be announced

Invited Addresses
Xavier Cabre, Universidad Politècnica de Cataluña, Barcelona, Title to be announced.
Charles Fefferman, Princeton University, Title to be announced.
Michael Hopkins, Massachusetts Institute of Technology, Title to be announced.
Ignacio Sols, Universidad Complutense, Madrid, Title to be announced.
Luis Vega, Universidad del Pais Vasco, Bilbao, Title to be announced.
Efim Zelmanov, Yale University, Title to be announced.

Special Sessions
Banach Spaces of Analytic Functions, Daniel Girela, University of Malaga, and Michael Stessin, SUNY at Albany.
Classical and Harmonic Analysis, Nets Katz, Washington University, Carlos Perez, Universidad de Sevilla, and Ana Vargas, Universidad Autonoma de Madrid.
Computational Methods in Algebra and Analysis, Eduardo Cattani, University of Massachusetts, Amherst, and Francisco Jesus Castro-Jimenez, Universidad de Sevilla.
History of Modern Mathematics—Gauss to Wiles, Jose Ferreiros, Universidad de Sevilla, and David Rowe, Universitat Mainz.
Interpolation Theory, Function Spaces and Applications, Fernando Cobos, University Complutense de Madrid, and Pencho Petrushev, University of South Carolina.
Nonlinear Dispersive Equations, Gustavo Ponce, University of California Santa Barbara, and Luis Vega, Universidad del Pais Vascos.
Variational Problems for Submanifolds, Frank Morgan, Williams College, and Antonio Ros, Universidad de Granada.
Meetings & Conferences

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
Meetings and Conferences of the AMS

Associate Secretaries of the AMS

Western Section: Michel L. Lapidus, Department of Mathematics, University of California, Sproul Hall, Riverside, CA 92521-0135; e-mail: lapidus@math.ucr.edu; telephone: 909-787-3113.

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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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.)

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.
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