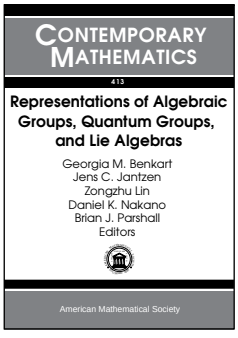
New Publications Offered by the AMS

Algebra and Algebraic Geometry



Representations of Algebraic Groups, Quantum Groups, and Lie Algebras

Georgia Benkart, *University of Wisconsin, Madison, WI*, **Jens C. Jantzen**, *Aarhus University, Denmark*, **Zongzhu Lin**, *Kansas State University, Manhattan, KS*, **Daniel K. Nakano**, *University of Georgia, Athens, GA*, and **Brian J. Parshall**, *University of Virginia, Charlottesville, VA*, Editors

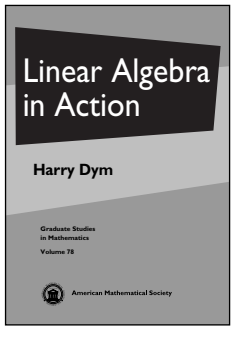
The book contains several well-written, accessible survey papers in many interrelated areas of current research. These areas cover various aspects of the representation theory of Lie algebras, finite groups of Lie types, Hecke algebras, and Lie superalgebras. Geometric methods have been instrumental in representation theory, and these proceedings include surveys on geometric as well as combinatorial constructions of the crystal basis for representations of quantum groups. Humphreys' paper outlines intricate connections among irreducible representations of certain blocks of reduced enveloping algebras of semi-simple Lie algebras in positive characteristic, left cells in two sided cells of affine Weyl groups, and the geometry of the nilpotent orbits. All these papers provide the reader with a broad picture of the interaction of many different research areas and should be helpful to those who want to have a glimpse of current research involving representation theory.

Contents: C. P. Bendel, **D. K. Nakano**, and **C. Pillen**, Extensions for finite groups of Lie type II: Filtering the truncated induction functor; **B. Deng** and **J. Du**, Algebras, representations and their derived categories over finite fields; **Y. Hashimoto**, **M. Kaneda**, and **D. Rumynin**, On localization of $\bar{D}$-modules; **J. E. Humphreys**, Representations of reduced enveloping algebras and cells in the affine Weyl group; **S.-J. Kang**, **J.-A. Kim**, and **D.-U. Shin**, Nakajima's monomials and crystal bases; **G. Karaali**, A new Lie bialgebra structure on $sl(2,1)$; **J. Kujawa**, The Steinberg tensor product theorem for $GL(m|n)$; **Z. Lin** and **H. Rui**, Cyclotomic q-Schur algebras and Schur-Weyl duality; **T. Nakashima**, Geometric crystals and affine crystals; **C. Pillen**, Self-extensions for finite symplectic groups via algebraic groups; **A. Premet** and **H. Strade**, Classification of finite dimensional simple Lie algebras in prime characteristics; **E. C. Rowell**, From quantum groups to unitary modular tensor categories; **J. Xiao** and **G. Zhang**, A trip from representations of the Kronecker quiver to canonical bases of quantum affine algebras.

Contemporary Mathematics, Volume 413

October 2006, 254 pages, Softcover, ISBN-10: 0-8218-3924-1, ISBN-13: 978-0-8218-3924-9, LC 2006045952, 2000 *Mathematics Subject Classification*: 05E10, 14L17, 16G20, 17Bxx, 20C08, 20Gxx, **All AMS members US$63**, List US$79, Order code CONM/413

COURSE ADOPTION



Linear Algebra in Action

Harry Dym, *Weizmann Institute of Science, Rehovot, Israel*

Linear algebra permeates mathematics, perhaps more so than any other single subject. It plays an essential role in pure and applied mathematics, statistics, computer science, and many aspects of physics and engineering. This book conveys in a user-friendly way the basic and advanced techniques of linear algebra from the point of view of a working analyst. The techniques are illustrated by a wide sample of applications and examples that are chosen to highlight the tools of the trade. In short, this is material that the author wishes he had been taught as a graduate student.

Roughly the first third of the book covers the basic material of a first course in linear algebra. The remaining chapters are devoted to applications drawn from vector calculus, numerical analysis, control theory, complex analysis, convexity and

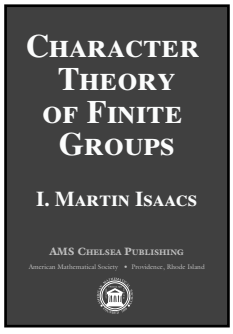
functional analysis. In particular, fixed point theorems, extremal problems, matrix equations, zero location and eigenvalue location problems, and matrices with nonnegative entries are discussed. Appendices on useful facts from analysis and supplementary information from complex function theory are also provided for the convenience of the reader.

The book is suitable as a text or supplementary reference for a variety of courses on linear algebra and its applications, as well as for self-study.

Contents: Vector spaces; Gaussian elimination; Additional applications of Gaussian elimination; Eigenvalues and eigenvectors; Determinants; Calculating Jordan forms; Normed linear spaces; Inner product spaces and orthogonality; Symmetric, Hermitian and normal matrices; Singular values and related inequalities; Pseudoinverses; Triangular factorization and positive definite matrices; Difference equations and differential equations; Vector valued functions; The implicit function theorem; Extremal problems; Matrix valued holomorphic functions; Matrix equations; Realization theory; Eigenvalue location problems; Zero location problems; Convexity; Matrices with nonnegative entries; Some facts from analysis; More complex variables; Bibliography; Index.

Graduate Studies in Mathematics, Volume 78

December 2006, 518 pages, Hardcover, ISBN-10: 0-8218-3813-X, ISBN-13: 978-0-8218-3813-6, LC 2006049906, 2000 *Mathematics Subject Classification*: 15-01, 30-01, 34-01, 39-01, 52-01, 93-01, **All AMS members US$63**, List US$79, Order code GSM/78



Character Theory of Finite Groups

I. Martin Isaacs, *University of Wisconsin, Madison, WI*

Character theory is a powerful tool for understanding finite groups. In particular, the theory has been a key ingredient in the classification of finite simple groups. Characters are also of interest in their own right, and their properties are closely related to properties of the structure of the underlying group.

The book begins by developing the module theory of complex group algebras. After the module-theoretic foundations are laid in the first chapter, the focus is primarily on characters. This enhances the accessibility of the material for students, which was a major consideration in the writing. Also with students in mind, a large number of problems are included, many of them quite challenging.

In addition to the development of the basic theory (using a cleaner notation than previously), a number of more specialized topics are covered with accessible presentations. These include projective representations, the basics of the Schur index, irreducible character degrees and group structure, complex linear groups, exceptional characters, and a fairly extensive introduction to blocks and Brauer characters.

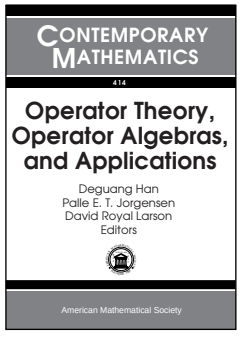
This is a corrected reprint of the original 1976 version, later reprinted by Dover. Since 1976 it has become the standard reference for character theory, appearing in the bibliography of almost every research paper in the subject. It is largely self-contained, requiring of the reader only the most basic facts of linear algebra, group theory, Galois theory and ring and module theory.

Contents: Algebras, modules, and representations; Group representations and characters; Characters and integrality; Products of characters; Induced characters; Normal subgroups; T.I. sets and exceptional characters; Brauer's theorem; Changing the field; The Schur index; Projective representations; Character degrees; Character correspondence; Linear groups; Changing the characteristic; Some character tables; Bibliographic notes; References; Index.

AMS Chelsea Publishing

December 2006, 303 pages, Hardcover, ISBN-10: 0-8218-4229-3, ISBN-13: 978-0-8218-4229-4, LC 2006049869, 2000 *Mathematics Subject Classification*: 20C15, 20C05, 20C20, 20C25, **All AMS members US$41**, List US$45, Order code CHEL/359.H

Analysis



Operator Theory, Operator Algebras, and Applications

Deguang Han, *University of Central Florida, Orlando, FL*, **Palle E.T. Jorgensen**, *University of Iowa, Iowa City, IA*, and **David Royal Larson**, *Texas A & M University, College Station, TX*, Editors

This book offers a presentation of some new trends in operator theory and operator algebras, with a view to their applications. It consists of separate papers written by some of the leading practitioners in the field. The content is put together by the three editors in a way that should help students and working mathematicians in other parts of the mathematical sciences gain insight into an important part of modern mathematics and its applications.

While different specialist authors are outlining new results in this book, the presentations have been made user friendly with the aid of tutorial material. In fact, each paper contains three things: a friendly introduction with motivation, tutorial material, and new research. The authors have strived to make their results relevant to the rest of mathematics. A list of topics discussed in the book includes wavelets, frames and their applications, quantum dynamics, multivariable operator theory, C^*-algebras, and von Neumann algebras. Some longer papers present recent advances on particular, long-standing problems such as extensions and dilations, the Kadison-Singer conjecture, and diagonals of self-adjoint operators.

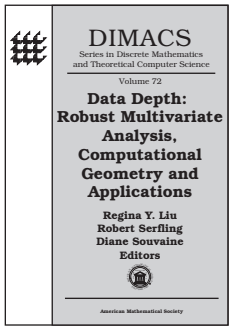
Contents: *Applications, wavelets, dynamics, and quantum theory:* **X. Guo**, **Y. Diao**, and **X. Dai**, Weyl-Heisenberg frame wavelets with basic supports; **P. E. T. Jorgensen**, Use of

operator algebras in the analysis of measures from wavelets and iterated function systems; **D. W. Kribs**, A brief introduction to operator quantum error correction; **N. S. Larsen** and **I. Raeburn**, From filters to wavelets via direct limits; **M.-S. Song**, Wavelet image compression; *Operator theory and harmonic analysis:* **G. Bogveradze** and **L. P. Castro**, Wiener-Hopf plus Hankel operators on the real line with unitary and sectorial symbols; **R. A. Cohen** and **M. E. Walter**, An explicit duality for finite groups; **P. W. Ng**, The corona factorization property; **A. P. Nolasco** and **L. P. Castro**, Factorization theory for Wiener-Hopf plus Hankel operators with almost periodic symbols; *Non-commutative geometry:* **F. Luef**, On spectral invariance of non-commutative tori; **M. A. Rieffel**, Lipschitz extension constants equal projection constants; *C^*-algebras:* **P. E. T. Jorgensen**, Certain representations of the Cuntz relations, and a question on wavelets decompositions; **H. Lin**, The Rokhlin property for automorphisms on simple C^*-algebras; **S. Sakai**, Some recent topics on C^*-algebras and related problems; **M. Tomforde**, Strong shift equivalence in the C^*-algebraic setting: Graphs and C^*-correspondences; **T. Yeend**, Topological higher-rank graphs and the C^*-algebras of topological 1-graphs; *von Neumann algebras:* **W. Arveson** and **R. V. Kadison**, Diagonals of self-adjoint operators; **T. Ş. Bîldea**, On the Laplacian subalgebra of certain tensors of group von Neumann algebras; *Frames in Hilbert space:* **W. Jing**, **D. Han**, and **R. N. Mohapatra**, Structured Parseval frames in Hilbert C^*-modules; **D. R. Larson**, **W.-S. Tang**, and **E. Weber**, Robertson-type theorems for countable groups of unitary operators; *The Kadison-Singer conjecture:* **P. G. Casazza**, **M. Fickus**, **J. C. Tremain**, and **E. Weber**, The Kadison-Singer problem in mathematics and engineering: A detailed account; *Extensions and dilations:* **A. Alevras**, The gauge group of an E_0-semigroup; **P. S. Muhly** and **B. Solel**, Extensions and dilations for C^*-dynamical systems; **R. T. Powers** and **G. L. Price**, On some E_0-semigroups induced from CP-flows on $\mathfrak{B}(\mathfrak{h})$; *Multivariable operator theory:* **H. Bercovici** and **D. Timotin**, Trace-class perturbations and functional calculus; **J. Kim** and **R. L. Moore**, Rank preserving maps on CSL algebras.

Contemporary Mathematics, Volume 414

November 2006, 417 pages, Softcover, ISBN-10: 0-8218-3923-3, ISBN-13: 978-0-8218-3923-2, LC 2006045961, 2000 *Mathematics Subject Classification*: 42C40, 43–02, 46L05, 46L10, 46L57, 47–02, 47A20, 47A58, 81–02, 81Q10, **All AMS members US$87**, List US$109, Order code CONM/414

Applications



Data Depth: Robust Multivariate Analysis, Computational Geometry and Applications

Regina Y. Liu, *Rutgers University, New Brunswick, NJ*, **Robert Serfling**, *University of Texas at Dallas, Richardson, TX*, and **Diane Souvaine**, *Tufts University, Medford, MA*, Editors

The book is a collection of some of the research presented at the workshop of the same name held in May 2003 at Rutgers University. The workshop brought together researchers from two different communities: statisticians and specialists in computational geometry. The main idea unifying these two research areas turned out to be the notion of *data depth*, which is an important notion both in statistics and in the study of efficiency of algorithms used in computational geometry. Many of the articles in the book lay down the foundations for further collaboration and interdisciplinary research.

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

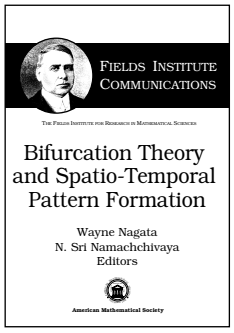
Copublished with the Center for Discrete Mathematics and Theoretical Computer Science beginning with Volume 8. Volumes 1–7 were copublished with the Association for Computer Machinery (ACM).

Contents: R. Serfling, Depth functions in nonparametric multivariate inference; **R. Y. Liu** and **K. Singh**, Rank tests for multivariate scale difference based on data depth; **J. Wang** and **R. Serfling**, On scale curves for nonparametric description of dispersion; **K. Mosler** and **R. Hoberg**, Data analysis and classification with the zonoid depth; **A. Hartikainen** and **H. Oja**, On some parametric, nonparametric and semiparametric discrimination rules; **A. Christmann**, Regression depth and support vector machine; **R. T. Elmore**, **T. P. Hettmansperger**, and **F. Xuan**, Spherical data depth and a multivariate median; **S. López-Pintado** and **J. Romo**, Depth-based classification for functional data; **J. A. Cuesta-Albertos** and **R. Fraiman**, Impartial trimmed means for functional data; **G. Aloupis**, Geometric measures of data depth; **B. Chakraborty** and **P. Chaudhuri**, Computation of half-space depth using simulated annealing; **D. Bremner**, **K. Fukuda**, and **V. Rosta**, Primal-dual algorithms for data depth; **M. A. Burr**, **E. Rafalin**, and **D. L. Souvaine**, Simplicial depth: An improved definition, analysis, and efficiency for the finite sample case; **J. H. Dulá**, Fast algorithms for frames and point depth; **S. Krishnan**, **N. H. Mustafa**, and **S. Venkatasubramanian**, Statistical data depth and the graphics hardware.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 72

December 2006, 246 pages, Hardcover, ISBN-10: 0-8218-3596-3, ISBN-13: 978-0-8218-3596-8, 2000 *Mathematics Subject Classification*: 60D05, 62G10, 62G30, 62G35, 62G99, 62H10, 62H15, 62H30, 65D18, 68U05, **All AMS members US$71**, List US$89, Order code DIMACS/72

Differential Equations



Bifurcation Theory and Spatio-Temporal Pattern Formation

Wayne Nagata, *University of British Columbia, Vancouver, BC, Canada*, and **N. Sri Namachchivaya**, *University of Illinois, Urbana-Champaign, IL*, Editors

Nonlinear dynamical systems and the formation of spatio-temporal patterns play an important role in current research on partial differential equations. This book contains articles on topics of current interest in applications of dynamical systems theory to problems of pattern formation in space and time. Topics covered include aspects of lattice dynamical systems, convection in fluid layers with large aspect ratios, mixed mode oscillations and canards, bacterial remediation of waste, gyroscopic systems, data clustering, and the second part of Hilbert's 16th problem. Most of the book consists of expository survey material, and so can serve as a source of convenient entry points to current research topics in nonlinear dynamics and pattern formation. This volume arose from a workshop held at the Fields Institute in December of 2003, honoring Professor William F. Langford's fundamental work on the occasion of his sixtieth birthday.

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

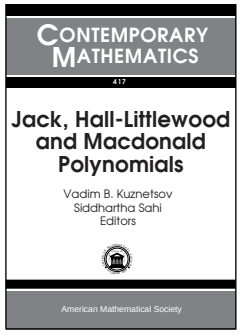
Titles in this series are copublished with the Fields Institute for Research in Mathematical Sciences (Toronto, Ontario, Canada).

Contents: F. Antoneli, **A. P. S. Dias**, **M. Golubitsky**, and **Y. Wang**, Flow invariant subspaces for lattice dynamical systems; **O. Batiste** and **E. Knobloch**, Waves in extended systems: From low- to high-dimensional behavior; **M. Brøns**, **M. Krupa**, and **M. Wechselberger**, Mixed mode oscillations due to the generalized Canard phenomenon; **C. Chen** and **J. Chadam**, Bioremediation of waste in a porous medium; **R. J. McDonald**, **N. S. Namachchivaya**, and **W. Nagata**, Bifurcations of gyroscopic systems near a 0 : 1 resonance; **J. Wu**, High dimensional data clustering from a dynamical systems point of view; **P. Yu**, Computation of limit cycles–The second part of Hilbert's 16th problem.

Fields Institute Communications, Volume 49

November 2006, 177 pages, Hardcover, ISBN-10: 0-8218-3725-7, ISBN-13: 978-0-8218-3725-2, LC 2006048362, 2000 *Mathematics Subject Classification*: 34–06, 35–06, 37–06, **All AMS members US$47**, List US$59, Order code FIC/49

Discrete Mathematics and Combinatorics



Jack, Hall-Littlewood and Macdonald Polynomials

Vadim B. Kuznetsov, and **Siddhartha Sahi**, *Rutgers University, New Brunswick, NJ*, Editors

The subject of symmetric functions began with the work of Jacobi, Schur, Weyl, Young and others on the Schur polynomials. In the 1950's and 60's, far-reaching generalizations of Schur polynomials were obtained by Hall and Littlewood (independently) and, in a different direction, by Jack. In the 1980's, Macdonald unified these developments by introducing a family of polynomials associated with arbitrary root systems.

The last twenty years have witnessed considerable progress in this area, revealing new and profound connections with representation theory, algebraic geometry, combinatorics, special functions, classical analysis and mathematical physics. All these fields and more are represented in this volume, which contains the proceedings of a conference on "Jack, Hall-Littlewood and Macdonald polynomials" held at ICMS, Edinburgh, during September 23–26, 2003.

In addition to new results by leading researchers, the book contains a wealth of historical material, including brief biographies of Hall, Littlewood, Jack and Macdonald; the original papers of Littlewood and Jack; notes on Hall's work by Macdonald; and a recently discovered unpublished manuscript by Jack (annotated by Macdonald). The book will be invaluable to students and researchers who wish to learn about this beautiful and exciting subject.

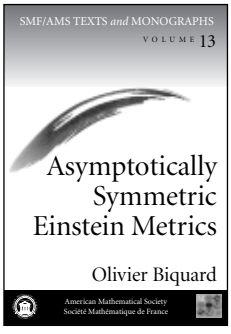
Contents: *Part 1. Historic Material:* **B. D. Sleeman**, Henry Jack 1917–1978; **A. O. Morris**, Philip Hall; **A. O. Morris**, Dudley Ernest Littlewood; **A. O. Morris**, Ian Macdonald; **I. G. Macdonald**, The algebra of partitions; **D. E. Littlewood**, On certain symmetric functions; **H. Jack**, A class of symmetric polynomials with a parameter; **H. Jack**, A class of polynomials in search of a definition, or the symmetric group parametrized; **I. G. Macdonald**, Commentary on the previous paper; **H. Jack**, **G. de B. Robinson**, and **W. N. Everitt**, First letter from Henry Jack to G. de B. Robinson/Second letter reply from G. de B. Robinson to Henry Jack/Third letter from W. N. Everitt to G. de B. Robinson; *Part 2. Research Articles:* **H. Coskun** and **R. A. Gustafson**, Well-poised Macdonald functions W_λ and Jackson coefficients ω_λ on BC_n; **J. F. van Diejen**, Asymptotics of multivariate orthogonal polynomials with hyperoctahedral symmetry; **P. Etingof** and **A. Oblomkov**, Quantization, orbifold cohomology, and Cherednik algebras; **B. Ion** and **S. Sahi**, Triple groups and Cherednik algebras; **M. Kasatani**, **T. Miwa**, **A. N. Sergeev**, and **A. P. Veselov**, Coincident root loci and Jack and Macdonald polynomials for special values of the parameters; **T. H. Koornwinder**, Lowering

and raising operators for some special orthogonal polynomials; **V. B. Kuznetsov** and **E. K. Sklyanin**, Factorization of symmetric polynomials; **E. Langmann**, A method to derive explicit formulas for an elliptic generalization of the Jack polynomials; **M. Lassalle**, A short proof of generalized Jacobi-Trudi expansions for Macdonald polynomials; **A. Okounkov** and **G. Olshanski**, Limits of BC-type orthogonal polynomials as the number of variables goes to infinity; **E. M. Rains**, A difference-integral representation of Koornwinder polynomials; **M. Schlosser**, Explicit computation of the q,t-Littlewood-Richardson coefficients; **V. P. Spiridonov**, A multiparameter summation formula for Riemann theta functions; *Part 3. Vadim Borisovich Kuznetsov 1963–2005:* **B. D. Sleeman** and **E. K. Sklyanin**, Vadim Borisovich Kuznetsov 1963–2005.

Contemporary Mathematics, Volume 417

December 2006, 360 pages, Softcover, ISBN-10: 0-8218-3683-8, ISBN-13: 978-0-8218-3683-5, LC 2006042899, 2000 *Mathematics Subject Classification*: 33D52; 33D80, 33D45, 33D67, **All AMS members US$79**, List US$99, Order code CONM/417

Geometry and Topology



Asymptotically Symmetric Einstein Metrics

Olivier Biquard, *Université Louis Pasteur et CNRS, Strasbourg Cedex, France*

The correspondence between Einstein metrics and their conformal boundaries has recently been the focus of great interest. This is particularly so in view of the relation with the physical theory of the AdS/CFT correspondence.

In this book, this correspondence is seen in the wider context of asymptotically symmetric Einstein metrics, that is Einstein metrics whose curvature is asymptotic to that of a rank one symmetric space. There is an emphasis on the correspondence between Einstein metrics and geometric structures on their boundary at infinity: conformal structures, CR structures, and quaternionic contact structures introduced and studied in the book.

Two new constructions of such Einstein metrics are given, using two different kinds of techniques:

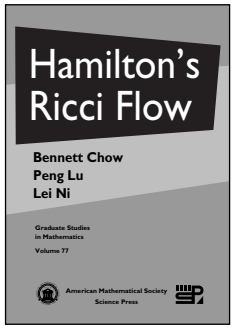
- analytic methods to construct complete Einstein metrics, with a unified treatment of all rank one symmetric spaces, relying on harmonic analysis;
- algebraic methods (twistor theory) to construct local solutions of the Einstein equation near the boundary.

Titles in this series are copublished with Société Mathématique de France. SMF members are entitled to AMS member discounts.

Contents: Introduction; Einstein deformations of hyperbolic metrics; Quaternionic contact structures; Quaternionic-Kähler metrics; Bibliography.

SMF/AMS Texts and Monographs, Volume 13

November 2006, 105 pages, Softcover, ISBN-10: 0-8218-3166-6, ISBN-13: 978-0-8218-3166-3, LC 2006049875, 2000 *Mathematics Subject Classification*: 53C25, 53C15, 32L25, **All AMS members US$31**, List US$39, Order code SMFAMS/13



Hamilton's Ricci Flow

Bennett Chow, *University of California, San Diego, La Jolla, CA*, **Peng Lu**, *University of Oregon, Eugene, OR*, and **Lei Ni**, *University of California, San Diego, La Jolla, CA*

Ricci flow is a powerful analytic method for studying the geometry and topology of manifolds. This book is an introduction to Ricci flow for graduate students and mathematicians interested in working in the subject. To this end, the first chapter is a review of the relevant basics of Riemannian geometry. For the benefit of the student, the text includes a number of exercises of varying difficulty.

The book also provides brief introductions to some general methods of geometric analysis and other geometric flows. Comparisons are made between the Ricci flow and the linear heat equation, mean curvature flow, and other geometric evolution equations whenever possible.

Several topics of Hamilton's program are covered, such as short time existence, Harnack inequalities, Ricci solitons, Perelman's no local collapsing theorem, singularity analysis, and ancient solutions.

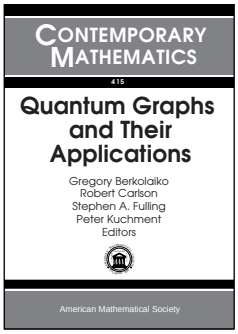
A major direction in Ricci flow, via Hamilton's and Perelman's works, is the use of Ricci flow as an approach to solving the Poincaré conjecture and Thurston's geometrization conjecture.

Contents: Riemannian geometry; Fundamentals of the Ricci flow equation; Closed 3-manifolds with positive Ricci curvature; Ricci solitons and special solutions; Isoperimetric estimates and no local collapsing; Preparation for singularity analysis; High-dimensional and noncompact Ricci flow; Singularity analysis; Ancient solutions; Differential Harnack estimates; Space-time geometry; Appendix A. Geometric analysis related to Ricci flow; Appendix B. Analytic techniques for geometric flows; Appendix S. Solutions to selected exercises; Bibliography; Index.

Graduate Studies in Mathematics, Volume 77

January 2007, 608 pages, Hardcover, ISBN-10: 0-8218-4231-5, ISBN-13: 978-0-8218-4231-7, LC 2006043027, 2000 *Mathematics Subject Classification*: 53C44, 53C21, 58J35, 35K55, **All AMS members US$63**, List US$79, Order code GSM/77

Mathematical Physics



Quantum Graphs and Their Applications

Gregory Berkolaiko, *Texas A&M University, College Station, TX*, **Robert Carlson**, *University of Colorado, Colorado Springs, CO*, and **Stephen A. Fulling** and **Peter Kuchment**, *Texas A&M University, College Station, TX*, Editors

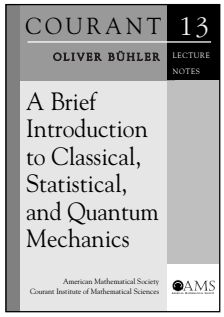
This volume is a collection of articles dedicated to quantum graphs, a newly emerging interdisciplinary field related to various areas of mathematics and physics. The reader can find a broad overview of the theory of quantum graphs. The articles present methods coming from different areas of mathematics: number theory, combinatorics, mathematical physics, differential equations, spectral theory, global analysis, and theory of fractals. They also address various important applications, such as Anderson localization, electrical networks, quantum chaos, mesoscopic physics, superconductivity, optics, and biological modeling.

Contents: M. Aizenman, **R. Sims**, and **S. Warzel**, Fluctuation-based proof of the stability of ac spectra of random operators on tree graphs; **M. Baker** and **X. Faber**, Metrized graphs, Laplacian operators, and electrical networks; **G. Berkolaiko**, Form factor expansion for large graphs: A diagrammatic approach; **J. Bolte** and **J. Harrison**, The spectral form factor for quantum graphs with spin-orbit coupling; **R. Carlson**, Linear network models related to blood flow; **K. Chen**, **S. Molchanov**, and **B. Vainberg**, Localization on Avron-Exner-last graphs: I. Local perturbations; **F. Chung** and **R. M. Richardson**, Weighted Laplacians and the sigma function of a graph; **P. Exner** and **O. Turek**, Approximations of permutation-symmetric vertex couplings in quantum graphs; **D. Fontaine**, **T. Smith**, and **A. Teplyaev**, Resistance of random Sierpiński gaskets; **M. Freidlin** and **M. Weber**, Small diffusion asymptotics for exit problems on graphs; **L. Friedlander**, Determinant of the Schrödinger operator on a metric graph; **S. A. Fulling**, Local spectral density and vacuum energy near a quantum graph vertex; **M. D. Horton**, **H. M. Stark**, and **A. A. Terras**, What are zeta functions of graphs and what are they good for?; **J. P. Keating**, Fluctuation statistics for quantum star graphs; **V. Kostrykin** and **R. Schrader**, Laplacians on metric graphs: Eigenvalues, resolvents and semigroups; **S. Molchanov** and **B. Vainberg**, Transition from a network of thin fibers to the quantum graph: An explicitly solvable model; **B.-S. Ong**, On the limiting absorption principle and spectra of quantum graphs; **J. Rubinstein**, Quantum mechanics, superconductivity and fluid flow in narrow networks; **H. Schanz**, A relation between the bond scattering matrix and the spectral counting function for quantum graphs; **U. Smilansky** and **M. Solomyak**, The quantum graph as a limit of a network of physical wires; **B. Winn**, On the trace formula for quantum star graphs.

Contemporary Mathematics, Volume 415

November 2006, 307 pages, Softcover, ISBN-10: 0-8218-3765-6, ISBN-13: 978-0-8218-3765-8, 2000 *Mathematics Subject Classification*: 05Cxx, 11Mxx, 15A52, 28A80, 34B45, 35J05, 35Pxx, 35Q40, 58Jxx, 60J60, 81Qxx, 81U15, 92C35, 94C99, **All AMS members US$71**, List US$89, Order code CONM/415

COURSE ADOPTION



A Brief Introduction to Classical, Statistical, and Quantum Mechanics

Oliver Bühler, *New York University, Courant Institute, NY*

This book provides a rapid overview of the basic methods and concepts in mechanics for beginning Ph.D. students and advanced undergraduates in applied mathematics or related fields. It is based on a graduate course given in 2006–07 at the Courant Institute of Mathematical Sciences. Among other topics, the book introduces Newton's law, action principles, Hamilton-Jacobi theory, geometric wave theory, analytical and numerical statistical mechanics, discrete and continuous quantum mechanics, and quantum path-integral methods.

The focus is on fundamental mathematical methods that provide connections between seemingly unrelated subjects. An example is Hamilton-Jacobi theory, which appears in the calculus of variations, in Fermat's principle of classical mechanics, and in the geometric theory of dispersive wavetrains. The material is developed in a sequence of simple examples and the book can be used in a one-semester class on classical, statistical, and quantum mechanics. Some familiarity with differential equations is required but otherwise the book is self-contained. In particular, no previous knowledge of physics is assumed.

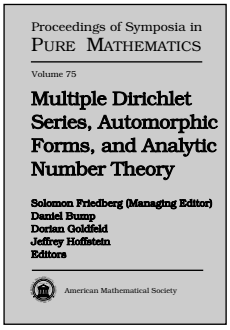
Titles in this series are copublished with the Courant Institute of Mathematical Sciences at New York University.

Contents: Classical mechanics of discrete systems; Wave mechanics; Statistical mechanics; Quantum mechanics; Bibliography; Index.

Courant Lecture Notes, Volume 13

October 2006, 153 pages, Softcover, ISBN-10: 0-8218-4232-3, ISBN-13: 978-0-8218-4232-4, LC 2006043002, 2000 *Mathematics Subject Classification*: 70–01, 74–01, 74J05, 81–01, 82–01, 82B05, 82B10, **All AMS members US$23**, List US$29, Order code CLN/13

Number Theory



Multiple Dirichlet Series, Automorphic Forms, and Analytic Number Theory

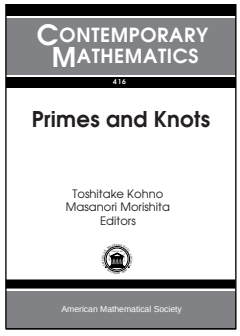
Solomon Friedberg, Managing Editor, *Boston College, Chestnut Hill, MA*, **Daniel Bump**, *Stanford University, CA*, **Dorian Goldfeld**, *Columbia University, New York, NY*, and **Jeffrey Hoffstein**, *Brown University, Providence, RI*, Editors

Multiple Dirichlet series are Dirichlet series in several complex variables. A multiple Dirichlet series is said to be perfect if it satisfies a finite group of functional equations and has meromorphic continuation everywhere. The earliest examples came from Mellin transforms of metaplectic Eisenstein series and have been intensively studied over the last twenty years. More recently, many other examples have been discovered and it appears that all the classical theorems on moments of L-functions as well as the conjectures (such as those predicted by random matrix theory) can now be obtained via the theory of multiple Dirichlet series. Furthermore, new results, not obtainable by other methods, are just coming to light. This volume offers an account of some of the major research to date and the opportunities for the future. It includes an exposition of the main results in the theory of multiple Dirichlet series, and papers on moments of zeta- and L-functions, on new examples of multiple Dirichlet series, and on developments in the allied fields of automorphic forms and analytic number theory.

Contents: *Multiple Dirichlet series and their applications:* **G. Chinta**, **S. Friedberg**, and **J. Hoffstein**, Multiple Dirichlet series and automorphic forms; **Q. Zhang**, Applications of multiple Dirichlet series in mean values of L-functions; **A. Diaconu** and **D. Goldfeld**, Second moments of quadratic Hecke L-series and multiple Dirichlet series I; **B. Brubaker**, **D. Bump**, **G. Chinta**, **S. Friedberg**, and **J. Hoffstein**, Weyl group multiple Dirichlet series I; **B. Brubaker** and **D. Bump**, Residues of Weyl group multiple Dirichlet series associated to $\widetilde{\mathrm{GL}}_{n+1}$; **M. R. Murty** and **K. Sinha**, Multiple Hurwitz zeta functions; **R. Masri**, Multiple zeta values over global function fields; **A. Deitmar**, Generalised Selberg zeta functions and a conjectural Lefschetz formula; *Automorphic forms and analytic number theory:* **Y. Choie** and **N. Diamantis**, Rankin-Cohen brackets on higher order modular forms; **D. Ginzburg**, Eulerian integrals for GL_n; **M. N. Huxley**, Is the Hlawka zeta function a respectable object?; **A. Ivić**, On sums of integrals of powers of the zeta-function in short intervals; **M. Jutila** and **Y. Motohashi**, Uniform bounds for Rankin-Selberg L-functions; **Y. Motohashi**, Mean values of zeta-functions via representation theory; **C. J. Mozzochi**, On the pair correlation of the Eigenvalues of the hyperbolic Laplacian for $\mathrm{PSL}(2,\mathbb{Z})\backslash H$ II; **Z. Rudnick** and **K. Soundararajan**, Lower bounds for moments of L-functions: Symplectic and orthogonal examples.

Proceedings of Symposia in Pure Mathematics, Volume 75

December 2006, approximately 306 pages, Hardcover, ISBN-10: 0-8218-3963-2, ISBN-13: 978-0-8218-3963-8, LC 2006049095, 2000 *Mathematics Subject Classification*: 11Fxx, 11Mxx, 11–02; 22E50, 22E55, **All AMS members US$55**, List US$69, Order code PSPUM/75



Primes and Knots

Toshitake Kohno, *University of Tokyo, Japan*, and **Masanori Morishita**, *Kyushu University, Fukuoka, Japan*, Editors

This volume deals systematically with connections between algebraic number theory and low-dimensional topology. Of particular note are various inspiring interactions between number theory and low-dimensional topology discussed in most papers in this volume. For example, quite interesting are the use of arithmetic methods in knot theory and the use of topological methods in Galois theory. Also, expository papers in both number theory and topology included in the volume can help a wide group of readers to understand both fields as well as the interesting analogies and relations that bring them together.

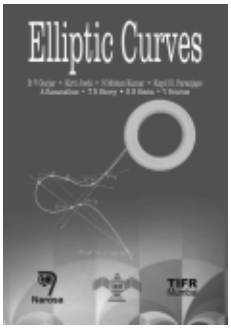
Contents: M. M. Asaeda, **J. H. Przytycki**, and **A. S. Sikora**, Categorification of the skein module of tangles; **A. Besser** and **H. Furusho**, The double shuffle relations for p-adic multiple zeta values; **N. Boston**, Galois p-groups unramified at p—A survey; **K. Fuluta**, On capitulation theorems for infinite groups; **H. Furusho**, Multiple zeta values and Grothendieck-Teichmüller groups; **S. Garoufalidis** and **J. S. Geronimo**, Asymptotics of q-difference equations; **W. M. Goldman**, The mapping class group acts reducibly on $SU(n)$-character varieties; **J. Hillman**, **D. Matei**, and **M. Morishita**, Pro-p link groups and p-homology groups; **H. Murakami**, A quantum introduction to knot theory; **K. Murasugi**, Classical knot invariants and elementary number theory; **H. Nakamura** and **H. Tsunogai**, Harmonic and equianharmonic equations in the Grothendieck-Teichmüller group, II; **L. Rozansky**, On p-adic properties of the Witten-Reshetikhin-Turaev invariant; **Y. Shimizu**, Seiberg-Witten integrable systems and periods of rational elliptic surfaces; **Y. Taguchi**, On the finiteness of various Galois representations; **H. Tsunogai**, Some new-type equations in the Grothendieck-Teichmüller group arising from geometry of $\mathcal{M}_{0,5}$.

Contemporary Mathematics, Volume 416

December 2006, 284 pages, Softcover, ISBN-10: 0-8218-3456-8, ISBN-13: 978-0-8218-3456-5, LC 2006040609, 2000 *Mathematics Subject Classification*: 11Gxx, 11Mxx, 11Rxx, 57Mxx, **All AMS members US$63**, List US$79, Order code CONM/416

New AMS-Distributed Publications

Algebra and Algebraic Geometry



Elliptic Curves

R. V. Gurjar, *Tata Institute of Fundamental Research, Mumbai, India*, **Kirti Joshi**, *University of Arizona, Tucson, AZ*, **N. Mohan Kumar**, *Washington University, St Louis, MO*, **Kapil H. Paranjape**, *Institute of Mathematical Sciences, Chennai, India*, **A. Ramanathan**, and **T. N. Shorey**, **R. R. Simha**, and **V. Srinivas**, *Tata Institute of Fundamental Research, Mumbai, India*

These notes constitute a lucid introduction to "Elliptic Curves", one of the central and vigorous areas of current mathematical research. The subject has been studied from diverse viewpoints—analytic, algebraic, and arithmetical. These notes offer the reader glimpses of all three aspects and present some of the basic important theorems in all of them. The first part introduces a little of the theory of Riemann surfaces and goes on to the study of tori and their projective embeddings as cubics. This part ends with a discussion of the identification of the moduli space of complex tori with the quotient of the upper half plane by the modular groups.

The second part handles the algebraic geometry of elliptic curves. It begins with a rapid introduction to some basic algebraic geometry and then focuses on elliptic curves. The Rieman–Roch theorem and the Riemann hypothesis for elliptic curves are proved, and the structure of the endomorphism ring of an elliptic curve is described.

The third and last part is on the arithmetic of elliptic curves over Q. The Mordell–Weil theorem, Mazur's theorem on torsion in rational points of an elliptic curve over Q, and theorems of Thue and Siegel are among the results which are presented. There is a brief discussion of theta functions, Eisenstein series and cusp forms with an application to representation of natural numbers as sums of squares.

The notes end with the formulation of the Birch and Swinnerton–Dyer conjectures. There is an additional brief chapter (Appendix C), written in July 2004 by Kirti Joshi, describing some developments since the original notes were written up in the present form in 1992.

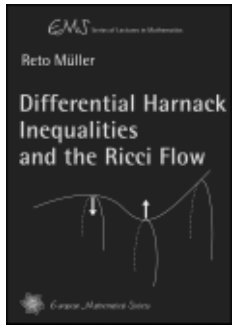
A publication of the Narosa Publishing House for Tata Institute of Fundamental Research. Distributed worldwide except in India, Bangladesh, Bhutan, Maldavis, Nepal, Pakistan, and Sri Lanka.

Contents: *Part I. Analytic theory of Elliptic Curves:* Doubly periodic functions; Riemann surfaces; Tori; Isomorphism of tori and the j invariant; All smooth cubics are complex tori; Moduli; *Part II. Geometry of Elliptic Curves:* Some results from commutative algebra; Varieties; Further properties of varieties; Intersection theory for plane curves; Geometry of curves; Geometry of elliptic curves; Structure of endomorphisms of elliptic curves; *Part III. Arithmetic of Elliptic Curves:* Rational points on curves; The Mordell–Weil theorem for elliptic curves over **Q**; Computing the Mordell–Weil group; Integer points, and the theorems of Thue and Siegel; Representation of numbers by squares; The conjecture of Birch and Swinnerton–Dyer; Appendices; Bibliography.

Tata Institute of Fundamental Research

July 2006, 400 pages, Hardcover, ISBN-10: 81-7319-502-1, ISBN-13: 978-81-7319-502-0, 2000 *Mathematics Subject Classification*: 60B15, 60Jxx, 43–XX, **All AMS members US$36**, List US$45, Order code TIFR/9

Analysis



Differential Harnack Inequalities and the Ricci Flow

Reto Müller, *ETH Zurich, Switzerland*

In 2002, Grisha Perelman presented a new kind of differential Harnack inequality which involves both the (adjoint) linear heat equation and the Ricci flow. This led to a completely new approach to the Ricci flow that allowed interpretation as a gradient flow which maximizes different entropy functionals. The goal of this book is to explain this analytic tool in full detail for the two examples of the linear heat equation and the Ricci flow. It begins with the original Li-Yau result, presents Hamilton's Harnack inequalities for the Ricci flow, and ends with Perelman's entropy formulas and space-time geodesics. The book is a self-contained, modern introduction to the Ricci flow and the analytic methods to study it. It is primarily addressed to students who have a basic introductory knowledge of analysis and of Riemannian geometry and who are attracted to further study in geometric analysis. No previous knowledge of differential Harnack inequalities or the Ricci flow is required.

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

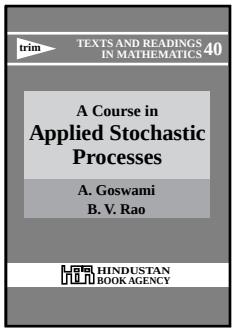
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: Introduction; Foundational material; Differential Harnack inequalities; Entropy formulas; Reduced distance and reduced volume; Bibliography; List of symbols; Index.

EMS Series of Lectures in Mathematics

August 2006, 100 pages, Softcover, ISBN-10: 3-03719-030-2, ISBN-13: 978-3-03719-030-2, 2000 *Mathematics Subject Classification*: 58J35, 53C44, 53C21, 35K55, 58E11, 58E10, **All AMS members US$22**, List US$28, Order code EMSSERLEC/5

Probability



A Course in Applied Stochastic Processes

A. Goswami and **B. V. Rao**, *Indian Statistical Institute, Kolkata, India*

This book is an introduction to applications of the theory of stochastic processes—more specifically Markov chain theory—in population dynamics, genetics, and epidemics. A prior exposure to basic probability theory should be helpful, but by no means essential. The book includes a quick review of probability that starts from elementary combinatorial probability and ends with some basic properties of diffusions, including a fairly extensive account of martingales and Markov chains, mostly with proofs. This is done fairly rigorously without using measure theoretic tools. In continuation of the effort to keep the prerequisites at the bare minimum, all the basic genetics the reader needs to know is included. Yet sophisticated material on Wright–Fisher and Moran models of genetics, including diffusion approximations, is presented. The material on epidemic models includes several important threshold theorems with carefully presented interpretation and complete proofs.

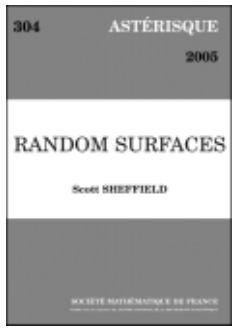
Although this book is primarily intended for use as a textbook for a course on applied stochastic processes, it can also be used by researchers in the fields of genetics or epidemics for learning about applications of probability in their respective areas.

A publication of Hindustan Book Agency. Distributed on an exclusive basis by the AMS in North America. Online bookstore rights worldwide.

Contents: Probability tools and techniques; Branching processes; Basic mathematical genetics; Markov models in genetics; Models in epidemics.

Hindustan Book Agency

September 2006, 226 pages, Hardcover, ISBN-10: 81-85931-69-0, ISBN-13: 978-81-85931-69-2, 2000 *Mathematics Subject Classification*: 60J20; 92D25, 92D30, **All AMS members US$29**, List US$36, Order code HIN/31



Random Surfaces

Scott Sheffield, *New York University-Courant Institute of Mathematical Sciences, NY*

The author develops a general theory of discrete and continuous height models governed by Gibbs potentials that depend only on height differences. He characterizes the gradient phases of a given slope as minimizers of specific free energy and gives large deviation principles for surface shapes and empirical measures. For convex, nearest neighbor Gibbs potentials, he shows that gradient phases are characterized by their slopes and, in higher dimensional discrete settings, by one additional parameter. For standard $2+1$ dimensional crystal surface models, he shows that all smooth phases (crystal facets) lie in the dual of the lattice of translation invariance.

A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Specific free energy and variational principle; Ergodic/extremal decompositions and SFE; Surface tension and energy; Analytical results for Sobolev spaces; Limit equalities and the variational principle; LDP for empirical measure profiles; Cluster swapping; Discrete, two-dimensional gradient phases; Open problems; A. *SFE* and the lexicographic past; B. Summary of notations; Bibliography.

Astérisque, Number 304

July 2006, 175 pages, Softcover, ISBN-10: 2-85629-187-2, ISBN-13: 978-2-85629-187-0, 2000 *Mathematics Subject Classification*: 60D05, 60F10, 60G60, **Individual member US$34**, List US$38, Order code AST/304