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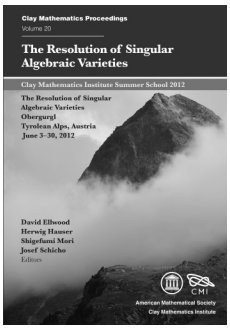
Algebra and Algebraic Geometry



The Resolution of Singular Algebraic Varieties

David Ellwood, *Harvard University, Cambridge, MA*, **Herwig Hauser**, *Universtitat Wien, Vienna, Austria*, **Shigefumi Mori**, *RIMS, Kyoto University, Japan*, and **Josef Schicho**, *Austrian Academy of Sciences, Linz, Austria*, Editors

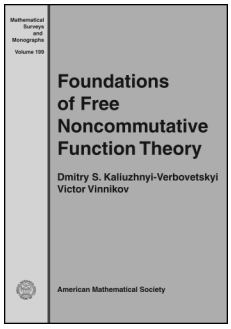
Resolution of Singularities has long been considered as being a difficult to access area of mathematics. The more systematic and simpler proofs that have appeared in the last few years in zero characteristic now give us a much better understanding of singularities. They reveal the aesthetics of both the logical structure of the proof and the various methods used in it. The present volume is intended for readers who are not yet experts but always wondered about the intricacies of resolution. As such, it provides a gentle and quite comprehensive introduction to this amazing field. The book may tempt the reader to enter more deeply into a topic where many mysteries—especially the positive characteristic case—await to be disclosed.

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

Contents: H. Hauser, Blowups and resolution; **A. Bravo** and **O. E. Villamayor U.**, On the behavior of the multiplicity on schemes: Stratification and blow ups; **J. Schicho**, A simplified game for resolution of singularities; **S. D. Cutkosky**, Resolution of singularities in char p and monomialization; **S. Encinas**, Resolution of toric varieties; **A. Frühbis-Krüger**, Desingularization in computational applications and experiments; **H. Kawanoue**, Introduction to the idealistic filtration program with emphasis on the radical saturation; **J. Schicho** and **J. Top**, Algebraic approaches to FlipIt; **T. Yasuda**, Higher Semple-Nash blowups and F-blowups.

Clay Mathematics Proceedings, Volume 20

January 2015, approximately 347 pages, Softcover, ISBN: 978-0-8218-8982-4, LC 2014031965, 2010 *Mathematics Subject Classification:* 14-01, 14-06, 14Bxx, 14Exx, 13-01, 13-06, 13Hxx, 32Bxx, 32Sxx, 58Kxx, **AMS members US$80.80**, List US$101, Order code CMIP/20



Foundations of Free Noncommutative Function Theory

Dmitry S. Kaliuzhnyi-Verbovetskyi, *Drexel University, Philadelphia, PA*, and **Victor Vinnikov**, *Ben Gurion University of the Negev, Beer Sheva, Israel*

In this book the authors develop a theory of free noncommutative functions, in both algebraic and analytic settings. Such functions are defined as mappings from square matrices of all sizes over a module (in particular, a vector space) to square matrices over another module, which respect the size, direct sums, and similarities of matrices. Examples include, but are not limited to, noncommutative polynomials, power series, and rational expressions.

Motivation and inspiration for using the theory of free noncommutative functions often comes from free probability. An important application area is "dimensionless" matrix inequalities; these arise, e.g., in various optimization problems of system engineering. Among other related areas are those of polynomial identities in rings, formal languages and finite automata, quasideterminants, noncommutative symmetric functions, operator spaces and operator algebras, and quantum control.

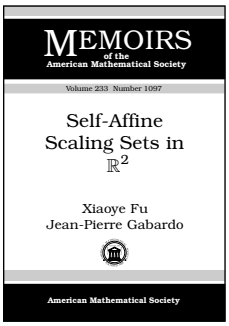
This item will also be of interest to those working in analysis and probability and statistics.

Contents: Introduction; NC functions and their difference-differential calculus; Higher order nc functions and their difference-differential calculus; The Taylor-Taylor formula; NC functions on nilpotent matrices; NC polynomials vs. polynomials in matrix entries; NC analyticity and convergence of TT series; Convergence of nc power series; Direct summands extensions of nc sets and nc functions; (Some) earlier work on nc functions; Appendix A. Similarity invariant envelopes and extension of nc functions; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 199

December 2014, 183 pages, Hardcover, ISBN: 978-1-4704-1697-3, LC 2014025799, 2010 *Mathematics Subject Classification:* 17A50, 40A05, 46-02, 46L52, 46L54, 47A60, 47L25, **AMS members US$61.60**, List US$77, Order code SURV/199

Analysis



Self-Affine Scaling Sets in $\mathbb{R}^2$

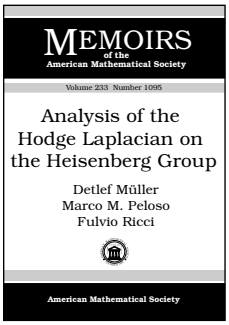
Xiaoye Fu, *The Chinese University of Hong Kong, Shatin, Hong Kong*, and **Jean-Pierre Gabardo**, *McMaster University, Hamilton, ON, Canada*

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

Contents: Introduction; Preliminary results; A sufficient condition for a self-affine tile to be an MRA scaling set; Characterization of the inclusion $K \subset BK$; Self-affine scaling sets in $\mathbb{R}^2$: the case $0 \in \mathcal{D}$; Self-affine scaling sets in $\mathbb{R}^2$: the case $\mathcal{D} = \{d_1, d_2\} \subset \mathbb{R}^2$; Conclusion; Bibliography.

Memoirs of the American Mathematical Society, Volume 233, Number 1097

January 2015, 85 pages, Softcover, ISBN: 978-1-4704-1091-9, 2010 *Mathematics Subject Classification:* 42C15; 52C20, **Individual member US$42.60**, List US$71, Institutional member US$56.80, Order code MEMO/233/1097



Analysis of the Hodge Laplacian on the Heisenberg Group

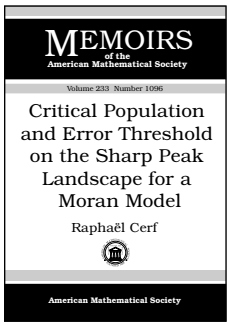
Detlef Müller, *Universität Kiel, Germany*, **Marco M. Peloso**, *Universita Degli Studi Di Mila, Milano, Italy*, and **Fulvio Ricci**, *Scuola Normale Superiore, Pisa, Italy*

Contents: Introduction; Differential forms and the Hodge Laplacian on H_n; Bargmann representations and sections of homogeneous bundles; Cores, domains and self-adjoint extensions; First properties of Δ_k; exact and closed forms; A decomposition of $L^2\Lambda_H^k$ related to the ∂ and $\bar{\partial}$ complexes; Intertwining operators and different scalar forms for Δ_k; Unitary intertwining operators and projections; Decomposition of $L^2\Lambda^k$; L^p-multipliers; Decomposition of $L^p\Lambda^k$ and boundedness of the Riesz transforms; Applications; Appendix; Bibliography.

Memoirs of the American Mathematical Society, Volume 233, Number 1095

January 2015, 91 pages, Softcover, ISBN: 978-1-4704-0939-5, 2010 *Mathematics Subject Classification:* 43A80, 42B15, **Individual member US$42.60**, List US$71, Institutional member US$56.80, Order code MEMO/233/1095

Applications



Critical Population and Error Threshold on the Sharp Peak Landscape for a Moran Model

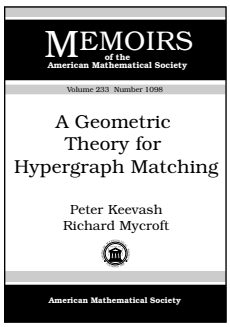
Raphaël Cerf, *Université Paris Sud, Orsay, France*

Contents: Introduction; The model; Main results; Coupling; Normalized model; Lumping; Monotonicity; Stochastic bounds; Birth and death processes; The neutral phase; Synthesis; Appendix on Markov chain; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 233, Number 1096

January 2015, 87 pages, Softcover, ISBN: 978-1-4704-0967-8, 2010 *Mathematics Subject Classification:* 60F10, 92D25, **Individual member US$42.60**, List US$71, Institutional member US$56.80, Order code MEMO/233/1096

Discrete Mathematics and Combinatorics



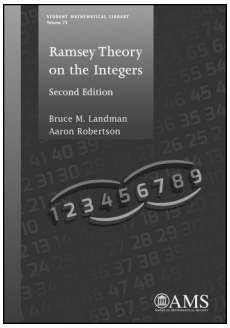
A Geometric Theory for Hypergraph Matching

Peter Keevash, *Queen Mary University of London, United Kingdom*, and **Richard Mycroft**, *University of Birmingham, United Kingdom*

Contents: Introduction; Results and examples; Geometric motifs; Transferrals; Transferrals via the minimum degree sequence; Hypergraph regularity theory; Matchings in k-systems; Packing tetrahedra; The general theory; Bibliography.

Memoirs of the American Mathematical Society, Volume 233, Number 1098

January 2015, 95 pages, Softcover, ISBN: 978-1-4704-0965-4, 2010 *Mathematics Subject Classification:* 05C65, 05C70, **Individual member US$42.60**, List US$71, Institutional member US$56.80, Order code MEMO/233/1098



Ramsey Theory on the Integers

Second Edition

Bruce M. Landman, *State University of West Georgia, Carrollton, GA*, and **Aaron Robertson**, *Colgate University, Hamilton, NY*

Ramsey theory is the study of the structure of mathematical objects that is preserved under partitions. In its full generality, Ramsey theory is quite powerful, but can quickly become complicated. By limiting the focus of this book to Ramsey theory applied to the set of integers, the authors have produced a gentle, but meaningful, introduction to an important and enticing branch of modern mathematics. *Ramsey Theory on the Integers* offers students a glimpse into the world of mathematical research and the opportunity for them to begin pondering unsolved problems.

For this new edition, several sections have been added and others have been significantly updated. Among the newly introduced topics are: rainbow Ramsey theory, an "inequality" version of Schur's theorem, monochromatic solutions of recurrence relations, Ramsey results involving both sums and products, monochromatic sets avoiding certain differences, Ramsey properties for polynomial progressions, generalizations of the Erdős-Ginzberg-Ziv theorem, and the number of arithmetic progressions under arbitrary colorings. Many new results and proofs have been added, most of which were not known when the first edition was published. Furthermore, the book's tables, exercises, lists of open research problems, and bibliography have all been significantly updated.

This innovative book also provides the first cohesive study of Ramsey theory on the integers. It contains perhaps the most substantial account of solved and unsolved problems in this blossoming subject. This breakthrough book will engage students, teachers, and researchers alike.

Reviews of the Previous Edition:

Students will enjoy it due to the highly accessible exposition of the material provided by the authors.

—***MAA Horizons***

What a wonderful book! … contains a very "student friendly" approach to one of the richest areas of mathematical research … a very good way of introducing the students to mathematical research … an extensive bibliography … no other book on the subject … which is structured as a textbook for undergraduates … The book can be used in a variety of ways, either as a textbook for a course, or as a source of research problems … strongly recommend this book for all researchers in Ramsey theory … very good book: interesting, accessible and beautifully written. The authors really did a great job!

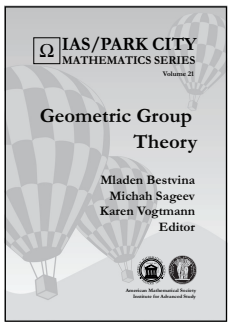
—***MAA Online***

Contents: Preliminaries; Van der Waerden's theorem; Supersets of AP; Subsets of AP; Other generalizations of $w(k;r)$; Arithmetic progressions (mod m); Other variations on van der Waerden's theorem; Schur's theorem; Rado's theorem; Other topics; Notation; Bibliography; Index.

Student Mathematical Library, Volume 73

December 2014, approximately 396 pages, Softcover, ISBN: 978-0-8218-9867-3, LC 2014025399, 2010 *Mathematics Subject Classification:* 05D10, **All Individuals US$48.80**, List US$61, Institutional member US$48.80, Order code STML/73

Geometry and Topology



Geometric Group Theory

Mladen Bestvina, *University of Utah, Salt Lake City, UT*, **Michah Sageev**, *Technion-Israel Institute of Technology, Haifa, Israel*, and **Karen Vogtmann**, *University of Warwick, Coventry, United Kingdom*

Geometric group theory refers to the study of discrete groups using tools from topology, geometry, dynamics and analysis. The field is evolving very rapidly and the present volume provides an introduction to and overview of various topics which have played critical roles in this evolution.

The book contains lecture notes from courses given at the Park City Math Institute on Geometric Group Theory. The institute consists of a set of intensive short courses offered by leaders in the field, designed to introduce students to exciting, current research in mathematics. These lectures do not duplicate standard courses available elsewhere. The courses begin at an introductory level suitable for graduate students and lead up to currently active topics of research. The articles in this volume include introductions to CAT(0) cube complexes and groups, to modern small cancellation theory, to isometry groups of general CAT(0) spaces, and a discussion of nilpotent genus in the context of mapping class groups and CAT(0) groups. One course surveys quasi-isometric rigidity, others contain an exploration of the geometry of Outer space, of actions of arithmetic groups, lectures on lattices and locally symmetric spaces, on marked length spectra and on expander graphs, Property tau and approximate groups.

This book is a valuable resource for graduate students and researchers interested in geometric group theory.

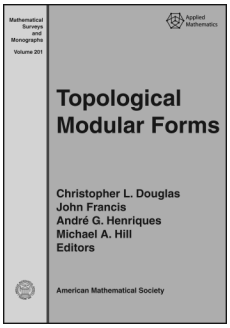
This item will also be of interest to those working in algebra and algebraic geometry.

Titles in this series are co-published with the Institute for Advanced Study/Park City Mathematics Institute. Members of the Mathematical Association of America (MAA) and the National Council of Teachers of Mathematics (NCTM) receive a 20% discount from list price.

Contents: M. Sageev, CAT(0) cube complexes and groups; **V. Guirardel**, Geometric small cancellation; **P.-E. Caprace**, Lectures on proper CAT(0) spaces and their isometry groups; **M. Kapovich**, Lectures on quasi-isometric rigidity; **M. Bestvina**, Geometry of outer space; **D. W. Morris**, Some arithmetic groups that do not act on the circle; **T. Gelander**, Lectures on lattices and locally symmetric spaces; **A. Wilkinson**, Lectures on marked length spectrum rigidity; **E. Breuillard**, Expander graphs, property (τ) and approximate groups; **M. R. Bridson**, Cube complexes, subgroups of mapping class groups, and nilpotent genus.

IAS/Park City Mathematics Series, Volume 21

January 2015, 405 pages, Hardcover, ISBN: 978-1-4704-1227-2, LC 2014029886, 2010 *Mathematics Subject Classification:* 20F65, **AMS members US$72**, List US$90, Order code PCMS/21



Topological Modular Forms

Christopher L. Douglas, *Oxford University, United Kingdom*, **John Francis**, *Northwestern University, Evanston, IL*, **André G. Henriques**, *Utrecht University, Netherlands*, and **Michael A. Hill**, *University of Virginia, Charlottesville, VA*, Editors

The theory of topological modular forms is an intricate blend of classical algebraic modular forms and stable homotopy groups of spheres. The construction of this theory combines an algebro-geometric perspective on elliptic curves over finite fields with techniques from algebraic topology, particularly stable homotopy theory. It has applications to and connections with manifold topology, number theory, and string theory.

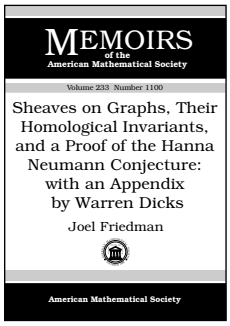
This book provides a careful, accessible introduction to topological modular forms. After a brief history and an extended overview of the subject, the book proper commences with an exposition of classical aspects of elliptic cohomology, including background material on elliptic curves and modular forms, a description of the moduli stack of elliptic curves, an explanation of the exact functor theorem for constructing cohomology theories, and an exploration of sheaves in stable homotopy theory. There follows a treatment of more specialized topics, including localization of spectra, the deformation theory of formal groups, and Goerss–Hopkins obstruction theory for multiplicative structures on spectra. The book then proceeds to more advanced material, including discussions of the string orientation, the sheaf of spectra on the moduli stack of elliptic curves, the homotopy of topological modular forms, and an extensive account of the construction of the spectrum of topological modular forms. The book concludes with the three original, pioneering and enormously influential manuscripts on the subject, by Hopkins, Miller, and Mahowald.

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

Contents: C. Redden, Elliptic genera and elliptic cohomology; **C. Mautner**, Ellliptic curves and modular forms; **A. Henriques**, The moduli stack of elliptic curves; **H. Hohnhold**, The Landweber exact functor theorem; **C. L. Douglas**, Sheaves in homotopy theory; **T. Bauer**, Bousfield localization and the Hasse square; **J. Lurie**, The local structure of the moduli stack of formal groups; **V. Angeltveit**, Goerss-Hopkins obstruction theory; **M. Hopkins**, From spectra to stacks; **M. Hopkins**, The string orientation; **M. Hopkins**, The sheaf of E_∞ ring spectra; **M. Behrens**, The construction of tmf; **A. Henriques**, The homotopy groups of tmf and of its localizations; **M. J. Hopkins** and **H. R. Miller**, Ellitpic curves and stable homotopy I; **M. Hopkins** and **M. Mahowald**, From elliptic curves to homotopy theory; **M. J. Hopkins**, $K(1)$-local E_∞ ring spectra; **C. L. Douglas**, **J. Francis**, **A. G. Henriques**, and **M. A. Hill**, Glossary.

Mathematical Surveys and Monographs, Volume 201

December 2014, 315 pages, Hardcover, ISBN: 978-1-4704-1884-7, LC 2014029076, 2010 *Mathematics Subject Classification:* 55N34, 55N35, 55N22, 57R77, 55T05, 55T15, 18G40, 14H52, 14D23, 13D03, **AMS members US$80**, List US$100, Order code SURV/201



Sheaves on Graphs, Their Homological Invariants, and a Proof of the Hanna Neumann Conjecture

Joel Friedman, *University of British Columbia, Vancouver, Canada* with an Appendix by Warren Dicks

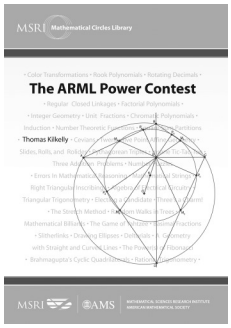
This item will also be of interest to those working in discrete mathematics and combinatorics.

Contents: Foundations of sheaves on graphs and their homological invariants; The Hanna Neumann conjecture; Appendix A. A direct view of ρ-kernels; Appendix B. Joel Friedman's proof of the strengthened Hanna Neumann conjecture *by Warren Dicks*; Bibliography.

Memoirs of the American Mathematical Society, Volume 233, Number 1100

January 2015, 106 pages, Softcover, ISBN: 978-1-4704-0988-3, 2010 *Mathematics Subject Classification:* 20E05, 05C10, 55N30, 18F20; 20E08, 05C05, 05C50, 18F10, 18F20, 14F20, **Individual member US$45**, List US$75, Institutional member US$60, Order code MEMO/233/1100

Math Education



The ARML Power Contest

Thomas Kilkelly, *Wayzata High School (retired), Plymouth, MN*

The ARML (American Regions Math League) Power Contest is truly a unique competition in which a team of students is judged on its ability to discover a pattern, express the pattern in precise mathematical language, and provide a logical proof of its conjectures. Just as a team of students can be self-directed to solve each problem set, a teacher, math team coach, or math circle leader could take these ideas and questions and lead students into problem solving and mathematical discovery.

This book contains thirty-seven interesting and engaging problem sets presented at ARML Power Contests from 1994 to 2013. They are generally extensions of the high school mathematics classroom and often connect two remote areas of mathematics. Additionally, they provide meaningful problem situations for both the novice and the veteran mathlete.

Thomas Kilkelly has been a mathematics teacher for forty-three years. During that time he has been awarded several teaching honors and has coached many math teams to state and national championships. He has always been an advocate for more discovery, integration, and problem solving in the mathematics classroom.

In the interest of fostering a greater awareness and appreciation of mathematics and its connections to other disciplines and everyday life, MSRI and the AMS are publishing books in the Mathematical

Circles Library series as a service to young people, their parents and teachers, and the mathematics profession.

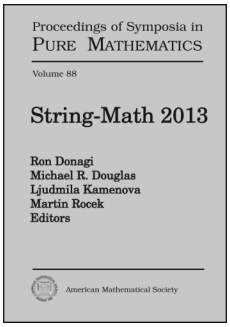
Titles in this series are co-published with the Mathematical Sciences Research Institute (MSRI).

Contents: Color transformations; Induction; Rook polynomials; Rotating decimals; Regular closed linkages; Factorial polynomials; Integer geometry; Unit fractions; Chromatic polynomials; Twenty-five point affine geometry; Square-sum partitions; Slides, rolls, and rolides; Pythagorean triples; Cevians; Insane tic-tac-toe; Three addition problems; Number theoretic functions; Errors in mathematical reasoning; Number theoretic functions; Right triangular inscribings; Algebra of electrical circuitry; Triangular trigonometry; Electing a candidate; Three's a charm!; The stretch method; Random walks in trees; Mathematical billiards; The game of Yahtzee; Basimal fractions; Slitherlinks; Drawing ellipses; Deltorials; A geometry with straight and curved lines; Number puzzles; The power(s) of Fibonacci; Brahmagupta's cyclic quadrilaterals; Rational trigonometry.

MSRI Mathematical Circles Library, Volume 15

December 2014, 376 pages, Softcover, ISBN: 978-1-4704-1880-9, LC 2014027946, 2010 *Mathematics Subject Classification:* 00-XX, 97-XX, 51-XX, 05-XX, 12-XX, **AMS members US$36**, List US$45, Order code MCL/15

Mathematical Physics



String-Math 2013

Ron Donagi, *University of Pennsylvania, Philadelphia, PA*, and **Michael R. Douglas**, **Ljudmila Kamenova**, and **Martin Rocek**, *Stony Brook University, NY*, Editors

This volume contains the proceedings of the conference 'String-Math 2013' which was held June 17–21, 2013 at the Simons Center for Geometry and Physics at Stony Brook University. This was the third in a series of annual meetings devoted to the interface of mathematics and string theory.

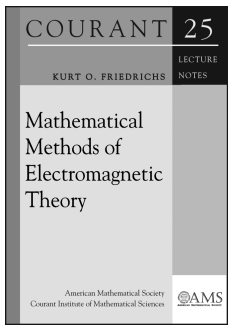
Topics include the latest developments in supersymmetric and topological field theory, localization techniques, the mathematics of quantum field theory, superstring compactification and duality, scattering amplitudes and their relation to Hodge theory, mirror symmetry and two-dimensional conformal field theory, and many more.

This book will be important reading for researchers and students in the area and for all mathematicians and string theorists who want to update themselves on developments in the math-string interface.

Contents: *Plenary talks:* **K. Costello**, Integrable lattice models from four-dimensional field theories; **D. S. Freed**, Anomalies and invertible field theories; **L. Katzarkov** and **Y. Liu**, Categorical base loci and spectral gaps, via Okounkov bodies and Nevanlinna theory; **B. Pioline**, Rankin-Selberg methods for closed string amplitudes; **S. Schäfer-Nameki**, Singular fibers and Coulomb phases; **P. Vanhove**, The physics and the mixed Hodge structure of Feynman integrals; *Contributed talks:* **M. Alim**, Polynomial rings and topological strings; **L. B. Anderson**, Exploring novel geometry in heterotic/F-theory dual pairs; **M. Bertolini**, **I. V. Melnikov**, and **M. R. Plesser**, Massless spectrum for hybrid CFTs; **I. Brunner**, **N. Carqueville**, and **D. Plencner**, A quick guide to defect orbifolds; **C. Daenzer**, Geometric t-dualization; **A. Dey**, Mirror symmetry in flavored affine D-type quivers; **T. Dimofte**, Duality domain walls in class $S[A_1]$; **J. Gray**, **A. Haupt**, and **A. Lukas**, Calabi-Yau fourfolds in products of projective space; **T. Johnson-Freyd**, Poisson AKSZ theories and their quantizations; **C. A. Keller**, Modularity, Calabi-Yau geometry and 2d CFTs; **P. Koroteev**, Three dimensional mirror symmetry and integrability; **A. Lai**, Strict deformation quantisation of the G-connections via Lie groupoid; **T. Okazaki** and **S. Yamaguchi**, Supersymmetric boundary conditions in 3d $\mathcal{N} = 2$ theories; **C. Papageorgakis** and **A. B. Royston**, Instanton-soliton loops in 5D super-Yang-Mills; **C. Y. Park**, 2d SCFT from M-branes and its spectral network.

Proceedings of Symposia in Pure Mathematics, Volume 88

January 2015, approximately 374 pages, Hardcover, ISBN: 978-1-4704-1051-3, LC 2014030695, 2010 *Mathematics Subject Classification:* 14-XX, 18-XX, 19-XX, 22-XX, 53-XX, 58-XX, 81-XX, 81Txx, 83Exx, 83E30, **AMS members US$80.80**, List US$101, Order code PSPUM/88



Mathematical Methods of Electromagnetic Theory

Kurt O. Friedrichs

This text provides a mathematically precise but intuitive introduction to classical electromagnetic theory and wave propagation, with a brief introduction to special relativity. While written in a distinctive, modern style, Friedrichs manages to convey the physical intuition and 19th century basis of the equations, with an emphasis on conservation laws. Particularly striking features of the book include: (a) a mathematically rigorous derivation of the interaction of electromagnetic waves with matter, (b) a straightforward explanation of how to use variational principles to solve problems in electro- and magnetostatics, and (c) a thorough discussion of the central importance of the conservation of charge. It is suitable for advanced undergraduate students in mathematics and physics with a background in advanced calculus and linear algebra, as well as mechanics and electromagnetics at an undergraduate level.

Apart from minor corrections to the text, the notation was updated in this edition to follow the conventions of modern vector calculus.

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

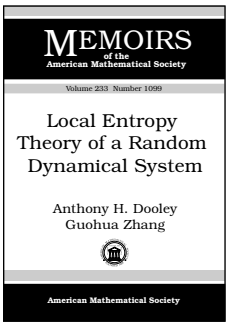
Titles in this series are co-published with the Courant Institute of Mathematical Sciences at New York University.

Contents: Preliminaries; Electrostatics; Currents and Ohm's law; Magnetostatics; Electromagnetic fields changing in time; Transmission lines. Method of the Laplace transformation; Electromagnetodynamics of moving bodies and the principle of relativity; Electromagnetic wave propagation; The scattering problem; References.

Courant Lecture Notes, Volume 25

December 2014, 145 pages, Softcover, ISBN: 978-1-4704-1711-6, LC 2014027921, 2010 *Mathematics Subject Classification:* 78-01, 78-03, 78A30, 78A40, 35-01, **AMS members US$27.20**, List US$34, Order code CLN/25

Probability and Statistics



Local Entropy Theory of a Random Dynamical System

Anthony H. Dooley, *University of Bath, United Kingdom*, and **Guohua Zhang**, *Fudan University, Shanghai, People's Republic of China*

Contents: Introduction; *Preliminaries:* Infinite countable discrete amenable groups; Measurable dynamical systems; Continuous bundle random dynamical systems; *A Local Variational Principle for Fiber Topological Pressure:* Local fiber topological pressure; Factor excellent and good covers; A variational principle for local fiber topological pressure; Proof of main result Theorem 7.1; Assumption (♠) on the family **D**; The local variational principle for amenable groups admitting a tiling Følner sequence; Another version of the local variational principle; *Applications of the Local Variational Principle:* Entropy tuples for a continuous bundle random dynamical system; Bibliography.

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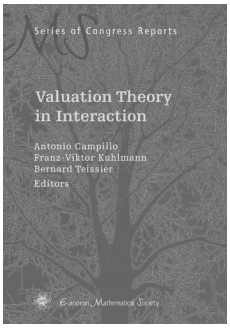

Valuation Theory in Interaction

Antonio Campillo Lopez, *Universidad de Valladolid, Spain*, **Franz-Viktor Kuhlmann**, *University of Saskatchewan, Saskatoon, Canada*, and **Bernard Teissier**, *Institut de Mathematiques de Jussieu, Paris, France*, Editors

For more than a century, valuation theory has had its classical roots in algebraic number theory, algebraic geometry and the theory of ordered fields and groups. In recent decades it has seen an amazing expansion into many other areas. Moreover, having been dormant for a while in algebraic geometry, it has now been reintroduced as a tool to attack the open problem of resolution of singularities in positive characteristic and to analyze the structure of singularities. Driven by this topic, and by its many new applications in other areas, the research in valuation theory itself has also been intensified, with a particular emphasis on the deep open problems in positive characteristic.

The multifaceted development of valuation theory has been monitored by two International Conferences and Workshops: the first in 1999 in Saskatoon, Canada, and the second in 2011 in Segovia and El Escorial in Spain. This book grew out of the second conference and presents high quality papers on recent research together with survey papers that illustrate the state of the art in several areas and applications of valuation theory.

This book is addressed to researchers and graduate students who work in valuation theory or the areas where it is applied, as well as a general mathematical audience interested in the expansion and usefulness of the valuation theoretical approach, which has been called the "most analytic" form of algebraic reasoning. For young mathematicians who want to enter these areas of research, it provides a valuable source of up-to-date information.

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

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