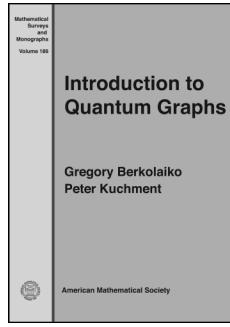


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Algebra and Algebraic Geometry



Introduction to Quantum Graphs

Gregory Berkolaiko and Peter Kuchment, *Texas A&M University, College Station, TX*

A “quantum graph” is a graph considered as a one-dimensional complex and equipped with a differential operator (“Hamiltonian”). Quantum graphs arise naturally as simplified models in mathematics, physics, chemistry, and engineering when one considers propagation of waves of various nature through a quasi-one-dimensional (e.g., “meso-” or “nano-scale”) system that looks like a thin neighborhood of a graph. Works that currently would be classified as discussing quantum graphs have been appearing since at least the 1930s, and since then, quantum graphs techniques have been applied successfully in various areas of mathematical physics, mathematics in general and its applications. One can mention, for instance, dynamical systems theory, control theory, quantum chaos, Anderson localization, microelectronics, photonic crystals, physical chemistry, nano-sciences, superconductivity theory, etc.

Quantum graphs present many non-trivial mathematical challenges, which makes them dear to a mathematician’s heart. Work on quantum graphs has brought together tools and intuition coming from graph theory, combinatorics, mathematical physics, PDEs, and spectral theory.

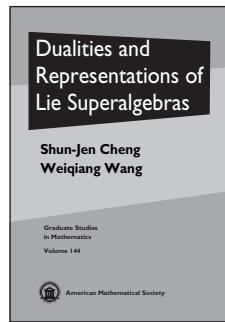
This book provides a comprehensive introduction to the topic, collecting the main notions and techniques. It also contains a survey of the current state of the quantum graph research and applications.

This item will also be of interest to those working in discrete mathematics and combinatorics and applications.

Contents: Operators on graphs; Quantum graphs; Quantum graphs—Some special topics; Spectra of quantum graphs; Spectra of periodic graphs; Spectra of quantum graphs—Special topics; Quantum chaos on graphs; Some applications and generalizations; Appendix A. Some notions of graph theory; Appendix B. Linear operators and operator-functions; Appendix C. Structure of spectra; Appendix D. Symplectic geometry and extension theory; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 186

December 2012, approximately 275 pages, Hardcover, ISBN: 978-0-8218-9211-4, 2010 *Mathematics Subject Classification*: 34B45, 35R02, 81Q35, 35Pxx, 58J50, 05C50, 82D77, 81Q50, 47N60, 82D80, 82D55, **AMS members US\$68.80**, List US\$86, Order code SURV/186



Dualities and Representations of Lie Superalgebras

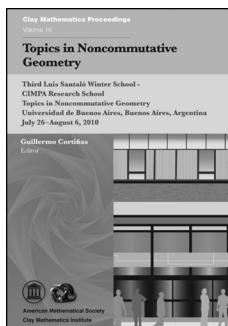
Shun-Jen Cheng, *Academia Sinica, Taipei, Taiwan*, and **Weiqiang Wang**, *University of Virginia, Charlottesville, VA*

This book gives a systematic account of the structure and representation theory of finite-dimensional complex Lie superalgebras of classical type and serves as a good introduction to representation theory of Lie superalgebras. Several folklore results are rigorously proved (and occasionally corrected in detail), sometimes with new proofs. Three important dualities are presented in the book, with the unifying theme of determining irreducible characters of Lie superalgebras. In order of increasing sophistication, they are Schur duality, Howe duality, and super duality. The combinatorics of symmetric functions is developed as needed in connections to Harish-Chandra homomorphism as well as irreducible characters for Lie superalgebras. Schur-Sergeev duality for the queer Lie superalgebra is presented from scratch with complete detail. Howe duality for Lie superalgebras is presented in book form for the first time. Super duality is a new approach developed in the past few years toward understanding the Bernstein-Gelfand-Gelfand category of modules for classical Lie superalgebras. Super duality relates the representation theory of classical Lie superalgebras directly to the representation theory of classical Lie algebras and thus gives a solution to the irreducible character problem of Lie superalgebras via the Kazhdan-Lusztig polynomials of classical Lie algebras.

Contents: Lie superalgebra ABC; Finite-dimensional modules; Schur duality; Classical invariant theory; Howe duality; Super duality; Symmetric functions; Bibliography; Index.

Graduate Studies in Mathematics, Volume 144

January 2013, 297 pages, Hardcover, ISBN: 978-0-8218-9118-6, LC 2012031989, 2010 *Mathematics Subject Classification*: 17B10, 17B20, **AMS members US\$51.20**, List US\$64, Order code GSM/144



Topics in Noncommutative Geometry

Guillermo Cortiñas, Universidad de Buenos Aires, Argentina, Editor

Luis Santaló Winter Schools are organized yearly by the Mathematics Department and the Santaló Mathematical Research Institute of the School of Exact and Natural Sciences of the University of Buenos Aires (FCEN).

This volume contains the proceedings of the third Luis Santaló Winter School, which was devoted to noncommutative geometry and held at FCEN July 26–August 6, 2010.

Topics in this volume concern noncommutative geometry in a broad sense, encompassing various mathematical and physical theories that incorporate geometric ideas to the study of noncommutative phenomena. It explores connections with several areas including algebra, analysis, geometry, topology and mathematical physics.

Bursztyn and Waldmann discuss the classification of star products of Poisson structures up to Morita equivalence. Tsygan explains the connections between Kontsevich's formality theorem, noncommutative calculus, operads and index theory. Hoefel presents a concrete elementary construction in operad theory. Meyer introduces the subject of C^* -algebraic crossed products. Rosenberg introduces Kasparov's KK -theory and noncommutative tori and includes a discussion of the Baum-Connes conjecture for K -theory of crossed products, among other topics. Lafont, Ortiz, and Sánchez-García carry out a concrete computation in connection with the Baum-Connes conjecture. Zuk presents some remarkable groups produced by finite automata. Mesland discusses spectral triples and the Kasparov product in KK -theory. Trinchero explores the connections between Connes' noncommutative geometry and quantum field theory. Karoubi demonstrates a construction of twisted K -theory by means of twisted bundles. Tabuada surveys the theory of noncommutative motives.

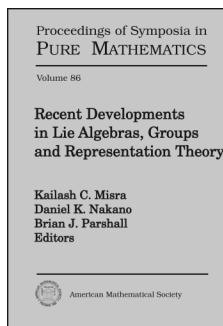
This item will also be of interest to those working in analysis, geometry and topology, and mathematical physics.

Titles in this series are co-published with the Clay Mathematics Institute (Cambridge, MA).

Contents: H. Bursztyn and S. Waldmann, Classifying Morita equivalent star products; B. Tsygan, Noncommutative calculus and operads; E. Hoefel, Some elementary operadic homotopy equivalences; R. Meyer, Actions of higher categories on C^* -algebras; J. Rosenberg, Examples and applications of noncommutative geometry and K -theory; J.-F. Lafont, I. J. Ortiz, and R. J. Sánchez-García, Rational equivariant K -homology of low dimensional groups; A. Zuk, Automata groups; B. Mesland, Spectral triples and KK -theory: A survey; R. Trinchero, Deformations of the canonical spectral triples; M. Karoubi, Twisted bundles and twisted K -theory; G. Tabuada, A guided tour through the garden of noncommutative motives.

Clay Mathematics Proceedings, Volume 16

December 2012, 276 pages, Softcover, ISBN: 978-0-8218-6864-5, LC 2012031426, 2010 *Mathematics Subject Classification*: 14A22, 18D50, 19K35, 19L47, 19L50, 20F10, 46L55, 53D55, 58B34, 81R60, **AMS members US\$63.20**, List US\$79, Order code CMIP/16



Recent Developments in Lie Algebras, Groups and Representation Theory

Kailash C. Misra, North Carolina State University, Raleigh, NC, **Daniel K. Nakano**, University of Georgia, Athens, GA, and **Brian J. Parshall**, University of Virginia, Charlottesville, VA, Editors

This book contains the proceedings of the 2009–2011 Southeastern Lie Theory Workshop Series, held October 9–11, 2009 at North Carolina State University, May 22–24, 2010, at the University of Georgia, and June 1–4, 2011 at the University of Virginia.

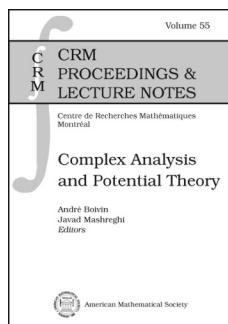
Some of the articles, written by experts in the field, survey recent developments while others include new results in Lie algebras, quantum groups, finite groups, and algebraic groups.

Contents: P. N. Achar, Perverse coherent sheaves on the nilpotent cone in good characteristic; C. P. Bendel, D. K. Nakano, and C. Pillen, On the vanishing ranges for the cohomology of finite groups of Lie type II; M. Bennett and V. Chari, Tilting modules for the current algebra of a simple Lie algebra; J. F. Carlson, Endotrivial modules; S.-J. Cheng, N. Lam, and W. Wang, Super duality for general linear Lie superalgebras and applications; J. Du, Structures and representations of affine q -Schur algebras; A. Francis and L. Jones, Multiplicative bases for the centres of the group algebra and Iwahori-Hecke algebra of the symmetric group; R. L. Griess, Jr., Moonshine paths and a VOA existence proof of the Monster; R. Guralnick and G. Malle, Characteristic polynomials and fixed spaces of semisimple elements; D.J. Hemmer, “Frobenius twists” in the representation theory of the symmetric group; J. Kujawa, The generalized Kac-Wakimoto conjecture and support varieties for the Lie superalgebra $\mathfrak{osp}(m|2n)$; S. Kumar, An approach towards the Kollar-Peskine problem via the instanton moduli space; G. Lusztig, On the representations of disconnected reductive groups over F_q ; B. J. Parshall and L. L. Scott, Forced gradings in integral quasi-hereditary algebras with applications to quantum groups; B. J. Parshall and L. L. Scott, A semisimple series for q -Weyl and q -Specht modules.

Proceedings of Symposia in Pure Mathematics, Volume 86

November 2012, 310 pages, Hardcover, ISBN: 978-0-8218-6917-8, LC 2012026116, 2010 *Mathematics Subject Classification*: 17B37, 17B55, 17B56, 17B65, 17B67, 20C08, 20C11, 20G05, 20G42, 20G43, **AMS members US\$64**, List US\$80, Order code PSPUM/86

Analysis



Complex Analysis and Potential Theory

André Boivin, *University of Western Ontario, London, ON, Canada*, and **Javad Mashreghi**, *Laval University, Québec, QC, Canada*, Editors

This is the proceedings volume of an international conference entitled *Complex Analysis and Potential Theory*, which was held to honor the important contributions of two influential analysts, Kohur N. GowriSankaran and Paul M. Gauthier, in June 2011 at the Centre de Recherches Mathématiques (CRM) in Montreal. More than fifty mathematicians from fifteen countries participated in the conference. The twenty-four surveys and research articles contained in this book are based on the lectures given by some of the most established specialists in the fields. They reflect the wide breadth of research interests of the two honorees: from potential theory on trees to approximation on Riemann surfaces, from universality to inner and outer functions and the disc algebra, from branching processes to harmonic extension and capacities, from harmonic mappings and the Harnack principle to integration formulae in \mathbb{C}^n and the Hartogs phenomenon, from fine harmonicity and plurisubharmonic functions to the binomial identity and the Riemann hypothesis, and more. This volume will be a valuable resource for specialists, young researchers, and graduate students from both fields, complex analysis and potential theory. It will foster further cooperation and the exchange of ideas and techniques to find new research perspectives.

Titles in this series are co-published with the Centre de Recherches Mathématiques.

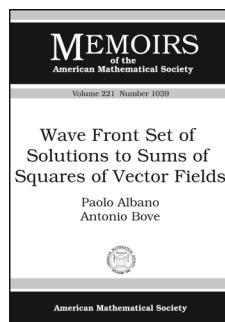
Contents: O. El-Fallah, K. Kellay, J. Mashreghi, and T. Ransford, A self-contained proof of the strong-type capacitary inequality for the Dirichlet space; N. Tarkhanov, A simple numerical approach to the Riemann hypothesis; C. Bénéteau and D. Khavinson, A survey of linear extremal problems in analytic function spaces; L. Beznă, O. Lupaşcu, and A.-G. Oprina, A unifying construction for measure-valued continuous and discrete branching processes; V. Nestoridis, Compactifications of the plane and extensions of the disc algebra; T. Kalmes, M. Nieß, and T. Ransford, Examples of quantitative universal approximation; J. McDougall, Harmonic mappings with quadrilateral image; A. Boggess, R. J. Dwilewicz, and Z. Ślodkowski, Hartogs phenomenon on unbounded domains—Conjectures and examples; L. M. Hernández-Pérez and E. S. Zeron, Integration formulae and kernels in singular subvarieties of \mathbb{C}^n ; M. Stoll, Invariant potential theory, derivatives of inner functions, and $B^{p,q}$ spaces in the unit ball of \mathbb{C}^n ; T. Itoh, Logarithmic Hölder estimates of p -harmonic extension operators in a metric measure space; N. Askaripour and A. Boivin, Meromorphic approximation on noncompact Riemann surfaces; J. Mashreghi, On a family of outer functions; P. V. Paramonov, On C^m -subharmonic extension sets of Walsh-type; A. Sadullaev, On maximal plurisubharmonic functions; R. Fournier and J.-M. Giguère, On universality of series in Banach spaces; Y. Mizuta and T. Ohno, Orlicz capacity of balls; H. Aikawa, Potential analysis on nonsmooth domains—Martin boundary and boundary Harnack principle; D. Singman, Potential theory on trees and multiplication operators; S. J. Gardiner, Recent progress on fine differentiability and fine

harmonicity; A. G. O'Farrell, Reversibility questions in groups arising in analysis; V. Anandam, Subordinate harmonic structures in an infinite network; M. Rao, The generalized binomial theorem; K. Y. Fedorovskiy, Uniform and C^m -approximation by polyanalytic polynomials.

CRM Proceedings & Lecture Notes, Volume 55

December 2012, approximately 337 pages, Softcover, ISBN: 978-0-8218-9173-5, 2010 *Mathematics Subject Classification*: 30-XX, 31-XX, 32-XX, **AMS members US\$108**, List US\$135, Order code CRMP/55

Differential Equations



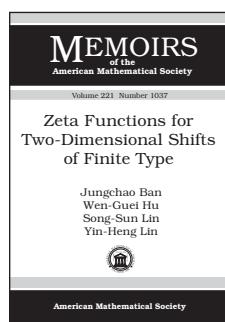
Wave Front Set of Solutions to Sums of Squares of Vector Fields

Paolo Albano and Antonio Bove, *Università di Bologna, Italy*

Contents: Introduction; The Poisson-Treves stratification; Standard forms for a system of vector fields; Nested strata; Bargman pseudodifferential operators; The “a priori” estimate on the FBI side; A single symplectic stratum; A single nonsymplectic stratum; Microlocal regularity in nested strata; Known cases and examples; Appendix A. A bracket lemma; Appendix B. Nonsymplectic strata do not have the reproducing bracket property; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 221, Number 1039

December 2012, 73 pages, Softcover, ISBN: 978-0-8218-7570-4, 2010 *Mathematics Subject Classification*: 35A18; 35H10, 35H20, **Individual member US\$37.20**, List US\$62, Institutional member US\$49.60, Order code MEMO/221/1039



Zeta Functions for Two-Dimensional Shifts of Finite Type

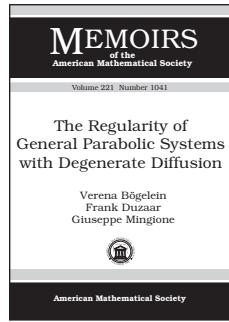
Jungchao Ban, *National Dong Hwa University, Hualien, Taiwan*, **Wen-Guei Hu** and **Song-Sun Lin**, *National Chiao Tung University, Hsinchu, Taiwan*, and **Yin-Heng Lin**, *National Central University, ChungLi, Taiwan*

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

Contents: Introduction; Periodic patterns; Rationality of ζ_n ; More symbols on larger lattice; Zeta functions presented in skew coordinates; Analyticity and meromorphic extensions of zeta functions; Equations on \mathbb{Z}^2 with numbers in a finite field; Square lattice Ising model with finite range interaction; Bibliography.

Memoirs of the American Mathematical Society, Volume 221, Number 1037

December 2012, 60 pages, Softcover, ISBN: 978-0-8218-7290-1, 2010
Mathematics Subject Classification: 37B50, 37B10, 37C30; 82B20,
11M41, Individual member US\$36, List US\$60, Institutional member
 US\$48, Order code MEMO/221/1037



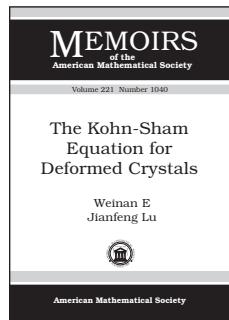
The Regularity of General Parabolic Systems with Degenerate Diffusion

Verena Bögelein and Frank Duzaar, University of Erlangen Nuremberg, Germany, and Giuseppe Mingione, University of Parma, Italy

Contents: Introduction and results; Technical preliminaries; Tools for the p -caloric approximation; The p -caloric approximation lemma; Caccioppoli and Poincaré type inequalities; Approximate \mathcal{A} -caloricity and p -caloricity; DiBenedetto & Friedman regularity theory revisited; Partial gradient regularity in the case $p > 2$; The case $p < 2$; Partial Lipschitz continuity of u ; Bibliography.

Memoirs of the American Mathematical Society, Volume 221, Number 1041

December 2012, 143 pages, Softcover, ISBN: 978-0-8218-8975-6, 2010
Mathematics Subject Classification: 35K55, 35K65, 35K67, **Individual member US\$45.60**, List US\$76, Institutional member US\$60.80, Order code MEMO/221/1041



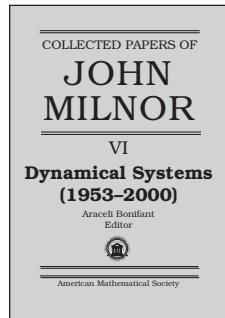
The Kohn-Sham Equation for Deformed Crystals

Weinan E, Princeton University, NJ, and Jianfeng Lu, Duke University, Durham, NC

Contents: Introduction; Perfect crystal; Stability condition; Homogeneously deformed crystal; Deformed crystal and the extended Cauchy-Born rule; The linearized Kohn-Sham operator; Proof of the results for the homogeneously deformed crystal; Exponential decay of the resolvent; Asymptotic analysis of the Kohn-Sham equation; Higher order approximate solution to the Kohn-Sham equation; Proofs of Lemmas 5.3 and 5.4; Appendix A. Proofs of Lemmas 9.3 and 9.9; Bibliography.

Memoirs of the American Mathematical Society, Volume 221, Number 1040

December 2012, 97 pages, Softcover, ISBN: 978-0-8218-7560-5, 2010
Mathematics Subject Classification: 74B20; 35Q40, **Individual member US\$41.40**, List US\$69, Institutional member US\$55.20, Order code MEMO/221/1040



Collected Papers of John Milnor

VI. Dynamical Systems (1953–2000)

Araceli Bonifant, University of Rhode Island, Kingston, RI, Editor

This book, the sixth in the series "Collected Papers of John Milnor", contains all of Milnor's work on Real and Complex Dynamics from 1953 to 1999, plus one paper from 2000.

These papers provide important and fundamental material in real and complex dynamical systems. Many of them have become classics in the field. Several questions addressed in them continue to be important in current research. Having them together in the same volume gives readers a taste of all the great mathematics developed by the author in the different areas of dynamics. In some cases, there have been minor corrections or clarifications, as well as references to more recent work which answers questions raised by the author.

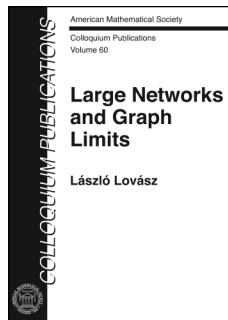
John Milnor's papers are accompanied by introductions that put them in perspective with respect to the current state of the field. There is also an index to facilitate searching the book for specific topics.

Contents: *Part I. Real dynamics:* Introduction to Part I; The characteristics of a vector field in the two-sphere (1953); On the concept of attractor (1985); On the concept of attractor: Correction and remarks (1985); Directional entropies of cellular automaton-maps (1986); On the entropy geometry of cellular automata (1988); Non-expansive Hénon maps (1988); with W. Thurston, On iterated maps of the interval (1988); with S. P. Dawson, R. Galeeva, and C. Tresser, A monotonicity conjecture for real cubic maps (1995); with C. Tresser, On entropy and monotonicity for real cubic maps (2000) (with an appendix by A. Douady and P. Sentenac); Furbin foiled: Katok's paradoxical example in measure theory (1997); *Part II. Complex dynamics:* Introduction to Part II; with S. Friedland, Dynamical properties of plane polynomial automorphisms (1989); Self-similarity and hairiness in the Mandelbrot set (1989); Remarks on iterated cubic maps (1992); Geometry and dynamics of quadratic rational maps (1993) (with an appendix by J. Milnor and T. Lei); with M. Lyubich, The Fibonacci unimodal map (1993); with L. Goldberg, Fixed points of polynomial maps. Part II. Fixed point portraits (1993); The mathematical work of Curt McMullen (1999); Index.

Collected Works, Volume 19

February 2013, 535 pages, Hardcover, ISBN: 978-0-8218-9139-1, 2010
Mathematics Subject Classification: 37-XX, 54H20, 26A18, 28D20, 32Hxx, 32S70, 28A35, 68Q80, 01A70, **AMS members US\$87.20**, List US\$109, Order code CWORKS/19.6

Discrete Mathematics and Combinatorics



Large Networks and Graph Limits

László Lovász, Eötvös Loránd University, Budapest, Hungary

Recently, it became apparent that a large number of the most interesting structures and phenomena of the world can be described by networks. Developing a mathematical theory of very large networks is an important challenge. This book

describes one recent approach to this theory, the limit theory of graphs, which has emerged over the last decade. The theory has rich connections with other approaches to the study of large networks, such as “property testing” in computer science and regularity partition in graph theory. It has several applications in extremal graph theory, including the exact formulations and partial answers to very general questions, such as which problems in extremal graph theory are decidable. It also has less obvious connections with other parts of mathematics (classical and non-classical, like probability theory, measure theory, tensor algebras, and semidefinite optimization).

This book explains many of these connections, first at an informal level to emphasize the need to apply more advanced mathematical methods, and then gives an exact development of the theory of the algebraic theory of graph homomorphisms and of the analytic theory of graph limits.

This is an amazing book: readable, deep, and lively. It sets out this emerging area, makes connections between old classical graph theory and graph limits, and charts the course of the future.

—**Persi Diaconis, Stanford University**

This book is a comprehensive study of the active topic of graph limits and an updated account of its present status. It is a beautiful volume written by an outstanding mathematician who is also a great expositor.

—**Noga Alon, Tel Aviv University, Israel**

Modern combinatorics is by no means an isolated subject in mathematics, but has many rich and interesting connections to almost every area of mathematics and computer science. The research presented in Lovász's book exemplifies this phenomenon. This book presents a wonderful opportunity for a student in combinatorics to explore other fields of mathematics, or conversely for experts in other areas of mathematics to become acquainted with some aspects of graph theory.

—**Terence Tao, University of California, Los Angeles, CA**

László Lovász has written an admirable treatise on the exciting new theory of graph limits and graph homomorphisms, an area of great importance in the study of large networks. It is an authoritative, masterful text that reflects Lovász's position as the main architect of this rapidly developing theory. The book is a must for combinatorialists, network theorists, and theoretical computer scientists alike.

—**Bela Bollobas, Cambridge University, UK**

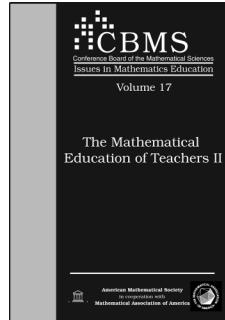
This item will also be of interest to those working in applications.

Contents: *Large graphs: An informal introduction:* Very large networks; Large graphs in mathematics and physics; *The algebra of graph homomorphisms:* Notation and terminology; Graph parameters and connection matrices; Graph homomorphisms; Graph algebras and homomorphism functions; *Limits of dense graph sequences:* Kernels and graphons; The cut distance; Szemerédi partitions; Sampling; Convergence of dense graph sequences; Convergence from the right; On the structure of graphons; The space of graphons; Algorithms for large graphs and graphons; Extremal theory of dense graphs; Multigraphs and decorated graphs; *Limits of bounded degree graphs:* Graphings; Convergence of bounded degree graphs; Right convergence of bounded degree graphs; On the structure of graphings; Algorithms for bounded degree graphs; *Extensions: A brief survey:* Other combinatorial structures; Appendix A; Bibliography; Author index; Subject index; Notation index.

Colloquium Publications, Volume 60

December 2012, 475 pages, Hardcover, ISBN: 978-0-8218-9085-1, 2010 *Mathematics Subject Classification:* 05C99; 05C25, 05C35, 05C80, 05C82, 05C85, 90B15, **AMS members US\$79.20**, List US\$99, Order code COLL/60

General Interest



The Mathematical Education of Teachers II

This report is a resource for those who teach mathematics and statistics to PreK-12 mathematics teachers, both future teachers and those who already teach in our nation's schools. The report makes recommendations for the mathematics that teachers should know and how they should come to know that mathematics. It urges greater involvement of mathematicians and statisticians in teacher education so that the nation's mathematics teachers have the knowledge, skills, and dispositions needed to provide students with a mathematics education that ensures high school graduates are college- and career-ready as envisioned by the Common Core State Standards.

This report draws on the experience and knowledge of the past decade to:

- Update the 2001 Mathematical Education of Teachers report's recommendations for the mathematical preparation of teachers at all grade levels: elementary, middle, and high school.
- Address the professional development of teachers of mathematics.
- Discuss the mathematical knowledge needed by teachers at different grade levels and by others who teach mathematics such as elementary mathematics specialists, special education teachers, and early childhood educators.

Each of the MET II writers is a mathematician, statistician, or mathematics educator with substantial expertise and experience in mathematics education. Among them are principal investigators for Math Science Partnerships as well as past presidents and chairs of the American Statistical Association, Association of Mathematics Teacher Educators, Association of State Supervisors of Mathematics,

Conference Board of the Mathematical Sciences, and National Council of Teachers of Mathematics.

The audience for this report includes all who teach mathematics to teachers—mathematicians, statisticians, and mathematics educators—and all who are responsible for the mathematical education of teachers—department chairs, educational administrators, and policy-makers at the national, state, school-district, and collegiate levels.

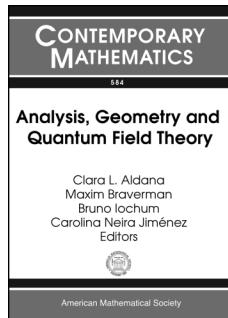
This series is published in cooperation with the Mathematical Association of America.

Contents: School mathematics and teachers' mathematics; The mathematical education of teachers: Traditions, research, current context; Recommendations: Mathematics for teachers; Roles for mathematicians; Elementary teachers; Middle grades teachers; High school teachers; Appendix A. Selected references and information sources; Appendix B. The common core state standards: Overview of content; Appendix C. The common core state standards for mathematical practice.

CBMS Issues in Mathematics Education, Volume 17

December 2012, 86 pages, Softcover, ISBN: 978-0-8218-6926-0, 2010 *Mathematics Subject Classification*: 97A99, 00-01, **AMS members US\$26.40**, List US\$33, Order code CBMATH/17

Geometry and Topology



Analysis, Geometry and Quantum Field Theory

Clara L. Aldana, Max Planck Institute for Gravitational Physics, Golm, Germany, Maxim Braverman, Northeastern University, Boston, MA, Bruno Iochum, Aix-Marseille Université, France, and Carolina Neira Jiménez, Universität Regensburg, Germany, Editors

This volume contains the proceedings of the conference “Analysis, Geometry and Quantum Field Theory” held at Potsdam University in September 2011, which honored Steve Rosenberg’s 60th birthday.

The papers in this volume cover a wide range of areas, including Quantum Field Theory, Deformation Quantization, Gerbes, Loop Spaces, Index Theory, Determinants of Elliptic Operators, K-theory, Infinite Rank Bundles and Mathematical Biology.

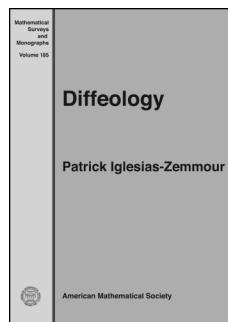
This item will also be of interest to those working in mathematical physics.

Contents: M. G. Eastwood and J. A. Wolf, A duality for the double fibration transform; P. Hekmati and M. Mathai, T-duality of current algebras and their quantization; Y. Maeda and A. Sako, Deformation quantization of instantons on \mathbb{R}^4 ; J. Mickelsson, The Chern character of certain infinite rank bundles arising in gauge theory; A. Larraín-Hubach, K-theories for classes of infinite rank bundles; K. Waldorf, A construction of string 2-group models using transgression-regression technique; A. Cardona, Extended symmetries and Poisson algebras associated to twisted Dirac

structures; S. T. Melo, T. Schick, and E. Schrohe, C^* -algebra approach to the index theory of boundary value problems; B. Boos-Bavnbek, Towards a nano geometry? Geometry and dynamics on nano scale; T. Liimatainen, Optimal Riemannian metric for a volumorphism and a mean ergodic theorem in complete global Alexandrov nonpositively curved spaces; C. Bär, Renormalized integrals and a path integral formula for the heat kernel on a manifold; S. Paycha, Affine transformations on symbols; C. L. Aldana, Determinants of Laplacians on non-compact surfaces; S. Scott, Calculation of the variation of $\det_\zeta D$; G. Misiołek and T. Yoneda, Ill-posedness examples for the quasi-geostrophic and the Euler equations.

Contemporary Mathematics, Volume 584

December 2012, 258 pages, Softcover, ISBN: 978-0-8218-9144-5, LC 2012027493, 2010 *Mathematics Subject Classification*: 58J35, 58D17, 58B25, 19L64, 81R60, 19K56, 22E67, 32L25, 46L80, 17B69, **AMS members US\$68.80**, List US\$86, Order code CONM/584



Diffeology

Patrick Iglesias-Zemmour, CNRS, Marseille, France, and The Hebrew University of Jerusalem, Israel

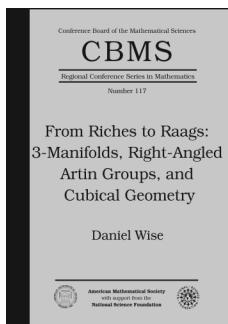
Diffeology is an extension of differential geometry. With a minimal set of axioms, diffeology allows us to deal simply but rigorously with objects which do not fall within the usual field of differential geometry: quotients of manifolds (even non-Hausdorff), spaces of functions, groups of diffeomorphisms, etc. The category of diffeology objects is stable under standard set-theoretic operations, such as quotients, products, co-products, subsets, limits, and co-limits. With its right balance between rigor and simplicity, diffeology can be a good framework for many problems that appear in various areas of physics.

Actually, the book lays the foundations of the main fields of differential geometry used in theoretical physics: differentiability, Cartan differential calculus, homology and cohomology, diffeological groups, fiber bundles, and connections. The book ends with an open program on symplectic diffeology, a rich field of application of the theory. Many exercises with solutions make this book appropriate for learning the subject.

Contents: Diffeology and diffeological spaces; Locality and diffeologies; Diffeological vector spaces; Modeling spaces, manifolds, etc.; Homotopy of diffeological spaces; Cartan-De Rham calculus; Diffeological groups; Diffeological fiber bundles; Symplectic diffeology; Solutions of exercises; Afterword; Notation and vocabulary; Bibliography.

Mathematical Surveys and Monographs, Volume 185

February 2013, approximately 449 pages, Hardcover, ISBN: 978-0-8218-9131-5, LC 2012032894, 2010 *Mathematics Subject Classification*: 53Cxx, 53Dxx, 55Pxx, 55P35, 55Rxx, 55R65, 58A10, 58A40, 58Bxx, **AMS members US\$93.60**, List US\$117, Order code SURV/185



From Riches to Raags: 3-Manifolds, Right-Angled Artin Groups, and Cubical Geometry

Daniel T. Wise, *McGill University, Montreal, QC, Canada*

This book presents an introduction to the geometric group theory associated with nonpositively curved cube complexes. It advocates the use of cube complexes to understand the fundamental groups of hyperbolic 3-manifolds as well as many other infinite groups studied within geometric group theory.

The main goal is to outline the proof that a hyperbolic group G with a quasiconvex hierarchy has a finite index subgroup that embeds in a right-angled Artin group. The supporting ingredients of the proof are sketched: the basics of nonpositively curved cube complexes, wallspaces and dual CAT(0) cube complexes, special cube complexes, the combination theorem for special cube complexes, the combination theorem for cubulated groups, cubical small-cancellation theory, and the malnormal special quotient theorem. Generalizations to relatively hyperbolic groups are discussed. Finally, applications are described towards resolving Baumslag's conjecture on the residual finiteness of one-relator groups with torsion, and to the virtual specialness and virtual fibering of certain hyperbolic 3-manifolds, including those with at least one cusp.

The text contains many figures illustrating the ideas.

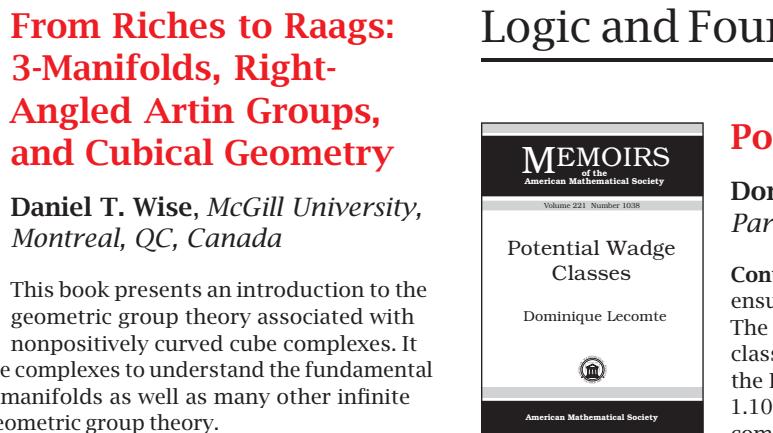
This item will also be of interest to those working in algebra and algebraic geometry.

A co-publication of the AMS and CBMS.

Contents: Overview; Nonpositively curved cube complexes; Cubical disk diagrams, hyperplanes, and convexity; Special cube complexes; Virtual specialness of malnormal amalgams; Wallspaces and their dual cube complexes; Finiteness properties of the dual cube complex; Cubulating malnormal graphs of cubulated groups; Cubical small cancellation theory; Walls in cubical small-cancellation theory; Annular diagrams; Virtually special quotients; Hyperbolicity and quasiconvexity detection; Hyperbolic groups with a quasiconvex hierarchy; The relatively hyperbolic setting; Applications; Bibliography; Index of notation and defined terms.

CBMS Regional Conference Series in Mathematics, Number 117

December 2012, approximately 144 pages, Softcover, ISBN: 978-0-8218-8800-1, LC 2012032056, 2010 *Mathematics Subject Classification*: 20F67, 20F06, 57M99, 20E26, **AMS members US\$32.80, All Individuals US\$32.80**, List US\$41, Order code CBMS/117



Logic and Foundations

Potential Wadge Classes

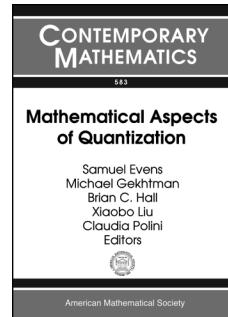
Dominique Lecomte, *Université Paris 6, France*

Contents: Introduction; A condition ensuring the existence of complicated sets; The proof of Theorem 1.10 for the Borel classes; The proof of Theorem 1.11 for the Borel classes; The proof of Theorem 1.10; The proof of Theorem 1.11; Injectivity complements; Bibliography.

Memoirs of the American Mathematical Society, Volume 221, Number 1038

December 2012, 83 pages, Softcover, ISBN: 978-0-8218-7557-5, 2010 *Mathematics Subject Classification*: 03E15; 54H05, 28A05, 26A21, **Individual member US\$37.20**, List US\$62, Institutional member US\$49.60, Order code MEMO/221/1038

Mathematical Physics



Mathematical Aspects of Quantization

Sam Evens, Michael Gekhtman, Brian C. Hall, Xiaobo Liu, and Claudia Polini, *University of Notre Dame, IN*, Editors

This book is a collection of expository articles from the Center of Mathematics at Notre Dame's 2011 program on quantization.

Included are lecture notes from a summer school on quantization on topics such as the Cherednik algebra, geometric quantization, detailed proofs of Willwacher's results on the Kontsevich graph complex, and group-valued moment maps.

This book also includes expository articles on quantization and automorphic forms, renormalization, Berezin-Toeplitz quantization in the complex setting, and the commutation of quantization with reduction, as well as an original article on derived Poisson brackets.

The primary goal of this volume is to make topics in quantization more accessible to graduate students and researchers.

Contents: Y. Berest and P. Samuelson, Dunkl operators and quasi-invariants of complex reflection groups; V. A. Dolgushev and C. L. Rogers, Notes on algebraic operads, graph complexes, and Willwacher's construction; E. Lerman, Geometric quantization: A crash course; E. Meinrenken, Lectures on group-valued moment maps and Verlinde formulas; T. Barron, Quantization and automorphic forms; Y. Berest, X. Chen, F. Eshmatov, and A. Ramadoss, Noncommutative Poisson structures, derived representation schemes and Calabi-Yau algebras; A. Kar and S. G. Rajeev, Renormalization by any means necessary; M. Schlichenmaier, Berezin-Toeplitz quantization and star products for compact Kähler manifolds;

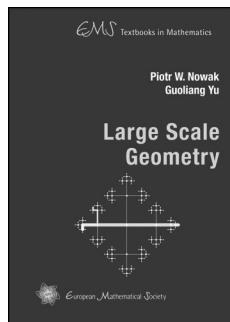
J. Śniatycki, Commutation of geometric quantization and algebraic reduction.

Contemporary Mathematics, Volume 583

December 2012, 308 pages, Softcover, ISBN: 978-0-8218-7573-5, LC 2012025701, 2010 *Mathematics Subject Classification*: 53D50, 53D55, 46L65, 81S10, **AMS members US\$77.60**, List US\$97, Order code CONM/583

New AMS-Distributed Publications

Geometry and Topology



Large Scale Geometry

Piotr W. Nowak, *Polish Academy of Sciences, Warsaw, Poland*, and Guoliang Yu, *Texas A & M University, College Station, TX*

Large scale geometry is the study of geometric objects viewed from a great distance. The idea of large scale geometry can be traced back to Mostow's work on rigidity and the work of Švarc, Milnor, and

Wolf on growth of groups. In the last decades, large scale geometry has found important applications in group theory, topology, geometry, higher index theory, computer science, and large data analysis.

This book provides a friendly approach to the basic theory of this exciting and fast growing subject and offers a glimpse of its applications to topology, geometry, and higher index theory. The authors have made a conscientious effort to make the book accessible to advanced undergraduate students, graduate students, and non-experts.

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

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

Contents: Metric spaces and large scale geometry; Asymptotic dimension and decomposition complexity; Amenability; Property A; Coarse embeddings; Group actions on Banach spaces; Coarse homology; Survey of applications; References; Index.

EMS Textbooks in Mathematics, Volume 13

October 2012, 203 pages, Hardcover, ISBN: 978-3-03719-112-5, 2010 *Mathematics Subject Classification*: 51-01, 20F69, 19K56, 57-01, 46L87, 58B34, 46L99, 53C20, **AMS members US\$35.20**, List US\$44, Order code EMSTEXT/13

The image is a collage of various scientific and mathematical images. At the top, there are three smaller images: a close-up of concentric lines, a view of power lines and poles, and a molecular model. Below these, the word 'mathematics' is written in a large, bold, white font. Underneath it, the words 'LANGUAGE OF THE SCIENCES' are written in a smaller, white font. To the right of the word 'mathematics', there is a large grid of smaller images: a brain scan, a DNA helix, a fingerprint, a satellite dish, a grid pattern, a water droplet, and a circular pattern. Below the collage, a list of interdisciplinary fields is written in a white, sans-serif font, including engineering, astronomy, robotics, genetics, medicine, biology, climatology, forensics, statistics, finance, computer science, physics, neuroscience, chemistry, geology, biochemistry, ecology, and molecular biology.