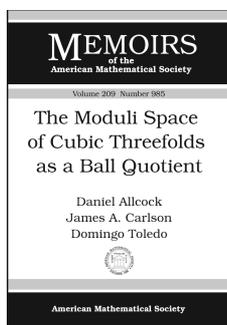


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Algebra and Algebraic Geometry



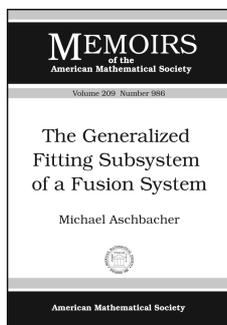
The Moduli Space of Cubic Threefolds as a Ball Quotient

Daniel Allcock, *University of Texas at Austin, TX*, and **James A. Carlson** and **Domingo Toledo**, *University of Utah, Salt Lake City, UT*

Contents: Moduli of smooth cubic threefolds; The discriminant near a chordal cubic; Extension of the period map; Degeneration to a chordal cubic; Degeneration to a nodal cubic; The Main theorem; The monodromy group and hyperplane arrangement; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 209, Number 985

February 2011, 70 pages, Softcover, ISBN: 978-0-8218-4751-0, LC 2010037801, 2000 *Mathematics Subject Classification*: 32G20; 14J30, **Individual member US\$39.60**, List US\$66, Institutional member US\$52.80, Order code MEMO/209/985



The Generalized Fitting Subsystem of a Fusion System

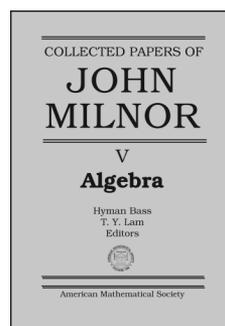
Michael Aschbacher, *California Institute of Technology, Pasadena, CA*

Contents: Introduction; Background; Direct products; $\mathcal{E}_1 \wedge \mathcal{E}_2$; The product of strongly closed subgroups; Pairs of commuting strongly closed subgroups; Centralizers; Characteristic and subnormal subsystems; $T\mathcal{F}_0$; Components; Balance; The fundamental group of \mathcal{F}^c ; Factorizing morphisms; Composition

series; Constrained systems; Solvable fusion systems; Fusion systems in simple groups; An example; Bibliography.

Memoirs of the American Mathematical Society, Volume 209, Number 986

February 2011, 110 pages, Softcover, ISBN: 978-0-8218-5303-0, LC 2010038097, 2000 *Mathematics Subject Classification*: 20D20, 55R35, **Individual member US\$42**, List US\$70, Institutional member US\$56, Order code MEMO/209/986



Collected Papers of John Milnor

V. Algebra

Hyman Bass, *University of Michigan, Ann Arbor, MI*, and **T. Y. Lam**, *University of California, Berkeley, CA*, Editors

In addition to his seminal work in topology, John Milnor is also an accomplished algebraist, producing a spectacular agenda-setting body of work related to algebraic K -theory and quadratic forms during the five-year period 1965–1970. These papers, together with other (some of them previously unpublished) works in algebra are assembled here in this fifth volume of Milnor's Collected Papers. They constitute not only an important historical archive, but also, thanks to the clarity and elegance of Milnor's mathematical exposition, a valuable resource for work in the fields treated. In addition, Milnor's papers are complemented by detailed surveys on the current state of the field in two areas. One is on the congruence subgroup problem, by Gopal Prasad and Andrei Rapinchuk. The other is on algebraic K -theory and quadratic forms, by Alexander Merkurjev.

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

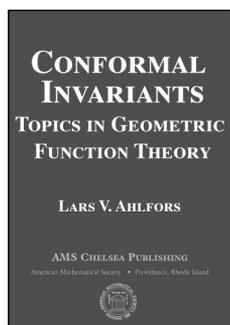
Contents: *Algebras and groups:* Introduction; On the structure of Hopf algebras, preprint; On the structure of Hopf algebras; Remarks on infinite-dimensional Lie groups; The representation rings of some classical groups; Growth of finitely generated solvable groups; *The congruence subgroup problem:* Introduction; On unimodular groups over number fields (preprint, 1965); Solution of the congruence subgroup problem for SL_n ($n \geq 3$) and Sp_{2n} ($n \geq 2$); On a functorial property of power residue symbols; On polylogarithms, Hurwitz zeta functions, and the Kubert identities; Developments on

the congruence subgroup problem after the work of Bass, Milnor and Serre; *Algebraic K-theory and quadratic forms*: Introduction; On isometries of inner product spaces; Algebraic K-theory and quadratic forms; Symmetric inner product spaces over a Dedekind domain (preprint, 1970); Symmetric inner products in characteristic 2; Developments in algebraic K-theory and quadratic forms after the work of Milnor; Index.

Collected Works, Volume 19

January 2011, approximately 408 pages, Hardcover, ISBN: 978-0-8218-4876-0, LC 2010035148, 2000 *Mathematics Subject Classification*: 00B60, 11E70, 11E81, 19D45, 20H05; 20D10, 22E65, 57T05, **AMS members US\$71.20**, List US\$89, Order code CWORKS/19.5

Analysis



Conformal Invariants

Topics in Geometric Function Theory

Lars V. Ahlfors

Most conformal invariants can be described in terms of extremal properties. Conformal invariants and extremal problems are therefore intimately linked and form together the central theme of this classic book which is primarily

intended for students with approximately a year's background in complex variable theory. The book emphasizes the geometric approach as well as classical and semi-classical results which Lars Ahlfors felt every student of complex analysis should know before embarking on independent research.

At the time of the book's original appearance, much of this material had never appeared in book form, particularly the discussion of the theory of extremal length. Schiffer's variational method also receives special attention, and a proof of $|a_4| \leq 4$ is included which was new at the time of publication. The last two chapters give an introduction to Riemann surfaces, with topological and analytical background supplied to support a proof of the uniformization theorem.

Included in this new reprint is a Foreword by Peter Duren, F. W. Gehring, and Brad Osgood, as well as an extensive errata.

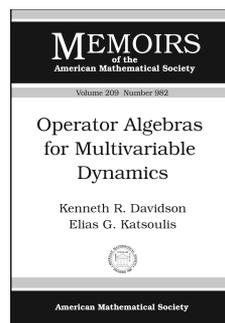
...encompasses a wealth of material in a mere one hundred and fifty-one pages. Its purpose is to present an exposition of selected topics in the geometric theory of functions of one complex variable, which in the author's opinion should be known by all prospective workers in complex analysis. From a methodological point of view the approach of the book is dominated by the notion of conformal invariant and concomitantly by extremal considerations. ...It is a splendid offering.

— *Reviewed for Math Reviews by M. H. Heins in 1975*

Contents: Applications of Schwarz's lemma; Capacity; Harmonic measure; Extremal length; Elementary theory of univalent functions; Löwner's method; The Schiffer variation; Properties of the extremal functions; Riemann surfaces; The uniformization theorem; Bibliography; Index; Errata.

AMS Chelsea Publishing, Volume 371

December 2010, 160 pages, Hardcover, ISBN: 978-0-8218-5270-5, LC 2010035576, 2000 *Mathematics Subject Classification*: 30-02, **AMS members US\$31.50**, List US\$35, Order code CHEL/371.H



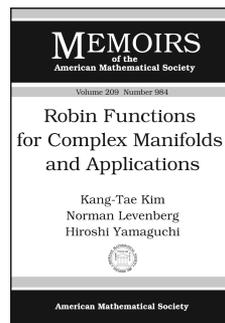
Operator Algebras for Multivariable Dynamics

Kenneth R. Davidson, *University of Waterloo, ON, Canada*, and **Elias G. Katsoulis**, *East Carolina University, Greenville, NC*

Contents: Introduction; Dilation theory; Recovering the dynamics; Semisimplicity; Open problems and future directions; Bibliography.

Memoirs of the American Mathematical Society, Volume 209, Number 982

February 2011, 53 pages, Softcover, ISBN: 978-0-8218-5302-3, LC 2010037690, 2000 *Mathematics Subject Classification*: 47L55; 47L40, 46L05, 37B20, 37B99, **Individual member US\$36**, List US\$60, Institutional member US\$48, Order code MEMO/209/982



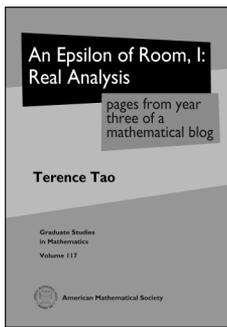
Robin Functions for Complex Manifolds and Applications

Kang-Tae Kim, *Pohang University of Science and Technology, South Korea*, **Norman Levenberg**, *Indiana University, Bloomington, IN*, and **Hiroshi Yamaguchi**, *Shiga University, Japan*

Contents: Introduction; The variation formula; Subharmonicity of $-\lambda$; Rigidity; Complex Lie groups; Complex homogeneous spaces; Flag space; Appendix A; Appendix B; Appendix C; Bibliography.

Memoirs of the American Mathematical Society, Volume 209, Number 984

February 2011, 111 pages, Softcover, ISBN: 978-0-8218-4965-1, LC 2010038099, 2000 *Mathematics Subject Classification*: 32U10; 32E10, 32M05, **Individual member US\$42**, List US\$70, Institutional member US\$56, Order code MEMO/209/984



An Epsilon of Room, I: Real Analysis

pages from year three of a mathematical blog

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

In 2007 Terry Tao began a mathematical blog to cover a variety of topics, ranging from his own research and other recent

developments in mathematics, to lecture notes for his classes, to nontechnical puzzles and expository articles. The first two years of the blog have already been published by the American Mathematical Society. The posts from the third year are being published in two volumes. The present volume consists of a second course in real analysis, together with related material from the blog.

The real analysis course assumes some familiarity with general measure theory, as well as fundamental notions from undergraduate analysis. The text then covers more advanced topics in measure theory, notably the Lebesgue-Radon-Nikodym theorem and the Riesz representation theorem, topics in functional analysis, such as Hilbert spaces and Banach spaces, and the study of spaces of distributions and key function spaces, including Lebesgue's L^p spaces and Sobolev spaces. There is also a discussion of the general theory of the Fourier transform.

The second part of the book addresses a number of auxiliary topics, such as Zorn's lemma, the Carathéodory extension theorem, and the Banach-Tarski paradox. Tao also discusses the epsilon regularisation argument—a fundamental trick from soft analysis, from which the book gets its title. Taken together, the book presents more than enough material for a second graduate course in real analysis.

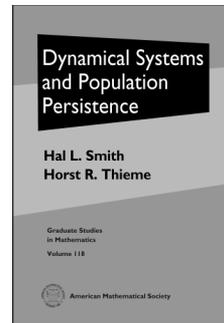
The second volume consists of technical and expository articles on a variety of topics and can be read independently.

Contents: Real analysis; Related articles; Bibliography; Index.

Graduate Studies in Mathematics, Volume 117

December 2010, approximately 333 pages, Hardcover, ISBN: 978-0-8218-5278-1, LC 2010036469, 2000 *Mathematics Subject Classification*: 42-01, 46-01, **AMS members US\$49.60**, List US\$62, Order code GSM/117

Applications



Dynamical Systems and Population Persistence

Hal L. Smith and **Horst R. Thieme**,
Arizona State University, Tempe, AZ

The mathematical theory of persistence answers questions such as which species, in a mathematical model of

interacting species, will survive over the long term. It applies to infinite-dimensional as well as to finite-dimensional dynamical systems, and to discrete-time as well as to continuous-time semiflows.

This monograph provides a self-contained treatment of persistence theory that is accessible to graduate students. The key results for deterministic autonomous systems are proved in full detail such as the acyclicity theorem and the tripartition of a global compact attractor. Suitable conditions are given for persistence to imply strong persistence even for nonautonomous semiflows, and time-heterogeneous persistence results are developed using so-called “average Lyapunov functions”.

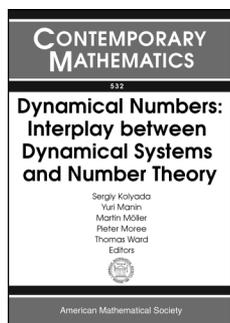
Applications play a large role in the monograph from the beginning. These include ODE models such as an SEIRS infectious disease in a meta-population and discrete-time nonlinear matrix models of demographic dynamics. Entire chapters are devoted to infinite-dimensional examples including an SI epidemic model with variable infectivity, microbial growth in a tubular bio-reactor, and an age-structured model of cells growing in a chemostat.

Contents: Introduction; Semiflows on metric spaces; Compact attractors; Uniform weak persistence; Uniform persistence; The interplay of attractors, repellers, and persistence; Existence of nontrivial fixed points via persistence; Nonlinear matrix models: Main act; Topological approaches to persistence; An SI endemic model with variable infectivity; Semiflows induced by semilinear Cauchy problems; Microbial growth in a tubular bio-reactor; Dividing cells in a chemostat; Persistence for nonautonomous dynamical systems; Forced persistence in linear Cauchy problems; Persistence via average Lyapunov functions; Tools from analysis and differential equations; Tools from functional analysis and integral equations; Bibliography; Index.

Graduate Studies in Mathematics, Volume 118

January 2011, approximately 411 pages, Hardcover, ISBN: 978-0-8218-4945-3, LC 2010033476, 2000 *Mathematics Subject Classification*: 37N25, 92D25, 92D30; 37B25, 37Lxx, **AMS members US\$60**, List US\$75, Order code GSM/118

Differential Equations



Dynamical Numbers: Interplay between Dynamical Systems and Number Theory

Sergiy Kolyada, *National Academy of Science of Ukraine, Kiev, Ukraine*, **Yuri Manin**, *Max Planck Institute for Mathematics, Bonn, Germany*, **Martin Möller**, *Goethe-Universität, Frankfurt, Frankfurt am Main, Germany*, **Pieter Moree**, *Max Planck Institute for Mathematics, Bonn, Germany*, and **Thomas Ward**, *University of East Anglia, Norwich, United Kingdom*, Editors

This volume contains papers from the special program and international conference on Dynamical Numbers which were held at the Max-Planck Institute in Bonn, Germany in 2009.

These papers reflect the extraordinary range and depth of the interactions between ergodic theory and dynamical systems and number theory. Topics covered in the book include stationary measures, systems of enumeration, geometrical methods, spectral methods, and algebraic dynamical systems.

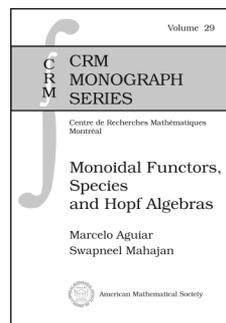
This item will also be of interest to those working in number theory.

Contents: **H. Furstenberg** and **E. Glasner**, Stationary dynamical systems; **J. Smillie** and **C. Ulcigrai**, Geodesic flow on the Teichmüller disk of the regular octagon, cutting sequences and octagon continued fractions maps; **P. Kůrka**, Expansion of rational numbers in Möbius number systems; **P. Moussa**, Localisation of algebraic integers and polynomial iteration; **J. Marklof**, Horospheres and Farey fractions; **T.-C. Dinh** and **N. Sibony**, Exponential mixing for automorphisms on compact Kähler manifolds; **A. M. Vershik**, Orbit theory, locally finite permutations and Morse arithmetic; **A. I. Danilenko** and **A. V. Solomko**, Ergodic abelian actions with homogeneous spectrum; **I. Kapovich** and **T. Nagnibeda**, Geometric entropy of geodesic currents on free groups; **F. Pakovich**, **C. Pech**, and **A. K. Zvonkin**, Laurent polynomial moment problem: A case study; **D. Lind**, **K. Schmidt**, and **E. Verbitskiy**, Entropy and growth rate of periodic points of algebraic \mathbb{Z}^d -actions; **M. Pollicott** and **R. Sharp**, Statistics of matrix products in hyperbolic geometry; **E. Lanneau**, Infinite sequence of fixed point free pseudo-Anosov homeomorphisms on a family of genus two surfaces.

Contemporary Mathematics, Volume 532

December 2010, 242 pages, Softcover, ISBN: 978-0-8218-4958-3, LC 2010027232, 2000 *Mathematics Subject Classification*: 11J70, 20F65, 22D40, 30E05, 37A15, 37A20, 37A30, 37A35, 54H20, 60B15, **AMS members US\$63.20**, List US\$79, Order code CONM/532

Discrete Mathematics and Combinatorics



Monoidal Functors, Species and Hopf Algebras

Marcelo Aguiar, *Texas A&M University, College Station, TX*, and **Swapneel Mahajan**, *Indian Institute of Technology, Mumbai, India*

This research monograph integrates ideas from category theory, algebra and combinatorics. It is organized in three parts.

Part I belongs to the realm of category theory. It reviews some of the foundational work of Bénabou, Eilenberg, Kelly and Mac Lane on monoidal categories and of Joyal and Street on braided monoidal categories, and proceeds to study higher monoidal categories and higher monoidal functors. Special attention is devoted to the notion of a bilax monoidal functor which plays a central role in this work.

Combinatorics and geometry are the theme of Part II. Joyal's species constitute a good framework for the study of algebraic structures associated to combinatorial objects. This part discusses the category of species focusing particularly on the Hopf monoids therein. The notion of a Hopf monoid in species parallels that of a Hopf algebra and reflects the manner in which combinatorial structures compose and decompose. Numerous examples of Hopf monoids are given in the text. These are constructed from combinatorial and geometric data and inspired by ideas of Rota and Tits' theory of Coxeter complexes.

Part III is of an algebraic nature and shows how ideas in Parts I and II lead to a unified approach to Hopf algebras. The main step is the construction of Fock functors from species to graded vector spaces. These functors are bilax monoidal and thus translate Hopf monoids in species to graded Hopf algebras. This functorial construction of Hopf algebras encompasses both quantum groups and the Hopf algebras of recent prominence in the combinatorics literature.

The monograph opens a vast new area of research. It is written with clarity and sufficient detail to make it accessible to advanced graduate students.

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

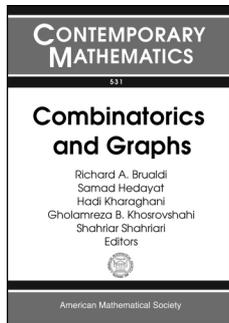
Titles in this series are co-published with the Centre de Recherches Mathématiques.

Contents: *Monoidal categories:* Monoidal categories; Graded vector spaces; Monoidal functors; Operad Lax monoidal functors; Bilax monoidal functors in homological algebra; 2-monoidal categories; Higher monoidal categories; *Hopf monoids in species:* Monoidal structures on species; Deformations of Hopf monoids; The Coxeter complex of type A; Universal constructions of Hopf monoids; Hopf monoids from geometry; Hopf monoids from combinatorics; Hopf monoids in colored species; *Fock functors:* From species to graded vector spaces; Deformations of Fock functors; From Hopf monoids to Hopf algebras: Examples; Adjoints of the Fock functors; Decorated Fock functors and creation-annihilation; Colored Fock functors; *Appendices:* Categorical preliminaries;

Operads; Pseudomonoids and the looping principle; Monoids and the simplicial category; *References*: Bibliography; Notation index; Author index; Subject index.

CRM Monograph Series, Volume 29

November 2010, 784 pages, Hardcover, ISBN: 978-0-8218-4776-3, LC 2010025240, 2000 *Mathematics Subject Classification*: 05A30, 16T30, 18D10, 18D35, 20B30, 81R50; 05A18, 05B35, 05C25, 05E05, 05E45, 06A11, 06A15, 16T25, 18D05, 18D20, 18D25, 18D50, 18G30, 18G35, 20F55, 51E24, 81S05, **AMS members US\$135.20**, List US\$169, Order code CRMM/29



Combinatorics and Graphs

Richard A. Brualdi, *University of Wisconsin, Madison, WI*, **Samad Hedayat**, *University of Illinois at Chicago, IL*, **Hadi Kharaghani**, *University of Lethbridge, AB, Canada*, **Gholamreza B. Khosrovshahi**, *IPM, Tehran, Iran*, and **Shahriar Shahriari**, *Pomona College, Claremont, CA*, Editors

This volume contains a collection of papers presented at the international conference IPM 20—Combinatorics 2009, which was held at the Institute for Research in Fundamental Sciences in Tehran, Iran, May 15–21, 2009.

The conference celebrated IPM's 20th anniversary and was dedicated to Reza Khosrovshahi, one of the founders of IPM and the director of its School of Mathematics from 1996 to 2007, on the occasion of his 70th birthday.

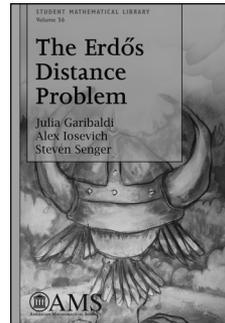
The conference attracted an international group of distinguished researchers from many different parts of combinatorics and graph theory, including permutations, designs, graph minors, graph coloring, graph eigenvalues, distance regular graphs and association schemes, hypergraphs, and arrangements.

Contents: **A. E. Brouwer**, The eigenvalues of oppositeness graphs in buildings of spherical type; **S. Akbari**, **M. Ghanbari**, and **S. Jahanbekam**, On the dynamic chromatic number of graphs; **A. H. Berliner**, **R. A. Brualdi**, **L. Deaett**, **K. P. Kiernan**, **S. A. Meyer**, and **M. W. Schroeder**, Signed domination of graphs and $(0,1)$ -matrices; **A. S. Hedayat** and **W. Zheng**, Totally balanced test-control incomplete crossover designs and their statistical applications; **E. Bannai** and **E. Bannai**, Euclidean designs and coherent configurations; **J. Širáň** and **Y. Wang**, Maps with highest level of symmetry that are even more symmetric than other such maps: Regular maps with largest exponent groups; **A. R. Barghi**, A note on finite groups determined by a combinatorial property; **S. Akbari**, **S. Alikhani**, **M. R. Oboudi**, and **Y. H. Peng**, On the zeros of domination polynomial of a graph; **S. Akbari**, **A. Doni**, **M. Ghanbari**, **S. Jahanbekam**, and **A. Saito**, List coloring of graphs with cycles of length divisible by a given integer; **Q. Wang**, On generalized Lucas sequences; **A. Sakzad** and **M.-R. Sadeghi**, On cycle-free lattices; **S. Akbari**, **M. R. Oboudi**, and **S. Qajar**, On the rational independence roots; **W. H. Haemers** and **F. Ramezani**, Graphs cospectral with Kneser graphs; **R. P. Stanley**, A survey of alternating permutations; **A. Mohammadian** and **B. Tayfeh-Rezaie**, The spectrum of the McKay-Miller-Širáň graphs; **D. Dellamonica, Jr.**, **P. Frankl**, and **V. Rödl**, A theorem on incidence

matrices and quasirandom hypergraphs; **M. Hasheminezhad** and **B. D. McKay**, Combinatorial estimates by the switching method; **J. H. Koolen**, **W. S. Lee**, and **W. J. Martin**, Characterizing completely regular codes from an algebraic viewpoint; **W. H. Holzmann**, **H. Kharaghani**, and **W. Orrick**, On the real unbiased Hadamard matrices; **R. M. Wilson**, The proportion of various graphs in graph-designs; **F. Didehvar**, **A. D. Mehrabi**, and **F. Raei B.**, On unique independence weighted graphs.

Contemporary Mathematics, Volume 531

December 2010, 264 pages, Softcover, ISBN: 978-0-8218-4865-4, LC 2010026895, 2000 *Mathematics Subject Classification*: 05A05, 05B05, 05B20, 05B25, 05C15, 05C22, 05C35, 05C50, 05D05, 05E30, **AMS members US\$71.20**, List US\$89, Order code CONM/531



The Erdős Distance Problem

Julia Garibaldi, *University of Rochester, NY*, and **Steven Senger**, *University of Missouri-Columbia, MO*

The Erdős problem asks, What is the smallest possible number of distinct distances between points of a large finite subset of the Euclidean space in

dimensions two and higher. The main goal of this book is to introduce the reader to the techniques, ideas, and consequences related to the Erdős problem. The authors introduce these concepts in a concrete and elementary way that allows a wide audience—from motivated high school students interested in mathematics to graduate students specializing in combinatorics and geometry—to absorb the content and appreciate its far reaching implications. In the process, the reader is familiarized with a wide range of techniques from several areas of mathematics and can appreciate the power of the resulting symbiosis.

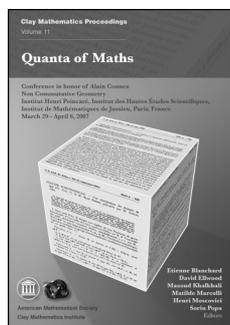
The book is heavily problem oriented, following the authors' firm belief that most of the learning in mathematics is done by working through the exercises. Many of these problems are recently published results by mathematicians working in the area. The order of the exercises is designed both to reinforce the material presented in the text and, equally importantly, to entice the reader to leave all worldly concerns behind and launch head first into the multifaceted and rewarding world of Erdős combinatorics.

Contents: Introduction; The \sqrt{n} theory; The $n^{2/3}$ theory; The Cauchy-Schwarz inequality; Graph theory and incidences; The $n^{4/5}$ theory; The $n^{6/7}$ theory; Beyond $n^{6/7}$; Information theory; Dot products; Vector spaces over finite fields; Distances in vector spaces over finite fields; Applications of the Erdős distance problem; Hyperbolas in the plane; Basic probability theory; Jensen's inequality; Bibliography; Biographical information; Index of terminology.

Student Mathematical Library, Volume 56

January 2011, approximately 161 pages, Softcover, ISBN: 978-0-8218-5281-1, LC 2010033266, 2000 *Mathematics Subject Classification*: 05-XX, 11-XX, 42-XX, 51-XX, **AMS members US\$23.20**, List US\$29, Order code STML/56

General Interest



Quanta of Maths

Etienne Blanchard, *University of Paris 7, France*, **David Ellwood**, *Clay Mathematics Institute, Cambridge, MA*, **Masoud Khalkhali**, *University of Western Ontario, London, ON, Canada*, **Matilde Marcolli**, *California Institute of Technology, Pasadena, CA*, **Henri Moscovici**, *Ohio State University, Columbus, OH*, and **Sorin Popa**, *University of California, Los Angeles, CA*, Editors

The work of Alain Connes has cut a wide swath across several areas of mathematics and physics. Reflecting its broad spectrum and profound impact on the contemporary mathematical landscape, this collection of articles covers a wealth of topics at the forefront of research in operator algebras, analysis, noncommutative geometry, topology, number theory and physics.

Specific themes covered by the articles are as follows:

- entropy in operator algebras, regular C^* -algebras of integral domains, properly infinite C^* -algebras, representations of free groups and 1-cohomology, Leibniz seminorms and quantum metric spaces;
- von Neumann algebras, fundamental Group of II_1 factors, subfactors and planar algebras;
- Baum-Connes conjecture and property T, equivariant K-homology, Hermitian K-theory;
- cyclic cohomology, local index formula and twisted spectral triples, tangent groupoid and the index theorem;
- noncommutative geometry and space-time, spectral action principle, quantum gravity, noncommutative ADHM and instantons, non-compact spectral triples of finite volume, noncommutative coordinate algebras;
- Hopf algebras, Vinberg algebras, renormalization and combinatorics, motivic renormalization and singularities;
- cyclotomy and analytic geometry over F_1 , quantum modular forms;
- differential K-theory, cyclic theory and S-cohomology.

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

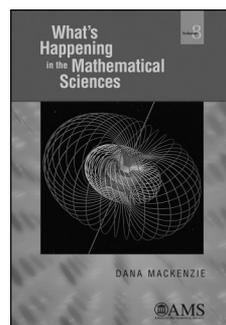
Titles in this series are co-published with the Clay Mathematics Institute (Cambridge, MA).

Contents: **P. Baum**, **N. Higson**, and **T. Schick**, A geometric description of equivariant K-homology for proper actions; **D. Bisch**, **P. Das**, and **S. K. Ghosh**, The planar algebra of diagonal subfactors; **E. Blanchard**, K_1 -injectivity for properly infinite C^* -algebras; **S. Brain** and **G. Landi**, Families of monads and instantons from a noncommutative ADHM construction; **D. Burghelea**, Cyclic theory for commutative differential graded algebras and S-cohomology; **P. Cartier**, Vinberg algebras, Lie groups and combinatorics; **A. H. Chamseddine**, Noncommutative geometry as the key to unlock the secrets of space-time; **J. Cuntz** and **X. Li**, The regular C^* -algebra of an integral domain; **M. Dubois-Violette**,

Noncommutative coordinate algebras; **A. Guionnet**, **V. F. R. Jones**, and **D. Shlyakhtenko**, Random matrices, free probability, planar algebras and subfactors; **N. Higson**, The tangent groupoid and the index theorem; **M. Karoubi**, Le théorème de périodicité en K -théorie hermitienne; **M. Khalkhali**, A short survey of cyclic cohomology; **D. Kreimer**, The core Hopf algebra; **V. Lafforgue**, Propriété (T) renforcée et conjecture de Baum-Connes; **J.-L. Loday** and **M. Ronco**, Combinatorial Hopf algebras; **Yu. I. Manin**, Cyclotomy and analytic geometry over F_1 ; **M. Marcolli**, Motivic renormalization and singularities; **F. Martin** and **A. Valette**, Free groups and reduced 1-cohomology of unitary representations; **H. Moscovici**, Local index formula and twisted spectral triples; **A. Perez** and **C. Rovelli**, Observables in quantum gravity; **S. Popa** and **S. Vaes**, On the fundamental group of II_1 factors and equivalence relations arising from group actions; **M. A. Rieffel**, Leibniz seminorms for “matrix algebras converge to the sphere”; **J. Simons** and **D. Sullivan**, Structured vector bundles define differential K-theory; **E. Størmer**, Entropy in operator algebras; **R. Wulkenhaar**, Non-compact spectral triples with finite volume; **G. Yu**, A characterization of the image of the Baum-Connes map; **D. Zagier**, Quantum modular forms.

Clay Mathematics Proceedings, Volume 11

December 2010, 675 pages, Softcover, ISBN: 978-0-8218-5203-3, LC 2010034787, 2000 *Mathematics Subject Classification*: 58B34, **AMS members US\$103.20**, List US\$129, Order code CMP/11



What's Happening in the Mathematical Sciences, Volume 8

Dana Mackenzie

The goal of the series is to shed light on topics on the leading edge of mathematical research in a way that is accessible to the mathematical layperson. The articles frequently combine mathematics with physics, and are written in a lively style

that should be accessible to anyone with genuine interest and some college-level experience in mathematics and science.

—*Choice*

What's Happening in the Mathematical Sciences showcases the remarkable recent progress in pure and applied mathematics. Once again, there are some surprises, where we discover new properties of familiar things, in this case tightly-packed tetrahedra or curious turtle-like shapes that right themselves. Mathematics also has played significant roles in current events, most notably the financial crisis, but also in screening for breast cancer. The Netflix competition to find a better algorithm for recommending videos to subscribers demonstrated how deeply mathematics is used behind the scenes in our everyday lives.

Mathematicians have settled several important conjectures in the past few years. In topology, the recently solved Kervaire invariant conjecture tells us about exotic spheres in high dimension. The Weinstein conjecture, proved by Cliff Taubes, guarantees periodicity in certain important dynamical systems. A very old dynamical system—the game of billiards—received two innovative makeovers. First, mathematicians proved the existence of “wandering” trajectories in an inside-out version of the game, called “outer billiards,” which some researchers consider a toy model for planetary motion. Second, mathematicians proved two different versions of the Quantum Unique Ergodicity conjecture, which says

that a quantum-mechanical billiard ball behaves, in the long term (and at high energies) similarly to a classical billiard ball. The proof uses ideas from pure number theory dating back to Ramanujan. Finally, in another area of statistical physics, mathematicians showed that the transition from an unmixed to a mixed system often happens, relatively speaking, in the blink of an eye.

Dana Mackenzie, a science and mathematics writer, makes the mathematics and the applications easily comprehensible, by calling on common sense or on similar but familiar phenomena. The stories invite you into the exciting world of modern mathematics, with its thrill of discovery and the anticipation of what is still to come. Anyone with an interest in mathematics, from high school teachers and college students to engineers and computer scientists, will find something of interest here. The stories are well told and the mathematics is gripping.

Contents: As one heroic age ends, another begins; A brave new symplectic world; The ultimate billiard shot; SimaPatient; Instant randomness; Accounting for taste; In search of quantum chaos; 3-D surprises; Mathematics and the financial crisis.

What's Happening in the Mathematical Sciences, Volume 8

January 2011, approximately 136 pages, Softcover, ISBN: 978-0-8218-4999-6, 2000 *Mathematics Subject Classification:* 00A06, **AMS members US\$18.40**, List US\$23, Order code HAPPENING/8



An Epsilon of Room, II
pages from year three of a mathematical blog

Terence Tao, University of California, Los Angeles, CA

There are many bits and pieces of folklore in mathematics that are passed down from advisor to student, or from collaborator to collaborator, but which are too fuzzy and nonrigorous to be discussed in the formal

literature. Traditionally, it was a matter of luck and location as to who learned such "folklore mathematics". But today, such bits and pieces can be communicated effectively and efficiently via the semiformal medium of research blogging. This book grew from such a blog.

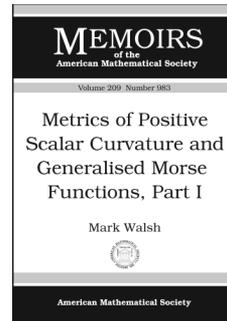
In 2007 Terry Tao began a mathematical blog to cover a variety of topics, ranging from his own research and other recent developments in mathematics, to lecture notes for his classes, to nontechnical puzzles and expository articles. The first two years of the blog have already been published by the American Mathematical Society. The posts from the third year are being published in two volumes. This second volume contains a broad selection of mathematical expositions and self-contained technical notes in many areas of mathematics, such as logic, mathematical physics, combinatorics, number theory, statistics, theoretical computer science, and group theory. Tao has an extraordinary ability to explain deep results to his audience, which has made his blog quite popular. Some examples of this facility in the present book are the tale of two students and a multiple-choice exam being used to explain the $P = NP$ conjecture and a discussion of "no self-defeating object" arguments that starts from a schoolyard number game and ends with results in logic, game theory, and theoretical physics.

The first volume consists of a second course in real analysis, together with related material from the blog, and it can be read independently.

Contents: Expository articles; Technical articles; Bibliography; Index.

January 2011, approximately 252 pages, Softcover, ISBN: 978-0-8218-5280-4, 2000 *Mathematics Subject Classification:* 00A99, **AMS members US\$33.60**, List US\$42, Order code MBK/77

Geometry and Topology



Metrics of Positive Scalar Curvature and Generalised Morse Functions, Part I

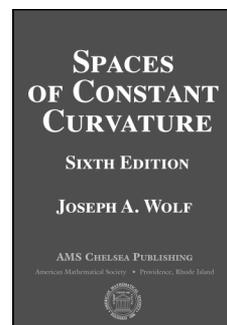
Mark Walsh, Westfälische Wilhelms-Universität Münster, Germany

Contents: Definitions and preliminary results; Revisiting the surgery theorem;

Constructing Gromov-Lawson cobordisms; Constructing Gromov-Lawson concordances; Gromov-Lawson concordance implies isotopy for cancelling surgeries; Gromov-Lawson concordance implies isotopy in the general case; Appendix: Curvature calculations from the surgery theorem; Bibliography.

Memoirs of the American Mathematical Society, Volume 209, Number 983

February 2011, 80 pages, Softcover, ISBN: 978-0-8218-5304-7, LC 2010037798, 2000 *Mathematics Subject Classification:* 53-02, 55-02, **Individual member US\$41.40**, List US\$69, Institutional member US\$55.20, Order code MEMO/209/983



Spaces of Constant Curvature
Sixth Edition

Joseph A. Wolf, University of California, Berkeley, CA

This book is the sixth edition of the classic *Spaces of Constant Curvature*, first published in 1967, with the previous (fifth) edition published in 1984. It illustrates the high degree of interplay between group theory and geometry. The reader will benefit from the very concise treatments of riemannian and pseudo-riemannian manifolds and their curvatures, of the representation theory of finite groups, and of indications of recent progress in discrete subgroups of Lie groups.

Part I is a brief introduction to differentiable manifolds, covering spaces, and riemannian and pseudo-riemannian geometry. It also contains a certain amount of introductory material on symmetry groups and space forms, indicating the direction of the later chapters. Part II is an updated treatment of euclidean space form.

Part III is Wolf's classic solution to the Clifford–Klein Spherical Space Form Problem. It starts with an exposition of the representation theory of finite groups. Part IV introduces riemannian symmetric spaces and extends considerations of spherical space forms to space forms of riemannian symmetric spaces. Finally, Part V examines space form problems on pseudo-riemannian symmetric spaces. At the end of Chapter 12 there is a new appendix describing some of the recent work on discrete subgroups of Lie groups with application to space forms of pseudo-riemannian symmetric spaces. Additional references have been added to this sixth edition as well.

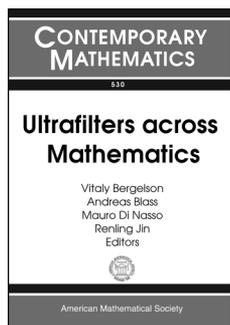
This item will also be of interest to those working in algebra and algebraic geometry.

Contents: *Riemannian geometry:* Affine differential geometry; Riemannian curvature; *The Euclidean space form problem:* Flat Riemannian manifolds; *The spherical space form problem:* Representations of finite groups; Vincent's work on the spherical space form problem; The classification of fixed point free groups; The solution to the spherical space form problem; *Space form problems on symmetric spaces:* Riemannian symmetric spaces; Space forms of irreducible symmetric spaces; Locally symmetric spaces of non-negative curvature; *Space form problems on indefinite metric manifolds:* Spaces of constant curvature; Locally isotropic manifolds; Appendix to Chapter 12; References; Additional references; Index.

AMS Chelsea Publishing, Volume 372

January 2011, 420 pages, Hardcover, ISBN: 978-0-8218-5282-8, LC 2010035675, 2000 *Mathematics Subject Classification:* 53-02, 53C21, 53C30, 53C35, 53C50, 20C05, 22C05; 14L35, 17B45, 20D99, AMS members US\$54, List US\$60, Order code CHEL/372.H

Logic and Foundations



Ultrafilters across Mathematics

Vitaly Bergelson, *Ohio State University, Columbus, OH*, **Andreas Blass**, *University of Michigan, Ann Arbor, MI*, **Mauro Di Nasso**, *Università di Pisa, Italy*, and **Renling Jin**, *College of Charleston, SC*, Editors

This volume originated from the International Congress "ULTRAMATH: Applications of Ultrafilters and Ultraproducts in Mathematics", which was held in Pisa, Italy, from June 1–7, 2008.

The volume aims to present the state-of-the-art of applications in the whole spectrum of mathematics which are grounded on the use of ultrafilters and ultraproducts. It contains two general surveys on ultrafilters in set theory and on the ultraproduct construction, as well as papers that cover additive and combinatorial number theory, nonstandard methods and stochastic differential equations, measure theory, dynamics, Ramsey theory, algebra in the space of ultrafilters, and large cardinals.

The papers are intended to be accessible and interesting for mathematicians who are not experts on ultrafilters and ultraproducts. Greater prominence has been given to results that can be formulated and presented in non-special terms and be, in

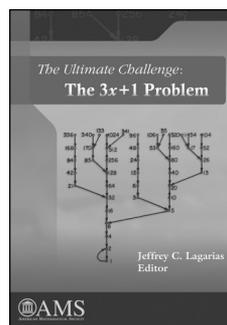
principle, understandable by any mathematician, and to those results that connect different areas of mathematics, revealing new facets of known important topics.

Contents: **V. Benci**, **S. Galatolo**, and **M. Ghimenti**, An elementary approach to stochastic differential equations using the infinitesimals; **V. Bergelson**, Ultrafilters, IP sets, dynamics, and combinatorial number theory; **A. Blass**, Ultrafilters and set theory; **D. H. Fremlin**, Measure-centering ultrafilters; **N. Hindman** and **D. Strauss**, Algebra in the space of ultrafilters and Ramsey theory; **R. Jin**, Ultrapower of \mathbb{N} and density problems; **H. J. Keisler**, The ultraproduct construction; **I. Neeman**, Ultrafilters and large cardinals.

Contemporary Mathematics, Volume 530

December 2010, 200 pages, Softcover, ISBN: 978-0-8218-4833-3, LC 2010025146, 2000 *Mathematics Subject Classification:* 03C20, 03E05, 03H05, 05C55, 28E15, AMS members US\$55.20, List US\$69, Order code CONM/530

Number Theory



The Ultimate Challenge

The $3x + 1$ Problem

Jeffrey C. Lagarias, *University of Michigan, Ann Arbor, MI*, Editor

The $3x + 1$ problem, or Collatz problem, concerns the following seemingly innocent arithmetic procedure applied to integers: If an integer x is odd then

"multiply by three and add one", while if it is even then "divide by two". The $3x + 1$ problem asks whether, starting from any positive integer, repeating this procedure over and over will eventually reach the number 1. Despite its simple appearance, this problem is unsolved. Generalizations of the problem are known to be undecidable, and the problem itself is believed to be extraordinarily difficult.

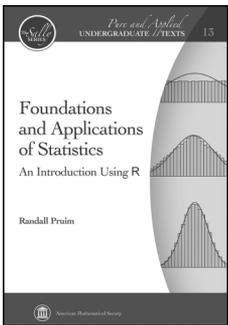
This book reports on what is known on this problem. It consists of a collection of papers, which can be read independently of each other. The book begins with two introductory papers, one giving an overview and current status, and the second giving history and basic results on the problem. These are followed by three survey papers on the problem, relating it to number theory and dynamical systems, to Markov chains and ergodic theory, and to logic and the theory of computation. The next paper presents results on probabilistic models for behavior of the iteration. This is followed by a paper giving the latest computational results on the problem, which verify its truth for $x < 5.4 \cdot 10^{18}$. The book also reprints six early papers on the problem and related questions, by L. Collatz, J. H. Conway, H. S. M. Coxeter, C. J. Everett, and R. K. Guy, each with editorial commentary. The book concludes with an annotated bibliography of work on the problem up to the year 2000.

Contents: *Survey papers:* **J. Lagarias**, The $3x + 1$ problem: An overview; **J. Lagarias**, The $3x + 1$ problem and its generalizations; *Survey papers:* **M. Chamberland**, A $3x + 1$ Survey: Number theory and dynamical systems; **K. R. Matthews**, Generalized $3x + 1$ mappings: Markov chains and ergodic theory; **P. Michel** and

M. Margenstern, Generalized $3x + 1$ functions and the theory of computation; *Stochastic modelling and computation papers*: **A. V. Kontorovich** and **J. Lagarias**, Stochastic models for the $3x + 1$ and $5x + 1$ problems and related problems; **T. O. e Silva**, Empirical verification of the $3x + 1$ and related conjectures; *Reprinted early papers*: **H. S. M. Coxeter**, Cyclic sequences and Frieze patterns; **J. H. Conway**, Unpredictable iterations; **C. J. Everett**, Iteration of the number-theoretic function $f(2n) = n, f(2n + 1) = 3n + 2$; **R. K. Guy**, Don't try to solve these problems!; **L. Collatz**, On the motivation and origin of the $(3n + 1)$ -problem; **J. H. Conway**, FRACTRAN: A simple universal programming language for arithmetic; *Annotated bibliography*: **J. Lagarias**, The $3x + 1$ problem: An annotated bibliography (1963–1999).

December 2010, approximately 348 pages, Hardcover, ISBN: 978-0-8218-4940-8, 2000 *Mathematics Subject Classification*: 11B83, 37A45; 11B37, 68Q99, **AMS members US\$47.20**, List US\$59, Order code MBK/78

Probability and Statistics



Foundations and Applications of Statistics

An Introduction Using R

Randall Pruim, *Calvin College, Grand Rapids, MI*

Foundations and Applications of Statistics simultaneously emphasizes both the foundational and the computational

aspects of modern statistics. Engaging and accessible, this book is useful to undergraduate students with a wide range of backgrounds and career goals.

The exposition immediately begins with statistics, presenting concepts and results from probability along the way. Hypothesis testing is introduced very early, and the motivation for several probability distributions comes from p-value computations. Pruim develops the students' practical statistical reasoning through explicit examples and through numerical and graphical summaries of data that allow intuitive inferences before introducing the formal machinery. The topics have been selected to reflect the current practice in statistics, where computation is an indispensable tool. In this vein, the statistical computing environment R is used throughout the text and is integral to the exposition. Attention is paid to developing students' mathematical and computational skills as well as their statistical reasoning. Linear models, such as regression and ANOVA, are treated with explicit reference to the underlying linear algebra, which is motivated geometrically.

Foundations and Applications of Statistics discusses both the mathematical theory underlying statistics and practical applications that make it a powerful tool across disciplines. The book contains ample material for a two-semester course in undergraduate probability and statistics. A one-semester course based on the book will cover hypothesis testing and confidence intervals for the most common situations.

Contents: Summarizing data; Probability and random variables; Continuous distributions; Parameter estimation and testing;

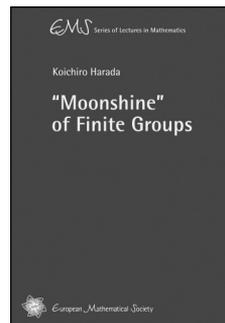
Likelihood-based statistics; Introduction to linear models; More linear models; A brief introduction to R; Some mathematical preliminaries; Geometry and linear algebra review; Review of Chapters 1–4; Hints, answers, and solutions to selected exercises; Bibliography; Index to R functions, packages, and data sets; Index.

Pure and Applied Undergraduate Texts, Volume 13

March 2011, approximately 615 pages, Hardcover, ISBN: 978-0-8218-5233-0, 2000 *Mathematics Subject Classification*: 62-01; 60-01, **AMS members US\$68**, List US\$85, Order code AMSTEXT/13

New AMS-Distributed Publications

Algebra and Algebraic Geometry



"Moonshine" of Finite Groups

Koichiro Harada, *Ohio State University, Columbus, OH*

This is an almost verbatim reproduction of the author's lecture notes written in 1983–84 at Ohio State University, Columbus. A substantial update is given in the bibliography.

Over the last 20 plus years there has been energetic activity in the field of finite simple group theory related to the monster simple group. Most notably, influential works have been produced in the theory of vertex operator algebras from research that was stimulated by the moonshine of the finite groups. Still, we can ask the same questions now that we did 30–40 years ago: What is the monster simple group? Is it really related to the theory of the universe as it was vaguely so envisioned? What lies behind the moonshine phenomena of the monster group? It may appear that we have only scratched the surface. These notes are primarily reproduced for the benefit of readers who wish to start learning about modular functions used in moonshine.

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

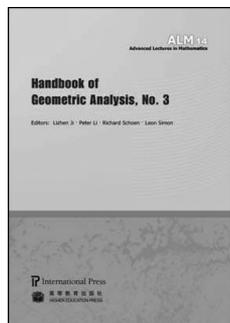
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: Modular functions and modular forms; Dedekind eta function; "Moonshine" of finite groups; Multiplicative product of η functions; Appendix. Genus zero discrete groups; Bibliography.

EMS Series of Lectures in Mathematics, Volume 12

September 2010, 83 pages, Softcover, ISBN: 978-3-03719-090-6, 2000 *Mathematics Subject Classification*: 20B05, 11F03, **AMS members US\$25.60**, List US\$32, Order code EMSSERLEC/12

Analysis



Handbook of Geometric Analysis Number 3

Lizhen Ji, *University of Michigan, Ann Arbor, MI*, **Peter Li**, *University of California, Irvine, CA*, and **Richard Schoen** and **Leon Simon**, *Stanford University, CA*, Editors

Geometric analysis combines differential equations and differential geometry, an important aspect of which is to solve geometric problems by studying differential equations. Besides some known linear differential operators such as the Laplace operator, many differential equations arising from differential geometry are nonlinear. A particularly important example is the Monge-Ampère equation. Applications to geometric problems have also motivated new methods and techniques in differential equations. The field of geometric analysis is broad and has had many striking applications.

This handbook of geometric analysis, the third to be published in the ALM series, provides introductions to and surveys of important topics in geometric analysis and their applications to related fields. It can be used as a reference by graduate students and researchers.

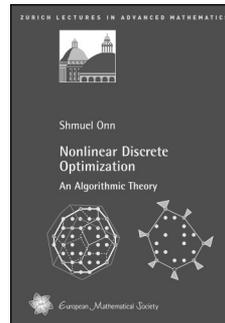
A publication of International Press. Distributed worldwide by the American Mathematical Society.

Contents: **M. T. Anderson**, A survey of Einstein metrics on 4-manifolds; **S. Brendle** and **R. Schoen**, Sphere theorems in geometry; **C. Gerhardt**, Curvature flows and CMC hypersurfaces; **N. C. Leung**, Geometric structures on Riemannian manifolds; **T.-J. Li**, Symplectic Calabi-Yau surfaces; **D. H. Phong** and **J. Sturm**, Lectures on stability and constant scalar curvature; **X.-P. Zhu**, Analytic aspect of Hamilton's Ricci flow.

International Press

August 2010, 472 pages, Softcover, ISBN: 978-1-57146-205-3, 2000 *Mathematics Subject Classification*: 01-02, 53-06, 58-06, **AMS members US\$52**, List US\$65, Order code INPR/92

Discrete Mathematics and Combinatorics



Nonlinear Discrete Optimization

An Algorithmic Theory

Shmuel Onn, *Israel Institute of Technology, Haifa, Israel*

This monograph develops an algorithmic theory of nonlinear discrete optimization. It introduces a simple and useful setup, which enables the polynomial time

solution of broad fundamental classes of nonlinear combinatorial optimization and integer programming problems in variable dimension. An important part of this theory is enhanced by recent developments in the algebra of Graver bases. The power of the theory is demonstrated by deriving the first polynomial time algorithms in a variety of application areas within operations research and statistics, including vector partitioning, matroid optimization, experimental design, multicommodity flows, multi-index transportation and privacy in statistical databases.

This monograph is intended for graduate students and researchers. It is accessible to anyone with standard undergraduate knowledge and mathematical maturity.

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

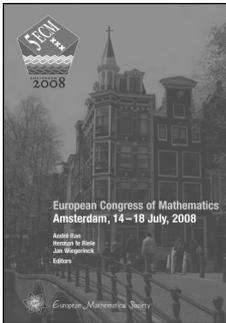
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: Introduction; Convex discrete maximization; Nonlinear integer programming; n -Fold integer programming; Multiway tables and universality; Nonlinear combinatorial optimization; Bibliography; Index.

Zurich Lectures in Advanced Mathematics, Volume 13

September 2010, 147 pages, Softcover, ISBN: 978-3-03719-093-7, 2000 *Mathematics Subject Classification*: 05Axx, 05Cxx, 05Dxx, 05Exx, 11Dxx, 11Hxx, 11Pxx, 13Pxx, 14Qxx, 15Axx, 15Bxx, 51Mxx, 52Axx, 52Bxx, 52Cxx, 62Hxx, 62Kxx, 62Qxx, 65Cxx, 68Qxx, 68Rxx, 68Wxx, 90Bxx, 90Cxx, **AMS members US\$33.60**, List US\$42, Order code EMSZLEC/13

General Interest



European Congress of Mathematics

Amsterdam, July 14–18, 2008

André Ran, *Vrije University, Amsterdam, The Netherlands*,
Herman te Riele, *CWI, Amsterdam, The Netherlands*,
and **Jan Wiegerinck**, *University of Amsterdam, The Netherlands*,
Editors

The European Congress of Mathematics, held every four years, has established itself as a major international mathematical event. Following those in Paris (1992), Budapest (1996), Barcelona (2000), and Stockholm (2004), the Fifth European Congress of Mathematics (5ECM) took place in Amsterdam, The Netherlands, July 14–18, 2008, with about 1000 participants from 68 different countries.

Ten plenary and thirty-three invited lectures were delivered. Three science lectures outlined applications of mathematics in other sciences: climate change, quantum information theory, and population dynamics. As in the four preceding EMS congresses, ten EMS prizes were granted to very promising young mathematicians. In addition, the Felix Klein Prize was awarded, for the second time, for an application of mathematics to a concrete and difficult industrial problem. There were twenty-two minisymposia, spread over the whole mathematical area. Two round table meetings were organized: one on industrial mathematics and one on mathematics and developing countries.

As part of the 44th Netherlands Mathematisch Congres, which was embedded in 5ECM, the so-called Brouwer lecture was presented. It is the Netherlands' most prestigious award in mathematics, organized every three years by the Royal Dutch Mathematical Society. Information about Brouwer was given in an invited historical lecture during the congress.

These proceedings contain a selection of the contributions to the congress, providing a permanent record of the best of what mathematics offers today.

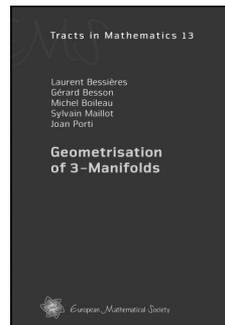
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: *Invited Lectures:* **J. A. Carrillo** and **J. Rosado**, Uniqueness of bounded solutions to aggregation equations by optimal transport methods; **B. Edixhoven**, On the computation of the coefficients of modular forms; **M. Einsiedler**, Effective equidistribution and spectral gap; **W. Lück**, Survey on aspherical manifolds; **S. A. Merkulov**, Wheeled props in algebra, geometry and quantization; **O. R. Musin**, Positive definite functions in distance geometry; **J. Nešetřil** and **P. Ossona de Mendez**, From sparse graphs to nowhere dense structures: decompositions, independence, dualities and limits; **J. Fuchs**, **T. Nikolaus**, **C. Schweigert**, and **K. Waldorf**, Bundle gerbes and surface holonomy; **C. Teleman**, Topological field theories in 2 dimensions; *Lecture on Invitation by the KWG:* **D. van Dalen**, The Revolution of 1907—Brouwer's dissertation; *Plenary Lectures:* **J. Bourgain**, New developments in combinatorial number theory and applications; **J.-F. Le Gall**,

Large random planar maps and their scaling limits; **F. Loeser**, Geometry and non-archimedean integrals; **M. Marcolli**, Feynman integrals and motives; **N. Reshetikhin**, Topological quantum field theory: 20 years later; *Prize Lectures:* **O. Holtz** and **N. Shomron**, Computational complexity and numerical stability of linear problems; **B. Klartag**, High-dimensional distributions with convexity properties; **L. Saint-Raymond**, Some recent results about the sixth problem of Hilbert: hydrodynamic limits of the Boltzmann equation; **A. Smoktunowicz**, Graded algebras associated to algebraic algebras need not be algebraic; Author index.

April 2010, 488 pages, Hardcover, ISBN: 978-3-03719-077-7, 2000 *Mathematics Subject Classification:* 00Bxx, **AMS members US\$78.40**, List US\$98, Order code EMSEMC/2008

Geometry and Topology



Geometrisation of 3-Manifolds

Laurent Bessières and **Gérard Besson**, *Université Joseph Fourier, Grenoble, France*, **Michel Boileau**, *Université Paul Sabatier, Toulouse, France*, **Sylvain Maillot**, *Université Montpellier II, France*, and **Joan Porti**, *Universitat Autònoma de Barcelona, Spain*

The geometrisation conjecture was proposed by William Thurston in the mid 1970s in order to classify compact 3-manifolds by means of a canonical decomposition along essential, embedded surfaces into pieces that possess geometric structures. It contains the famous Poincaré Conjecture as a special case.

In 2002 Grigory Perelman announced a proof of the geometrisation conjecture based on Richard Hamilton's Ricci flow approach and presented it in a series of three celebrated arXiv preprints. Since then there has been an ongoing effort to understand Perelman's work by giving more detailed and accessible presentations of his ideas or alternative arguments for various parts of the proof.

This book is a contribution to this endeavor. Its two main innovations are first a simplified version of Perelman's Ricci flow with surgery, which is called Ricci flow with bubbling-off, and secondly a completely different and original approach to the last step of the proof. In addition, special effort has been made to simplify and streamline the overall structure of the argument and make the various parts independent of one another.

A complete proof of the geometrisation conjecture is given, modulo pre-Perelman results on Ricci flow, Perelman's results on the \mathcal{L} -functional and κ -solutions, as well as the Colding-Minicozzi extinction paper. The book can be read by anyone already familiar with these results or willing to accept them as black boxes. The structure of the proof is presented in a lengthy introduction which does not require knowledge of geometric analysis. The bulk of the proof is the existence theorem for Ricci flow with bubbling-off, which is treated in parts I and II. Part III deals with the long-time behaviors of Ricci flow with bubbling-off. Part IV finishes the proof of the geometrisation conjecture.

New AMS-Distributed Publications

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

Contents: The Geometrisation conjecture; *Part I. Ricci flow with bubbling-off: definitions and statements:* Basic definitions; Piecing together necks and caps; κ -noncollapsing, canonical geometry and pinching; Ricci flow with (r, δ, κ) -bubbling-off; *Part II. Ricci flow with bubbling-off: existence:* Choosing cutoff parameters; Metric surgery and the proof of Proposition A; Persistence; Canonical neighbourhoods and the proof of Proposition B; κ -noncollapsing and the proof of Proposition C; *Part III. Long-time behaviour of Ricci flow with bubbling-off:* The thin-thick decomposition theorem; Refined estimates for long-time behaviour; *Part IV. Weak collapsing and hyperbolisation:* Collapsing, simplicial volume and strategy of proof; Proof of the weak collapsing theorem; A rough classification of 3-manifolds; Appendix A. 3-manifold topology; Appendix B. Comparison geometry; Appendix C. Ricci flow; Appendix D. Alexandrov spaces; Appendix E. A sufficient condition for hyperbolicity; Bibliography; Index.

EMS Tracts in Mathematics, Volume 13

September 2010, 247 pages, Hardcover, ISBN: 978-3-03719-082-1,
2000 *Mathematics Subject Classification:* 57-02, 57M50, 53C44,
AMS members US\$51.20, List US\$64, Order code EMSTM/13

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To learn more about social networking and the AMS please visit:

www.ams.org/about-us/social

