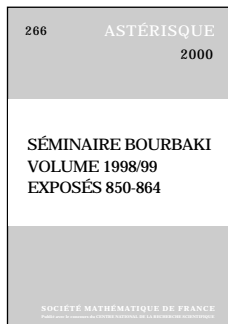


New Publications Offered by the AMS

Algebra and Algebraic Geometry



Séminaire Bourbaki, Volume 1998/99, Exposés 850–864

A publication of the Société Mathématique de France.

Following the format of the seminar, one finds here fifteen survey lectures on the following topics of current interest: the theory of Lie groups and algebras, algebraic geometry, p -adic arithmetical algebraic geometry,

combinatorial geometry, differential geometry, partial differential equations, probabilities, celestial mechanics, and quantum computing. Four articles are in English, the rest are in French.

This item will also be of interest to those working in geometry and topology, differential equations, number theory, probability, mathematical physics, discrete mathematics and combinatorics, and applications.

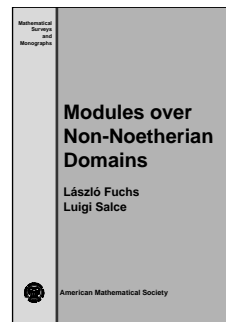
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a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

Contents: *Novembre 1998:* **J.-Y. Chemin**, Explosion géométrique pour certaines équations d'ondes non linéaires [d'opér Serge Alinhac]; **P. Colmez**, Fonctions L p -adiques; **J.-P. Demailly**, Méthodes L^2 et résultats effectifs en géométrie algébrique; **T. Komorowski**, Brownian motion in a Poisson obstacle field; **S. Marmi**, Chaotic behaviour in the solar system [following J. Laskar]; *Mars 1999:* **M. Boileau**, Uniformisation en dimension trois; **N. Burq**, Formules de trace, résonances et quasi-modes [d'après Sjöstrand-Zworski, Stefanov-Vodev et al.]; **H. Carayol**, Preuve de la conjecture de Langlands locale pour GL_n : Travaux de Harris-Taylor et Henniart; **O. Mathieu**, Classification des algèbres de Lie simples; **M. Talagrand**, Verres de spin et optimisation combinatoire; *Juin 1999:* **C. Breuil**, Intégration sur les variétés p -adiques [d'après Coleman, Colmez]; **R. Bryant**, Recent advances in the theory of holonomy; **Y. I. Manin**, Classical computing, quantum computing, and Shor's factoring algorithm; **J. Oesterlé**, Densité maximale des empilements de sphères en dimension 3 [d'après T. C. Hales et

S. P. Ferguson]; **J.-P. Serre**, Sous-groupes finis des groupes de Lie.

Astérisque, Number 266

June 2000, 483 pages, Softcover, ISBN 2-85629-090-6, 2000 *Mathematics Subject Classification:* 35L40, 11Fxx, 11Gxx, 11Rxx, 11Sxx, 14Fxx, 14Gxx, 14C30, 14F17, 14J60, 60K40, 82D30, 70F10, 70F15, 70K50, 37Jxx, 37Kxx, 53Dxx, 70Hxx, 57M07, 57M50, 20E08, 51M10, 35L05, 35P25, 11F70, 11G18, 11R39, 14L05, 17B20, 60G70, 60G15, 90C27, 14Hxx, 14Kxx, 14Lxx, 30Fxx, 30Gxx, 32Jxx, 53C10, 53B05, 58A15, 68Q05, 68P25, 81P99, 68Q25, 51M04, 51M16, 52C17, 20-XX, 22-XX, **Individual member \$89**, List \$99, Order code AST/266N



Modules over Non-Noetherian Domains

László Fuchs, *Tulane University, New Orleans, LA*, and **Luigi Salce**, *University of Padova, Italy*

In this book, the authors present both traditional and modern discoveries in the subject area, concentrating on

advanced aspects of the topic.

Existing material is studied in detail, including finitely generated modules, projective and injective modules, and the theory of torsion and torsion-free modules. Some topics are treated from a new point of view. Also included are areas not found in current texts, for example, pure-injectivity, divisible modules, uniserial modules, etc.

Special emphasis is given to results that are valid over arbitrary domains. The authors concentrate on modules over valuation and Prüfer domains, but also discuss Krull and Matlis domains, h -local, reflexive, and coherent domains. The volume can serve as a standard reference book for specialists working in the area and also is a suitable text for advanced-graduate algebra courses and seminars.

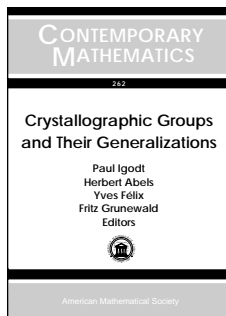
Contents: Commutative domains and their modules; Valuation domains; Prüfer domains; More non-Noetherian domains; Finitely generated modules; Projectivity and projective dimension; Divisible modules; Topology and filtration; Injective modules; Uniserial modules; Heights, invariants and basic submodules; Polyserial modules; RD- and pure-injectivity; Torsion modules; Torsion-free modules of finite rank; Infinite

New Publications Offered by the AMS

rank torsion-free modules; Appendix on set theory; Bibliography; Author index; Subject index.

Mathematical Surveys and Monographs

November 2000, 613 pages, Hardcover, ISBN 0-8218-1963-1, LC 00-044205, 2000 *Mathematics Subject Classification*: 13Cxx, 13Fxx, 13G05, 13Jxx, 13Hxx, **Individual member \$65**, List \$109, Institutional member \$87, Order code SURV-FUCHSN



Crystallographic Groups and Their Generalizations

Paul Igodt, *Katholieke Universiteit Leuven, Kortrijk, Belgium*, **Herbert Abels**, *Universitaet Bielefeld, Germany*, **Yves Félix**, *Université Catholique de Louvain, Belgium*, and

Fritz Grunewald, *Heinrich Heine Universität, Düsseldorf, Germany*, Editors

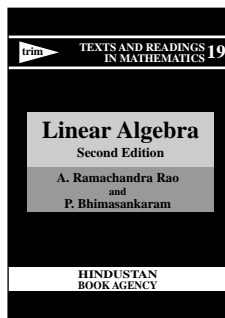
This volume contains articles written by the invited speakers and workshop participants from the conference on "Crystallographic Groups and Their Generalizations", held at Katholieke Universiteit Leuven, Kortrijk (Belgium). Presented are recent developments and open problems. Topics include the theory of affine structures and polynomial structures, affine Schottky groups and crooked tilings, theory and problems on the geometry of finitely generated solvable groups, flat Lorentz 3-manifolds and Fuchsian groups, filiform Lie algebras, hyperbolic automorphisms and Anosov diffeomorphisms on infra-nilmanifolds, localization theory of virtually nilpotent groups and aspherical spaces, projective varieties, and results on affine apartment systems. Participants delivered high-level research mathematics and a discussion forum was held for new researchers. The survey results and original papers contained in this volume offer a comprehensive view of current developments in the field.

Contents: **Y. Benoist**, Tores affines; **C. Casacuberta**, On structures preserved by idempotent transformations of groups and homotopy types; **V. Charette** and **W. M. Goldman**, Affine Schottky groups and crooked tilings; **K. Dekimpe**, Polynomial structures on polycyclic groups: Recent developments; **B. Farb** and **L. Mosher**, Problems on the geometry of finitely generated solvable groups; **W. M. Goldman** and **G. A. Margulis**, Flat Lorentz 3-manifolds and cocompact Fuchsian groups; **O. Baues**, Varieties of discontinuous groups; **D. Burde**, Affine cohomology classes for filiform Lie algebras; **C. Cassidy**, **N. Kennedy**, and **D. Scevenels**, Hyperbolic automorphisms for groups in $\mathcal{T}(4, 2)$; **S. Dupont**, Variétés projectives à holonomie dans le groupe $\text{Aff}^+(\mathbf{R})$; **Y. Kamishima**, Classification of homogeneous complex affinely flat surfaces with compact quotients and applications to complex projective structures; **Y. Kamishima** and **T. Udono**, On the fundamental groups of compact complete quaternionic affinely flat 2-manifolds; **W. Malfait**, An obstruction to the existence of Anosov diffeomorphisms on infra-nilmanifolds; **N. O'Sullivan**, Genus and localization of virtually nilpotent groups; **A. Parreau**, Immeubles affines: construction par les normes et étude des isométries; **J. A. Wolf**, Isoclinic spheres and flat homogeneous pseudo-Riemannian manifolds.

Contemporary Mathematics, Volume 262

September 2000, approximately 336 pages, Softcover, ISBN 0-8218-2001-X, LC 00-044744, 2000 *Mathematics Subject Classification*: 20H15, 20E42, 22E25, 20F16, 57S30, 55P60, 53C50, 17B30, 51E24, **Individual member \$47**, List \$79, Institutional member \$63, Order code CONM/262N

Supplementary Reading



Linear Algebra Second Edition

A. Ramachandra Rao, *Indian Statistical Institute, Calcutta*, and **P. Bhimasankaram**, *Indian Statistical Institute, Hyderabad*

A publication of the Hindustan Book Agency.

The vector space approach to the treatment of linear algebra is useful for geometric intuition leading to transparent proofs; it's also useful for generalization to infinite-dimensional spaces. The Indian School, led by Professors C. R. Rao and S. K. Mitra, successfully employed this approach. This book follows their approach and systematically develops the elementary parts of matrix theory, exploiting the properties of row and column spaces of matrices.

Developments in linear algebra during the past few decades have brought into focus several techniques not included in basic texts, such as rank-factorization, generalized inverses, and singular value decomposition. These techniques are actually simple enough to be taught at the advanced undergraduate level. When properly used, they provide a better understanding of the topic and give simpler proofs, making the subject more accessible to students.

This book explains these techniques. It is intended as a textbook for the advanced student of mathematics and/or statistics. It will also be useful for students of physics, computer science, engineering, operations research, and research scientists.

Distributed worldwide except in India by the American Mathematical Society.

Contents: Preliminaries; Vector spaces; Algebra of matrices; Rank and inverse; Elementary operations and reduced forms; Linear equations; Determinants; Inner product and orthogonality; Eigenvalues; Quadratic forms; References; More hints and solutions; List of symbols; Index.

Hindustan Book Agency

May 2000, 414 pages, Hardcover, ISBN 81-85931-26-7, 2000 *Mathematics Subject Classification*: 15-XX, **All AMS members \$32**, List \$40, Order code HIN/5N

Analysis

Back in Print from the AMS

A Classic

Lectures on the Calculus of Variations

Third Edition

Oskar Bolza

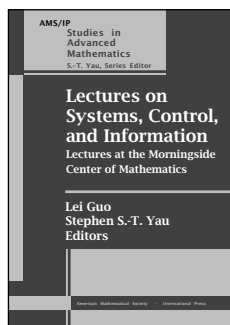
Based on lectures delivered at the AMS meeting in 1901, this book describes the progress in calculus of variations made in the last 30 years of the nineteenth century. Among other topics, the author describes the landmark results of Weierstrass on sufficient conditions for the extremum of a functional in terms of the second variation. Also discussed are Kneser's sufficient conditions, Weierstrass's theory of the isoperimetric problem, and Hilbert's theorem on the existence of an extremum of an integral. Although the original book was written nearly 100 years ago, it remains very useful in learning about classical calculus of variations.

Contents: The first variation of the integral $\int_{x_0}^{x_1} F(x, y, y') dx$; The second variation of the integral $\int_{x_0}^{x_1} F(x, y, y') dx$; Sufficient conditions for an extremum of the integral $\int_{x_0}^{x_1} F(x, y, y') dx$; Weierstrass's theory of the problem in parameter representation; Kneser's theory; Weierstrass's theory of the isoperimetric problems; Hilbert's existence theorem; Index.

AMS Chelsea Publishing

December 2000, 269 pages, Hardcover, ISBN 0-8218-2144-X, LC 73-16324, 2000 *Mathematics Subject Classification*: 49-02, All AMS members \$17, List \$19, Order code CHEL/145.HN

Applications



Lectures on Systems, Control, and Information

Lectures at the Morningside Center of Mathematics

Lei Guo, *Chinese Academy of Sciences, Beijing, People's Republic of China*, and

Stephen S.-T. Yau, *University of Illinois, Chicago*, Editors

This volume presents lectures delivered at a workshop held at the Chinese Academy of Sciences (Beijing). The following articles are included: "Nonlinear Control Systems" by R. Brockett, "Adaptive Control of Discrete-Time Nonlinear Systems with Structural Uncertainties" by L.-L. Xie and L. Guo, "Networks and Learning" by P. R. Kumar, "Mathematical Aspects of the Power Control Problem in Mobile Communication Systems" by C. W. Sung and W. S. Wong, and "Brockett's Problem on Nonlinear Filtering Theory" by S. S.-T. Yau.

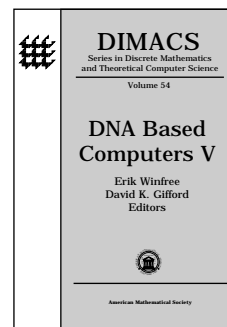
Basic concepts and current research are both presented in this book. The volume offers a comprehensive and easy-to-follow account of many fundamental issues in this diverse field. It would be a suitable text for a graduate course on wireless communication.

Titles in this series are co-published with International Press, Cambridge, MA.

Contents: R. Brockett, Beijing lectures on nonlinear control systems; L.-L. Xie and L. Guo, Adaptive control of discrete-time nonlinear systems with structural uncertainties; P. R. Kumar, Networks and learning; C. W. Sung and W. S. Wong, Mathematical aspects of the power control problem in mobile communication systems; S. S.-T. Yau, Brockett's problem on nonlinear filtering theory.

AMS/IP Studies in Advanced Mathematics, Volume 17

August 2000, 212 pages, Softcover, ISBN 0-8218-2009-5, LC 00-044146, 2000 *Mathematics Subject Classification*: 90B35, 90B36, 93Cxx, 93C10, 93C40, 93C55, 93C95, 93D15, 93D21, 93E11, All AMS members \$39, List \$49, Order code AMSIP/17N



DNA Based Computers V

Erik Winfree, *California Institute of Technology, Pasadena*, and David K. Gifford, *Massachusetts Institute of Technology, Cambridge*, Editors

This proceedings volume presents the talks from the Fifth Annual Meeting on DNA Based Computers held at MIT. The conference brought together researchers and theorists from many disciplines who shared research results in biomolecular computation.

Two styles of DNA computing were explored at the conference: 1) DNA computing based on combinatorial search, where randomly created DNA strands are used to encode potential solutions to a problem, and constraints induced by the problem are used to identify DNA strands that are solution witnesses; and 2) DNA computing based on finite-state machines, where the state of a computation is encoded in DNA, which controls the biochemical steps that advance the DNA-based machine from state to state.

Featured articles include discussions on the formula satisfiability problem, self-assembly and nanomachines, simulation and design of molecular systems, and new theoretical approaches.

Contents: D. Faulhammer, A. R. Cukras, R. J. Lipton, and L. F. Landweber, When the Knight falls: On constructing an RNA computer; H. Yoshida and A. Suyama, Solution to 3-SAT by breadth first search; D. H. Wood, J. Chen, E. Antipov, B. Lemieux, and W. Cedeño, *In vitro* selection for a OneMax DNA evolutionary computation; B. Bloom and C. Bancroft, Liposome mediated biomolecular computation; K. Chen and E. Winfree, Error correction in DNA computing: Misclassification and strand loss; A. P. Mills, Jr., B. Yurke, and P. M. Platzman, DNA analog vector algebra and physical constraints on large-scale DNA-based neural network computation; A. Marathe, A. E. Condon, and R. M. Corn, On combinatorial DNA word design; M. Garzon, R. J. Deaton, and J. A. Rose, Soft molecular computing;

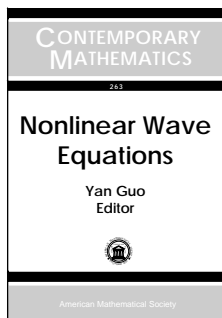
New Publications Offered by the AMS

M. Yamamoto, J. Yamashita, T. Shiba, T. Hirayama, S. Takiya, K. Suzuki, M. Munekata, and A. Ohuchi, A study on the hybridization process in DNA computing; A. J. Hartemink, T. S. Mikkelsen, and D. K. Gifford, Simulating biological reactions: A modular approach; T. H. LaBean, E. Winfree, and J. H. Reif, Experimental progress in computation by self-assembly of DNA tilings; M. G. Lagoudakis and T. H. LaBean, 2D DNA self-assembly for satisfiability; T. Yokomori, YAC: Yet another computation model of self-assembly; A. J. Turberfield, B. Yurke, and A. P. Mills, Jr., DNA hybridization catalysts and molecular tweezers; M. P. Robertson, J. Hesselberth, J. C. Cox, and A. D. Ellington, Designing and selecting components for nucleic acid computers; A. Ehrenfeucht, H. J. Hoogeboom, G. Rozenberg, and N. van Vugt, Forbidding and enforcing; L. Kari and L. F. Landweber, Computational power of gene rearrangement; G. Păun and T. Yokomori, Membrane computing based on splicing; A. Gehani, T. H. LaBean, and J. H. Reif, DNA-based cryptography.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 54

September 2000, approximately 264 pages, Hardcover, ISBN 0-8218-2053-2, LC 00-040621, 2000 *Mathematics Subject Classification*: 68-06, 68Q05, 68Q10, 68M99, 92-06, 92B05, 92B20, 92C05, **Individual member \$41**, List \$69, Institutional member \$55, Order code DIMACS/54N

Differential Equations



Nonlinear Wave Equations

Yan Guo, *Brown University, Providence, RI*, Editor

This volume presents original research papers and expository articles from the conference in honor of Walter A. Strauss's sixtieth birthday held at Brown University in Providence (RI). The book offers a collection of original papers and expository articles mainly

devoted to the study of nonlinear wave equations. The articles cover a wide range of topics, including scattering theory, dispersive waves, classical field theory, mathematical fluid dynamics, kinetic theory, stability theory, and variational methods. The book offers a nice cross-section of current trends and research directions in the study of nonlinear wave equations and related topics.

Contents: C. Bardos, J.-M. Ghidaglia, and S. Kamvissis, Weak convergence and deterministic approach to turbulent diffusion; D. Christodoulou, On hyperbolicity; J. Ginibre and G. Velo, Scattering theory in the energy space for a class of Hartree equations; R. T. Glassey and J. Schaeffer, The relativistic Vlasov-Maxwell system in 2D and 2.5D; M. G. Grillakis, On the wave map problem; Y. Guo, On the generalized Antonov stability criterion; T. Kato, On the smoothness of trajectories in incompressible perfect fluids; C. E. Kenig, G. Ponce, and L. Vega, On the concentration of blow up solutions for the generalized KdV equation critical in L^2 ; P. H. Rabinowitz, Heteroclinics to periodics of different homotopy type on \mathbb{T}^2 ; J. Shatah, Homoclinic orbits and spatiotemporal chaos; T. C. Sideris, Uniform decay estimates for some hyperbolic equations; L. Vazquez, The Sine-Gordon and ϕ^4 models perturbed with singular potentials.

Contemporary Mathematics, Volume 263

September 2000, 201 pages, Softcover, ISBN 0-8218-2071-0, LC 00-044158, 2000 *Mathematics Subject Classification*: 35-XX, 37-XX, 42-XX, 49-XX, 58-XX, 70-XX, 76-XX, 85-XX, **Individual member \$29**, List \$49, Institutional member \$39, Order code CONM/263N

General and Interdisciplinary



Combined Membership List 2000-2001

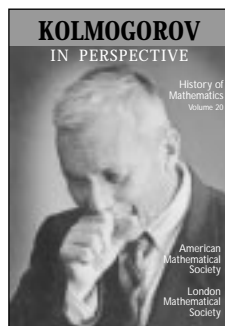
The *Combined Membership List* (CML) is a comprehensive directory of the membership of the American Mathematical Society, the American Mathematical Association of Two-Year Colleges, the Association for Women in Mathematics, the Mathematical Association of America, and the

Society for Industrial and Applied Mathematics.

There are two lists of individual members. The first is a complete alphabetical list of all members in all five organizations. For each member, the CML provides his or her address, title, department, institution, telephone number (if available), and electronic address (if indicated), and also indicates membership in the five participating societies. The second is a list of individual members according to their geographic locations. In addition, the CML lists academic, institutional, and corporate members of the five participating societies providing addresses and telephone numbers of mathematical sciences departments.

The CML is distributed on request to AMS members in even-numbered years. MAA members can request the CML in odd-numbered years from the MAA. The CML is an invaluable reference for keeping in touch with colleagues and for making connections in the mathematical sciences community in the United States and abroad.

December 2000, approximately 387 pages, Softcover, ISBN 0-8218-2637-9, 2000 *Mathematics Subject Classification*: 00-XX, **Individual member \$39**, List \$65, Institutional member \$52, Order code CML/2000/2001N



Kolmogorov in Perspective

The editorial board for the History of Mathematics series has selected for this volume a series of translations from two Russian publications, *Kolmogorov in Remembrance and Mathematics and its Historical Development*. This book, *Kolmogorov in Perspective*, includes articles written by Kolmogorov's students and colleagues and his personal accounts

of shared experiences and lifelong mathematical friendships. Specifically, the article, "Andreï Nikolaevich Kolmogorov. A Biographical Sketch of His Life and Creative Paths" by A. N. Shiryayev, gives an excellent personal and scientific biography of Kolmogorov. The volume also includes the following arti-

cles: "On A. N. Kolmogorov" by V. I. Arnol'd, "In Memory of A. N. Kolmogorov" by S. M. Nikol'skiĭ, "Remembrances of A. N. Kolmogorov" by Ya. G. Sinaĭ, "The Influence of Andreĭ Nikolaevich Kolmogorov on My Life" by P. L. Ul'yanov, "A Few Words on A. N. Kolmogorov" by P. S. Aleksandrov, "Memories of P. S. Aleksandrov" by A. N. Kolmogorov, "Newton and Contemporary Mathematical Thought" by A. N. Kolmogorov, and an extensive bibliography with the complete list of Kolmogorov's works—including the articles written for encyclopedias and newspapers. The book is illustrated with photographs and includes quotations from Kolmogorov's letters and conversations, uniquely reflecting his mathematical tastes and opinions.

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

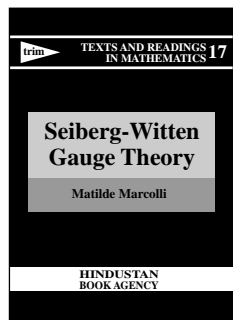
Contents: A. N. Shiryayev, Andreĭ Nikolaevich Kolmogorov (April 25, 1903 to October 20, 1987) A biographical sketch of his life and creative paths; V. I. Arnol'd, On A. N. Kolmogorov; S. M. Nikol'skiĭ, In memory of A. N. Kolmogorov; Ya. G. Sinaĭ, Remembrances of A. N. Kolmogorov; P. L. Ul'yanov, The influence of Andreĭ Nikolaevich Kolmogorov on my life; P. S. Aleksandrov, A few words on A. N. Kolmogorov; A. N. Kolmogorov, Memories of P. S. Aleksandrov; A. N. Kolmogorov, Newton and contemporary mathematical thought.

History of Mathematics

October 2000, approximately 233 pages, Hardcover, ISBN 0-8218-0872-9, LC 00-044162, 2000 *Mathematics Subject Classification*: 01A70, **All AMS members \$39**, List \$49, Order code HMATH-KOLMOGOROVN

Geometry and Topology

Supplementary Reading



Seiberg-Witten Gauge Theory

Matilde Marcolli,
Massachusetts Institute of Technology, Cambridge

A publication of the Hindustan Book Agency.

The newly developed field of Seiberg-Witten gauge theory has become a well-established part of the differential topology of four-manifolds and three-manifolds. This book offers an introduction and an up-to-date review of the state of current research.

The first part of the book collects some preliminary notions and then gives an introduction of Seiberg-Witten theory of four-dimensional manifolds. In the second part, the author introduces the dimensional reduction and uses it to describe Seiberg-Witten in three-dimensional manifolds. In both parts, the Seiberg-Witten equations are derived, the moduli spaces of solutions are constructed, and the corresponding invariants of manifolds are introduced.

In the third part, the author gives an overview of geometric and topological results obtained via Seiberg-Witten theory. Through all these parts of the book, Seiberg-Witten gauge

theory is considered as a completely self-contained subject and no a priori knowledge of Donaldson theory is assumed. In fact, all the sections that refer to Donaldson theory can be skipped, and this will not affect the comprehension of the remaining sections.

In the final part of the book, the author describes physical theories that are responsible for the emergence of this new piece of mathematics, the Seiberg-Witten theory.

Distributed worldwide except in India by the American Mathematical Society.

Contents: Introduction; Seiberg-Witten on four-manifolds; Seiberg-Witten on three-manifolds; Topology and geometry; Seiberg-Witten and physics; Appendix: a bibliographical guide.

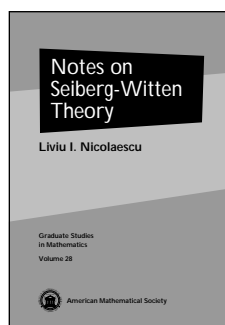
Hindustan Book Agency

May 2000, 228 pages, Hardcover, ISBN 81-85931-22-4, 2000 *Mathematics Subject Classification*: 57R57; 57R58, 81T13, 81T60, **All AMS members \$38**, List \$48, Order code HIN/6N

Recommended Text

Notes on Seiberg-Witten Theory

Liviu I. Nicolaescu, *University of Notre Dame, Indiana*



In this volume the author presents, in great detail and with many examples, a basic collection of principles, techniques, and applications needed to conduct independent research in

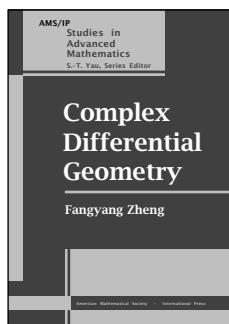
gauge theory and its use in geometry and topology. Complete and self-contained computations of the Seiberg-Witten invariants of most simply connected algebraic surfaces using only Witten's factorization method are included. Also given is a new approach to cutting and pasting Seiberg-Witten invariants, which is illustrated by examples such as the connected sum theorem, the blow-up formula, and a proof of a vanishing result of Fintushel and Stern. The book is a suitable textbook for advanced graduate courses in differential geometry, algebraic topology, basic PDEs and functional analysis.

Contents: Preliminaries; The Seiberg-Witten invariants; Seiberg-Witten equations on complex surfaces; Gluing techniques; Epilogue; Bibliography; Index.

Graduate Studies in Mathematics, Volume 28

October 2000, approximately 484 pages, Hardcover, ISBN 0-8218-2145-8, LC 00-044761, 2000 *Mathematics Subject Classification*: 57R57, 57R19, 57R15, 58D27, 14J80, 53C55, 58J05, 58J52, **All AMS members \$47**, List \$59, Order code GSM/28N

Recommended Text



Complex Differential Geometry

Fangyang Zheng, *Ohio State University, Columbus*

The theory of complex manifolds overlaps with several branches of mathematics, including differential geometry, algebraic geometry, several complex variables, global analysis, topology, algebraic number theory, and mathematical physics. Complex

manifolds provide a rich class of geometric objects, for example the (common) zero locus of any generic set of complex polynomials is always a complex manifold. Yet complex manifolds behave differently than generic smooth manifolds; they are more coherent and fragile. The rich yet restrictive character of complex manifolds makes them a special and interesting object of study.

This book is a self-contained graduate textbook that discusses the differential geometric aspects of complex manifolds. The first part contains standard materials from general topology, differentiable manifolds, and basic Riemannian geometry. The second part discusses complex manifolds and analytic varieties, sheaves and holomorphic vector bundles, and gives a brief account of the surface classification theory, providing readers with some concrete examples of complex manifolds. The last part is the main purpose of the book; in it, the author discusses metrics, connections, curvature, and the various roles they play in the study of complex manifolds. A significant amount of exercises are provided to enhance student comprehension and practical experience.

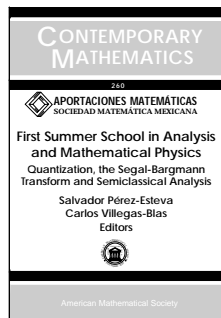
Contents: *Riemannian geometry:* Part 1 introduction; Differentiable manifolds and vector bundles; Metric, connection, and curvature; The geometry of complete Riemannian manifolds; *Complex manifolds:* Part 2 introduction; Complex manifolds and analytic varieties; Holomorphic vector bundles, sheaves and cohomology; Compact complex surfaces; *Kähler geometry:* Part 3 introduction; Hermitian and Kähler metrics; Compact Kähler manifolds; Kähler geometry; Bibliography; Index.

AMS/IP Studies in Advanced Mathematics, Volume 18

October 2000, 264 pages, Hardcover, ISBN 0-8218-2163-6, LC 00-056549, 2000 *Mathematics Subject Classification:* 53-01; 53-00, 53-02, 53C55, All AMS members \$39, List \$49, Order code AMSIP/18N

Mathematical Physics

Supplementary Reading



First Summer School in Analysis and Mathematical Physics

Quantization, the Segal-Bargmann Transform and Semiclassical Analysis

Salvador Pérez-Esteva and Carlos Villegas-Blas,

Universidad Nacional Autónoma de México, Cuernavaca Morelos, Editors

The first Summer School of Analysis and Mathematical Physics of the Universidad Nacional Autónoma de México (Cuernavaca) offered graduate and advanced undergraduate students courses on modern topics in the overlap between analysis and physics. This volume contains the expanded notes from the lectures by Brian Hall, Alejandro Uribe, and David Borthwick. The articles introduce readers to mathematical methods of classical and quantum mechanics and the link between these two theories: quantization and semiclassical analysis. Hall writes about holomorphic methods in analysis and mathematical physics and includes exercises. Uribe's lectures covered trace formulae, in particular asymptotic behavior and the relationship between the asymptotics and the geometric properties of the classical system. Borthwick presents an introduction to Kähler quantization, including the moment map, the orbit method, and symmetry and reduction. The exposition in the entire volume is geared to introducing graduate students with a basic knowledge of mathematics into areas of active research.

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

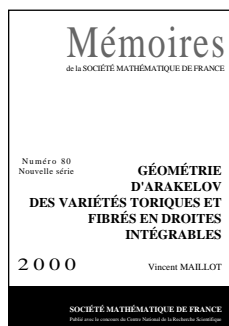
This volume is a joint publication of the American Mathematical Society and the Sociedad Matemática Mexicana. Members of the SMM may order directly from the AMS at the AMS member price.

Contents: B. C. Hall, Holomorphic methods in analysis and mathematical physics; A. Uribe, Trace formulae; D. Borthwick, Introduction to Kähler quantization.

Contemporary Mathematics, Volume 260

August 2000, 132 pages, Softcover, ISBN 0-8218-2115-6, LC 00-034991, 2000 *Mathematics Subject Classification:* 81-06; 81S10, 81Q20, 81S30, Individual member \$21, List \$35, Institutional member \$28, Order code CONM/260N

Number Theory



Géométrie d'Arakelov des Variétés Toriques et Fibrés en Droites Intégrables

Vincent Maillot, *École Normale Supérieure, Paris, France*

A publication of the Société Mathématique de France.

The author's aim in this paper is twofold. First, he extends the Gillet-Soulé arithmetic intersection theory so that it encompasses integrable line bundles. In so doing, he uses as an essential tool a product theory for positive currents developed by Bedford-Taylor and Demailly. Secondly, he applies this construction to smooth projective toric varieties. In this framework, he proves, among other things, that canonical heights of hypersurfaces are related to their Mahler measure. As a consequence of the results, the author proves an arithmetic analogue of the Bernstein-Kushnirenko theorem. Text is in French.

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

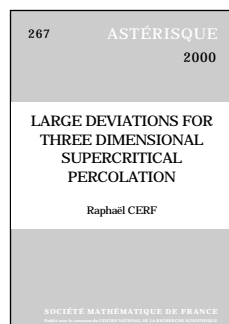
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a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

Contents: Introduction; Variétés toriques sur $\text{Spec}\mathbb{Z}$; Variétés toriques complexes; Produits de courants; Groupes de Chow arithmétiques généralisés; Courants de Chern canoniques sur les variétés toriques; Géométrie d'Arakelov des variétés toriques; Un théorème de Bernstein-Koushnirenko arithmétique; Bibliographie; Index des notations.

Mémoires de la Société Mathématique de France, Number 80

June 2000, 129 pages, Softcover, ISBN 2-85629-088-4, 2000 *Mathematics Subject Classification:* 11D75, 14G40, 14M25, **Individual member \$30**, List \$33, Order code SMFMEM/80N

Probability



Large Deviations for Three Dimensional Supercritical Percolation

Raphaël Cerf, *Université Paris Sud, Orsay, France*

A publication of the Société Mathématique de France.

In this volume, the author considers Bernoulli bond percolation on the three dimensional cubic lattice in the supercritical regime. He proves a large deviation

principle for the rescaled configuration. From that, a picture of the Wulff crystal of the model emerges.

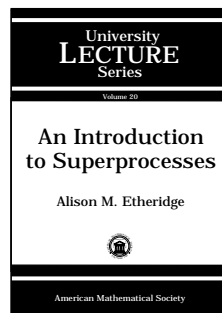
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a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

Contents: Introduction; The large deviation principles; Sketch of the proofs; The model; Surface tension; The surface energy of a Caccioppoli set; Coarse graining; The central lemma; Proof of the LDP for a single cluster; Collections of sets; The surface energy of a Caccioppoli partition; Proof of the LDP for the whole configuration; Appendix; References.

Astérisque, Number 267

June 2000, 177 pages, Softcover, ISBN 2-85629-091-4, 2000 *Mathematics Subject Classification:* 60F10, 82B24, 49Q20, 82B43, **Individual member \$50**, List \$55, Order code AST/267N

Recommended Text



An Introduction to Superprocesses

Alison M. Etheridge, *University of Oxford, England*

Over the past 20 years, the study of superprocesses has expanded into a major industry and can now be regarded as a central theme in modern probability theory. This book is intended as a rapid introduction to the subject, geared toward graduate students and researchers in stochastic analysis.

A variety of different approaches to the superprocesses emerged over the last ten years. Yet no one approach superseded any others. In this book, readers are exposed to a number of different ways of thinking about the processes, and each is used to motivate some key results. The emphasis is on why results are true rather than on rigorous proof. Specific results are given, including extensive references to current literature for their general form.

Contents: Superprocesses as diffusion approximations; Qualitative behaviour I; The Le Gall representation; The relationship between our two classes of superprocesses; A countable representation; Qualitative behaviour II; Introducing interactions; Superprocesses and partial differential equations; Some more interacting models; Appendix; Bibliography; Index of notation; Index.

University Lecture Series, Volume 20

September 2000, 187 pages, Softcover, ISBN 0-8218-2706-5, LC 00-044160, 2000 *Mathematics Subject Classification:* 60-02; 60G57, 60J80, 60K35, 60H30, 60J70, 60G17, 60H15, **All AMS members \$26**, List \$33, Order code ULECT/20N

Previously Announced Publications

Independent Study

Recommended Text

Exploring the Number Jungle: A Journey into Diophantine Analysis

Edward B. Burger, *Williams College, Williamstown, MA*

Welcome to diophantine analysis—an area of number theory in which we attempt to discover hidden treasures and truths within the jungle of numbers by exploring rational numbers. Diophantine analysis comprises two different but interconnected domains—diophantine approximation and diophantine equations. This highly readable book brings to life the fundamental ideas and theorems from diophantine approximation, geometry of numbers, diophantine geometry and p -adic analysis. Through an engaging style, readers are active participants in a journey through these areas of number theory.

Each mathematical theme is presented in a self-contained manner and is motivated by very basic notions. The reader becomes an active participant in the explorations, as each module includes a sequence of numbered questions to be answered and statements to be verified. Many hints and remarks are provided to be freely used and enjoyed. Each module then closes with a Big Picture Question that invites the reader to step back from all the technical details and take a panoramic view of how the ideas at hand fit into the larger mathematical landscape. This book enlists the reader to build intuition, develop ideas and prove results in a very user-friendly and enjoyable environment.

Little background is required and a familiarity with number theory is not expected. All that is needed for most of the material is an understanding of calculus and basic linear algebra together with the desire and ability to prove theorems. The minimal background requirement combined with the author's fresh approach and engaging style make this book enjoyable and accessible to second-year undergraduates, and even advanced high school students. The author's refreshing new spin on more traditional discovery approaches makes this book appealing to any mathematician and/or fan of number theory.

Student Mathematical Library, Volume 8

August 2000, 151 pages, Softcover, ISBN 0-8218-2640-9, LC 00-033180, 2000 *Mathematics Subject Classification*: 11-01, 11J25, 11H06, 11G05, 11J70, 11J82, 11D45, 11J06, 11F85, **All AMS members \$16**, List \$20, Order code STML/8RT009

Recommended Text

Dirac Operators in Riemannian Geometry

Thomas Friedrich, *Institut für Mathematik, Humboldt-Universität, Berlin, Germany**From a review of the German edition:*

This work is to a great extent a written version of lectures given by the author. As a consequence of this fact, the text contains full, detailed and elegant proofs throughout, all calculations are carefully performed, and considerations are well formulated and well motivated. This style is typical of the author. It is a pleasure to read the book; any beginning graduate student should have access to it.

—*Mathematical Reviews*

For a Riemannian manifold M , the geometry, topology and analysis are interrelated in ways that are widely explored in modern mathematics. Bounds on the curvature can have significant implications for the topology of the manifold. The eigenvalues of the Laplacian are naturally linked to the geometry of the manifold. For manifolds that admit spin (or spin^C) structures, one obtains further information from equations involving Dirac operators and spinor fields. In the case of four-manifolds, for example, one has the remarkable Seiberg-Witten invariants.

In this text, Friedrich examines the Dirac operator on Riemannian manifolds, especially its connection with the underlying geometry and topology of the manifold. The presentation includes a review of Clifford algebras, spin groups and the spin representation, as well as a review of spin structures and spin^C structures. With this foundation established, the Dirac operator is defined and studied, with special attention to the cases of Hermitian manifolds and symmetric spaces. Then, certain analytic properties are established, including self-adjointness and the Fredholm property.

An important link between the geometry and the analysis is provided by estimates for the eigenvalues of the Dirac operator in terms of the scalar curvature and the sectional curvature. Considerations of Killing spinors and solutions of the twistor equation on M lead to results about whether M is an Einstein manifold or conformally equivalent to one. Finally, in an appendix, Friedrich gives a concise introduction to the Seiberg-Witten invariants, which are a powerful tool for the study of four-manifolds. There is also an appendix reviewing principal bundles and connections.

This detailed book with elegant proofs is suitable as a text for courses in advanced differential geometry and global analysis, and can serve as an introduction for further study in these areas. This edition is translated from the German edition published by Vieweg Verlag.

Graduate Studies in Mathematics, Volume 25

September 2000, 195 pages, Hardcover, ISBN 0-8218-2055-9, LC 00-038614, 2000 *Mathematics Subject Classification*: 58Jxx; 53C27, 53C28, 57R57, 58J05, 58J20, 58J50, 81R25, **All AMS members \$27**, List \$34, Order code GSM/25RT009

Mathematics Education Research: A Guide for the Research Mathematician

Curtis McKnight, Andy Magid, and Teri J. Murphy,
University of Oklahoma, Norman, and Michelynn
McKnight, *Norman, OK*

Mathematics education research in undergraduate mathematics has increased significantly in the last decade and shows no signs of abating in the near future. Thus far, this research has often been associated with innovations in curriculum such as calculus reform, statistics education, and the use of computational and graphing technology in instruction.

Carefully conducted mathematics education research is something far more fundamental and widely useful than might be implied by its use by the advocates of innovation in undergraduate mathematics education. Most simply, mathematics education research is inquiry by carefully developed research methods aimed at providing evidence about the nature and relationships of many mathematics learning and teaching phenomena. It seeks to clarify the phenomena, illuminate them, explain how they are related to other phenomena, and explain how this may be related to undergraduate mathematics course organization and teaching.

This book—the collaborative effort of a research mathematician, mathematics education researchers who work in a research mathematics department and a professional librarian—introduces research mathematicians to education research. The work presents a non-jargon introduction for educational research, surveys the more commonly used research methods, along with their rationales and assumptions, and provides background and careful discussions to help research mathematicians read or listen to education research more critically.

This guide is of practical interest to university-based research mathematicians. It introduces the methodology of quantitative and qualitative research in education, provides critical guidelines for assessing the reliability and validity of mathematics education research, and explains how to use online database resources to locate education research. The book will also be valuable to graduate students in mathematics who are planning academic careers, and to mathematics department chairs and their deans.

July 2000, 106 pages, Softcover, ISBN 0-8218-2016-8, LC 00-035550, 2000 *Mathematics Subject Classification*: 97C99; 97-XX, **All AMS members \$16**, List \$20, Order code MERRT009

The Fermat Diary

C. J. Mozzochi, *Princeton, NJ*

This book concentrates on the final chapter of the story of perhaps the most famous mathematics problem of our time: Fermat's Last Theorem. The full story begins in 1637, with Pierre de Fermat's enigmatic marginal note in his copy of Diophantus's *Arithmetica*. It ends with the spectacular solution by Andrew Wiles some 350 years later. *The Fermat Diary* provides a record in pictures and words of the dramatic time from June 1993 to August 1995, including the period when Wiles completed the last stages of the proof and concluding with the mathematical world's celebration of Wiles's result at Boston University.

This diary takes us through the process of discovery as reported by those who worked on the great puzzle: Gerhard Frey who conjectured that Shimura-Taniyama implies Fermat; Ken Ribet who followed a difficult and speculative plan of attack suggested by Jean-Pierre Serre and established the statement by Frey; and Andrew Wiles who announced a proof of enough of the Shimura-Taniyama conjecture to settle Fermat's Last Theorem, only to

announce months later that there was a gap in the proof. Finally, we are brought to the historic event on September 19, 1994, when Wiles, with the collaboration of Richard Taylor, dramatically closed the gap. The book follows the much-in-demand Wiles through his travels and lectures, finishing with the Conference on Fermat's Last Theorem at Boston University.

There are many important names in the recent history of Fermat's Last Theorem. This book puts faces and personalities to those names. Mozzochi also uncovers the details of certain key pieces of the story. For instance, we learn in Frey's own words the story of his conjecture, about his informal discussion and later lecture at Oberwolfach and his letter containing the actual statement. We learn from Faltings about his crucial role in the weeks before Wiles made his final announcement. Shimura explains his position concerning the evolution of the Shimura-Taniyama conjecture. Mozzochi also conveys the atmosphere of the mathematical community—and the Princeton Mathematics Department in particular—during this important period in mathematics.

September 2000, approximately 200 pages, Hardcover, ISBN 0-8218-2670-0, LC 00-030629, 2000 *Mathematics Subject Classification*: 11D41, **All AMS members \$23**, List \$29, Order code FERMATDRT009

Supplementary Reading

Codes and Curves

Judy L. Walker, *University of Nebraska, Lincoln*

When information is transmitted, errors are likely to occur. Coding theory examines efficient ways of packaging data so that these errors can be detected, or even corrected.

The traditional tools of coding theory have come from combinatorics and group theory. Since the work of Goppa in the late 1970s, however, coding theorists have added techniques from algebraic geometry to their toolboxes. In particular, by re-interpreting the Reed-Solomon codes as coming from evaluating functions associated to divisors on the projective line, one can see how to define new codes based on other divisors or on other algebraic curves. For instance, using modular curves over finite fields, Tsfasman, Vladut, and Zink showed that one can define a sequence of codes with asymptotically better parameters than any previously known codes.

This monograph is based on a series of lectures the author gave as part of the IAS/PCMI program on arithmetic algebraic geometry. Here, the reader is introduced to the exciting field of algebraic geometric coding theory. Presenting the material in the same conversational tone of the lectures, the author covers linear codes, including cyclic codes, and both bounds and asymptotic bounds on the parameters of codes. Algebraic geometry is introduced, with particular attention given to projective curves, rational functions and divisors. The construction of algebraic geometric codes is given, and the Tsfasman-Vladut-Zink result mentioned above is discussed.

No previous experience in coding theory or algebraic geometry is required. Some familiarity with abstract algebra, in particular finite fields, is assumed. However, this material is reviewed in two appendices. There is also an appendix containing projects that explore other codes not covered in the main text.

Student Mathematical Library, Volume 7

June 2000, 66 pages, Softcover, ISBN 0-8218-2628-X, LC 00-038112, 2000 *Mathematics Subject Classification*: 11T71, 94B27; 11D45, 11G20, 14H50, 94B05, 94B65, **All AMS members \$12**, List \$15, Order code STML/7RT009