

2003 Fulkerson Prize

The 2003 Delbert Ray Fulkerson Prize was presented at the 18th International Symposium on Mathematical Programming, held in Copenhagen, Denmark, August 18–22, 2003.

The prize was awarded to the authors of the following papers.

J. F. GEELLEN, A. M. H. GERARDS, and A. KAPOOR, The excluded minors for $\text{GF}(4)$ -representable matroids, *J. Combin. Theory Ser. B* **79** (2000), 247–299.

Matroid representation theory studies the question of when a matroid is representable by the columns of a matrix over some field. The matroids representable over $\text{GF}(2)$ and $\text{GF}(3)$ were characterized by their excluded minors in the 1950s and the 1970s respectively. Rota then conjectured that the matroids representable over any finite field $\text{GF}(q)$ could be characterized in terms of a finite list of excluded minors.

For more than twenty-five years progress on Rota's conjecture stalled. The proofs for $\text{GF}(2)$ and $\text{GF}(3)$ relied on the uniqueness properties of representations over these fields, properties that do not hold for other fields. Thus the result of Geelen, Gerards, and Kapoor came as a big surprise. The paper of Geelen, Gerards, and Kapoor gives an excluded minor characterization for matroids represented over $\text{GF}(4)$ by working around the non-uniqueness of the representation. It has reawakened interest in the area of matroid representation and brought renewed hope of progress toward the solution of Rota's conjecture.

J. F. Geelen is an associate professor in the Department of Combinatorics and Optimization at the University of Waterloo. A. M. H. Gerards leads the Networks and Logic—Optimization and Programming Theme at the Centrum voor Wiskunde en Informatica (CWI, Center for Mathematics and

Computer Science) in Amsterdam, the Netherlands. A. Kapoor is at Realization Technologies.

BERTRAND GUENIN, A characterization of weakly bipartite graphs, *J. Combin. Theory Ser. B* **83** (2001), 112–168.

A long-standing area of interest in the field of discrete optimization is finding conditions under which a given polyhedron has integer vertices so that integer optimization problems can be solved as linear programs. In the case of a particular set-covering formulation for the maximum cut problem, a graph is called weakly bipartite if the polyhedron has integer vertices for that graph. Guenin's result gives a precise characterization of the graphs that are weakly bipartite in terms of an excluded minor. This solves the graphical case of a famous conjecture about ideal binary clutters made by Seymour in his 1977 Fulkerson Prize-winning paper. Guenin's proof makes ingenious use of a deep theorem of Lehman, itself a Fulkerson Prize winner. Guenin's work has motivated several remarkable subsequent papers.

Bertrand Guenin is an assistant professor in the Department of Combinatorics and Optimization at the University of Waterloo.

SATORU IWATA, LISA FLEISCHER, and SATORU FUJISHIGE, A combinatorial strongly polynomial algorithm for minimizing submodular functions, *J. ACM* **48** (July 2001), 761–777.

ALEXANDER SCHRIJVER, A combinatorial algorithm minimizing submodular functions in strongly polynomial time, *J. Combin. Theory Ser. B* **80** (2000), 346–355.

Submodular functions provide a discrete analog of convex functions, and submodular function minimization arises in such diverse areas as dynamic



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and submodular flows, facility location problems, multiterminal source coding, and graph connectivity problems. The first polynomial-time algorithm for submodular function minimization was given by Grötschel, Lovász, and Schrijver in 1981; however, the algorithm relies on the ellipsoid method, requires advanced knowledge of bounds on the function values, and is not combinatorial. In 1999 the papers of Iwata, Fleischer, and Fujishige, and of Schrijver independently, gave combinatorial, strongly polynomial-time algorithms for this fundamental problem. These results are a significant step in the history of combinatorial, strongly polynomial-time algorithms for discrete optimization problems and can be compared with the Edmonds-Karp algorithm for the maximum flow problem and Tardos's algorithm for the minimum-cost flow problem.

Satoru Iwata is an associate professor of information science and technology in the Department of Mathematical Informatics at the University of Tokyo. Lisa Fleischer is an associate professor of operations research and mathematics at Carnegie Mellon University. Satoru Fujishige is a professor at the Research Institute for Mathematical Sciences at Kyoto University. Alexander Schrijver is the leader of the scientific cluster for Probability, Networks, and Algorithms at CWI in Amsterdam.

About the Prize

The Delbert Ray Fulkerson Prize recognizes outstanding papers in the area of discrete mathematics. Established in 1979, the prize is sponsored jointly by the Mathematical Programming Society (MPS) and the AMS. Up to three awards of \$1,500 each are made every three years at each (triennial) international symposium of the MPS. The prize is made possible by a memorial fund established by friends of the late Delbert Ray Fulkerson to encourage mathematical excellence in the fields of research in which he worked.

The prize is presented for papers published during the six calendar years preceding the year in which the prize is given. The prize is given for single papers, not series of papers or books, and in the event of joint authorship the prize is divided. The topics of papers considered for the prize include graph theory, networks, mathematical programming, applied combinatorics, and related subjects.

The selection committee for the 2003 Fulkerson Prize consisted of Gérard Cornuéjols, Andrew Odlyzko, and David P. Williamson (chair).

—Allyn Jackson

Mathematics People

Bethuel Receives Mergier-Bourdeix Prize

The Académie des Sciences de Paris has awarded the Prix Mergier-Bourdeix of 45,750 euros (about US\$51,000) to FABRICE BETHUEL, professor at the Université Pierre et Marie Curie, for his fundamental discoveries at the interface between analysis, topology, geometry, and physics. His research concerns the study of nonlinear partial differential equations arising in physics, particularly in the theory of liquid crystals and superconductors.

His work on Sobolev maps between manifolds has paved the way for a field that has been in full swing over the past ten years. The new techniques he has introduced are widely used in the analysis of singularities of harmonic maps between manifolds. Bethuel and his collaborators have made spectacular advances on the equation introduced in the 1950s by the physicists Landau and Ginzburg. In turn, the mathematical progress has led to a better understanding of the phenomenon of quantized vorticity observed in superconductors. Fabrice Bethuel is a mathematician who combines a genuine interest in physics with a deep geometric intuition and tremendous skill when confronted with complex computations.

—*Académie des Sciences de Paris*

Schramm Awarded 2003 Loève Prize

The 2003 Line and Michel Loève International Prize in Probability is awarded to ODED SCHRAMM of Microsoft Research. The prize, which carries a monetary award of \$30,000, will be presented at a ceremony in Berkeley on October 20, 2003.

Oded Schramm received his Ph.D. in 1990 under William Thurston at Princeton University, and his early research

included deep results in circle packings. His research in probability was sparked by his interest in the conjecture that the limit of two-dimensional critical percolation was conformally invariant.

In trying to understand this limit as well as limits of other models such as the loop-erased walk, Schramm combined classical results in complex variables of C. Loewner with probability theory to invent the process now called the Schramm-Loewner evolution (SLE). This process has proved to be a critical ingredient for understanding conformally invariant limits of planar systems. In collaboration with G. Lawler and W. Werner, Schramm has used SLE to solve a number of open problems, in particular Mandelbrot's conjecture that the outer boundary of planar Brownian motion has dimension $4/3$ and the determination of the scaling limit of loop-erased work. Schramm also showed that if the scaling limit of percolation was conformally invariant, then the boundaries between clusters would be given by SLE. That this is true for site percolation on the triangular lattice has been proved by S. Smirnov.

The prize commemorates Michel Loève, who was a professor at the University of California, Berkeley, from 1948 until his untimely death in 1979. The prize was established by his widow, Line Loève, shortly before her death in 1992. Awarded every two years, it is intended to recognize outstanding contributions by researchers in probability who are under forty-five years old.

—*David Aldous, University of California, Berkeley*

2003 Dirac Medals Awarded

The 2003 Dirac Medals of the Abdus Salam International Centre for Theoretical Physics (ICTP) have been awarded to ROBERT H. KRAICHNAN (Exa Corporation, Lexington, Massachusetts), and VLADIMIR E. ZAKHAROV (Landau Institute for Theoretical Physics, Moscow, Russian Federation) for their contributions to the theory of turbulence, particularly the exact results and the prediction of inverse cascades, and

for identifying classes of turbulence problems for which in-depth understanding has been achieved.

The award citation reads: "Kraichnan's most profound contribution has been his pioneering work on field theoretic approaches to turbulence and other nonequilibrium systems; one of his profound physical ideas is that of the inverse cascade for two-dimensional turbulence. Zakharov's achievements have consisted of putting the theory of wave turbulence on a firm mathematical ground by finding turbulence spectra as exact solutions and solving the stability problem, and in introducing the notion of inverse and dual cascades in wave turbulence."

The ICTP awarded its first Dirac Medal in 1985. Given in honor of P. A. M. Dirac, the medal is awarded annually on Dirac's birthday, August 8, to an individual who has made significant contributions to theoretical physics and mathematics. The medalists also receive a prize of US\$5,000. An international committee of distinguished scientists selects the winners from a list of nominated candidates. The Dirac Medal is not awarded to Nobel laureates or Wolf Foundation Prize winners.

—From an ICTP announcement

Carleson Awarded Sylvester Medal

The Sylvester Medal of the Royal Society for 2003 has been awarded to LENNART CARLESON of the Royal Institute of Technology in Stockholm for his deep and fundamental contributions to mathematics in the field of analysis and complex dynamics, particularly his proof of the convergence almost everywhere of the Fourier series of square integrable and continuous functions.

The medal is named after James Joseph Sylvester (1814–1897), who was Savilian Professor of Geometry at Oxford University in the 1880s. It is awarded every three years.

—From a Royal Society announcement

Prix Alfred Verdaguer Awarded

The Institut de France has awarded the Prix Alfred Verdaguer for 2003 to VLADIMIR MAŽYA and TATYANA SHAPOSHNIKOVA, both of Linköping University, for their book *Jacques Hadamard: A Universal Mathematician* (AMS, 1998). The prize citation calls the work "an historical book about a great citizen and a scientific book about a great mathematician."

—From an Institut de France announcement

ICIAM Prizes Awarded

Several prizes were awarded at the International Congress on Industrial and Applied Mathematics (ICIAM) held in July 2003 in Sydney, Australia.

The Pioneer Prize was awarded to STANLEY OSHER of the University of California, Los Angeles, for his contributions to applied mathematics and computational science, particularly for his work in shock-capturing schemes, PDE-based image processing, and the level-set method. The prize recognizes pioneering work in using applied mathematical methods and scientific computing techniques in industrial problems or in new scientific fields of applications.

The Maxwell Prize was awarded to MARTIN D. KRUSKAL of Rutgers University for his discovery of the particle-like behavior of solitary waves (solitons), for introducing the inverse scattering transform method for solving the KDV equation, and for many other contributions to applied mathematics. The prize recognizes a mathematician who demonstrates originality in applied mathematics.

The Collatz Prize was awarded to WEINAN E of Princeton University for his work in diverse areas of applied mathematics, ranging from fluid dynamics to condensed matter physics. The prize recognizes individual scientists under the age of forty-two for outstanding work on industrial and applied mathematics.

The Lagrange Prize was given to ENRICO MAGENES of the University of Pavia for his contributions to the development of applied mathematics, including his work in setting the foundation for a modern treatment of partial differential equations and on free boundary problems using variational inequalities and the applications of these methods to flow through porous media and to phase transition. The award recognizes mathematicians who have made exceptional contributions to applied mathematics throughout their careers.

—From a SIAM announcement

Hairer and Wanner Receive Henrici Prize

The Peter Henrici Prize for 2003 has been awarded to ERNST HAIRER and GERHARD WANNER, both of the University of Geneva. The citation praises them as "driving forces in the development and the analysis of numerical methods for ordinary differential equations and geometric integration."

The Henrici Prize is awarded jointly by the Society for Industrial and Applied Mathematics (SIAM) and the Eidgenössische Technische Hochschule-Zürich (ETHZ) for original contributions to applied analysis and/or for exposition appropriate for applied mathematics and scientific computing. It is awarded every four years.

—From a SIAM announcement

SIAM Prizes Awarded

The Society for Industrial and Applied Mathematics (SIAM) awarded several prizes at its annual meeting in Montreal, Canada, in June 2003.

HAROLD J. KUSHNER of Brown University received the W. T. and Idalia Reid Prize. This prize is given for research

in or other contributions to the areas of differential equations and control theory. It carries a cash award of \$10,000.

GRAEME W. MILTON of the University of Utah received the Ralph E. Kleinman Prize. This prize is awarded to an individual for outstanding research or other contributions that bridge the gap between mathematics and applications. The prize carries a cash award of approximately \$5,000.

SEBASTIAN REICH of Imperial College, London, was awarded the Germund Dahlquist Prize, which recognizes a young scientist (normally under forty-five) for original contributions to fields associated with Germund Dahlquist, especially the numerical solution of differential equations and numerical methods for scientific computing. The cash amount of the award is approximately \$1,000.

LINDA R. PETZOLD of the University of California, Santa Barbara, received the first AWM-SIAM Sonia Kovalevsky Lectureship, which was created to highlight significant contributions by women to applied or computational mathematics.

HEINZ-OTTO KREISS of the University of California, Los Angeles, received the John von Neumann Lectureship, which carries a cash award of \$2,500.

GILBERT STRANG of the Massachusetts Institute of Technology was given the SIAM Prize for Distinguished Service to the Profession.

Three SIAM Outstanding Paper Prizes were awarded. This award recognizes outstanding papers that were published in SIAM journals. The awardees were: JOHAN HASTAD, RUSSELL IMPAGLIAZZO, LEONID A. LEVIN, and MICHAEL LUBY for their joint article "A pseudorandom generator from any one-way function", *SIAM Journal on Computing*, vol. 28, 1999; DAVID D. YAO, SHUZHONG ZHANG, and XUN YU ZHOU for their joint article "Stochastic linear-quadratic control via semi-definite programming", *SIAM Journal on Control and Optimization*, vol. 40, 2001; and STEFAN HENN and KRISTIAN WITSCH for their joint article "Iterative multigrid regularization techniques for image matching", *SIAM Journal on Scientific Computing*, vol. 23, 2001. Each recipient receives a cash award of \$500.

—From a SIAM announcement

MAA Writing Awards Presented

The Mathematical Association of America (MAA) presented several awards for excellence in expository writing at its Summer Mathfest in Boulder, Colorado, in July and August 2003.

The Carl B. Allendoerfer Awards are given for articles published in *Mathematics Magazine* and carry a cash award of \$500. The 2003 awards were given to EZRA BROWN, Virginia Polytechnic Institute and State University, for his article "The many names of (7,3,1)", *Mathematics Magazine*, vol. 75, 2002; and to DAN KALMAN, American University, for his article "Doubly recursive multivariate automatic differentiation", *Mathematics Magazine*, vol. 75, 2002.

The Trevor Evans Award is given to authors of expository articles that are accessible to undergraduates and

that were published in *Math Horizons*. This prize carries a cash award of \$250. Two awards were given for 2003. LAURA TAALMAN, James Madison University, and EUGÉNIE HUNSICKER, Lawrence University, were chosen for their joint article "Simplicity is not simple", *Math Horizons*, September 2002. PHILIP D. STRAFFIN JR., Beloit College, was honored for his article "The instability of democratic decisions", *Math Horizons*, April 2002.

The Lester R. Ford Award honors articles published in *The American Mathematical Monthly* and carries a cash prize of \$500. Five awards were made for 2003. LEONARD GILLMAN of Austin, Texas, was honored for his article "Two classical surprises concerning the axiom of choice and the continuum hypothesis", *American Mathematical Monthly*, vol. 109, 2002. WARREN P. JOHNSON, Bates College, was selected for his article "The curious history of Faà di Bruno's formula", *American Mathematical Monthly*, vol. 109, 2002. SAM NORTHSHIELD, State University of New York, College at Plattsburgh, was chosen for his article "Associativity of the secant method", *American Mathematical Monthly*, vol. 109, 2002. ELEANOR ROBSON, Oxford University, won for her article "Words and pictures: New light on Plimpton 322", *American Mathematical Monthly*, vol. 109, 2002. SERGIO B. VOLCHAN, Pontificia Universidad Católica, was honored for his article "What is a random sequence?", *American Mathematical Monthly*, vol. 109, 2002.

The George Pólya Award is given for articles published in *The College Mathematics Journal* and has a cash prize of \$500. Two awards were given in 2003. DAVID L. FINN, Rose-Hulman Institute of Technology, was honored for his article "Can a bicycle create a unicycle track?", *College Mathematics Journal*, vol. 33, 2002. DAN KALMAN, American University, was selected for his article "An undetermined linear system for GPS", *College Mathematics Journal*, vol. 33, 2002.

—From an MAA announcement

B. H. Neumann Awards Given

The B. H. Neumann Awards for 2003 have been awarded by the Board of the Australian Mathematics Trust to EDWARD R. BRENNAN, Wavell High School, Brisbane, Australia; MICHAEL DEAKIN, Monash University; and LORRAINE MOTTESHEAD, Mathematics Challenge for Young Australians. The awards, named for Bernhard H. Neumann, are presented each year to mathematicians who have made important contributions over many years to the enrichment of mathematics learning in Australia and its region.

—Board of the Australian Mathematics Trust

ONR Young Investigators Awards Announced

The Office of Naval Research (ONR) has announced the awarding of twenty-six grants in the 2003 ONR Young



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Mathematics People

Investigators Program competition. Two individuals in the mathematical sciences received awards. They are FRANCESCO BULLO of the University of Illinois, Urbana-Champaign, and J. COLE SMITH of the University of Arizona.

Bullo will do research on distributed and adaptive coordination algorithms for mobile sensing networks. Smith's research will focus on optimization methods for routing problems on networks with stochastic failures.

The Young Investigator Program supports basic research by exceptional faculty at U.S. universities who have received Ph.D.'s or equivalent degrees within the preceding five years. Grants to their institutions provide up to \$100,000 per year for three years. The funds may be applied to a variety of research costs, including salary, graduate student support, laboratory supplies, and operating costs. Young Investigators are selected on the basis of prior professional achievement, the submission of a meritorious research proposal, and evidence of strong support by their respective universities. The program supports outstanding research in a wide range of science and engineering fields that are critical to the evolution of a first-rate Navy and Marine Corps.

—From an ONR announcement