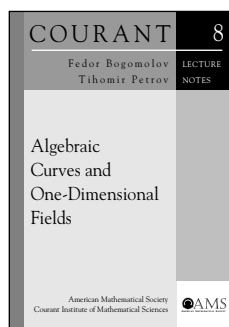


New Publications Offered by the AMS

Algebra and Algebraic Geometry

Recommended Text

Independent Study



Algebraic Curves and One-Dimensional Fields

Fedor Bogomolov and Tihomir Petrov, *New York University–Courant Institute of Mathematical Sciences, NY*

Algebraic curves have many special properties that make their study particularly rewarding. As a result,

curves provide a natural introduction to algebraic geometry. In this book, the authors also bring out aspects of curves that are unique to them and emphasize connections with algebra.

This text covers the essential topics in the geometry of algebraic curves, such as line bundles and vector bundles, the Riemann-Roch Theorem, divisors, coherent sheaves, and zeroth and first cohomology groups. The authors make a point of using concrete examples and explicit methods to ensure that the style is clear and understandable.

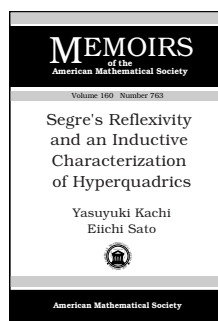
Several chapters develop the connections between the geometry of algebraic curves and the algebra of one-dimensional fields. This is an interesting topic that is rarely found in introductory texts on algebraic geometry.

This book makes an excellent text for a first course for graduate students.

Contents: Algebraic Preliminaries; From algebra to geometry; Geometry of dimension one; Divisors and line bundles; Vector bundles, coherent sheaves, and cohomology; Vector bundles on \mathbb{P}^1 ; General theory of curves; Elliptic curves; The Riemann-Roch theorem; Curves over arithmetic fields; Bibliography; Index.

Courant Lecture Notes, Volume 8

November 2002, 214 pages, Softcover, ISBN 0-8218-2862-2, LC 2002028230, 2000 *Mathematics Subject Classification*: 13J10, 13A18, 13B22, 14H05, 14H52, 14H60, 14F05, 14C40, 32L10, **All AMS members \$22**, List \$27, Order code CLN/8N



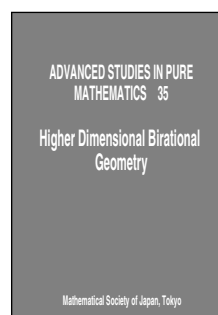
Segre's Reflexivity and an Inductive Characterization of Hyperquadrics

Yasuyuki Kachi, *University of Tennessee, Knoxville*, and **Eiichi Sato**, *Kyushu University, Fukuoka, Japan*

Contents: Introduction; The universal pseudo-quotient for a family of subvarieties; Normal bundles of quadrics in X ; Morphisms from quadrics to Grassmannians; Pointwise uniform vector bundles on non-singular quadrics; Theory of extensions of families over Hilbert schemes; Existence of algebraic quotient—proof of Theorem 0.3; Appendix. Deformations of vector bundles on infinitesimally rigid projective varieties with null global i -forms; References.

Memoirs of the American Mathematical Society, Volume 160, Number 763

November 2002, 116 pages, Softcover, ISBN 0-8218-3225-5, LC 2002074589, 2000 *Mathematics Subject Classification*: 14E30, 14E05, 14J35, **Individual member \$30**, List \$50, Institutional member \$40, Order code MEMO/160/763N



Higher Dimensional Birational Geometry

Shigefumi Mori, *Kyoto University, Japan*, and **Yoichi Miyaoka**, *University of Tokyo, Japan*, Editors

A publication of the Mathematical Society of Japan.

This volume contains four papers written by participants of the international conference on Higher Dimensional Algebraic Varieties held at the Research Institute of Mathematical Sciences (RIMS) at Kyoto University (Japan). Rather than an ordinary proceedings of the conference, the editors have compiled a selection of independent, full expositions on topics of fundamental importance in algebraic geometry: moduli spaces of abelian

surfaces, rational curves on algebraic varieties, 3-dimensional flips, and the theory of elliptic fibrations.

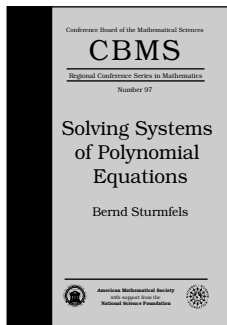
The authors—including a Fields medalist and the founder of fundamental results in algebraic geometry—discuss the topics fully, giving complete proofs of new results, technical preparations, and an historical overview. The book is suitable for graduate students and research mathematicians interested in algebraic geometry.

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

Contents: K. Cho, Y. Miyaoka, and N. I. Shepherd-Barron, Characterizations of projective space and applications to complex symplectic manifolds; K. Hulek and G. K. Sankaran, The geometry of Siegel modular varieties; S. Mori, On semi-stable extremal neighborhoods; N. Nakayama, Local structure of an elliptic fibration.

Advanced Studies in Pure Mathematics, Volume 35

October 2002, 295 pages, Hardcover, ISBN 4-931469-19-1, 2000 *Mathematics Subject Classification*: 14-06; 14Dxx, 14Exx, 14Jxx, 14Kxx, **All AMS members \$64**, List \$80, Order code ASPM/35N



Solving Systems of Polynomial Equations

Bernd Sturmfels, *University of California, Berkeley*

A classic problem in mathematics is solving systems of polynomial equations in several unknowns. Today, polynomial models are ubiquitous and widely used across the sciences. They

arise in robotics, coding theory, optimization, mathematical biology, computer vision, game theory, statistics, and numerous other areas.

This book furnishes a bridge across mathematical disciplines and exposes many facets of systems of polynomial equations. It covers a wide spectrum of mathematical techniques and algorithms, both symbolic and numerical.

The set of solutions to a system of polynomial equations is an algebraic variety—the basic object of algebraic geometry. The algorithmic study of algebraic varieties is the central theme of computational algebraic geometry. Exciting recent developments in computer software for geometric calculations have revolutionized the field. Formerly inaccessible problems are now tractable, providing fertile ground for experimentation and conjecture.

The first half of the book gives a snapshot of the state of the art of the topic. Familiar themes are covered in the first five chapters, including polynomials in one variable, Gröbner bases of zero-dimensional ideals, Newton polytopes and Bernstein's Theorem, multidimensional resultants, and primary decomposition.

The second half of the book explores polynomial equations from a variety of novel and unexpected angles. It introduces interdisciplinary connections, discusses highlights of current research, and outlines possible future algorithms. Topics include computation of Nash equilibria in game theory, semi-

definite programming and the real Nullstellensatz, the algebraic geometry of statistical models, the piecewise-linear geometry of valuations and amoebas, and the Ehrenpreis-Palamodov theorem on linear partial differential equations with constant coefficients.

Throughout the text, there are many hands-on examples and exercises, including short but complete sessions in Maple®, MATLAB®, Macaulay 2, Singular, PHCpack, CoCoA, and SOSTools. These examples will be particularly useful for readers with no background in algebraic geometry or commutative algebra. Within minutes, readers can learn how to type in polynomial equations and actually see some meaningful results on their computer screens.

Prerequisites include basic abstract and computational algebra. The book is designed as a text for a graduate course in computational algebra.

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

© Waterloo Maple, Inc., Ontario, Canada.

© MATLAB, The MathWorks, Inc., Natick, MA.

Singular is a free software distributed under the GNU license. ©Department of Mathematics, and Centre for Computer Algebra, University of Kaiserslautern, Germany.

Macaulay 2, © Daniel R. Grayson and Michael E. Stillman (1993–2001) and is distributed under the GNU license.

PHCpack ©1998, Katholieke Universiteit Leuven, Department of Computer Science, Heverlee, Belgium.

CoCoA, A. Capani, G. Niesi, L. Robbiano, a system for doing Computations in Commutative Algebra, available via anonymous ftp from: <http://cocoa.dima.unige.it>.

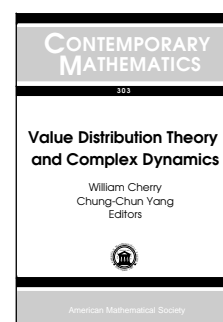
SOSTools is a MATLAB® toolbox and freely available under the GNU license at <http://www.cds.caltech.edu/sostools> or <http://www.aut.ee.ethz.ch/~parrilo/sostools>.

Contents: Polynomials in one variable; Gröbner bases of zero-dimensional ideals; Bernstein's theorem and fewnomials; Resultants; Primary decomposition; Polynomial systems in economics; Sums of squares; Polynomial systems in statistics; Tropical algebraic geometry; Linear partial differential equations with constant coefficients; Bibliography; Index.

CBMS Regional Conference Series in Mathematics, Number 97

October 2002, 152 pages, Softcover, ISBN 0-8218-3251-4, LC 2002027951, 2000 *Mathematics Subject Classification*: 13P10, 14Q99, 65H10; 12D10, 14P10, 35E20, 52B20, 62J12, 68W30, 90C22, 91A06, **All AMS members \$26**, List \$32, Order code CBMS/97N

Analysis



Value Distribution Theory and Complex Dynamics

William Cherry, *University of North Texas, Denton*, and **Chung-Chun Yang**, *The Hong Kong University of Science and Technology, China*, Editors

This volume contains six detailed papers written by participants of the special session on value distribution theory and complex dynamics held in Hong Kong

at the First Joint International Meeting of the AMS and the Hong Kong Mathematical Society in December 2000. It demonstrates the strong interconnections between the two fields and introduces recent progress of leading researchers from Asia.

In the book, W. Bergweiler discusses proper analytic maps with one critical point and generalizes a previous result concerning Leau domains. W. Cherry and J. Wang discuss non-Archimedean analogs of Picard's theorems. P.-C. Hu and C.-C. Yang give a survey of results in non-Archimedean value distribution theory related to unique range sets, the *abc*-conjecture, and Shiffman's conjecture. L. Keen and J. Kotus explore the dynamics of the family of $f_\lambda(z) = \lambda \tan(z)$ and show that it has much in common with the dynamics of the familiar quadratic family $f_c(z) = z^2 + c$. R. Oudkerk discusses the interesting phenomenon known as parabolic implosion and, in particular, shows the persistence of Fatou coordinates under perturbation. Finally, M. Taniguchi discusses deformation spaces of entire functions and their combinatorial structure of singularities of the functions.

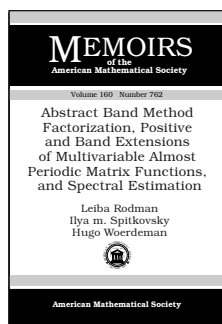
The book is intended for graduate students and research mathematicians interested in complex dynamics, function theory, and non-Archimedean function theory.

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

Contents: W. Bergweiler, On proper analytic maps with one critical point; W. Cherry and J. T.-Y. Wang, Non-Archimedean analytic maps to algebraic curves; P.-C. Hu and C.-C. Yang, Some progress in non-Archimedean analysis; L. Keen and J. Kotus, On period doubling phenomena and Sharkovskii type ordering for the family $\lambda \tan(z)$; R. Oudkerk, The parabolic implosion: Lavaurs maps and strong convergence for rational maps; M. Taniguchi, Synthetic deformation space of an entire function.

Contemporary Mathematics, Volume 303

October 2002, 136 pages, Softcover, ISBN 0-8218-2980-7, LC 2002026231, 2000 *Mathematics Subject Classification*: 11D75, 30D05, 30D20, 30D35, 30G06, 32G15, 32H25, 32H30, 37F10, 37F45, **Individual member** \$23, List \$39, Institutional member \$31, Order code CONM/303N



Abstract Band Method via Factorization, Positive and Band Extensions of Multivariable Almost Periodic Matrix Functions, and Spectral Estimation

Leiba Rodman, Ilya M. Spitkovsky, and Hugo J. Woerdeman, *The College of William and Mary, Williamsburg, VA*

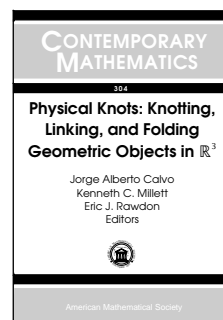
Contents: Introduction; Abstract band method: New variations; Toeplitz and Wiener algebras of operator matrices;

Positive extensions in Wiener classes of almost periodic matrix functions; Appendix; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 160, Number 762

November 2002, 71 pages, Softcover, ISBN 0-8218-2996-3, LC 2002074588, 2000 *Mathematics Subject Classification*: 42A75, 15A54, 47A68, 47A56, 47A57, 42A82, 47B35, 93E10, 60G12, **Individual member** \$28, List \$46, Institutional member \$37, Order code MEMO/160/762N

Applications



Physical Knots: Knotting, Linking, and Folding Geometric Objects in \mathbb{R}^3

Jorge Alberto Calvo, *North Dakota State University, Fargo*, Kenneth C. Millett, *University of California, Santa Barbara*,

and Eric J. Rawdon, *Duquesne University, Pittsburgh, PA*, Editors

The properties of knotted and linked configurations in space have long been of interest to physicists and mathematicians. More recently and more widely, they have become important to biologists, chemists, computer scientists, and engineers. The depth and breadth of their applications are widely appreciated. Nevertheless, fundamental and challenging questions remain to be answered.

Based on a Special Session at the AMS Sectional Meeting in Las Vegas (NV) in April 2001, this volume discusses critical questions and introduces new ideas that will stimulate multi-disciplinary applications.

Some of the papers are primarily theoretical; others are experimental. Some are purely mathematical; others deal with applications of mathematics to theoretical computer science, engineering, physics, biology, or chemistry. Connections are made between classical knot theory and the physical world of macromolecules, such as DNA, geometric linkages, rope, and even cooked spaghetti.

This book introduces the world of physical knot theory in all its manifestations and points the way for new research. It is suitable for a diverse audience of mathematicians, computer scientists, engineers, biologists, chemists, and physicists.

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

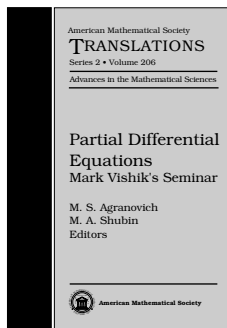
Contents: J. Simon, Physical knots; R. Randell, The space of piecewise-linear knots; J. A. Calvo, Characterizing polygons in \mathbb{R}^3 ; E. J. Rawdon and R. G. Scharein, Upper bounds for equilateral stick numbers; K. C. Millett, An investigation of equilateral knot spaces and ideal physical knot configurations; T. Deguchi and M. K. Shimamura, Topological effects on the average size of random knots; A. Dobay, P.-E. Sottas, J. Dubochet, and A. Stasiak, Bringing an order into random knots;

E. J. J. van Rensburg, The probability of knotting in lattice polygons; E. J. J. van Rensburg, Knotting in adsorbing lattice polygons; P. Pieranski and S. Przybyl, In search of the ideal trefoil knot; Y. Diao and C. Ernst, The crossing numbers of thick knots and links; R. Kusner, On thickness and packing density for knots and links; J. M. Sullivan, Approximating ropelength by energy functions; R. Langevin and J. O'Hara, Conformal geometric viewpoints for knots and links I; O. Gonzalez, J. H. Maddocks, and J. Smutny, Curves, circles, and spheres; G. Dietler, P. Pieranski, S. Kasas, and A. Stasiak, The rupture of knotted strings under tension; L. H. Kauffman and S. Lambropoulou, Classifying and applying rational knots and rational tangles; D. Roseman, Untangling some spheres in \mathbb{R}^4 by energy minimizing flow; M. Soss and G. T. Toussaint, Convexifying polygons in 3D: A survey; R. Connelly, E. D. Demaine, and G. Rote, Infinitesimally locked self-touching linkages with applications to locked trees; L. H. Kauffman, Biologic.

Contemporary Mathematics, Volume 304

November 2002, 342 pages, Softcover, ISBN 0-8218-3200-X, LC 2002027976, 2000 *Mathematics Subject Classification*: 57M25, 49Q10, 53A04, 57M27, 82D60, 82B41, 92C05, 52C25, 53A30, 74C99, **Individual member \$53**, List \$89, Institutional member \$71, Order code CONM/304N

Differential Equations



Partial Differential Equations

M. S. Agranovich, *Moscow Institute of Electronics and Mathematics, Russia*, and M. A. Shubin, *Northeastern University, Boston, MA*, Editors

Mark Vishik's Partial Differential Equations seminar held at Moscow State University was one of the world's

leading seminars in PDEs for over 40 years. This book celebrates Vishik's eightieth birthday. It comprises new results and survey papers written by many renowned specialists who actively participated over the years in Vishik's seminars.

Contributions include original developments and methods in PDEs and related fields, such as mathematical physics, tomography, and symplectic geometry. Papers discuss linear and nonlinear equations, particularly linear elliptic problems in angles and general unbounded domains, linear elliptic problems with a parameter for mixed order systems, infinite-dimensional Schrödinger equations, Navier-Stokes equations, and nonlinear Maxwell equations. The book ends on a historical note with a paper about Vishik's seminar as a whole and a list of selected talks given from 1964 through 1989.

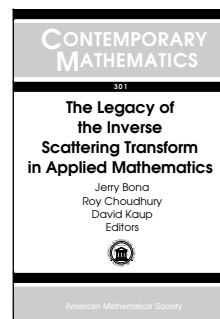
The book is suitable for graduate students and researchers in pure and applied mathematics and mathematical physics.

Contents: A. Babin and A. Figotin, Multilinear spectral decomposition for nonlinear Maxwell equations; R. Denk and L. Volevich, Elliptic boundary value problems with large parameter for mixed order systems; A. Dynin, Feynman integral

for functional Schrödinger equations; B. Fedosov, On normal Darboux coordinates; A. Fursikov, Real process corresponding to the 3D Navier-Stokes system, and its feedback stabilization from the boundary; A. Komech, A. Merzon, and P. Zhevandrov, A method of complex characteristics for elliptic problems in angles, and its applications; S. B. Kuksin, On exponential convergence to a stationary measure for nonlinear PDEs, perturbed by random kick-forces, and the turbulence-limit; V. P. Palamodov, Impedance tomography, inverse scattering, and phase space analysis; A. Volpert and V. Volpert, Normal solvability and properness of elliptic problems; M. S. Agranovich, Mark Vishik's seminar at Moscow state university; M. Shubin, List of selected talks at M. I. Vishik's seminar in Moscow.

American Mathematical Society Translations—Series 2 (*Advances in the Mathematical Sciences*), Volume 206

November 2002, 278 pages, Hardcover, ISBN 0-8218-3303-0, LC 91-640741, 2000 *Mathematics Subject Classification*: 35-XX, **Individual member \$65**, List \$109, Institutional member \$87, Order code TRANS2/206N



The Legacy of the Inverse Scattering Transform in Applied Mathematics

Jerry Bona, *University of Illinois, Chicago*, and Roy Choudhury and David Kaup, *University of Central Florida, Orlando*, Editors

Swift progress and new applications characterize the area of solitons and the inverse scattering transform. There are rapid developments in current nonlinear optical technology: Larger intensities are more available; pulse widths are smaller; relaxation times and damping rates are less significant. In keeping with these advancements, exactly integrable soliton equations, such as 3-wave resonant interactions and second harmonic generation, are becoming more and more relevant in experimental applications. Techniques are now being developed for using these interactions to frequency convert high intensity sources into frequency regimes where there are no lasers. Other experiments involve using these interactions to develop intense variable frequency sources, opening up even more possibilities.

This volume contains new developments and state-of-the-art research arising from the conference on the "Legacy of the Inverse Scattering Transform" held at Mount Holyoke College (South Hadley, MA). Unique to this volume is the opening section, "Reviews". This part of the book provides reviews of major research results in the inverse scattering transform (IST), on the application of IST to classical problems in differential geometry, on algebraic and analytic aspects of soliton-type equations, on a new method for studying boundary value problems for integrable partial differential equations (PDEs) in two dimensions, on chaos in PDEs, on advances in multi-soliton complexes, and on a unified approach to integrable systems via Painlevé analysis.

continued

This conference provided a forum for general exposition and discussion of recent developments in nonlinear waves and related areas with potential applications to other fields. The book will be of interest to graduate students and researchers interested in mathematics, physics, and engineering.

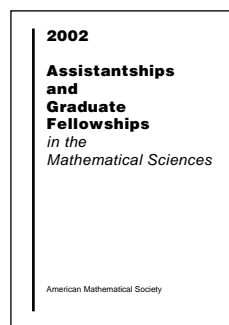
This item will also be of interest to those working in applications.

Contents: **D. J. Kaup**, The legacy of the IST; **V. Zakharov**, Application of inverse scattering method to problems of differential geometry; **V. S. Gerdjikov**, Algebraic and analytic aspects of soliton type equations; **A. S. Fokas**, Differential forms, spectral theory, and boundary value problems; **Y. C. Li**, Chaos in partial differential equations; **N. N. Akhmediev**, **A. A. Sukhorukov**, and **A. Ankiewicz**, Multi-soliton complexes; **S. R. Choudhury**, A unified approach to integrable systems via Painlevé analysis; **V. S. Buslaev** and **C. Sulem**, Asymptotic stability of solitary waves for nonlinear Schrödinger equations; **A. de Bouard** and **A. Debussche**, Finite-time blow-up in the additive supercritical stochastic nonlinear Schrödinger equations: The real noise case; **O. I. Bogoyavlenskij**, Method of symmetry transforms for ideal magnetohydrodynamics equilibrium equations; **R. Young**, The p -system I: The Riemann problem; **G. J. Morrow** and **S. Chakravarty**, Statistical analysis of collision-induced timing shifts in a wavelength-division-multiplexed optical soliton-transmission system; **R. Grimshaw**, **G. A. Green**, and **B. A. Malomed**, Cuspons and peakons vis-a-vis regular solitons and collapse in a three-wave system; **S. Chakravarty** and **R. G. Halburd**, First integrals and gradient flow for a generalized Darboux-Halphen system; **L. Casian** and **Y. Kodama**, Blow-ups of the Toda lattices and their intersections with the Bruhat cells; **M. Kovalyov**, Superposition principle for oscillatory solutions of integrable systems; **H. Steudel**, Scattering at truncated solitons and inverse scattering on the semiline.

Contemporary Mathematics, Volume 301

October 2002, 338 pages, Softcover, ISBN 0-8218-3161-5, LC 2002027974, 2000 *Mathematics Subject Classification*: 35Q51, 35Q53, 35Q55, 35Q58, 35A20, 35C05, **Individual member \$47**, List \$79, Institutional member \$63, Order code CONM/301N

General and Interdisciplinary



Assistantships and Graduate Fellowships 2002

Review of a previous edition:

This directory is a tool for undergraduate mathematics majors seeking information about graduate programs in mathematics. Although most of the information can be gleaned from the Internet, the usefulness of this directory for the prospective graduate

student is the consistent format for comparing different mathematics graduate programs without the hype. Published annually, the information is up-to-date, which is more than can be said of some Websites. Support for graduate students in

mathematics is a high priority of the American Mathematical Society, which also provides information for fellowships and grants they offer as well as support from other societies and foundations. The book is highly recommended for academic and public libraries.

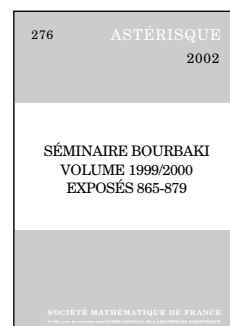
—*American Reference Books Annual*

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

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

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

November 2002, approximately 128 pages, Softcover, ISBN 0-8218-3230-1, 2000 *Mathematics Subject Classification*: 00-XX, **Individual member \$13**, List \$22, Order code ASST/2002N



Séminaire Bourbaki Volume 1999/2000, Exposés 865-879

A publication of the Société Mathématique de France.

The talks at Bourbaki seminars are devoted to the most important research topics of current interest. This volume contains 15 lectures (given in 1999/2000) on the following

subjects: group theory, infinite dimensional algebras, algebraic geometry, arithmetic geometry, Langlands correspondence, probability, partial differential equations, operator algebras, model theory, and polynomial functors.

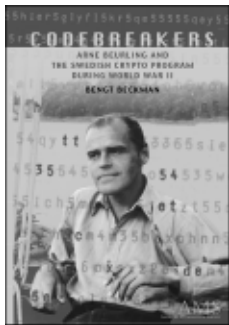
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a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

Contents: Résumés des exposés; *Novembre 1999:* **C. Kassel**, L'ordre de Dehornoy sur les tresses; **J.-F. Le Gall**, Exposants critiques pour le mouvement brownien et les marches aléatoires [d'après Kenyon, Lawler et Werner]; **M. Reid**, La correspondance de McKay; **T. Rivière**, Ginzburg-Landau vortices: the static model; **G. Skandalis**, Progrès récents sur la conjecture de Baum-Connes. Contribution de Vincent Lafforgue; *Mars 2000:* **É. Bouscaren**, Théorie des modèles et conjecture de Manin-Mumford [d'après Ehud Hrushovski]; **B. Edixhoven**, Rational elliptic curves are modular [after

Breuil, Conrad, Diamond and Taylor]; V. Kharlamov, Variétés de Fano réelles [d'après C. Viterbo]; G. Laumon, La correspondance de Langlands sur les corps de fonctions [d'après Laurent Lafforgue]; E. Looijenga, Motivic measures; *Juin 2000*: E. Frenkel, Vertex algebras and algebraic curves; S. S. Kudla, Derivatives of Eisenstein series and generating functions for arithmetic cycles; T. Pirashvili, Polynomial functors over finite fields [after Franjou, Friedlander, Henn, Lannes, Schwartz, Suslin]; V. Turaev, Faithful linear representations of the braid groups; P. Van Moerbeke, Random matrices and permutations, matrix integrals and integrable systems.

Astérisque, Number 276

January 2002, 433 pages, Softcover, ISBN 2-85629-110-4, 2000 *Mathematics Subject Classification*: 20F36, 20F60, 20F10, 57M07, 06F15, 03E55, 08A50, 60J65, 05C70, 14-XX, 35Jxx, 35Qxx, 49Jxx, 58E15, 81T13, 19K99, 22E50, 03C60, 14K15, 11G10, 03C45, 11F80, 11G18, 14G35, 53D12, 14P25, 11Fxx, 14Fxx, 22Exx, 14Exx, 14F42, 17B67, 17B68, 81T40, 14H10, 14H60, 14G40, 11G15, 11F27, 11F30, 11G50, 11F46, 19D55, 55S10, 16G10, 57M99, 15A52, 37K10, **Individual member \$90**, List \$100, Order code AST/276N



Codebreakers Arne Beurling and the Swedish Crypto Program during World War II

Bengt Beckman

From Reviews of the Swedish Edition:

The present volume is an excellent illustration of the best kind of popularization of a complex, technical subject,

in this case, Swedish wartime cryptanalysis. Bengt Beckman ... a grey eminence with Sweden's Sigint organization ... has been permitted to twitch the company veil and show what his colleagues got up to during World War II ... the reader is gently introduced to the basic ideas of cryptanalysis before coming face-to-face with the Geheimschreiber ... Merlin the Magician, in the shape of Arne Beurling ... uncover[ed] the structure of the underlying cryptosystem and ... [was able to] identify its vulnerabilities, thus ensuring a steady flow of decrypts ... The resulting intelligence was used in framing Swedish wartime policy in the fields of defense, diplomacy, economic negotiations, and counterespionage ... The abiding presence of Arne Beurling is felt throughout the book. It therefore fittingly closes with a portrait of this brilliant but quirky hero seen throughout the eyes of colleagues, students, and friends.

—*Cryptologia*

The book contains a well of information ... including detailed accounts of how several of the breaks were performed ... The Swedish cryptanalytical achievements are top class and therefore, it is only appropriate to put Sweden in the same league as the other cryptographic 'superpowers' at the time: Poland, England, and the USA ... The book is well written and at times, reads like a good thriller ... contains new and unpublished information ...

—*Cryptologia*

One of the greatest accomplishments in the history of cryptography occurred in 1940 when a Swedish mathematician broke the German code used for strategic military communications. This story has all the elements of a classic thriller: a

desperate wartime situation; a moody and secretive mathematical genius with a talent for cryptography; and a stunning mathematical feat, mysterious to this day. Arne Beurling, the man who inherited Einstein's office at Princeton's Institute for Advanced Study, was the figure who played this role at a crucial moment in world history.

Though the cracking of the code from the *Geheimschreiber* (G-Schreiber) device is every bit as impressive as the breaking of the Enigma code by the Poles and English, this secret has been kept for over 50 years! Through the eyes of a former head of Sweden's signal intelligence organization, Bengt Beckman, the reader will learn about the events leading up to the breakthrough and make the acquaintance of not only a remarkable mathematician, but also a remarkable human being.

Arne Beurling was a leading international figure who achieved beautiful results in mathematical analysis. By the arrival of World War II, he was one of the most powerful and original mathematicians in the world and widely considered a genius. During his military service, he demonstrated a flair for code and was well known within Swedish cryptology circles. The natural choice of the Swedish intelligence service was to place Beurling at the center of the group charged with breaking the G-Schreiber code. His single-handed effort "broke the unbreakable". Using only teleprinter tapes and cipher text, he deciphered the code that the Germans believed impossible to crack—in two weeks!

The feat, in a word, was astonishing. Many wonder how he did it. But Beurling took his secret to the grave, retorting when asked, "A magician does not reveal his secrets."

The author, Bengt Beckman, for many years was the head of the cryptanalysis department of the Swedish signal intelligence agency. In writing this book, he made extensive use of its archives. He also interviewed many people who participated in the Swedish wartime intelligence effort. He describes in detail Beurling's attack on the G-Schreiber system as well as attacks on several other wartime crypto systems, noting high points from the history of Swedish cryptology.

The book will appeal to a broad audience of readers, from historians and biography buffs to mathematicians to anyone with a passing interest in cryptology and cryptanalysis.

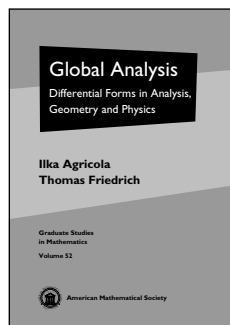
This English edition has been translated by Kjell-Ove Widman, Director of Sweden's Mittag-Leffler Institute.

Contents: Map; *Part 1:* An 18th century cipher; The world's first ciphering machine; Damm, Hagelin, and Gyldén; Radio signal interception and cryptanalysis before 1939; War; Enter Arne Beurling; The Russian Baltic Navy; Mysterious signals; Teleprinters; Beurling's Analysis; The G-Schreiber and the apps; Continued cryptanalysis; Exit Gyldén—but Beurling comes back; The double transposition; Operation Barbarossa; The work place; Contents; The birth of the FRA; Brilliant results—despite everything; Downturn and leakage; The Red Army and the Arctic Sea; The doubly enciphered Russian code; Stella Polaris; Gradual loss of German traffic; Borelius pays a visit to the Germans; Information—but of what value?; Norway; The last years of the war; The Swedes' own crypto systems; Arne Beurling 1943–1945; *Part 2:* Arne Beurling; Through the eyes of a woman; A magical friendship; Sources; Index of names.

December 2002, approximately 289 pages, Hardcover, ISBN 0-8218-2889-4, LC 2002026234, 2000 *Mathematics Subject Classification*: 01A70, 94A60, 01A60, 94-03, **All AMS members \$31**, List \$39, Order code SWCRYN

Geometry and Topology

Recommended Text



Global Analysis Differential Forms in Analysis, Geometry and Physics

Ilka Agricola and Thomas Friedrich, *Humboldt University, Berlin, Germany*

From a Review of the German edition:

Drawing on his great experience in research, writing books, teaching, and working with students, Friedrich presents once more a clearly written, smoothly readable self-contained textbook. The mathematical material and approaches are well motivated, enriched by valuable considerations and reflections. Proofs are elegant, not too technical and carefully performed ... Each chapter finishes with exercises designed to increase comprehension ... For any student who has passed the linear algebra course and calculus, this book offers an excellent opportunity to learn global analysis and its applications to mathematical physics.

—*Mathematical Reviews*

This book is devoted to differential forms and their applications in various areas of mathematics and physics. Well-written and with plenty of examples, this introductory textbook originated from courses on geometry and analysis and presents a widely used mathematical technique in a lucid and very readable style. The authors introduce readers to the world of differential forms while covering relevant topics from analysis, differential geometry, and mathematical physics.

The book begins with a self-contained introduction to the calculus of differential forms in Euclidean space and on manifolds. Next, the focus is on Stokes' theorem, the classical integral formulas and their applications to harmonic functions and topology. The authors then discuss the integrability conditions of a Pfaffian system (Frobenius's theorem). Chapter 5 is a thorough exposition of the theory of curves and surfaces in Euclidean space in the spirit of Cartan. The following chapter covers Lie groups and homogeneous spaces. Chapter 7 addresses symplectic geometry and classical mechanics. The basic tools for the integration of the Hamiltonian equations are the moment map and completely integrable systems (Liouville-Arnold Theorem). The authors discuss the Newton, Lagrange, and Hamilton formulations of mechanics. Chapter 8 contains an introduction to statistical mechanics and thermodynamics. The final chapter deals with electrodynamics. The material in the book is carefully illustrated with figures and examples, and there are over 100 exercises.

Readers should be familiar with first-year algebra and advanced calculus. The book is intended for graduate students and researchers interested in delving into geometric analysis and its applications to mathematical physics.

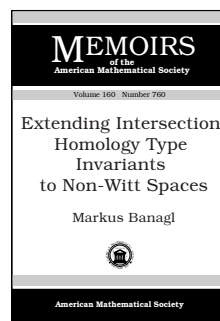
This item will also be of interest to those working in analysis.

Contents: Elements of multilinear algebra; Differential forms in \mathbb{R}^n ; Vector analysis on manifolds; Pfaffian systems; Curves and surfaces in Euclidean 3-space; Lie groups and homoge-

neous spaces; Symplectic geometry and mechanics; Elements of statistical mechanics and thermodynamics; Elements of electrodynamics; Bibliography; Symbols; Index.

Graduate Studies in Mathematics, Volume 52

November 2002, approximately 360 pages, Hardcover, ISBN 0-8218-2951-3, 2000 *Mathematics Subject Classification*: 53-01; 57-01, 58-01, 22-01, 74-01, 78-01, 80-01, 35-01, **All AMS members \$47**, List \$59, Order code GSM/52N



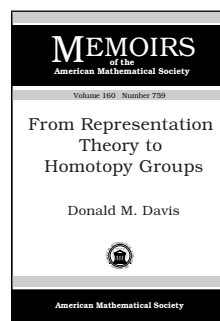
Extending Intersection Homology Type Invariants to Non-Witt Spaces

Markus Banagl, *University of Wisconsin, Madison*

Contents: Introduction; The algebraic framework; Ordered resolutions; The cobordism group Ω_*^{SD} ; Lagrangian structures and ordered resolutions; Appendix A. On signs; Bibliography.

Memoirs of the American Mathematical Society, Volume 160, Number 760

November 2002, 83 pages, Softcover, ISBN 0-8218-2988-2, LC 2002074586, 2000 *Mathematics Subject Classification*: 55N33, 57N80, 57R20, 32S60; 32S45, 57Q50, **Individual member \$29**, List \$48, Institutional member \$38, Order code MEMO/160/760N



From Representation Theory to Homotopy Groups

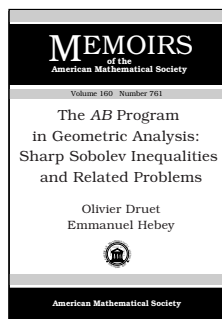
Donald M. Davis, *Lehigh University, Bethlehem, PA*

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

Contents: Introduction; Representation theory and ψ^2 in K -theory; Nice form for ψ^2 in $PK^1(E_8)_{(5)}$ and $PK^1(X)$; Determination of $\nu_1^{-1}\pi_{2m}(E_8; 5)$; Determination of $\nu_1^{-1}\pi_{2m-1}(E_8; 5)$; Calculation of $\nu_1^{-1}\pi_*(E_8; 3)$; LiE program for computing λ^2 in $R(E_8)$; Analysis of F_4 and E_7 at the prime 3; References.

Memoirs of the American Mathematical Society, Volume 160, Number 759

November 2002, 50 pages, Softcover, ISBN 0-8218-2987-4, LC 2002074585, 2000 *Mathematics Subject Classification*: 55T15, **Individual member \$25**, List \$41, Institutional member \$33, Order code MEMO/160/759N



The *AB* Program in Geometric Analysis: Sharp Sobolev Inequalities and Related Problems

Olivier Druet and Emmanuel Hebey, *University of Cergy-Pontoise, France*

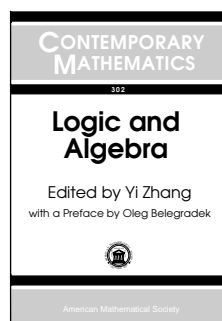
This item will also be of interest to those working in analysis.

Contents: Euclidean background; Statement of the *AB* program; Some historical motivations; The H_1^2 -inequality—Part I; The H_1^2 -inequality—Part II; PDE methods; The isoperimetric inequality; Bibliography.

Memoirs of the American Mathematical Society, Volume 160, Number 761

November 2002, 98 pages, Softcover, ISBN 0-8218-2989-0, LC 2002074587, 2000 *Mathematics Subject Classification*: 58E35, **Individual member \$29**, List \$48, Institutional member \$38, Order code MEMO/160/761N

Logic and Foundations



Logic and Algebra

Yi Zhang, *University of Michigan, Ann Arbor*, Editor

This volume outlines current developments in model theory and combinatorial set theory and presents state-of-the-art research. Well-known researchers report on their work in model theory and set theory with applications to algebra.

The papers of J. Brendle and A. Blass present one of the most interesting areas of set theory. Brendle gives a very detailed and readable account of Shelah's solution for the long-standing problem of $\text{Con}(\aleph < \aleph)$. It could be used in an advanced graduate seminar on set theory.

Papers by T. Altinel, J. T. Baldwin, R. Grossberg, W. Hodges, T. Hyttinen, O. Lessmann, and B. Zilber deal with questions of model theory from the viewpoint of stability theory. Here, Zilber constructs an ω -stable complete theory of "pseudo-analytic" structures on algebraically closed fields. This result is part of his program of the model-theoretic study of analytic structures by including Hrushovski's method in the analytic context.

The book presents this and further developments in model theory. It is geared toward advanced graduate students and researchers interested in logic and foundations, algebra, and algebraic geometry.

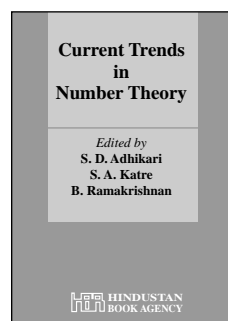
This item will also be of interest to those working in algebra and algebraic geometry.

Contents: J. Brendle, Mad families and iteration theory; A. Blass, Nearly adequate sets; J. D. Hamkins, How tall is the automorphism tower of a group?; J. Stavi and J. Väänänen, Reflection principles for the continuum; B. Zilber, A theory of a generic function with derivations; O. Belegradek, Polyregular ordered abelian groups; V. Tolstyykh, On the logical strength of the automorphism groups of free nilpotent groups; T. Altinel, Classification of the simple groups of finite Morley rank; O. Lessmann, Homogeneous model theory: Existence and categoricity; R. Grossberg, Classification theory for abstract elementary classes; J. T. Baldwin, Forking and multiplicity in first order theories; T. Hyttinen, Groups acting on geometries; W. Hodges, Relative categoricity in linear orderings; M. Di Nasso and Y. Zhang, Nonstandard analysis and an application to the symmetric group on natural numbers; M. Di Nasso and M. Forti, On the ordering of the nonstandard real line; A. Bovykin and R. Kaye, Order-types of models of Peano arithmetic.

Contemporary Mathematics, Volume 302

September 2002, 285 pages, Softcover, ISBN 0-8218-2984-X, LC 200207665, 2000 *Mathematics Subject Classification*: 03E17, 03E35, 03E50, 03C35, 03C45, 03C60, 03C98, 03C62, 20E32, 20B30, **Individual member \$41**, List \$69, Institutional member \$55, Order code CONM/302N

Number Theory



Current Trends in Number Theory

S. D. Adhikari, *Harish-Chandra Research Institute, Allahabad, India*, S. A. Katre, *University of Pune, India*, and B. Ramakrishnan, *Harish-Chandra Research Institute, Allahabad, India*, Editors

A publication of the Hindustan Book Agency.

The book gives a glimpse of current research in combinatorial, algebraic, and analytic aspects of number theory. The articles are refereed and expanded versions of talks given at the International Conference on Number Theory held at the Harish-Chandra Research Institute (Allahaba, India). Also included are some articles on arithmetic algebraic geometry. Distributed worldwide except in India by the American Mathematical Society.

Contents: S. D. Adhikari and G. Coppola, On the average of the sum-of-odd-divisors function; A. K. Agarwal, Rogers-Ramanujan identities; I. Baoulina, On the problem of explicit evaluation of the number of solutions of the equation $a_1x_1^2 + \dots + a_nx_n^2 = bx_1 \cdots x_n$ in a finite field; E. Ghate, An introduction to congruences between modular forms; S. A. Katre, The cyclotomic problem; S. Kobayashi, The local root number of elliptic curves; M. Manickam, On skew-holomorphic Jacobi forms; A. Mukhopadhyay, The view-obstruction problem; V. K. Murty, The addition law on hyperelliptic Jacobians; M. R. Murty, Sieving using Dirichlet series; D. S. Nagaraj, Higher circular ℓ -units of Anderson and Ihara; S. Nakajima, On automorphism groups of algebraic curves; V. C. Nanda, Special

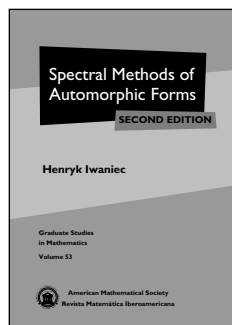
integral bases with restricted coefficients for extensions of Dedekind domains; **A. Narasimhan**, Zeta functions for curves defined over finite fields; **I. B. S. Passi**, Algebraic elements in group rings; **N. Sanat**, Reflection representation and theta correspondence; **J. Sengupta**, Some aspects of the central critical value of automorphic L -functions; **P. Shastri**, Integral points on the circle $X^2 + Y^2 = c$; **T. N. Shorey**, An equation of Goormaghtigh and diophantine approximations; **R. Tandon**, Base change, distinguishedness and a theorem of Saito; **D. S. Thakur**, Elliptic curves in function field arithmetic; **R. Thangadurai**, On certain zero-sum problems in finite Abelian groups; **T. C. Vasudevan**, Modular forms and functional equations; **T. N. Venkataramana**, Lefschetz properties of subvarieties of Shimura varieties.

Number 11

April 2002, 270 pages, Hardcover, ISBN 81-85931-33-X, 2000 *Mathematics Subject Classification*: 11N37, 11P81, 05A17, 11G25, 11T24, 11F33, 11T22, 11G05, 11G07, 11G40, 11F11, 11F50, 11H06, 11T71, 14Q05, 11N35, 14H25, 14H05, 14H30, 13F05, 14G10, 20C07, 16U99, 15A23, 20G40, 11F66, 11F67, 11R04, 11R27, 11D61, 22E50, 11G09, 20D60, 11M06, 11R42, 14G35; 05A15, 05A19, 11F67, 11T24, 11R18, 52A20, 11Y16, 14G15, 11M41, 11G20, 14H30, 14H37, 13B22, 11S99, 11F11, 11F25, 22E55, 11F70, 11B75, 11F46, 11F41, **All AMS members \$32**, List \$40, Order code HIN/11N

Recommended Text

Supplementary Reading



Spectral Methods of Automorphic Forms Second Edition

Henryk Iwaniec, *Rutgers University, Piscataway, NJ*

From a review of the first edition:

The material and exposition are well-suited for second-year or higher graduate students ... This clear and comprehensive book concerning the

spectral theory of $GL(2)$ automorphic forms belongs on many a bookshelf.

—*Mathematical Reviews*

Automorphic forms are one of the central topics of analytic number theory. In fact, they sit at the confluence of analysis, algebra, geometry, and number theory. In this book, Henryk Iwaniec once again displays his penetrating insight, powerful analytic techniques, and lucid writing style.

The first edition of this volume was an underground classic, both as a textbook and as a respected source for results, ideas, and references. The book's reputation sparked a growing interest in the mathematical community to bring it back into print. The AMS has answered that call with the publication of this second edition.

In the book, Iwaniec treats the spectral theory of automorphic forms as the study of the space $L^2(H\Gamma)$, where H is the upper half-plane and Γ is a discrete subgroup of volume-preserving transformations of H . He combines various techniques from analytic number theory. Among the topics discussed are Eisenstein series, estimates for Fourier coefficients of automorphic

forms, the theory of Kloosterman sums, the Selberg trace formula, and the theory of small eigenvalues.

Henryk Iwaniec was awarded the 2002 AMS Cole Prize for his fundamental contributions to analytic number theory. Also available from the AMS by H. Iwaniec is *Topics in Classical Automorphic Forms*, Volume 17 in the Graduate Studies in Mathematics series.

The book is designed for graduate students and researchers working in analytic number theory.

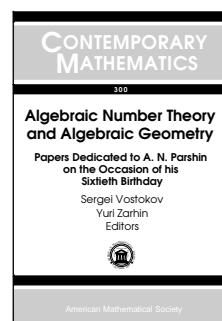
This item will also be of interest to those working in analysis.

This book is co-published by the AMS and Revista Matemática Iberoamericana (RMI), Madrid, Spain.

Contents: Harmonic analysis on the Euclidean plane; Harmonic analysis on the hyperbolic plane; Fuchsian groups; Automorphic forms; The spectral theorem. Discrete part; The automorphic Green function; Analytic continuation of the Eisenstein series; The spectral theorem. Continuous part; Estimates for the Fourier coefficients of Maass forms; Spectral theory of Kloosterman sums; The trace formula; The distribution of eigenvalues; Hyperbolic lattice-point problems; Spectral bounds for cusp forms; Classical analysis; Special functions; References; Subject index; Notation index.

Graduate Studies in Mathematics, Volume 53

December 2002, 220 pages, Hardcover, ISBN 0-8218-3160-7, LC 2002027749, 2000 *Mathematics Subject Classification*: 11F12, 11F30, 11F72, **All AMS members \$39**, List \$49, Order code GSM/53N



Algebraic Number Theory and Algebraic Geometry Papers Dedicated to A. N. Parshin on the Occasion of his Sixtieth Birthday

Sergei Vostokov, *St. Petersburg University, Russia*, and

Yuri Zarhin, *Pennsylvania State University, University Park*, Editors

A. N. Parshin is a world-renowned mathematician who has made significant contributions to number theory through the use of algebraic geometry. Articles in this volume present new research and the latest developments in algebraic number theory and algebraic geometry and are dedicated to Parshin's sixtieth birthday. Well-known mathematicians contributed to this volume, including, among others, F. Bogomolov, C. Deninger, and G. Faltings.

The book is intended for graduate students and research mathematicians interested in number theory, algebra, and algebraic geometry.

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

Contents: V. Abrashkin, Ramification theory for higher dimensional local fields; F. Bogomolov and Y. Tschinkel, Unramified correspondences; M. V. Bondarko, Local Leopoldt's problem for ideals in totally ramified p -extensions of complete discrete

valuation fields; **A. Buium**, Quotients of algebraic varieties by Zariski dense equivalence relations; **C. Deninger**, A note on arithmetic topology and dynamical systems; **G. Faltings**, A relation between two moduli spaces studied by V. G. Drinfeld; **G. van der Geer** and **T. Katsura**, An invariant for varieties in positive characteristic; **F. Lorenz** and **S. Vostokov**, Honda groups and explicit pairings on the modules of Cartier curves; **A. Merkurjev**, Algebraic oriented cohomology theories; **Y. G. Zarhin**, Hyperelliptic Jacobians without complex multiplication, doubly transitive permutation groups and projective representations; **I. Zhukov**, Ramification of surfaces: Artin-Schreier extensions.

Contemporary Mathematics, Volume 300

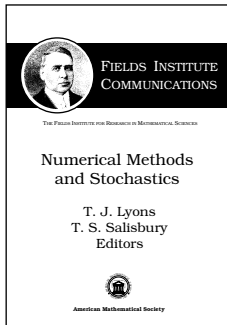
October 2002, 220 pages, Softcover, ISBN 0-8218-3267-0, LC 2002074698, 2000 *Mathematics Subject Classification*: 11S15, 11S31, 14E22, 14F20, 14H30, 14H40, 14K10, 14K99, 14L05, **Individual member \$35**, List \$59, Institutional member \$47, Order code CONM/300N

O. D. Walsh, Embedding and the convergence of the binomial and trinomial tree schemes.

Fields Institute Communications, Volume 34

December 2002, approximately 128 pages, Hardcover, ISBN 0-8218-1994-1, LC 2002027936, 2000 *Mathematics Subject Classification*: 60-06; 65C30, 65C35, **Individual member \$29**, List \$49, Institutional member \$39, Order code FIC/34N

Probability



Numerical Methods and Stochastics

T. J. Lyons, *University of Oxford, UK*, and **T. S. Salisbury**, *York University, Toronto, ON, Canada*, Editors

This volume represents the proceedings of the Workshop on Numerical Methods and Stochastics held at The Fields Institute in April 1999. The goal of the workshop was to identify

emerging ideas in probability theory that influence future work in both probability and numerical computation. The book focuses on new results and gives novel approaches to computational problems based on the latest techniques from the theory of probability and stochastic processes.

Three papers discuss particle system approximations to solutions of the stochastic filtering problem. Two papers treat particle system equations. The paper on "rough paths" describes how to generate good approximations to stochastic integrals. An expository paper discusses a long-standing conjecture: the stochastic fast dynamo effect. A final paper gives an analysis of the error in binomial and trinomial approximations to solutions of the Black-Scholes stochastic differential equations.

The book is intended for graduate students and research mathematicians interested in probability theory.

Contents: **D. Crisan**, Numerical methods for solving the stochastic filtering problem; **D. Crisan** and **T. Lyons**, Optimal filtering on discrete sets; **P. Del Moral** and **J. Jacod**, The Monte-Carlo method for filtering with discrete-time observations: Central limit theorems; **A. Guionnet**, Approximations of Markovian non linear partial differential equations by particle systems; **A. Guionnet**, Non-Markovian limit diffusions and spin glasses; **S. B. Hazra** and **F. G. Viens**, Towards pathwise stochastic fast dynamo in magneto-hydrodynamics; **T. J. Lyons**, System control and rough paths; **J. B. Walsh** and