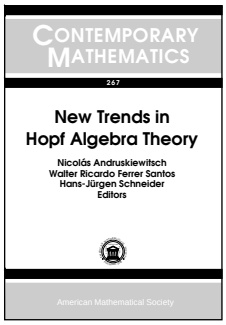
New Publications Offered by the AMS

Algebra and Algebraic Geometry



New Trends in Hopf Algebra Theory

Nicolás Andruskiewitsch, *Universidad Nacional de Córdoba, Argentina*, **Walter Ricardo Ferrer Santos**, *Centro de Matemática, Montevideo, Uruguay*, and **Hans-Jürgen Schneider**, *Universität München, Germany*, Editors

This volume presents the proceedings from the Colloquium on Quantum Groups and Hopf Algebras held in Córdoba (Argentina) in 1999. The meeting brought together researchers who discussed recent developments in Hopf algebras, one of the most important being the influence of quantum groups.

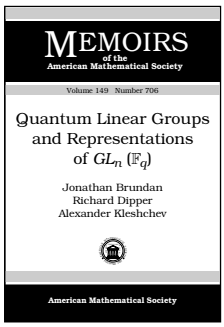
Articles offer introductory expositions and surveys on topics of current interest that, to date, have not been available in the current literature. Surveys are included on characteristics of Hopf algebras and their generalizations, biFrobenius algebras, braided Hopf algebras, inner actions and Galois theory, face algebras, and infinitesimal Hopf algebras. The following topics are also covered: existence of integrals, classification of semisimple and pointed Hopf algebras, $*$-Hopf algebras, dendriform algebras, etc. Non-classical topics are also included, reflecting its applications both inside and outside the theory.

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

Contents: M. Aguiar, Infinitesimal Hopf algebras; **S. Caenepeel** and **E. De Groot**, Modules over weak entwining structures; **M. Cohen**, On generalized characters; **Y. Doi** and **M. Takeuchi**, BiFrobenius algebras; **A. García** and **R. Trinchero**, Integrable models and star structures; **M. Graña**, On Nichols algebras of low dimension; **J. A. Guccione** and **J. J. Guccione**, A generalization of crossed products; **T. Hayashi**, A brief introduction to face algebras; **L. H. Kauffman** and **D. E. Radford**, On two proofs for the existence and uniqueness of integrals for finite-dimensional Hopf algebras; **A. Masuoka**, Cocycle deformations and Galois objects for some cosemisimple Hopf algebras of finite dimension; **A. Milinski** and **H.-J. Schneider**, Pointed indecomposable Hopf algebras over Coxeter groups; **D. Nikshych**, A duality theorem for quantum groupoids; **M. Ronco**, Primitive elements in a free dendriform algebra; **S. Sachse**, On operator representations of $U_q(isl(2,\mathbb{R}))$; **P. Schauenburg**, Duals and doubles of quantum groupoids ($\times_R$-Hopf algebras); **M. Takeuchi**, Survey of braided Hopf algebras; **S. Westreich**, Inner and outer actions of pointed Hopf algebras; **J.-H. Lu**, **M. Yan**, and **Y. Zhu**, Quasi-triangular structures on Hopf algebras with positive bases.

Contemporary Mathematics, Volume 267

December 2000, 356 pages, Softcover, ISBN 0-8218-2126-1, LC 00-045366, 2000 *Mathematics Subject Classification*: 16W30, 16W25, 16W35, 16S40; 16L60, **Individual member \$45**, List \$75, Institutional member \$60, Order code CONM/267N



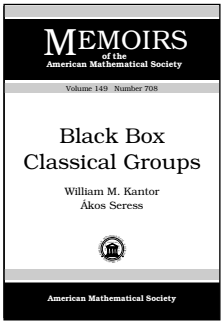
Quantum Linear Groups and Representations of $GL_n(\mathbb{F}_q)$

Jonathan Brundan, *University of Oregon, Eugene*, **Richard Dipper**, *Universität Stuttgart, Germany*, and **Alexander Kleshchev**, *University of Oregon, Eugene*

Contents: Introduction; Quantum linear groups and polynomial induction; Classical results on GL_n; Connecting GL_n with quantum linear groups; Further connections and applications; The affine general linear group; Bibliography.

Memoirs of the American Mathematical Society, Volume 149, Number 706

January 2001, 112 pages, Softcover, ISBN 0-8218-2616-6, LC 00-046918, 2000 *Mathematics Subject Classification*: 20C20, 20C33, 20G05, 17B37, **Individual member \$28**, List \$46, Institutional member \$37, Order code MEMO/149/706N



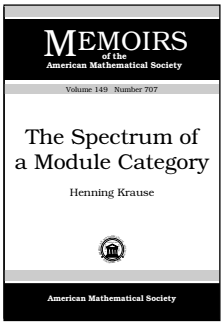
Black Box Classical Groups

William M. Kantor, *University of Oregon, Eugene*, and **Ákos Seress**, *Ohio State University, Columbus*

Contents: Introduction; Preliminaries; Special linear groups: $\mathrm{PSL}(d,q)$; Orthogonal groups: $\mathrm{P}\Omega^{\varepsilon}(d,q)$; Symplectic groups: $\mathrm{PSp}(2m,q)$; Unitary groups: $\mathrm{PSU}(d,q)$; Proofs of Theorems 1.1 and 1.1′, and of corollaries 1.2–1.4; Permutation group algorithms; Concluding remarks; References.

Memoirs of the American Mathematical Society, Volume 149, Number 708

January 2001, 168 pages, Softcover, ISBN 0-8218-2619-0, LC 00-046914, 2000 *Mathematics Subject Classification*: 20B40, 20G40; 20P05, 68Q25, **Individual member $32**, List $53, Institutional member $42, Order code MEMO/149/708N



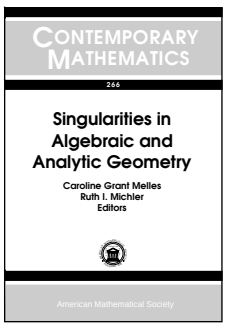
The Spectrum of a Module Category

Henning Krause, *University of Bielefeld, Germany*

Contents: Introduction; The functor category; Definable subcategories; Left approximations; duality; Ideals in the category of finitely presented modules; Endofinite modules; Krull-Gabriel dimension; The infinite radical; Functors between module categories; Tame algebras; Rings of definable scalars; Reflective definable subcategories; Sheaves; Tame hereditary algebras; Coherent rings; Appendix A. Locally coherent Grothendieck categories; Appendix B. Dimensions; Appendix C. Finitely presented functors and ideals; Bibliography.

Memoirs of the American Mathematical Society, Volume 149, Number 707

January 2001, 125 pages, Softcover, ISBN 0-8218-2618-2, LC 00-046916, 2000 *Mathematics Subject Classification*: 16D70, 16D90, 16G60; 16G70, 16P70, 16S90, 18G25, **Individual member $28**, List $47, Institutional member $38, Order code MEMO/149/707N



Singularities in Algebraic and Analytic Geometry

Caroline Grant Melles, *U.S. Naval Academy, Annapolis, MD*, and **Ruth I. Michler**, *University of North Texas, Denton*, Editors

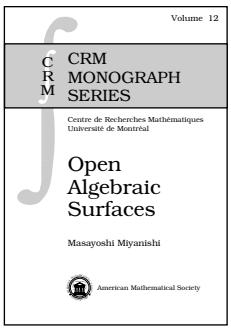
This volume contains the proceedings of an AMS special session held at the 1999 Joint Mathematics Meetings in San Antonio. The participants were an international group of researchers studying singularities from algebraic and analytic viewpoints. The contributed papers contain original results as well as some expository and historical material. This volume is dedicated to Oscar Zariski, on the one hundredth anniversary of his birth.

Topics include the role of valuation theory in algebraic geometry with recent applications to the structure of morphisms; algorithmic approaches to resolution of equisingular surface singularities and locally toric varieties; weak subintegral closures of ideals and Rees valuations; constructions of universal weakly subintegral extensions of rings; direct-sum decompositions of finitely generated modules; construction and examples of resolution graphs of surface singularities; Jacobians of meromorphic curves; investigation of spectral numbers of curve singularities using Puiseux pairs; Gröbner basis calculations of Hochschild homology for hypersurfaces with isolated singularities; and the theory of characteristic classes of singular spaces—a brief history with conjectures and open problems.

Contents: S. S. Abhyankar and **A. Assi**, Factoring the Jacobian; **M. A. Vitulli**, Weak normalization and weak subintegral closure; **L. G. Roberts**, Integral dependence and weak subintegrality; **R. Wiegand**, Singularities and direct-sum decompositions; **S. D. Cutkosky**, Valuations in algebra and geometry; **C. Ban** and **L. J. McEwan**, Simultaneous resolution of equisingular quasi-ordinary singularities; **C. G. Melles** and **P. Milman**, Single-step combinatorial resolution via coherent sheaves of ideals; **A. Némethi**, Resolution graphs of some surface singularities, I. (Cyclic coverings); **A. Némethi** and **Á. Szilárd**, Resolution graphs of some surface singularities, II. (Generalized Iomdin series); **L. J. McEwan**, Inequalities for spectral distributions of curve singularities; **R. I. Michler**, Isolated singularities with large Hochschild homology; **J.-P. Brasselet**, Milnor classes via polar varieties.

Contemporary Mathematics, Volume 266

November 2000, 187 pages, Softcover, ISBN 0-8218-2005-2, LC 00-064610, 2000 *Mathematics Subject Classification*: 13B22, 14B05, 32S05, 32S20; 13F45, 14C17, 14E15, 14H30, 14J17, 32S40, 32S45, 32S50, **Individual member $29**, List $49, Institutional member $39, Order code CONM/266N



Open Algebraic Surfaces

Masayoshi Miyanishi, *Osaka University, Toyonaka, Japan*

Open algebraic surfaces are a synonym for algebraic surfaces that are not necessarily complete. An open algebraic surface is understood as a Zariski open set of a projective algebraic surface. There is a long history of research on projective algebraic surfaces, and there exists a beautiful Enriques-Kodaira classification of such surfaces. The research accumulated by Ramanujan, Abhyankar, Moh, and Nagata and others has established a classification theory of open algebraic surfaces comparable to the Enriques-Kodaira theory. This research provides powerful methods to study the geometry and topology of open algebraic surfaces.

The theory of open algebraic surfaces is applicable not only to algebraic geometry, but also to other fields, such as commutative algebra, invariant theory, and singularities. This book

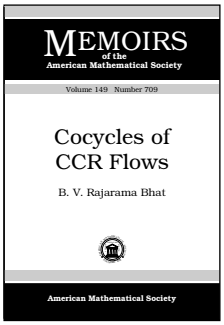
contains a comprehensive account of the theory of open algebraic surfaces, as well as several applications, in particular to the study of affine surfaces. Prerequisite to understanding the text is a basic background in algebraic geometry. This volume is a continuation of the work presented in the author's previous publication, *Algebraic Geometry*, Volume 136 in the AMS series, Translations of Mathematical Monographs.

Contents: Complete algebraic surfaces; Open algebraic surfaces; Affine algebraic surfaces; Bibliography; Index.

CRM Monograph Series, Volume 12

December 2000, 259 pages, Hardcover, ISBN 0-8218-0504-5, LC 00-045394, 2000 *Mathematics Subject Classification*: 14–02; 14J99, 14R05, **Individual member $35**, List $59, Institutional member $47, Order code CRMM/12N

Analysis



Cocycles of CCR Flows

B. V. Rajarama Bhat, *Indian Statistical Institute, Bangalore, India*

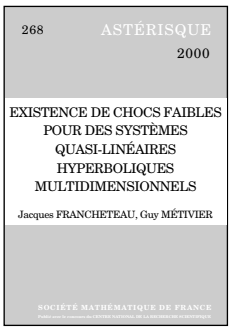
This item will also be of interest to those working in mathematical physics.

Contents: Introduction; Compressions and dilations; Minimal dilation and induced semigroup; Domination for E_0-semigroups; Compression under domination; Units; Cocycle computation for CCR flows; Factorization theorem; Hudson-Parthasarathy cocycles; Appendix A. Continuity; Appendix B. Discrete case; References.

Memoirs of the American Mathematical Society, Volume 149, Number 709

January 2001, 114 pages, Softcover, ISBN 0-8218-2632-8, LC 00-046915, 2000 *Mathematics Subject Classification*: 46L55, 81S25, **Individual member $28**, List $46, Institutional member $37, Order code MEMO/149/709N

Differential Equations



Existence de Chocs Faibles pour des Systèmes Quasi-Linéaires Hyperboliques Multidimensionnels

Jacques Francheteau, *Écoles de Saint-Cyr Coëtquidan, Guer, France*, and **Guy Métivier,** *Université de Rennes, France*

A publication of the Société Mathématique de France.

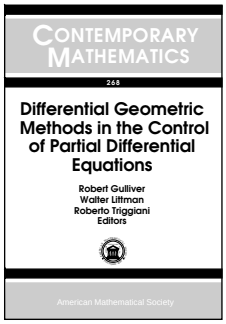
In this work, the authors consider weak shocks for systems of conservation laws in any space dimension. The main result is the construction on a space-time domain, independent of the parameter ε, of families of weak solutions u^ε, discontinuous along a smooth hypersurface Σ^ε, with jumps of order ε. For a fixed ε, the problem can be recast as a nonlinear mixed hyperbolic problem with a free noncharacteristic boundary. It has been solved by A. Majda. When ε tends to zero, the front tends to be characteristic. This induces a loss of stability and regularity. As a consequence, the classical nonlinear methods based on Picard's iterations and differentiation of the equations do not apply. In this work, to prove the suitable *a priori* estimates and to construct the solutions, the authors use more sophisticated methods, such as the paradifferential calculus and Nash-Moser-type iteration schemes. An important application of the results concern Euler's equations of gas dynamics. They apply to the full system and to the isentropic system. The authors construct and compare weak shock solutions of these two systems.

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

Contents: Introduction; Résultats principaux; Les étapes des preuves; Estimations préliminaires; Opérateurs de traces et de relèvement de traces; Compatibilités, constructions de solutions approchées; Paralinéarisation; Estimations d'énergie conormales; Estimations a priori pour le problème non-linéaire; Le théorème de prolongement à ε fixé; Prolongement de la régularité; Application au système d'Euler. Comparaison des solutions; Bibliographie.

Astérisque, Number 268

September 2000, 198 pages, Softcover, ISBN 2-85629-092-2, 2000 *Mathematics Subject Classification*: 35L67, 35L65, 35L50, 76L05, **Individual member $50**, List $55, Order code AST/268N



Differential Geometric Methods in the Control of Partial Differential Equations

Robert Gulliver and **Walter Littman**, *University of Minnesota, Minneapolis*, and **Roberto Triggiani**, *University of Virginia, Charlottesville*, Editors

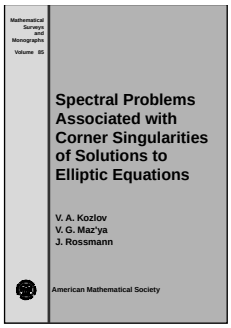
This volume contains selected papers that were presented at the AMS-IMS-SIAM Joint Summer Research Conference on "Differential Geometric Methods in the Control of Partial Differential Equations", which was held at the University of Colorado in Boulder in June 1999.

The aim of the conference was to explore the infusion of differential-geometric methods into the analysis of control theory of partial differential equations, particularly in the challenging case of variable coefficients, where the physical characteristics of the medium vary from point to point. While a mutually profitable link has been long established, for at least 30 years, between differential geometry and control of ordinary differential equations, a comparable relationship between differential geometry and control of partial differential equations (PDEs) is a new and promising topic. Very recent research, just prior to the Colorado conference, supported the expectation that differential geometric methods, when brought to bear on classes of PDE modelling and control problems with variable coefficients, will yield significant mathematical advances.

The papers included in this volume—written by specialists in PDEs and control of PDEs as well as by geometers—collectively support the claim that the aims of the conference are being fulfilled. In particular, they endorse the belief that both subjects—differential geometry and control of PDEs—have much to gain by closer interaction with one another. Consequently, further research activities in this area are bound to grow.

Contemporary Mathematics, Volume 268

January 2001, 406 pages, Softcover, ISBN 0-8218-1927-5, LC 00-046884, 2000 *Mathematics Subject Classification*: 53–XX, 35–XX, 49–XX, 93–XX, **Individual member $47**, List $79, Institutional member $63, Order code CONM/268N



Spectral Problems Associated with Corner Singularities of Solutions to Elliptic Equations

V. A. Kozlov and **V. G. Maz'ya**, *University of Linköping, Sweden*, and **J. Rossmann**, *University of Rostock, Germany*

This book focuses on the analysis of eigenvalues and eigenfunctions that describe singularities of solutions to elliptic boundary value problems in domains with corners and edges. The authors treat both classical problems of mathematical physics and general elliptic boundary value problems.

The volume is divided into two parts: The first is devoted to the power-logarithmic singularities of solutions to classical boundary value problems of mathematical physics. The second deals with similar singularities for higher order elliptic equations and systems.

Chapter 1 collects basic facts concerning operator pencils acting in a pair of Hilbert spaces. Related properties of ordinary differential equations with constant operator coefficients are discussed and connections with the theory of general elliptic boundary value problems in domains with conic vertices are outlined. New results are presented. Chapter 2 treats the Laplace operator as a starting point and a model for the subsequent study of angular and conic singularities of solutions. Chapter 3 considers the Dirichlet boundary condition beginning with the plane case and turning to the space problems. Chapter 4 investigates some mixed boundary conditions. The Stokes system is discussed in Chapters 5 and 6, and Chapter 7 concludes with the Dirichlet problem for the polyharmonic operator.

Chapter 8 studies the Dirichlet problem for general elliptic differential equations of order $2m$ in an angle. In Chapter 9, an asymptotic formula for the distribution of eigenvalues of operator pencils corresponding to general elliptic boundary value problems in an angle is obtained. Chapters 10 and 11 discuss the Dirichlet problem for elliptic systems of differential equations of order 2 in an n-dimensional cone. Chapter 12 studies the Neumann problem for general elliptic systems, in particular with eigenvalues of the corresponding operator pencil in the strip $|\Re\lambda - m + /2n| \leq 1/2$. It is shown that only integer numbers contained in this strip are eigenvalues.

Continued

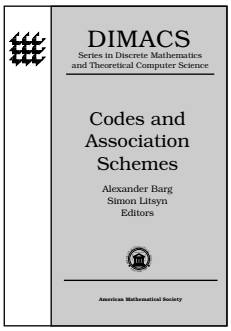
Applications are placed within chapter introductions and as special sections at the end of chapters. Prerequisites include standard PDE and functional analysis courses.

Contents: Introduction; *Singularities of solutions to equations of mathematical physics:* Prerequisites on operator pencils; Angle and conic singularities of harmonic functions; The Dirichlet problem for the Lamé system; Other boundary value problems for the Lamé system; The Dirichlet problem for the Stokes system; Other boundary value problems for the Stokes system in a cone; The Dirichlet problem for the biharmonic and polyharmonic equations; *Singularities of solutions to general elliptic equations and systems:* The Dirichlet problem for elliptic equations and systems in an angle; Asymptotics of the spectrum of operator pencils generated by general boundary value problems in an angle; The Dirichlet problem for strongly elliptic systems in particular cones; The Dirichlet problem in a cone; The Neumann problem in a cone; Bibliography; Index; List of symbols.

Mathematical Surveys and Monographs, Volume 85

December 2000, 436 pages, Hardcover, ISBN 0-8218-2727-8, LC 00-045110, 2000 *Mathematics Subject Classification*: 31B30, 35J05, 35J40, 35J55, 35P15, 35Q30, 47A75, 74B05, **Individual member $57**, List $95, Institutional member $76, Order code SURV/85N

Discrete Mathematics and Combinatorics



Codes and Association Schemes

Alexander Barg, *Bell Labs - Lucent Technologies, Murray Hill, NJ*, and **Simon Litsyn**, *Tel Aviv University, Israel*, Editors

This volume presents papers related to the DIMACS workshop, "Codes and Association Schemes". The articles are devoted to the following topics: applications of association schemes and of the polynomial method to properties of codes, structural results for codes, structural results for association schemes, and properties of orthogonal polynomials and their applications in combinatorics.

Papers on coding theory are related to classical topics, such as perfect codes, bounds on codes, codes and combinatorial arrays, weight enumerators, and spherical designs. Papers on orthogonal polynomials provide new results on zeros and symptotic properties of standard families of polynomials encountered in coding theory. The theme of association schemes is represented by new classification results and new classes of schemes related to posets.

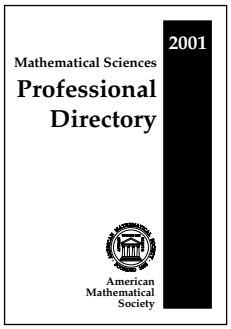
This volume collects up-to-date applications of the theory of association schemes to coding and presents new properties of both polynomial and general association schemes. It offers a solid representation of results in problems in areas of current interest.

Contents: C. Bachoc, Harmonic weight enumerators of nonbinary codes and MacWilliams identities; **A. Barg** and **D. B. Jaffe**, Numerical results on the asymptotic rate of binary codes; **J. Bierbrauer** and **H. Schellwat**, Weakly biased arrays, almost independent arrays and error-correcting codes; **P. Boyvalenkov**, **D. Danev**, and **P. Kazakov**, Indexes of spherical codes; **P. Camion**, Codes over $\mathbb{Z}_{p^n}$ and association schemes; **C. Carlet** and **P. Guillot**, Bent, resilient functions and the numerical normal form; **G. D. Cohen**, **I. Honkala**, **A. Lobstein**, and **G. Zémor**, On identifying codes; **I. J. Dejter** and **K. T. Phelps**, Ternary hamming and binary perfect covering codes; **I. Duursma**, A Riemann hypothesis analogue for self-dual codes; **T. Etzion**, On perfect codes in the Johnson scheme; **T. Etzion** and **J. van Lint**, On perfect constant weight codes; **P. Gaborit**, **W. C. Huffman**, **J.-L. Kim**, and **V. Pless**, On additive $GF(4)$ codes; **L. Habsieger**, Integral zeroes of Krawtchouk polynomials; **T. Ito**, **K. Tanabe**, and **P. Terwilliger**, Some algebra related to P- and Q-polynomial association schemes; **I. Krasikov**, Bounds for the Christoffel-Darboux kernel of the binary Krawtchouk polynomials; **I. Krasikov** and **S. Litsyn**, Survey of binary Krawtchouk polynomials; **T. Laihonen**, On an algebraic method for bounding the covering radius; **W. J. Martin**, Design systems: Combinatorial characterizations of Delsarte $\mathcal{T}$-designs via partially ordered sets; **M. Muzychuk**, **M. Klin**, and **R. Pöschel**, The isomorphism problem for circulant graphs via Schur ring theory; **I. Siap**, **N. Aydin**, and **D. Ray-Chaudhuri**, New 1-generator quasi-twisted codes over GF(5); **U. Tamm**, Communication complexity and orthogonal polynomials; **A. Ashikhmin**, **A. Barg**, and **S. Litsyn**, Estimates of the distance distribution of nonbinary codes, with applications.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science

January 2001, approximately 320 pages, Hardcover, ISBN 0-8218-2074-5, 2000 *Mathematics Subject Classification*: 94Bxx, 05E30, 05E35, **Individual member $53**, List $89, Institutional member $71, Order code DIMACS-BARGN

General and Interdisciplinary

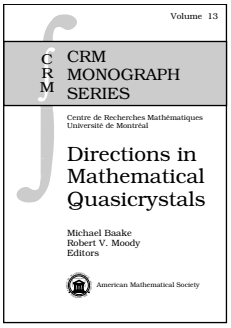


Mathematical Sciences Professional Directory, 2001

This annual directory provides a handy reference to various organizations in the mathematical sciences community. Listed in the directory are the following: officers and committee members of over thirty professional mathematical organizations (terms of office and other pertinent information are also provided in some cases); key mathematical sciences personnel of selected government agencies; academic departments in the mathematical sciences; mathematical units in nonacademic organizations; and alphabetic listings of colleges and universities. Current addresses, telephone numbers, and electronic addresses for individuals when provided are listed in the directory.

March 2001, approximately 232 pages, Softcover, ISBN 0-8218-2658-1, 2000 *Mathematics Subject Classification*: 00–XX, List $50, Institutional member $40, Order code PRODIR/2001N

Geometry and Topology



Directions in Mathematical Quasicrystals

Michael Baake, *Universität Tübingen, Germany*, and **Robert V. Moody**, *University of Alberta, Edmonton, AB, Canada*, Editors

This volume includes twelve solicited articles which survey the current state of knowledge and some of the open questions on the mathematics of aperiodic order. A number of the articles deal with the sophisticated mathematical ideas that are being developed from physical motivations.

Many prominent mathematical aspects of the subject are presented, including the geometry of aperiodic point sets and their diffractive properties, self-affine tilings, the role of C^*-algebras in tiling theory, and the interconnections between symmetry and aperiodic point sets. Also discussed are the question of pure point diffraction of general model sets, the arithmetic of shelling icosahedral quasicrystals, and the study of self-similar measures on model sets.

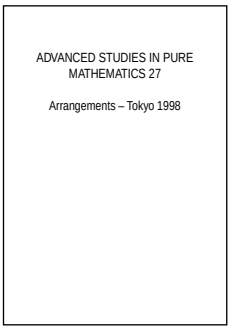
From the physical perspective, articles reflect approaches to the mathematics of quasicrystal growth and the Wulff shape, recent results on the spectral nature of aperiodic Schrödinger operators with implications to transport theory, the characterization of spectra through gap-labeling, and the mathematics of planar dimer models.

A selective bibliography with comments is also provided to assist the reader in getting an overview of the field. The book will serve as a comprehensive guide and an inspiration to those interested in learning more about this intriguing subject.

Contents: M. Baake and **R. V. Moody**, Self-similar measures for quasicrystals; **G. Bernuau** and **M. Duneau**, Fourier analysis of deformed model sets; **J. C. Lagarias**, Mathematical quasicrystals and the problem of diffraction; **P. A. B. Pleasants**, Designer quasicrystals: Cut-and-project sets with pre-assigned properties; **M. Schlottmann**, Generalized model sets and dynamical systems; **A. Weiss**, On shelling icosahedral quasicrystals; **J. Kellendonk** and **I. F. Putnam**, Tilings, $C*$-algebras, and K-theory; **J. Bellissard**, **D. J. L. Herrmann**, and **M. Zarrouati**, Hulls of aperiodic solids and gap labeling theorems; **K. Böröczky, Jr.**, **U. Schnell**, and **J. M. Wills**, Quasicrystals, parametric density, and Wulff-shape; **D. Damanik**, Gordon-type arguments in the spectral theory of one-dimensional quasi-crystals; **R. Kenyon**, The planar dimer model with boundary: A survey; **A. Vince**, Digit tiling of euclidean space; **M. Baake** and **U. Grimm**, A guide to quasicrystal literature; Index.

CRM Monograph Series, Volume 13

January 2001, 379 pages, Hardcover, ISBN 0-8218-2629-8, 2000 *Mathematics Subject Classification*: 52C23, 43A25, 28A80, 46L80, 47B25, 11R52, 52C17, 82B20, **Individual member $47**, List $79, Institutional member $63, Order code CRMM/13N



Arrangements–Tokyo 1998

Michael Falk, *Northern Arizona University, Flagstaff*, and **Hiroaki Terao**, *Tokyo Metropolitan University, Japan*, Editors

A publication of the Mathematical Society of Japan.

This volume comprises some of the written lectures from the proceedings of the conference on hyperplane arrangements held at the Tokyo Metropolitan University as a Regional Workshop of the Mathematical Society of Japan. This workshop was in celebration of the sixtieth birthday of Peter Orlik. The book contains contributions from an impressive group of mathematicians across a wide range of topics in singularity theory, topology, combinatorics, and geometry.

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

Contents: C. A. Athanasiadis, Deformations of Coxeter hyperplane arrangements and their characteristic polynomials; **D. C. Cohen**, On the cohomology of discriminantal arrangements and Orlik-Solomon algebras; **J. Damon**, On the number of bounding cycles for nonlinear arrangements; **M. Deza** and **M. Shtogrin**, Embedding the graphs of regular tilings and star-honeycombs into the graphs of hypercubes and cubic lattices; **M. Falk** and **R. Randell**, On the homotopy theory of arrangements, II; **E. Hironaka**, Plumbing graphs for normal surface-curve pairs; **K. Iwasaki**, Polytopes, invariants and harmonic functions; **T. Kohno**, Vassiliev invariants of braids and iterated integrals; **A. Libgober** and **S. Yuzvinsky**, Cohomology of local systems; **D. Matei** and **A. I. Suciu**, Cohomology rings and nilpotent quotients of real and complex arrangements; **K. Matsumoto** and **M. Yoshida**, Recent progress of intersection theory for twisted (co)homology groups; **E. Mukhin** and **A. Varchenko**, Remarks on critical points of phase functions and norms of Bethe vectors; **P. Orlik** and **R. Silvotti**, Local system homology of arrangement complements; **L. Paris**, On the fundamental group of the complement of a complex hyperplane arrangement; **A. Shepler** and **H. Terao**, Logarithmic forms and anti-invariant forms of reflection groups.

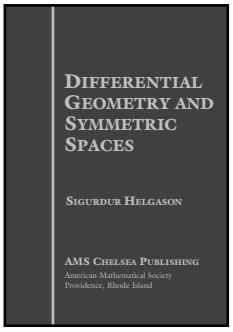
Advanced Studies in Pure Mathematics, Volume 27

August 2000, 278 pages, Hardcover, ISBN 4-314-10140-7, 2000 *Mathematics Subject Classification*: 32S22; 52C30, 55N25, 33C70, 20F36, **Individual member $51**, List $85, Institutional member $68, Order code ASPM/27N

Logic and Foundations

Recommended Text

A Classic!



Differential Geometry and Symmetric Spaces

Sigurdur Helgason, *Massachusetts Institute of Technology, Cambridge*

Remarkably well written … might be used as a textbook for how to write mathematics.

—***Bulletin of the AMS***

Sigurdur Helgason's *Differential Geometry and Symmetric Spaces* was quickly recognized as a remarkable and important book. For many years, it was the standard text both for Riemannian geometry and for the analysis and geometry of symmetric spaces. Several generations of mathematicians relied on it for its clarity and careful attention to detail.

Although much has happened in the field since the publication of this book, as demonstrated by Helgason's own three-volume expansion of the original work, this single volume is still an excellent overview of the subjects. For instance, even though there are now many competing texts, the chapters on differential geometry and Lie groups continue to be among the best treatments of the subjects available. There is also a well-developed treatment of Cartan's classification and structure theory of symmetric spaces. The last chapter, on functions on symmetric spaces, remains an excellent introduction to the study of spherical functions, the theory of invariant differential operators, and other topics in harmonic analysis. This text is rightly called a classic.

Sigurdur Helgason was awarded the Steele Prize for *Groups and Geometric Analysis* and the companion volume, *Differential Geometry, Lie Groups and Symmetric Spaces*.

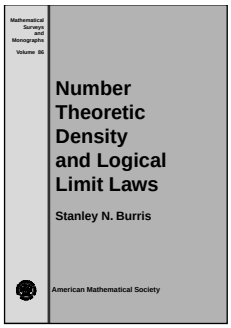
This item will also be of interest to those working in algebra and algebraic geometry and analysis.

Contents: Elementary differential geometry; Lie groups and Lie algebras; Structure of semisimple Lie algebras; Symmetric spaces; Decomposition of symmetric spaces; Symmetric spaces of the noncompact type; Symmetric spaces of the compact type; Hermitian symmetric spaces; On the classification of symmetric spaces; Functions on symmetric spaces; Bibliography; List of notational conventions; Symbols frequently used; Author index; Subject index; Reviews for the first edition.

AMS Chelsea Publishing

January 2001, 486 pages, Hardcover, ISBN 0-8218-2735-9, LC 00-048511, 2000 *Mathematics Subject Classification*: 22E15, 53C35, 22E46, 22F30, 43A85, 43A90, 53C20, 53C30, **All AMS members $44**, List $49, Order code CHEL/341.HN

Supplementary Reading



Number Theoretic Density and Logical Limit Laws

Stanley N. Burris, *University of Waterloo, ON, Canada*

This book shows how a study of generating series (power series in the additive case and Dirichlet series in the multiplicative case), combined with structure theorems for the finite models of a sentence, lead to general and powerful results on limit laws, including $0-1$ laws. The book is unique in its approach to giving a combined treatment of topics from additive as well as from multiplicative number theory, in the setting of abstract number systems, emphasizing the remarkable parallels in the two subjects. Much evidence is collected to support the thesis that local results in additive systems lift to global results in multiplicative systems.

All necessary material is given to understand thoroughly the method of Compton for proving logical limit laws, including a full treatment of Ehrenfeucht-Fraissé games, the Feferman-Vaught Theorem, and Skolem's quantifier elimination for finite Boolean algebras. An intriguing aspect of the book is to see so many interesting tools from elementary mathematics pull together to answer the question: What is the probability that a randomly chosen structure has a given property? Prerequisites are undergraduate analysis and some exposure to abstract systems.

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

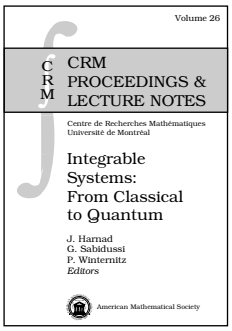
Contents: *Additive number systems:* Background from analysis; Counting functions and fundamental identities; Density and partition sets; The case $\rho = 1$; The case $0 < \rho < 1$; Monadic second-order limit laws; *Multiplicative number systems:* Background from analysis; Counting functions and fundamental identities; Density and partition sets; The case $\alpha = 0$; The case $0 < \alpha < \infty$; First-order limit laws; Formal power series; Refined counting; Consequences of $\delta(\mathsf{P}) = 0$; On the monotonicity of $a(n)$ when $p(n) \leq 1$; Results of Woods; Bibliography; Symbol index; Subject index.

Mathematical Surveys and Monographs, Volume 86

January 2001, approximately 312 pages, Hardcover, ISBN 0-8218-2666-2, LC 00-048512, 2000 *Mathematics Subject Classification*: 03C13, 05A15, 05A16, 05C30, 11M41, 11M45, 11N45, 11N80, 11P82, 11U09, **Individual member $41**, List $69, Institutional member $55, Order code SURV/86N

Mathematical Physics

Supplementary Reading



Integrable Systems: From Classical to Quantum

J. Harnad, *Centre de Recherches Matématiques, Université de Montréal, PQ, Canada*, **G. Sabidussi**, *Université de Montréal, PQ, Canada*, and **P. Winternitz**, *Centre de Recherches Matématiques, Université de Montréal, PQ, Canada*, Editors

This volume presents the papers based upon lectures given at the 1999 Séminaire de Mathémathiques Supérieurs held in Montréal. It includes contributions from many of the most active researchers in the field. This subject has been in a remarkably active state of development throughout the past three decades, resulting in new motivation for study in surprisingly different directions.

Beyond the intrinsic interest in the study of integrable models of many-particle systems, spin chains, lattice and field theory models at both the classical and the quantum level, and completely solvable models in statistical mechanics, there have been new applications in relation to a number of other fields of current interest. These fields include theoretical physics and pure mathematics, for example the Seiberg-Witten approach to supersymmetric Yang-Mills theory, the spectral theory of random matrices, topological models of quantum gravity, conformal field theory, mirror symmetry, quantum cohomology, etc.

This collection gives a nice cross-section of the current state of the work in the area of integrable systems which is presented by some of the leading active researchers in this field. The scope and quality of the articles in this volume make this a valuable resource for those interested in an up-to-date introduction and an overview of many of the main areas of study in the theory of integral systems.

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

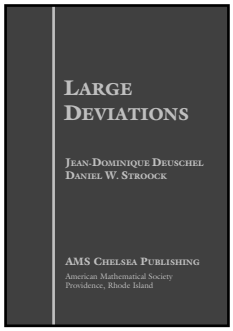
Contents: J. Balog, **L. Fehér**, and **L. Palla**, On the chiral WZNW phase space, exchange r-matrices and Poisson-Lie groupoids; **J. Harnad**, Loop groups, R-matrices and separation of variables; **J. C. Hurtubise**, The geometry of generalised Hitchin systems; **V. E. Korepin**, Determinant representation for form factors; **D. A. Korotkin**, Isomonodromic deformations in genus zero and one: Algebro-geometric solutions and Schlesinger transformations; **J.-M. Maillet**, Quantum inverse scattering problem and correlation functions of integrable models; **W. Miller, Jr.**, Multiseparability and superintegrability for classical and quantum systems; **T. Miwa**, Integrability and symmetry of the XXZ model; **N. Reshetikhin**, Characteristic systems on Poisson Lie groups and their quantization; **S. N. M. Ruijsenaars**, Special functions associated with Calogero-Moser type quantum systems; **E. K. Sklyanin**, Bäcklund transformations and Baster's Q-operator; **C. A. Tracy** and **H. Widom**, Universality of the distribution functions of random matrix theory.

CRM Proceedings & Lecture Notes, Volume 26

November 2000, 264 pages, Softcover, ISBN 0-8218-2093-1, LC 00-064611, 2000 *Mathematics Subject Classification*: 81–02, 81–06, 82–02, 82–06, 33–02, 33–06, 35Qxx; 37J15, 37J35, 37K10, 37K15, 70H06, 81R12, 81R50, 82B20, 82B23, **Individual member $47**, List $79, Institutional member $63, Order code CRMP/26N

Probability

Supplementary Reading



Large Deviations

Jean-Dominique Deuschel, *Technical University of Berlin, Germany*, and **Daniel W. Stroock**, *Massachusetts Institute of Technology, Cambridge*

From a review for the First Edition *...*

The book provides a sound base for Large Deviations Theory and answers questions and clears up technical problems found in articles previously written on the subject ... Here you will find the interesting material, the reward for having read so far. One could liken the experience to that of climbing a mountain. After struggling with difficult technical demands, you then get to enjoy a grandiose view over a crystal landscape, where you can perceive traces of life way off in the distance.

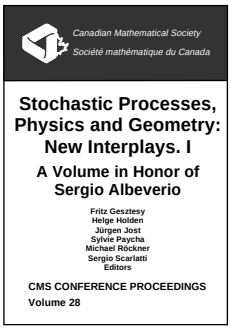
—Zentralblatt für Mathematik

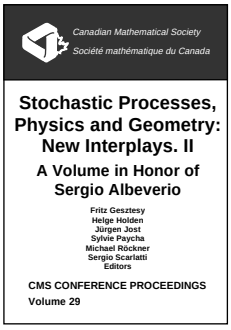
This is the second printing of the book first published in 1988. The first four chapters of the volume are based on lectures given by Stroock at MIT in 1987. They form an introduction to the basic ideas of the theory of large deviations and make a suitable package on which to base a semester-length course for advanced graduate students with a strong background in analysis and some probability theory. A large selection of exercises presents important material and many applications. The last two chapters present various non-uniform results (Chapter 5) and outline the analytic approach that allows one to test and compare techniques used in previous chapters (Chapter 6).

Contents: Some examples; Some generalities; General Cramér theory; Uniform large deviations; Non-uniform results; Analytic considerations; Historical notes and references; Name index; Bibliography; Frequently used notation; Index.

AMS Chelsea Publishing

January 2001, approximately 296 pages, Hardcover, ISBN 0-8218-2757-X, 2000 *Mathematics Subject Classification*: 60F10, 60F17, 28D20, 28D05, **All AMS members $35**, List $39, Order code CHEL/342.HN





Stochastic Processes, Physics and Geometry: New Interplays, I and II

Volumes in Honor of Sergio Albeverio

Fritz Gesztesy, *University of Missouri, Columbia*, **Helge Holden**, *Norwegian University of Science and Technology, Trondheim*, **Jürgen Jost**, *Max Planck Institut für Mathematik, Leipzig, Germany*, **Sylvie Paycha**, *Université Blaise Pascal, Aubiere, France*, **Michael Röckner**, *Universität Bielefeld, Germany*, and **Sergio Scarlatti**, *Universitá G. D'Annunzio, Pescara, Italy*, Editors

These volumes present state-of-the-art research currently unfolding at the interface between mathematics and physics. Included are select articles from the international conference held in Leipzig (Germany) in honor of Sergio Albeverio's sixtieth birthday. The theme of the conference, "Infinite Dimensional (Stochastic) Analysis and Quantum Physics", was chosen to reflect Albeverio's wide-ranging scientific interests. The articles in these books reflect that broad range of interests and provide a detailed overview highlighting the deep interplay among stochastic processes, mathematical physics, and geometry.

The contributions are written by internationally recognized experts in the fields of stochastic analysis, linear and nonlinear (deterministic and stochastic) PDEs, infinite dimensional analysis, functional analysis, commutative and noncommutative probability theory, integrable systems, quantum and statistical mechanics, geometric quantization, and neural networks. Also included are applications in biology and other areas.

Most of the contributions are high-level research papers. However, there are also some overviews on topics of general interest. The articles selected for publication in these volumes were specifically chosen to introduce readers to advanced topics, to emphasize interdisciplinary connections, and to stress future research directions. Volume I contains contributions from invited speakers; Volume II contains additional contributed papers.

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

Members of the Canadian Mathematical Society may order at the AMS member price.

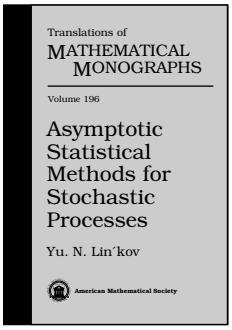
Contents, *Volume I*: F. Gesztesy, **H. Holden**, **J. Jost**, **S. Paycha**, **M. Röckner**, and **S. Scarlatti**, A brief curriculum vitae of Sergio Albeverio; **F. Gesztesy**, **H. Holden**, **J. Jost**, **S. Paycha**, **M. Röckner**, and **S. Scarlatti**, Students and postdoctoral fellows supervised by Sergio Albeverio; **F. Gesztesy**, **H. Holden**, **J. Jost**, **S. Paycha**, **M. Röckner**, and **S. Scarlatti**, Publications of Sergio Albeverio; **P. Blanchard**, On the occasion of Sergio Albeverio's 60th birthday; **G. B. Arous** and **A. F. Ramirez**, Growth and saturation in random media; **Z. Brzez´niak** and **S. Peszat**, Maximal inequalities and exponential estimates for stochastic convolutions in Banach spaces; **A. M. Chebotarev** and **V. P. Maslov**, On Markov evolution equations in quotient probability spaces; **G. Da Prato** and **A. Debussche**, Maximal dissipativity of the Dirichlet operator corresponding to the Burgers equation; **G. F. Dell'Antonio**, **R. Figari**, and **A. Teta**, The Schrödinger equation with moving point interactions in three dimensions; **C. Drumond**, **M. de Faria**, and **L. Streit**, The square of self intersection local time of Brownian motion; **D. Dürr** and **S. Teufel**, On the role of flux in scattering theory; **E. B. Dynkin**, Probability and nonlinear analysis; **K. D. Elworthy** and **X.-M. Li**, Special Itô maps and an L^2 Hodge theory for one forms on path spaces; **V. Z. Enolskii**, **F. Gesztesy**, and **H. Holden**, The classical massive Thirring system revisited; **M. Fukushima**, On Ito's formulae for additive functionals of symmetric diffusion processes; **D. Hundertmark** and **W. Kirsch**, Spectral theory of sparse potentials; **G. Jona-Lasinio**, Invariant measures under Schrödinger evolution and quantum statistical mechanics; **Yu. G. Kondratiev**, **R. A. Minlos**, **M. Röckner**, and **G. V. Shchepan'uk**, Exponential mixing for classical continuous systems; **Z.-M. Ma** and **M. Röckner**, Diffusions on "simple" configuration spaces; **R. A. Minlos**, One- and two-particle branches of the spectrum of "many component" operators; **H. Ouerdiane** and **A. Rezgui**, Représentation intégrale de fonctionnelles analytiques positives; **M. Piccioni** and **S. Scarlatti**, Mean field models and propagation of chaos in feedforward neural networks; **M. Sanz-Solé** and **M. Sarrà**, Path properties of a class of Gaussian processes with applications to spde's; **B. Simon**, A Feynman-Kac formula for unbounded semigroups; **B. Zegarliński**, Hypercontractivity in non-commutative $\mathbf{L_p}$ spaces.

Contents, *Volume II*: V. Adamyan and **B. Pavlov**, Valuation of bonds and options under floating interest rate; **I. Ya. Aref'eva** and **I. V. Volovich**, The large time behaviour in quantum field theory and quantum chaos; **L. V. Bogachev**, **S. A. Molchanov**, **Yu. A. Makhnovskii**, and **A. M. Berezhkovskii**, Correlation effects in the trapping problem: General approach and rigorous results; **B. Booss-Bavnbek**, Boundary reduction of spectral invariants–Results and puzzles; **S. Borac** and **R. Seiler**, Loop group factorization of biorthogonal wavelet bases; **J. F. Brasche**, **M. M. Malamud**, and **H. Neidhardt**, Weyl functions and singular continuous spectra of self-adjoint extensions; **J. Brüning**, Irregular spectral asymptotics; **L. Cattaneo** and **U. Cattaneo**, The Lagrangian gauge problem in classical mechanics and group cohomology; **F. Cipriani**, Perron theory for positive maps and semigroups on von Neumann algebras; **Ph. Clément**, **G. Gripenberg**, and **V. Högnäs**, Some remarks on the method of sums; **M. Demuth**, Stochastic processes and the spectrum of Feller operators; **B. K. Driver** and **B. C. Hall**, The energy representation has no non-zero fixed vectors; **G. G. Emch** and **A. Z. Jadczyk**, Weakly projective representations, quaternions, and monopoles; **P. Exner**, Point interactions in a tube; **R. Fan** and **K. Lange**, Asymptotic properties of the maximal subinterval of a Poisson process; **F. Figliolini** and **D. Guido**, Inclusions of second quantization algebras; **L. Gawarecki** and **V. Mandrekar**, Weak solutions to stochastic differential equations with discontinuous drift in Hilbert space; **F. Gesztesy**, **K. A. Makarov**, and **A. K. Motovilov**, Monotonicity and concavity properties of the spectral shift function; **V. A. Geyler** and **V. A. Margulis**, Zero-range perturbations of the Schrödinger operator with a saddle-point potential; **R. Gielerak** and **P. Ługiewicz**, 4D gauge-like quantum fields from rectangular systems of stochastic partial differential equations; **G. A. Goldin** and **U. Moschella**, Generalized configuration spaces for quantum systems; **K. Gustafson**, A composition adjoint lemma;

K. Habermann, An $M_p^{\mathbb{C}}$-spinorial approach to a geometric-type quantization for symplectic manifolds; **A. Hilbert** and **R. Léandre**, Nagel-Stein-Wainger estimates for balls associated with the Bismut condition; **F. Hiroshima**, Euclidean Gell-Mann-Low formula and double stochastic integrals; **H. Holden**, **K. H. Karlsen**, and **K.-A. Lie**, Operator splitting methods for degenerate convection-diffusion equations I: Convergence and entropy estimates; **Y. Hu**, A class of SPDE driven by fractional white noise; **Y. Hu**, **B. Øksendal**, and **T. Zhang**, Stochastic partial differential equations driven by multiparameter fractional white noise; **P. Imkeller**, Some support properties of the laws of invariant spaces of stochastic differential equations; **G. W. Johnson** and **L. Nielsen**, A stability theorem for Feynman's operational calculus; **N. A. Kachanovsky**, On a biorthogonal approach to the construction of non-Gaussian analysis; **G. Karner**, Twist maps, kicked rotors, and quantum chaos; **W. Karwowski** and **V. Koshmanenko**, The generalized Laplace operator in $L_2(\mathbb{R}^n)$; **A. Khrennikov** and **B. Tirozzi**, Learning of p-adic neural networks; **Y. Kozitsky**, Quantum effects in lattice models of vector anharmonic oscillators; **P. Kurasov** and **K. Watanabe**, On rank one H_{-3}-perturbations of positive self-adjoint operators; **K. Kuwae**, On a strong maximum principle for Dirichlet forms; **B.-H. Li** and **Y.-Q. Li**, On the relation between the model product and the harmonic product of distributions; **X. D. Li**, Sobolev spaces and capacity theory on path spaces; **V. Liebscher**, Integration by parts formulae for point processes; **J. M. Lindsay** and **S. J. Wills**, Fock space Markovian cocycles: Their representation, generation, and dilation; **I. Mitoma**, Wiener space approach to a perturbative Chern-Simons integral; **L. M. Morato**, From Nelson's kinematics to symmetric and non symmetric ground-state transformations; **G. Morchio** and **F. Strocchi**, Representations of *-algebras in indefinite inner product spaces; **D. Noja** and **A. Posilicano**, Delta interactions and electrodynamics of point particles; **N. Obata**, Coherent state representations in white noise calculus; **Y. Oshima**, Certain ratio limit theorem for time inhomogeneous Markov chains; **H. Osswald**, Infinitesimals in abstract Wiener spaces; **G. Panati** and **A. Teta**, The flux-across-surfaces theorem for a point interaction Hamiltonian; **B. Rüdiger** and **J.-L. Wu**, Construction by subordination of processes with jumps on infinite dimensional state spaces and corresponding non local Dirichlet forms; **A. Sergeev**, $\mathrm{Diff}_+(S^1)/S^1$ as a space of complex structures on loop spaces of compact Lie groups; **O. G. Smolyanov**, **H. v. Weizsäcker**, and **O. Wittich**, Brownian motion on a manifold as limit of stepwise conditioned standard Brownian motions; **R. F. Streater**, The analytic quantum information manifold; **M. Takeda**, L^p-independence of the spectral radius of symmetric Markov semigroups; **M. Zähle**, Measure theoretic Laplace operators on fractals; **W. Zheng**, Estimation of the phase transition time in the Stefan problem; **W. Zhengdong**, Cocycles of loop groups.

Conference Proceedings, Canadian Mathematical Society, Volume 28 and Volume 29

December 2000, 333 pages, Softcover, ISBN 0-8218-1959-3, LC 00-046237, 2000 *Mathematics Subject Classification*: 58J20, 58J65, 60G15, 60G20, 60H07, 60H10, 60H15, 60H30, 60H40, 60J60, 60J65, 82B31, 82B44, **Individual member $45**, List $75, Institutional member $60, Order code CMSAMS/28
December 2000, approximately 664 pages, Softcover, ISBN 0-8218-1960-7, LC 00-046237, 2000 *Mathematics Subject Classification*: 58J20, 58J65, 60G15, 60G20, 60H07, 60H10, 60H15, 60H30, 60H40, 60J60, 60J65, 82B31, 82B44, **Individual member $75**, List $125, Institutional member $100, Order code CMSAMS/29N



Asymptotic Statistical Methods for Stochastic Processes

Yu. N. Lin´kov, *Institute of Applied Mathematics & Mechanics, Donetsk, Ukraine*

The asymptotic properties of the likelihood ratio play an important part in solving problems in statistics for various schemes of observations. In this book, the author describes the asymptotic methods for parameter estimation and hypothesis testing based on asymptotic properties of the likelihood ratios in the case where an observed stochastic process is a semimartingale.

Chapter 1 gives the general basic notions and results of the theory under consideration. Chapters 2 and 3 are devoted to the problem of distinguishing between two simple statistical hypotheses. In Chapter 2, certain types of asymptotic distinguishability between families of hypotheses are introduced. The types are characterized in terms of likelihood ratio, Hellinger integral of order ϵ, Kakutani-Hellinger distance, and the distance in variation between hypothetical measures, etc. The results in Chapter 2 are used in Chapter 3 in statistical experiments generated by observations of semimartingales. Chapter 4 applies the general limit theorems on asymptotic properties of maximum likelihood and Bayes estimates obtained by Ibragimov and Has'minskii for observations of an arbitrary nature to observations of semimartingales. In Chapter 5, an unknown parameter is assumed to be random, and under this condition, certain information-theoretic problems of estimation of parameters are considered.

This English edition includes an extensive list of references and revised bibliographical notes.

Contents: Local densities of measures and limit theorems for stochastic processes; Asymptotic distinguishing between simple hypotheses in the scheme of general statistical experiments; Asymptotic behavior of the likelihood ratio in problems of distinguishing between simple hypotheses for semimartingales; Asymptotic estimation of parameters; Asymptotic information-theoretic problems in parameter estimation; Bibliographical notes; References; Index.

Translations of Mathematical Monographs, Volume 196

December 2000, 216 pages, Hardcover, ISBN 0-8218-1183-5, LC 00-045349, 2000 *Mathematics Subject Classification*: 62Mxx; 60Gxx, **Individual member $51**, List $85, Institutional member $68, Order code MMONO/196N

Previously Announced Publications

Methods of Information Geometry

Shun-ichi Amari, *RIKEN Brain Science Institute, Saitama, Japan*, and **Hiroshi Nagaoka**, *University of Electro-Communications, Tokyo, Japan*

Information geometry provides the mathematical sciences with a new framework of analysis. It has emerged from the investigation of the natural differential geometric structure on manifolds of probability distributions, which consists of a Riemannian metric defined by the Fisher information and a one-parameter family of affine connections called the α-connections. The duality between the α-connection and the $(-\alpha)$-connection together with the metric play an essential role in this geometry. This kind of duality, having emerged from manifolds of probability distributions, is ubiquitous, appearing in a variety of problems which might have no explicit relation to probability theory. Through the duality, it is possible to analyze various fundamental problems in a unified perspective.

The first half of this book is devoted to a comprehensive introduction to the mathematical foundation of information geometry, including preliminaries from differential geometry, the geometry of manifolds or probability distributions, and the general theory of dual affine connections. The second half of the text provides an overview of wide areas of applications, such as statistics, linear systems, information theory, quantum mechanics, convex analysis, neural networks, and affine differential geometry. The book will serve as a suitable text for a topics course for advanced undergraduates and graduate students.

This volume is copublished by the AMS and Oxford University Press. The AMS has exclusive distribution rights in North America. AMS members in Europe may purchase the book from the AMS. Both the AMS and OUP have worldwide distribution rights.

Translations of Mathematical Monographs, Volume 191

December 2000, 206 pages, Hardcover, ISBN 0-8218-0531-2, LC 00-059362, 2000 *Mathematics Subject Classification*: 00A69, 53–02, 53B05, 53A15, 62–02, 62F05, 62F12, 93C05, 81Q70, 94A15, **Individual member $33**, List $55, Institutional member $44, Order code MMONO/191RT012

Recommended Text

A Course in Differential Geometry

Thierry Aubin, *University of Paris, France*

This textbook for second-year graduate students is intended as an introduction to differential geometry with principal emphasis on Riemannian geometry. Chapter I explains basic definitions and gives the proofs of the important theorems of Whitney and Sard. Chapter II deals with vector fields and differential forms. Chapter III addresses integration of vector fields and p-plane fields. Chapter IV develops the notion of connection on a Riemannian manifold considered as a means to define parallel transport on the manifold. The author also discusses related notions of torsion and curvature, and gives a working knowledge of the covariant derivative. Chapter V specializes on Riemannian manifolds by deducing global properties from local properties of curvature, the final goal being to determine the manifold completely. Chapter VI explores some problems in PDEs suggested by the geometry of manifolds.

The author is well-known for his significant contributions to the field of geometry and PDEs—particularly for his work on the Yamabe problem—and for his expository accounts on the subject.

The text contains many problems and solutions, permitting the reader to apply the theorems and to see concrete developments of the abstract theory.

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

Graduate Studies in Mathematics, Volume 27

January 2001, approximately 208 pages, Hardcover, ISBN 0-8218-2709-X, LC 00-058275, 2000 *Mathematics Subject Classification*: 53B05, 53C05, 53C22, 53C40, 58A17, 58C05, 58C25, 58C35, 58J05, **All AMS members $28**, List $35, Order code GSM/27RT012

Supplementary Reading

Local Analytic Geometry

Basic Theory and Applications

Theo de Jong, *Universität des Saarlandes, Saarbrücken, Germany*, and **Gerhard Pfister**, *Universität Kaiserslautern, Germany*

A publication of the Vieweg Verlag.

This volume presents the basic tools of algebra and analytic geometry, including the Weierestraß Division Theorem, the Nullstellensatz, dimension theory, normalization, and further topics. As applications, fundamental facts of singularity theory are presented.

The authors give full proofs of all statements in the book or present them as exercises with sufficient hints. Prerequisites include basic algebra, analysis, and function theory. The volume can be used by advanced undergraduates and graduate students for course study, seminars, or as a reference source for research papers in algebraic and analytic geometry.

The AMS is exclusive distributor in North America, and non-exclusive distributor worldwide except in Germany, Switzerland, Austria, and Japan.

Vieweg Advanced Lectures in Mathematics

June 2000, 382 pages, Softcover, ISBN 3-528-03137-9, 2000 *Mathematics Subject Classification*: 32Bxx, **All AMS members $53**, List $59, Order code VWALM/7RT012

A Classic

Lectures on Mathematics

Felix Klein

In the late summer of 1893, following the Congress of Mathematicians held in Chicago, Felix Klein gave two weeks of lectures on the current state of mathematics. Rather than offering a universal perspective, Klein presented his personal view of the most important topics of the time. It is remarkable how most of the topics continue to be important today. Originally published in 1893 and republished by the AMS in 1911, we are pleased to bring this work into print once more with this new edition.

Klein begins by highlighting the works of Clebsch and of Lie. In particular, he discusses Clebsch's work on Abelian functions and compares his approach to the theory with Riemann's more geometrical point of view. Klein devotes two lectures to Sophus Lie, focussing on his contributions to geometry, including sphere geometry and contact geometry.

Klein's ability to connect different mathematical disciplines clearly comes through in his lectures on mathematical developments. For instance, he discusses recent progress in non-Euclidean geometry by emphasizing the connections to

projective geometry and the role of transformation groups. In his descriptions of analytic function theory and of recent work in hyperelliptic and Abelian functions, Klein is guided by Riemann's geometric point of view. He discusses Galois theory and solutions of algebraic equations of degree five or higher by reducing them to normal forms that might be solved by non-algebraic means. Thus, as discovered by Hermite and Kronecker, the quintic can be solved "by elliptic functions". This also leads to Klein's well-known work connecting the quintic to the group of the icosahedron.

Klein expounds on the roles of intuition and logical thinking in mathematics. He reflects on the influence of physics and the physical world on mathematics and, conversely, on the influence of mathematics on physics and the other natural sciences. The discussion is strikingly similar to today's discussions about "physical mathematics".

There are a few other topics covered in the lectures which are somewhat removed from Klein's own work. For example, he discusses Hilbert's proof of the transcendence of certain types of numbers (including π and e), which Klein finds much simpler than the methods used by Lindemann to show the transcendence of π. Also, Klein uses the example of quadratic forms (and forms of higher degree) to explain the need for a theory of ideals as developed by Kummer.

Klein's look at mathematics at the end of the 19th Century remains compelling today, both as history and as mathematics. It is delightful and fascinating to observe from a one-hundred year retrospect, the musings of one of the masters of an earlier era.

AMS Chelsea Publishing

September 2000, 109 pages, Hardcover, ISBN 0-8218-2733-2, LC 00-058295, 2000 *Mathematics Subject Classification*: 01A55, 01A73, 11-XX, 13-XX, 14-XX, 22Exx, 33-XX, 34-XX, 34Mxx, 35-XX, 51M10, 53Axx, 53Dxx, **All AMS members $17**, List $19, Order code CHEL/339.HRT012

Supplementary Reading

Function Theory in Several Complex Variables

Toshio Nishino, *Kyushu University, Fukuoka, Japan*

Kiyoshi Oka, at the beginning of his research, regarded the collection of problems which he encountered in the study of domains of holomorphy as large mountains which separate today and tomorrow. Thus, he believed that there could be no essential progress in analysis without climbing over these mountains ... this book is a worthwhile initial step for the reader in order to understand the mathematical world which was created by Kiyoshi Oka.
—***From the* Preface**

This book explains results in the theory of functions of several complex variables which were mostly established from the late nineteenth century through the middle of the twentieth century. In the work, the author introduces the mathematical world created by his advisor, Kiyoshi Oka.

In this volume, Oka's work is divided into two parts. The first is the study of analytic functions in univalent domains in $\mathbf{C}^n$. Here Oka proved that three concepts are equivalent: domains of holomorphy, holomorphically convex domains, and pseudo-convex domains; and moreover that the Poincaré problem, the Cousin problems, and the Runge problem, when stated properly, can be solved in domains of holomorphy satisfying the appropriate conditions. The second part of Oka's work established a method for the study of analytic functions defined in a ramified domain over $\mathbf{C}^n$ in which the branch points are considered as interior points of the domain. Here analytic functions in an analytic space are treated, which is a slight generalization of a ramified domain over $\mathbf{C}^n$.

In writing the book, the author's goal was to bring to readers a real understanding of Oka's original papers. This volume is an English translation of the original Japanese edition, published by the University of Tokyo Press (Japan). It would make a suitable course text for advanced graduate level introductions to several complex variables.

Translations of Mathematical Monographs

January 2001, approximately 450 pages, Hardcover, ISBN 0-8218-0816-8, LC 00-058292, 2000 *Mathematics Subject Classification*: 32A05, 32A10, 32B15, 32C20, 32C22, 32C55, 32D05, 32E10, 32E40, 32U05, **Individual member $77**, List $129, Institutional member $103, Order code MMONO-NISHINORT012

Recommended Text

C^*-Algebras and Elliptic Operators in Differential Topology

Yu. P. Solovyov and **E. V. Troitsky**, *Moscow State University, Russia*

The aim of this book is to present some applications of functional analysis and the theory of differential operators to the investigation of topological invariants of manifolds.

The main topological application discussed in the book concerns the problem of the description of homotopy-invariant rational Pontryagin numbers of non-simply connected manifolds and the Novikov conjecture of homotopy invariance of higher signatures. The definition of higher signatures and the formulation of the Novikov conjecture are given in Chapter 3. In this chapter, the authors also give an overview of different approaches to the proof of the Novikov conjecture. First, there is the Mishchenko symmetric signature and the generalized Hirzebruch formulae and the Mishchenko theorem of homotopy invariance of higher signatures for manifolds whose fundamental groups have a classifying space, being a complete Riemannian non-positive curvature manifold. Then the authors present Solovyov's proof of the Novikov conjecture for manifolds with fundamental group isomorphic to a discrete subgroup of a linear algebraic group over a local field, based on the notion of the Bruhat-Tits building. Finally, the authors discuss the approach due to Kasparov based on the operator KK-theory and another proof of the Mishchenko theorem. In Chapter 4, they outline the approach to the Novikov conjecture due to Connes and Moscovici involving cyclic homology. That allows one to prove the conjecture in the case when the fundamental group is a (Gromov) hyperbolic group.

The text provides a concise exposition of some topics from functional analysis (for instance, C^*-Hilbert modules, K-theory or C^*-bundles, Hermitian K-theory, Fredholm representations, KK-theory, and functional integration) from the theory of differential operators (pseudodifferential calculus and Sobolev chains over C^*-algebras), and from differential topology (characteristic classes).

The book explains basic ideas of the subject and can serve as a course text for an introduction to the study of original works and special monographs.

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

Translations of Mathematical Monographs, Volume 192

November 2000, 213 pages, Hardcover, ISBN 0-8218-1399-4, LC 00-059367, 2000 *Mathematics Subject Classification*: 46Lxx; 19K56, 35S05, 47G30, 57R99, **Individual member $51**, List $85, Institutional member $68, Order code MMONO/192RT012