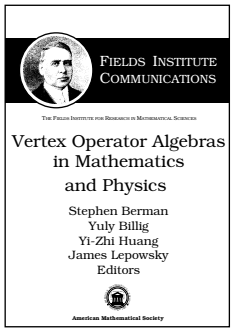
New Publications Offered by the AMS

Algebra and Algebraic Geometry



Vertex Operator Algebras in Mathematics and Physics

Stephen Berman, *University of Saskatchewan, Saskatoon, Canada*, **Yuly Billig**, *Carleton University, Ottawa, ON, Canada*, and **Yi-Zhi Huang** and **James Lepowsky**, *Rutgers University, Piscataway, NJ*, Editors

Vertex operator algebras are a class of algebras underlying a number of recent constructions, results, and themes in mathematics. These algebras can be understood as "string-theoretic analogues" of Lie algebras and of commutative associative algebras. They play fundamental roles in some of the most active research areas in mathematics and physics. Much recent progress in both physics and mathematics has benefited from cross-pollination between the physical and mathematical points of view.

This book presents the proceedings from the workshop, "Vertex Operator Algebras in Mathematics and Physics", held at The Fields Institute. It consists of papers based on many of the talks given at the conference by leading experts in the algebraic, geometric, and physical aspects of vertex operator algebra theory.

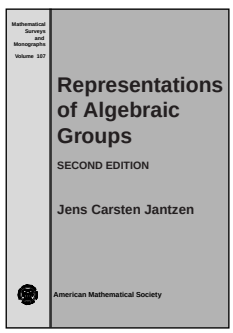
The book is suitable for graduate students and research mathematicians interested in the major themes and important developments on the frontier of research in vertex operator algebra theory and its applications in mathematics and physics.

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

Contents: T. Abe and **K. Nagatomo**, Finiteness of conformal blocks over the projective line; **P. Bantay**, Permutation orbifolds and their applications; **J. Fuchs** and **C. Schweigert**, Category theory for conformal boundary conditions; **R. L. Griess, Jr.**, GNAVOA, I. Studies in groups, nonassociative algebras and vertex operator algebras; **G. Höhn**, Genera of vertex operator algebras and three-dimensional topological quantum field theories; **Y.-Z. Huang**, Riemann surfaces with boundaries and the theory of vertex operator algebras; **H. Li**, Vertex (operator) algebras are "algebras" of vertex operators; **A. Milas**, Correlation functions, differential operators and vertex operator algebras; **M. Primc**, Relations for annihilating fields of standard modules for affine Lie algebras; **A. Recknagel**, From branes to boundary conformal field theory: Draft of a dictionary; **V. Schomerus**, Open strings and non-commutative geometry; **C. Schweigert** and **J. Fuchs**, The world sheet revisited.

Fields Institute Communications, Volume 39

December 2003, 249 pages, Hardcover, ISBN 0-8218-2856-8, LC 2003062777, 2000 *Mathematics Subject Classification*: 17B69, 17B81, 17B67, 17B68, 17B65, 81T40, 81T30, 81R10, 57R56, **All AMS members $60**, List $75, Order code FIC/39N



Representations of Algebraic Groups
Second Edition

Jens Carsten Jantzen, *Aarhus University, Denmark*

From reviews of the First Edition:

Very readable … meant to give its reader an introduction to the representation theory of reductive algebraic groups …

—Zentralblatt MATH

Those familiar with [Jantzen's previous] works will approach this new book … with eager anticipation. They will not be disappointed, as the high standard of the earlier works is not only maintained but exceeded … very well written and the author has taken great care over accuracy both of mathematical details and in references to the work of others. The discussion is well motivated throughout … This impressive and wide ranging volume will be extremely useful to workers in the theory of algebraic groups … a readable and scholarly book.

—Mathematical Reviews

Back in print from the AMS, the first part of this book is an introduction to the general theory of representations of algebraic group schemes. Here, Janzten describes important basic notions: induction functors, cohomology, quotients, Frobenius kernels, and reduction mod p, among others. The second part

of the book is devoted to the representation theory of reductive algebraic groups and includes topics such as the description of simple modules, vanishing theorems, the Borel-Bott-Weil theorem and Weyl's character formula, and Schubert schemes and line bundles on them.

This is a significantly revised edition of a modern classic. The author has added nearly 150 pages of new material describing later developments and has made major revisions to parts of the old text. It continues to be the ultimate source of information on representations of algebraic groups in finite characteristics.

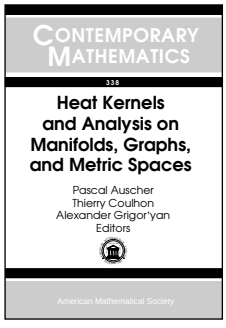
The book is suitable for graduate students and research mathematicians interested in algebraic groups and their representations.

Contents: *Part I. General theory:* Schemes; Group schemes and representations; Induction and injective modules; Cohomology; Quotients and associated sheaves; Factor groups; Algebras of distributions; Representations of finite algebraic groups; Representations of Frobenius kernels; Reduction mod p; *Part II. Representations of reductive groups:* Reductive groups; Simple G-modules; Irreducible representations of the Frobenius kernels; Kempf's vanishing theorem; The Borel-Bott-Weil theorem and Weyl's character formula; The linkage principle; The translation functors; Filtrations of Weyl modules; Representations of G_rT and G_rB; Geometric reductivity and other applications of the Steinberg modules; Injective G_r-modules; Cohomology of the Frobenius kernels; Schubert schemes; Line bundles on Schubert schemes; Truncated categories and Schur algebras; Results over the integers; Lusztig's conjecture and some consequences; Radical filtrations and Kazhdan-Lusztig polynomials; Tilting modules; Frobenius splitting; Frobenius splitting and good filtrations; Representations of quantum groups; References; List of notations; Index.

Mathematical Surveys and Monographs, Volume 107

December 2003, 576 pages, Hardcover, ISBN 0-8218-3527-0, 2000 *Mathematics Subject Classification*: 20–02, 20G05; 17B10, 17B45, 17B56, 22E45, **All AMS members $79**, List $99, Order code SURV/107N

Analysis



Heat Kernels and Analysis on Manifolds, Graphs, and Metric Spaces

Pascal Auscher, *Université Paris-Sud, Orsay*, **Thierry Coulhon**, *Université de Cergy-Pontoise, Cergy Pontoise, France*, and **Alexander Grigor'yan**, *Imperial College London*, Editors

This volume contains the expanded lecture notes of courses taught at the Emile Borel Centre of the Henri Poincaré Institute (Paris). In the book, leading experts introduce recent research in their fields. The unifying theme is the study of heat kernels in various situations using related geometric and analytic tools. Topics include analysis of complex-coefficient elliptic operators, diffusions on fractals and on infinite-dimensional groups, heat kernel and isoperimetry on Riemannian manifolds, heat kernels and infinite dimensional analysis, diffusions and Sobolev-type spaces on metric spaces, quasi-regular mappings and p-Laplace operators, heat kernel and spherical inversion on $SL_2(C)$, random walks and spectral geometry on crystal lattices, isoperimetric and isocapacitary inequalities, and generating function techniques for random walks on graphs.

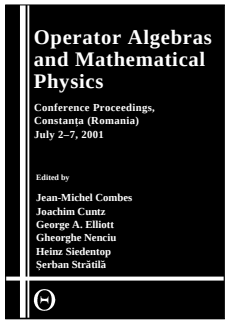
This volume is suitable for graduate students and research mathematicians interested in random processes and analysis on manifolds.

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

Contents: P. Auscher, Some questions on elliptic operators; **M. T. Barlow**, Heat kernels and sets with fractal structure; **A. Bendikov** and **L. Saloff-Coste**, Brownian motions on compact groups of infinite dimension; **T. Coulhon**, Heat kernel and isoperimetry on non-compact Riemannian manifolds; **B. K. Driver**, Heat kernels measures and infinite dimensional analysis; **A. Grigor'yan**, Heat kernels and function theory on metric measure spaces; **P. Hajlasz**, Sobolev spaces on metric-measure spaces; **I. Holopainen**, Quasiregular mappings and the p-Laplace operator; **J. Jorgenson** and **S. Lang**, Spherical inversion on $SL_2(C)$; **M. Kotani** and **T. Sunada**, Spectral geometry of crystal lattices; **V. Maz'ya**, Lectures on isoperimetric and isocapacitary inequalities in the theory of Sobolev spaces; **S. Semmes**, Some topics related to analysis on metric spaces; **K.-T. Sturm**, Probability measures on metric spaces of nonpositive curvature; **W. Woess**, Generating function techniques for random walks on graphs.

Contemporary Mathematics, Volume 338

January 2004, 424 pages, Softcover, ISBN 0-8218-3383-9, 2000 *Mathematics Subject Classification*: 58Jxx, 60Hxx, 60Gxx, 60Jxx, 60Bxx, 58Exx, 47Dxx, 53Cxx, 35Jxx, **All AMS members $79**, List $99, Order code CONM/338N



Operator Algebras and Mathematical Physics

Jean-Michel Combes, *Université de Toulon et du Var, La Garde, France*, **Joachim Cuntz**, *University of Münster, Germany*, **George A. Elliott**, *University of Toronto, ON, Canada*, **Gheorghe Nenciu**, *University of Bucharest, Romania*, **Heinz Siedentop**, *Ludwig-Maximilians-Universität München, Germany*, and **Şerban Strătilă**, *University of Bucharest, Romania*, Editors

This volume presents the proceedings of the conference on Operator Algebras and Mathematical Physics held in Constanta, Romania. The conference gathered experts to examine and discuss the interesting connections between these two areas.

The book contains 24 research and expository papers reflecting a broad variety of topics from both domains: C^*-algebras and dynamical systems, geometric and operator algebraic quantization, modular invariants, q-commutation

relations, superselection theory, positive linear maps, groupoids, spectral analysis of Hamiltonians, random operators, and quantum systems. The material is suitable for graduate students and research mathematicians interested in operator algebras, mathematical physics, and their interaction.

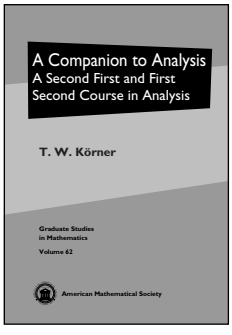
This item will also be of interest to those working in mathematical physics.

A publication of the Theta Foundation. Distributed worldwide, except in Romania, by the AMS.

Contents: E. J. Beggs, 2-forms and noncommutative Hamiltonian dynamics; **M.-T. Benameur** and **H. Oyono-Oyono**, Gap-labelling for quasi-crystals (proving a conjecture by J. Bellissard); **W. R. Bergmann** and **R. Conti**, On infinite tensor products of Hilbert $*$-bimodules; **M. Buneci**, Haar systems and homomorphisms on groupoids; **M. Choda**, Actions of the matrix groups on the free group factors and entropy of automorphisms; **M. Dadarlat**, Some remarks on the universal coefficient theorem in KK-theory; **P. Duclos**, **O. Lev**, **P. Šťovíček**, and **M. Vittot**, Progressive diagonalization and applications; **D. E. Evans**, Critical phenomena, modular invariants and operator algebras; **C. Ferrari** and **N. Macris**, Spectral properties of finite quantum Hall systems; **V. Georgescu** and **A. Iftimovici**, C^*-algebras of quantum Hamiltonians; **F. Hiai**, q-deformed Araki-Woods algebras; **J. A. Jeong**, Real rank of graph C^*-algebras; **T. Katsura**, On crossed products of the Cuntz algebra $\mathcal{O}_\infty$ by quasi-free actions of abelian groups; **B. Kuckert**, Moving quantum systems: particles versus vacuum; **S.-H. Kye**, On the facial structures for positive linear maps between matrix algebras; **N. P. Landsman**, Quantization and the tangent groupoid; **D. Lenz** and **P. Stollmann**, Delone dynamical systems and associated random operators; **W. A. Majewski**, On entanglement of states and quantum correlations; **M. Măntoiu**, C^*-algebras, dynamical systems, spectral analysis; **G. Morsella**, The structure of charges in the ultraviolet and an intrinsic notion of confinement; **D. Pask** and **S.-J. Rho**, Some intrinsic properties of simple graph C^*-algebras; **N. C. Phillips**, When are crossed products by minimal diffeomorphisms isomorphic?; **J. Renault**, AF equivalence relations and their cocycles; **S. Vaes** and **A. Van Daele**, The Heisenberg commutation relations, commuting squares and the Haar measure on locally compact quantum groups.

International Book Series of Mathematical Texts

July 2003, 400 pages, Hardcover, ISBN 973-85432-2-3, 2000 *Mathematics Subject Classification*: 46-06, 81-06, 35-06; 47-06, **All AMS members $35**, List $44, Order code THETA/4N



A Companion to Analysis

A Second First and First Second Course in Analysis

T. W. Körner, *University of Cambridge, England*

This book not only provides a lot of solid information about real analysis, it also answers those questions which students want to ask but cannot figure how to formulate. To read this book is to spend time with one of the modern masters in the subject.

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

T. W. Körner's A Companion to Analysis *is a welcome addition to the literature on undergraduate-level rigorous analysis. It is written with great care with regard to both mathematical correctness and pedagogical soundness. Körner shows good taste in deciding what to explain in detail and what to leave to the reader in the exercises scattered throughout the text. And the enormous collection of supplementary exercises in Appendix K, which comprises almost one-third of the whole book, is a valuable resource for both teachers and students.*

One of the major assets of the book is Körner's very personal writing style. By keeping his own engagement with the material continually in view, he invites the reader to a similarly high level of involvement. And the witty and erudite asides that are sprinkled throughout the book are a real pleasure.

—Gerald Folland, University of Washington, Seattle

Many students acquire knowledge of a large number of theorems and methods of calculus without being able to say how they work together. This book provides those students with the coherent account that they need. *A Companion to Analysis* explains the problems that must be resolved in order to procure a rigorous development of the calculus and shows the student how to deal with those problems.

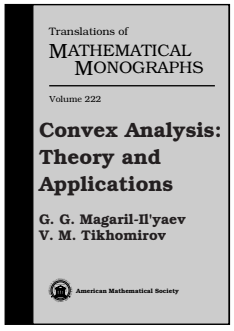
Starting with the real line, the book moves on to finite-dimensional spaces and then to metric spaces. Readers who work through this text will be ready for courses such as measure theory, functional analysis, complex analysis, and differential geometry. Moreover, they will be well on the road that leads from mathematics student to mathematician.

With this book, well-known author Thomas Körner provides able and hard-working students a great text for independent study or for an advanced undergraduate or first-level graduate course. It includes many stimulating exercises. An appendix contains a large number of accessible but non-routine problems that will help students advance their knowledge and improve their technique.

Contents: The real line; A first philosophical interlude; Other versions of the fundamental axiom; Higher dimensions; Sums and suchlike; Differentiation; Local Taylor theorems; The Riemann integral; Developments and limitations of the Riemann integral; Metric spaces; Complete metric spaces; Contraction mappings and differential equations; Inverse and implicit functions; Completion; Appendices; Executive summary; Exercises; Bibliography; Index.

Graduate Studies in Mathematics, Volume 62

January 2004, 590 pages, Hardcover, ISBN 0-8218-3447-9, LC 2003062905, 2000 *Mathematics Subject Classification*: 26-01, **All AMS members $63**, List $79, Order code GSM/62N



Convex Analysis: Theory and Applications

G. G. Magaril-Il'yaev, *Central Research Institute of Complex Automation, Moscow*, and **V. M. Tikhomirov**, *Moscow State University*

This book is an introduction to convex analysis and some of its applications. It starts with basic theory, which is explained within the framework of finite-dimensional spaces. The only prerequisites are basic analysis and simple geometry. The second chapter presents some applications of convex analysis, including problems of linear programming, geometry, and approximation. Special attention is paid to applications of convex analysis to Kolmogorov-type inequalities for derivatives of functions in one variable. Chapter 3 collects some results on geometry and convex analysis in infinite-dimensional spaces. A comprehensive introduction written "for beginners" illustrates the fundamentals of convex analysis in finite-dimensional spaces.

The book can be used for an advanced undergraduate or graduate-level course on convex analysis and its applications. It is also suitable for independent study of this important area of mathematics.

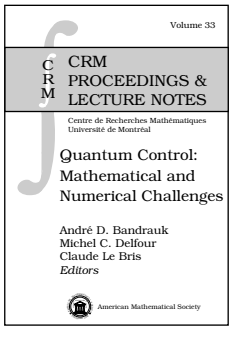
This item will also be of interest to those working in applications.

Contents: Introduction; Theory; Applications; Appendix; Bibliography; Index.

Translations of Mathematical Monographs, Volume 222

November 2003, 183 pages, Softcover, ISBN 0-8218-3525-4, LC 2003062858, 2000 *Mathematics Subject Classification*: 52–01, 46N10; 47N10, **All AMS members $28**, List $35, Order code MMONO/222N

Applications



Quantum Control: Mathematical and Numerical Challenges

André D. Bandrauk, *Université de Sherbrooke, QC, Canada*, **Michel C. Delfour**, *Université de Montréal, QC, Canada*, and **Claude Le Bris**, *Ecole Nationale des Ponts et Chaussées, Marne-la-vallée, France*, Editors

An entirely new branch of science now known as *Laser Control of Molecular Processes* is steadily making an impact on the experimental and technological worlds, with internationally distinguished scientists making many outstanding contributions. In parallel, mathematicians from control theory and numerical simulation are getting progressively involved and making their contributions to this scientific endeavor.

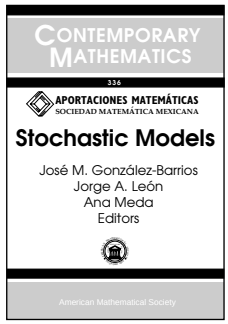
This volume presents the proceedings of the workshop, "Quantum Control: Mathematical and Numerical Challenges", held at the Centre de recherches mathématiques of the Université de Montréal (CRM). The workshop concentrated on advanced numerical methods and new mathematical control and optimization approaches and tools for the quantum control of matter at the molecular level using current laser technology. It brought together mathematicians, theoretical chemists, and physicists working in the area of control and optimization of systems to address the outstanding numerical and mathematical problems.

The volume is suitable for graduate students and research mathematicians interested in mathematical methods of control of molecular processes. It will also be useful to chemical engineers and chemists working in control and optimization of systems.

Contents: O. Atabek and **C. M. Dion**, Molecular alignment and orientation: From laser-induced mechanisms to optimal control; **A. Auger**, **A. Ben Haj-Yedder**, and **M. Schoenauer**, Overview and software guide of evolutionary algorithms; A case study in quantum control; **A. D. Bandrauk**, **F. Légaré**, and **H. T. Yu**, Laser control of molecular states—Nonperturbative examples; **V. S. Batista** and **P. Brumer**, Coherent control: Principles and semiclassical implementations; **G. Chen**, **D. A. Church**, **B.-G. Englert**, and **M. S. Zubairy**, Mathematical models of contemporary elementary quantum computing devices; **M. C. Delfour**, Addendum and remarks on doubly conservative numerical schemes for the nonlinear Schrödinger equation and its control; **R. Illner**, **H. Lange**, and **H. Teismann**, A note on the exact internal control of nonlinear Schrödinger equations; **C. Le Bris**, **Y. Maday**, and **G. Turinici**, Towards efficient numerical approaches for quantum control; **H. Lefebvre-Brion**, Multichannel quantum defect study of the control in the frequency domain: Example of HI; **Y. Ohtsuki** and **H. Rabitz**, Development of solution algorithms for quantum optimal control equations in product spaces; **X.-G. Wang** and **T. Carrington, Jr.**, Using contracted basis functions to solve the Schrödinger equation; **E. Zuazua**, Remarks on the controllability of the Schrödinger equation.

CRM Proceedings & Lecture Notes, Volume 33

January 2004, 211 pages, Softcover, ISBN 0-8218-3330-8, 2000 *Mathematics Subject Classification*: 49J20, 81V10, 81V80, 78A60, 81P68; 35Q40, 37N20, 46N50, 47N50, **All AMS members $49**, List $61, Order code CRMP/33N



Stochastic Models

José M. González-Barrios, *Universidad Nacional Autónoma de México*, **Jorge A. León**, *Instituto Politécnico Nacional, México*, and **Ana Meda** *Universidad Nacional Autónoma de México*, Editors

The volume includes lecture notes and research papers by participants of the Seventh Symposium on Probability and Stochastic Processes held in Mexico City. The lecture notes introduce recent advances in stochastic calculus

with respect to fractional Brownian motion, principles of large deviations and of minimum entropy concerning equilibrium prices in random economic systems, and give a complete and thorough survey of credit risk theory.

The research papers cover areas such as financial markets, Gaussian processes, stochastic differential equations, stochastic integration, quantum dynamical semigroups, self-intersection local times, etc.

Readers should have a basic background in probability theory, stochastic integration, and stochastic differential equations. The book is suitable for graduate students and research mathematicians interested in probability, stochastic processes, and risk theory.

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

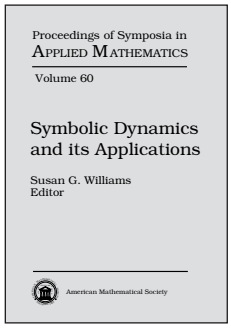
This volume is a joint publication of the American Mathematical Society and the Sociedad Matemática Mexicana. Members of the SMM may order directly from the AMS at the AMS member price.

Contents: *Lecture notes:* **D. Nualart**, Stochastic integration with respect to fractional Brownian motion and applications; **E. Nummelin**, Entropy and economic equilibrium; **T. Schmidt** and **W. Stute**, Credit risk–A survey; *Research papers:* **N. Castañeda-Leyva** and **D. Hernández-Hernández**, Optimal investment in incomplete financial markets with stochastic volatility; **M. Galea**, **J. Ma**, and **S. Torres**, Price calculation for power exponential jump-diffusion models—A Hermite-series approach; **J. C. García** and **R. Quezada**, Conditions for nonconservativity in quantum dynamical semigroups; **J. M. González-Barrios**, Some notes on a dependency measure; **J. González-Hernández**, An example of an averaged Markov decision process without stable policies; **E. Gordienko**, **M. Mendieta**, and **J. Ruiz de Chávez**, Closeness estimates for sums of independent random variables; **C. Houdré** and **J. Villa**, An example of infinite dimensional quasi-helix; **J. A. León** and **M. Sarrà**, A non-homogeneous wave equation driven by a Poisson process; **J. A. López-Mimbela** and **J. Villa**, Existence of self-intersection local time of the multitype Dawson-Watanabe superprocess; **V. Pérez-Abreu** and **A. Rocha-Arteaga**, Lévy processes in Banach spaces: Distributional properties and subordination; **L. A. Rincón**, Phase space path integral representation for the solution of a stochastic Schrödinger equation; **A. Talarczyk**, A note on covariance characterization of some generalized Gaussian random fields; **C. Tudor**, On two-parameter Stieltjes integrals for functions in Besov-Liouville spaces and stochastic integrals.

Contemporary Mathematics, Volume 336

December 2003, 272 pages, Softcover, ISBN 0-8218-3466-5, LC 2003062763, 2000 *Mathematics Subject Classification*: 60E15, 60F10, 60G15, 60G50, 60H05, 60H10, 60H15, 60J60, 91B26, 91B30, **All AMS members $55**, List $69, Order code CONM/336N

Differential Equations



Symbolic Dynamics and its Applications

Susan G. Williams, *University of South Alabama, Mobile,* Editor

Symbolic dynamics originated as a tool for analyzing dynamical systems and flows by discretizing space as well as time. The development of information theory gave impetus to the study of symbol sequences as objects in their own right. Today, symbolic dynamics has expanded to encompass multi-dimensional arrays of symbols and has found diverse applications both within and beyond mathematics.

This volume is based on the AMS Short Course on Symbolic Dynamics and its Applications. It contains introductory articles on the fundamental ideas of the field and on some of its applications. Topics include the use of symbolic dynamics techniques in coding theory and in complex dynamics, the relation between the theory of multi-dimensional systems and the dynamics of tilings, and strong shift equivalence theory.

Contributors to the volume are experts in the field and are clear expositors. The book is suitable for graduate students and research mathematicians interested in symbolic dynamics and its applications.

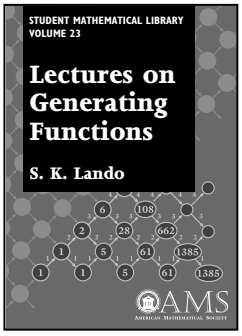
This item will also be of interest to those working in applications.

Contents: S. G. Williams, Introduction to symbolic dynamics; **B. Marcus**, Combining modulation codes and error correcting codes; **P. Blanchard**, **R. L. Devaney**, and **L. Keen**, Complex dynamics and symbolic dynamics; **D. Lind**, Multi-dimensional symbolic dynamics; **E. A. Robinson, Jr.**, Symbolic dynamics and tilings of $\mathbb{R}^d$; **J. B. Wagoner**, Strong shift equivalence theory; Index.

Proceedings of Symposia in Applied Mathematics, Volume 60

January 2004, approximately 168 pages, Hardcover, ISBN 0-8218-3157-7, 2000 *Mathematics Subject Classification*: 37B10, 37B50, 37A15, 37F45, 94B05, 19C99, **All AMS members $31**, List $39, Order code PSAPM/60N

Discrete Mathematics and Combinatorics



Lectures on Generating Functions

S. K. Lando, *Independent University of Moscow*

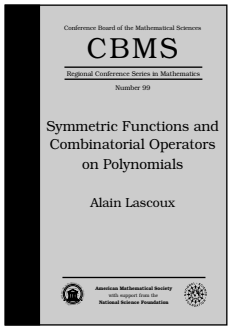
This book introduces readers to the language of generating functions, which nowadays, is the main language of enumerative combinatorics. The book starts with definitions, simple properties, and numerous examples of generating functions. It then discusses topics such as formal grammars, generating functions in several variables, partitions and decompositions, and the exclusion-inclusion principle. In the final chapter, the author describes applications to enumeration of trees, plane graphs, and graphs embedded in two-dimensional surfaces.

Throughout the book, the author motivates readers by giving interesting examples rather than general theories. It contains numerous exercises to help students master the material. The only prerequisite is a standard calculus course. The book is an excellent text for a one-semester undergraduate course in combinatorics.

Contents: Formal power series and generating functions. Operations with formal power series. Elementary generating functions; Generating functions for well-known sequences; Unambiguous formal grammars. The Lagrange theorem; Analytic properties of functions represented as power series and their asymptotics of their coefficients; Generating functions of several variables; Partitions and decompositions; Dirichlet generating functions and the inclusion-exclusion principle; Enumeration of embedded graphs; Final and bibliographical remarks; Bibliography; Index.

Student Mathematical Library, Volume 23

November 2003, 148 pages, Softcover, ISBN 0-8218-3481-9, LC 200355939, 2000 *Mathematics Subject Classification*: 05A15, 05C30, **All AMS members $23**, List $29, Order code STML/23



Symmetric Functions and Combinatorial Operators on Polynomials

Alain Lascoux, *Institut Gaspard Monge, Université de Marne-la-Vallée, France*

The theory of symmetric functions is an old topic in mathematics which is used as an algebraic tool in many classical fields. With λ-rings, one can regard symmetric functions as operators on polynomials and reduce the theory to just a handful of fundamental formulas.

One of the main goals of the book is to describe the technique of λ-rings. The main applications of this technique to the theory of symmetric functions are related to the Euclid algorithm and its occurrence in division, continued fractions, Padé approximants, and orthogonal polynomials.

Putting the emphasis on the symmetric group instead of symmetric functions, one can extend the theory to non-symmetric polynomials, with Schur functions being replaced by Schubert polynomials. In two independent chapters, the author describes the main properties of these polynomials, following either the approach of Newton and interpolation methods or the method of Cauchy.

The last chapter sketches a non-commutative version of symmetric functions, using Young tableaux and the plactic monoid.

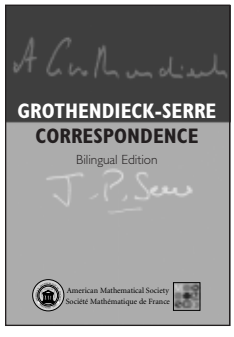
The book contains numerous exercises clarifying and extending many points of the main text. It will make an excellent supplementary text for a graduate course in combinatorics.

Contents: Symmetric functions; Symmetric functions as operators and λ-rings; Euclidean division; Reciprocal differences and continued fractions; Division, encore; Padé approximants; Symmetrizing operators; Orthogonal polynomials; Schubert polynomials; The ring of polynomials as a module over symmetric ones; The plactic algebra; Complements; Solutions of exercises; Bibliography; Index.

CBMS Regional Conference Series in Mathematics, Number 99

December 2003, 268 pages, Softcover, ISBN 0-8218-2871-1, 2000 *Mathematics Subject Classification*: 05E05, 05E10, 14M15, 20C30, 41A10, 41A21, 42C05, **All Individuals $44**, List $55, Order code CBMS/99N

General and Interdisciplinary



Grothendieck-Serre Correspondence

Bilingual Edition

This extraordinary volume contains a large part of the mathematical correspondence between A. Grothendieck and J-P. Serre. It forms a vivid introduction to the development of algebraic geometry during the years 1955–1965. During this period, algebraic geometry went through a remarkable transformation, and Grothendieck and Serre were among central figures in this process.

In the book, the reader can follow the creation of some of the most important notions of modern mathematics. The letters also reflect the mathematical and political atmosphere of this period. They are supplemented by J-P. Serre's notes, which give explanations, corrections, and references to further results.

The book is a unique bilingual (French and English) volume. The original French text is supplemented here by the English trans-

lation, with French text printed on the left-hand pages and the corresponding English text printed on the right. The book also includes several facsimiles of original letters. The original French volume was edited by Pierre Colmez and J-P. Serre. The English translation for this volume was prepared by Catriona Maclean with the assistance of Leila Schneps and J-P. Serre.

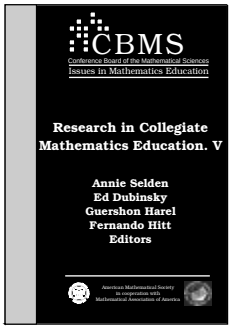
The book should be useful to specialists in algebraic geometry, mathematical historians, and to all mathematicians who want to experience the unfolding of great mathematics.

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

This book is jointly published by the AMS and the Société Mathématique de France. SMF members are entitled to AMS member discounts.

Contents: P. Colmez and **J-P. Serre**, Correspondence; Notes; Bibliography.

January 2004, approximately 600 pages, Hardcover, ISBN 0-8218-3424-X, LC 2003062815, 2000 *Mathematics Subject Classification*: 14–03; 01A25, **All AMS members $55**, List $69, Order code CGSN



Research in Collegiate Mathematics Education. V

Annie Selden, *Tennessee Technological University, Cookeville,* **Ed Dubinsky**, *Kent State University, OH*, **Guershon Harel**, *University of California San Diego, La Jolla,* and **Fernando Hitt**, *CINVESTAV, Mexico,* Editors

This fifth volume of *Research in Collegiate Mathematics Education* (RCME) presents state-of-the-art research on understanding, teaching, and learning mathematics at the post-secondary level. The articles in RCME are peer-reviewed for two major features: (1) advancing our understanding of collegiate mathematics education, and (2) readability by a wide audience of practicing mathematicians interested in issues affecting their own students. This is not a collection of scholarly arcana, but a compilation of useful and informative research regarding the ways our students think about and learn mathematics.

The volume begins with a study from Mexico of the cross-cutting concept of variable followed by two studies dealing with aspects of calculus reform. The next study frames its discussion of students' conceptions of infinite sets using the psychological work of Efraim Fischbein on (mathematical) intuition. This is followed by two papers concerned with APOS theory and other frameworks regarding mathematical understanding. The final study provides some preliminary results on student learning using technology when lessons are delivered via the Internet.

Whether specialists in education or mathematicians interested in finding out about the field, readers will obtain new insights about teaching and learning and will take away ideas they can use.

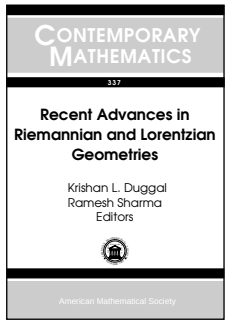
This series is published in cooperation with the Mathematical Association of America.

Contents: M. Trigueros and **S. Ursini**, First-year undergraduates' difficulties in working with different uses of variable; **A. Herzig** and **D. T. Kung**, Cooperative learning in calculus reform: What have we learned?; **C. Roddick**, Calculus reform and traditional students' use of calculus in an engineering mechanics course; **P. Tsamir**, Primary intuitions and instruction: The case of actual infinity; **K. Weller**, **J. M. Clark**, **E. Dubinsky**, **S. Loch**, **M. A. McDonald**, and **R. R. Merkovsky**, Student performance and attitudes in courses based on APOS theory and the ACE teaching cycle; **D. E. Meel**, Models and theories of mathematical understanding: Comparing Pirie and Kieren's model of the growth of mathematical understanding and APOS theory; **J. Bookman** and **D. Malone**, The nature of learning in interactive technological environments: A proposal for a research agenda based on grounded theory.

CBMS Issues in Mathematics Education, Volume 12

December 2003, 206 pages, Softcover, ISBN 0-8218-3302-2, 2000 *Mathematics Subject Classification*: 00–XX, 97–XX, **All Individuals $39**, List $49, Order code CBMATH/12N

Geometry and Topology



Recent Advances in Riemannian and Lorentzian Geometries

Krishan L. Duggal, *University of Windsor, ON, Canada*, and **Ramesh Sharma**, *University of New Haven, West Haven, CT*, Editors

This volume covers material presented by invited speakers at the AMS special session on Riemannian and Lorentzian geometries held at the annual Joint Mathematics Meetings in Baltimore. Topics covered include classification of curvature-related operators, curvature-homogeneous Einstein 4-manifolds, linear stability/instability singularity and hyperbolic operators of spacetimes, spectral geometry of holomorphic manifolds, cut loci of nilpotent Lie groups, conformal geometry of almost Hermitian manifolds, and also submanifolds of complex and contact spaces.

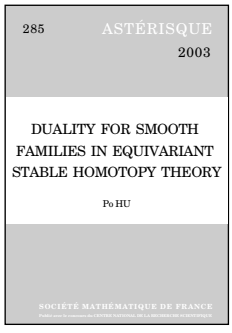
This volume can serve as a good reference source and provide indications for further research. It is suitable for graduate students and research mathematicians interested in differential geometry.

Contents: K. Abe, **D. Grantcharov**, and **G. Grantcharov**, On some complex manifolds with torus symmetry; **M. J. S. L. Ashley** and **S. M. Scott**, Curvature singularities and abstract boundary singularity theorems for space-time; **A. Derdzinski**, Curvature-homogeneous indefinite Einstein metrics in dimension four: The diagonalizable case; **P. E. Ehrlich**, **Y.-T. Jung**, **J.-S. Kim**, and **S.-B. Kim**, Jacobians and volume comparison for Lorentzian warped products; **B. Fiedler** and **P. Gilkey**, Nilpotent Szabó, Osserman and Ivanov-Petrova pseudo-Riemannian manifolds; **P. B. Gilkey**,

R. Ivanova, and **I. Stavrov**, Jordan Szabó algebraic covariant derivative curvature tensors; **A. D. Helfer**, Differential topology, differential geometry, and hyperbolic operators; **C. Jang** and **P. E. Parker**, Examples of conjugate loci of pseudoriemannian 2-step nilpotent Lie groups with nondegenerate center; **R. G. McLenaghan**, **R. G. Smirnov**, and **D. The**, Group invariant classification of orthogonal coordinate webs; **J. H. Park**, Spectral geometry and the Kaehler condition for Hermitian manifolds with boundary; **P. Rukimbira**, Energy, volume and deformation of contact metrics; **R. Sharma**, Holomorphically planar conformal vector fields on almost Hermitian manifolds; **B. D. Suceavă**, Fundamental inequalities and strongly minimal submanifolds; **M. Tanimoto**, Linear perturbations of spatially locally homogeneous spacetimes; **M. M. Tripathi**, Certain basic inequalities for submanifolds in (κ, μ)-spaces.

Contemporary Mathematics, Volume 337

January 2004, approximately 202 pages, Softcover, ISBN 0-8218-3379-0, LC 2003062907, 2000 *Mathematics Subject Classification*: 53C25, 53C30, 53C40, 53C50, 53C55, 83C25, 83C75; 22E25, 35L30, 53D10, **All AMS members $47**, List $59, Order code CONM/337N



Duality for Smooth Families in Equivariant Stable Homotopy Theory

Po Hu, *Wayne State University, Detroit, MI*

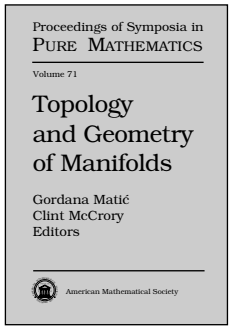
In this volume, the author formulates and proves a duality theorem for the equivariant stable homotopy category, using the language of Verdier duality from sheaf theory. He works with the category of G-equivariant spectra (for a compact Lie group G) parametrized over a G-space X and considers a smooth equivariant family $f : X \to Y$, which is a G-equivariant bundle whose fiber is a smooth compact manifold, and with actions of subgroups of G varying smoothly over Y. Then the main theorem is a natural equivalence between a certain direct image functor f_* and a "direct image with proper support functor" $f_!$, in the stable equivariant homotopy category over Y. In particular, the Wirthmüller and Adams isomorphisms in equivariant stable homotopy theory turn out to be special cases of this duality theorem.

A publication of the Société Mathématique de France (Marseilles), 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; Motivation; Spaces and spectra over a base space; Closed model structure on spectra over a base; The equivariant duality theorem; Proof of the main theorem; The Wirthmüller and Adams isomorphisms; Proof of results on the model structure over a base; Bibliography.

Astérisque, Number 285

October 2003, 108 pages, Softcover, ISBN 2-85629-136-8, 2000 *Mathematics Subject Classification*: 55P91, 55P42, 55R70, **Individual member $32**, List $36, Order code AST/285N



Topology and Geometry of Manifolds

Gordana Matić and **Clint McCrory**, *University of Georgia, Athens,* Editors

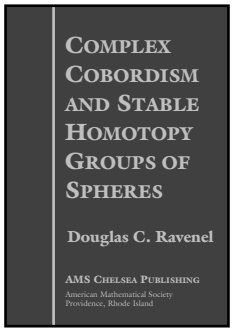
Since 1961, the Georgia Topology Conference has been held every eight years to discuss the newest developments in topology. The goals of the conference are to disseminate new and important results and to encourage interaction among topologists who are in different stages of their careers. Invited speakers are encouraged to aim their talks to a broad audience, and several talks are organized to introduce graduate students to topics of current interest. Each conference results in high-quality surveys, new research, and lists of unsolved problems, some of which are then formally published. Continuing in this 40-year tradition, the AMS presents this volume of articles and problem lists from the 2001 conference. Topics covered include symplectic and contact topology, foliations and laminations, and invariants of manifolds and knots.

Articles of particular interest include John Etnyre's, "Introductory Lectures on Contact Geometry", which is a beautiful expository paper that explains the background and setting for many of the other papers. This is an excellent introduction to the subject for graduate students in neighboring fields. Etnyre and Lenhard Ng's "Problems in Low-Dimensional Contact Topology" and Danny Calegari's extensive paper,"Problems in Foliations and Laminations of 3-Manifolds", are carefully selected problems in keeping with the tradition of the conference. They were compiled by Etnyre and Ng and by Calegari with the input of many who were present. This book provides material of current interest to graduate students and research mathematicians interested in the geometry and topology of manifolds.

Contents: J. Roberts, Rozansky-Witten theory; **C. Connell** and **B. Farb**, Some recent applications of the barycenter method in geometry; **S. Bigelow**, The Lawrence-Krammer representation; **W. H. Meeks III**, Topological properties of properly embedded minimal surfaces in $\mathbb{R}^3$; **J. B. Etnyre**, Introductory lectures on contact geometry; **V. Colin**, **E. Giroux**, and **K. Honda**, On the coarse classification of tight contact structures; **P. Ghiggini** and **S. Schönenberger**, On the classification of tight contact structures; **M. Symington**, Four dimensions from two in symplectic topology; **H. U. Boden**, **C. M. Herald**, and **P. Kirk**, On the integer valued SU(3) Casson invariant; **P. M. N. Feehan** and **T. G. Leness**, On Donaldson and Seiberg-Witten invariants; **J. S. Carter** and **M. Saito**, Quandle homology theory and cocycle knot invariants; **T. Li**, Boundary train tracks of laminar branched surfaces; **S. Schleimer**, Strongly irreducible surface automorphisms; **D. Calegari**, Problems in foliations and laminations of 3-manifolds; **J. B. Etnyre** and **L. L. Ng**, Problems in low dimensional contact topology.

Proceedings of Symposia in Pure Mathematics, Volume 71

December 2003, 357 pages, Hardcover, ISBN 0-8218-3507-6, LC 2003062859, 2000 *Mathematics Subject Classification*: 57–06, 57M50, 53D10, 57R30, 53D05, 57M27, **All AMS members $63**, List $79, Order code PSPUM/71N



Complex Cobordism and Stable Homotopy Groups of Spheres

Second Edition

Douglas C. Ravenel, *University of Rochester, NY*

From reviews of the First Edition:

This book on the Adams and Adams-Novikov spectral sequence and their applications to the computation of the stable homotopy groups of spheres is the first which does not only treat the definition and construction but leads the reader to concrete computations. It contains an overwhelming amount of material, examples, and machinery … The style of writing is very fluent, pleasant to read and typical for the author, as everyone who has read a paper written by him will recognize … this is a very welcome book …

—Zentralblatt MATH

This book provides a substantial introduction to many of the current problems, techniques, and points of view in homotopy theory … gives a readable and extensive account of methods used to study the stable homotopy groups of spheres. It can be read by an advanced graduate student, but experts will also profit from it as a reference … fine exposition.

—Mathematical Reviews

Since the publication of its first edition, this book has served as one of the few available on the classical Adams spectral sequence and is the best account on the Adams-Novikov spectral sequence. This new edition has been updated in many places, especially the final chapter, which has been completely rewritten with an eye toward future research in the field. It remains the definitive reference on the stable homotopy groups of spheres.

The first three chapters introduce the homotopy groups of spheres and take the reader from the classical results in the field though the computational aspects of the classical Adams spectral sequence and its modifications, which are the main tools topologists have to investigate the homotopy groups of spheres. Nowadays, the most efficient tools are the Brown-Peterson theory, the Adams-Novikov spectral sequence, and the chromatic spectral sequence, a device for analyzing the global structure of the stable homotopy groups of spheres and relating them to the cohomology of the Morava stabilizer groups. These topics are described in detail in Chapters 4 to 6. The revamped Chapter 7 is the computational payoff of the book, yielding a lot of information about the stable homotopy group of spheres. Appendices follow, giving self-contained accounts of the theory of formal group laws and the homological algebra associated with Hopf algebras and Hopf algebroids.

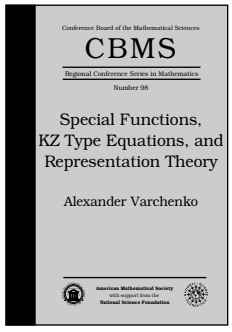
The book is intended for anyone wishing to study computational stable homotopy theory. It is accessible to graduate students with a knowledge of algebraic topology and recommended to anyone wishing to venture into the frontiers of the subject.

Contents: An introduction to the homotopy groups of spheres; Setting up the Adams spectral sequence; The classical Adams spectral sequence; *BP*-theory and the Adams-Novikov spectral sequence; The chromatic spectral sequence; Morava stabilizer algebras; Computing stable homotopy groups with the Adams-Novikov spectral sequence; Hopf algebras and Hopf algebroids; Formal group laws; Tables of homotopy groups of spheres; Bibliography; Index.

AMS Chelsea Publishing

January 2004, 395 pages, Hardcover, ISBN 0-8218-2967-X, 2000 *Mathematics Subject Classification*: 55-02; 55N22, 55Q40, 55Q45, 55Q50, 55Q51, 55T15, 55T25, **All AMS members $53**, List $59, Order code CHEL/347.HN

Mathematical Physics



Special Functions, KZ Type Equations, and Representation Theory

Alexander Varchenko, *University of North Carolina, Chapel Hill*

The last twenty years have seen an active interaction between mathematics and physics. This book is devoted to one of the new areas which deals with mathematical structures related to conformal field theory and its q-deformations. In the book, the author discusses the interplay between Knizhnik–Zamolodchikov type equations, the Bethe ansatz method, representation theory, and geometry of multi-dimensional hypergeometric functions.

This book aims to provide an introduction to the area and expose different facets of the subject. It contains constructions, discussions of notions, statements of main results, and illustrative examples. The exposition is restricted to the simplest case of the theory associated with the Lie algebra $\mathfrak{sl}_2$.

This book is intended for researchers and graduate students in mathematics and in mathematical physics, in particular to those interested in applications of special functions.

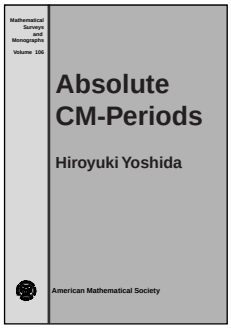
This item will also be of interest to those working in analysis.

Contents: Hypergeometric solutions of KZ equations; Cycles of integrals and the monodromy of the KZ equation; Selberg integral, determinant formulas, and dynamical equations; Critical points of master functions and the Bethe ansatz; Elliptic hypergeometric functions; q-hypergeometric solutions of qKZ equations; Bibliography; Index.

CBMS Regional Conference Series in Mathematics, Number 98

December 2003, 118 pages, Softcover, ISBN 0-8218-2867-3, 2000 *Mathematics Subject Classification*: 14Dxx, 22Exx, 33Cxx; 39Axx, 81Rxx, 82Bxx, **All Individuals $28**, List $35, Order code CBMS/98N

Number Theory



Absolute CM-Periods

Hiroyuki Yoshida, *Kyoto University, Japan*

The central theme of this book is an invariant attached to an ideal class of a totally real algebraic number field. This invariant provides us with a unified understanding of periods of abelian varieties with complex multiplication and the Stark-Shintani units. This is a new point of view, and the book contains many new results related to it.

To place these results in proper perspective and to supply tools to attack unsolved problems, the author gives systematic expositions of fundamental topics. Thus the book treats the multiple gamma function, the Stark conjecture, Shimura's period symbol, the absolute period symbol, Eisenstein series on $GL(2)$, and a limit formula of Kronecker's type. The discussion of each of these topics is enhanced by many examples. The majority of the text is written assuming some familiarity with algebraic number theory. About thirty problems are included, some of which are quite challenging.

The book is intended for graduate students and researchers working in number theory and automorphic forms.

Contents: Introduction; Multiple gamma function and its generalizations; The Stark-Shintani conjecture; Absolute CM-periods; Explicit cone decompositions and applications; Applications of a limit formula of Kronecker's type; Eisenstein series on $GL(2)$; On higher derivatives of L-functions; Transcendental property of CM-periods; References; Index.

Mathematical Surveys and Monographs, Volume 106

November 2003, 282 pages, Hardcover, ISBN 0-8218-3453-3, LC 2003062762, 2000 *Mathematics Subject Classification*: 11G15, 11Fxx, 11M41, 11R42, 33B99; 11J89, 11Y99, 30E15,
All AMS members $63, List $79, Order code SURV/106N