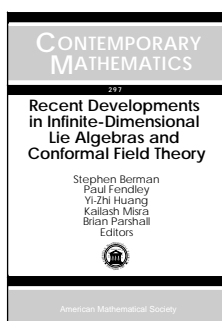


# New Publications Offered by the AMS

## Algebra and Algebraic Geometry



### Recent Developments in Infinite-Dimensional Lie Algebras and Conformal Field Theory

Stephen Berman, *University of Saskatchewan, Saskatoon, SK, Canada*, Paul Fendley and

Brian Parshall, *University of Virginia, Charlottesville*, Yi-Zhi Huang, *Rutgers University, Piscataway, NJ*, Kailash Misra, *North Carolina State University, Raleigh*, Editors

Because of its many applications to mathematics and mathematical physics, the representation theory of infinite-dimensional Lie and quantized enveloping algebras comprises an important area of current research. This volume includes articles from the proceedings of an international conference, "Infinite-Dimensional Lie Theory and Conformal Field Theory", held at the University of Virginia. Many of the contributors to the volume are prominent researchers in the field.

This conference provided an opportunity for mathematicians and physicists to interact in an active research area of mutual interest. The talks focused on recent developments in the representation theory of affine, quantum affine, and extended affine Lie algebras and Lie superalgebras. They also highlighted applications to conformal field theory, integrable and disordered systems.

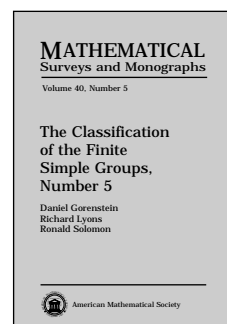
Some of the articles are expository and accessible to a broad readership of mathematicians and physicists interested in this area; others are research articles that are appropriate for more advanced readers.

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

**Contents:** S. Berman, Y. Billig, and J. Szmigielski, Vertex operator algebras and the representation theory of toroidal algebras; V. Chari and M. Kleber, Symmetric functions and representations of quantum affine algebras; B. L. Cox, Two realizations of toroidal  $\mathfrak{sl}_2(\mathbb{C})$ ; C. Dong, H. Li, and G. Mason, Vertex Lie algebras, vertex Poisson algebras and vertex algebras; A. J. Feingold and M. D. Weiner, Type A fusion rules from elementary group theory; J. Fuchs and C. Schweigert, Lie algebra automorphisms in conformal field theory; Y. Hara, M. Jimbo, H. Konno, S. Odake, and J. Shiraishi, On Lepowsky-Wilson's  $\mathcal{Z}$ -algebra; G. Hatayama, A. Kuniba, M. Okado, T. Takagi, and Y. Yamada, Scattering rules in soliton cellular automata associated with crystal bases; B. M. McCoy, Algebra versus analysis in statistical mechanics and quantum field theory; A. Milas, Weak modules and logarithmic intertwining operators for vertex operator algebras; A. Schilling and S. O. Warnaar, Conjugate Bailey pairs; M. Vazirani, Irreducibility of affine Hecke algebra modules induced from Specht modules; W. Wang, Algebraic structures behind Hilbert schemes and wreath products; W. Zhao, Some generalizations of genus zero two-dimensional conformal field theory.

**Contemporary Mathematics**, Volume 297

September 2002, 334 pages, Softcover, ISBN 0-8218-2716-2, LC 2002071170, 2000 *Mathematics Subject Classification*: 17B10, 17B37, 17B65, 17B69, 17B80, 17B81; 81T40, 82B23, **Individual member \$47**, List \$79, Institutional member \$63, Order code CONM/297N



### The Classification of the Finite Simple Groups, Number 5

Daniel Gorenstein, Richard Lyons, *Rutgers University, Piscataway, NJ*, and Ronald Solomon, *Ohio State University, Columbus*

The classification of finite simple groups is a landmark result of modern mathematics. The original proof is spread over scores of articles by dozens of researchers. In this multivolume book, the authors are assembling the proof with explanations and references. It is a monumental task. The book, along with background from sections of the previous volumes, presents critical aspects of the classification.

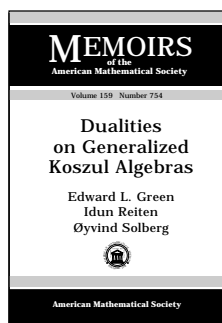
In four prior volumes (Surveys of Mathematical Monographs, Volumes 40.1, 40.2, 40.3, and 40.4), the authors began the proof of the classification theorem by establishing certain uniqueness and preuniqueness results. In this volume, they now begin the proof of a major theorem from the classification grid, namely Theorem  $C_7$ .

The book is suitable for graduate students and researchers interested in group theory.

**Contents:** Theorem  $C_7$ : General introduction; General group-theoretic results; Theorem  $C_7^*$ : Stage 1; Theorem  $C_7^*$ : Stage 2; Theorem  $C_7^*$ : Stage 3a; Properties of  $K$ -groups; Background references; Expository references; Glossary of symbols and terms.

**Mathematical Surveys and Monographs**, Volume 40

September 2002, 467 pages, Hardcover, ISBN 0-8218-2776-6, LC 94-23001, 2000 *Mathematics Subject Classification*: 20D06, 20D08; 20D05, 20E32, 20G40, **Individual member \$57**, List \$95, Institutional member \$76, Order code SURV/40.5N



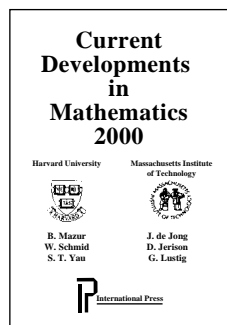
## Dualities on Generalized Koszul Algebras

Edward L. Green, *Virginia Polytechnic Institute and State University, Blacksburg*, and Idun Reiten and Øyvind Solberg, *Norwegian University of Science and Technology, Trondheim, Norway*

**Contents:** Main results and examples; Proofs of main results; Generalized  $T$ -Koszul algebras; Further results and questions; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 159, Number 754

September 2002, 67 pages, Softcover, ISBN 0-8218-2934-3, LC 2002025583, 2000 *Mathematics Subject Classification*: 16W50, 16S37, 16D90; 18E05, 16E05, **Individual member \$28**, List \$46, Institutional member \$37, Order code MEMO/159/754N



## Current Developments in Mathematics 2000

B. Mazur, W. Schmid, and S. T. Yau, *Harvard University, Cambridge, MA*, and J. de Jong, D. Jerison, and G. Lustig, *Massachusetts Institute of Technology, Cambridge*

*A publication of the International Press.*

This volume contains articles from lectures given at the annual joint mathematics meeting sponsored by Harvard and

MIT (Cambridge, MA). The speakers are well-known research mathematicians who have been involved in some of the most important and interesting recent developments in mathematics for the year. These proceedings provide an unparalleled opportunity to stay abreast of current developments in mathematics.

*This item will also be of interest to those working in mathematical physics, number theory, geometry and topology, and probability.*

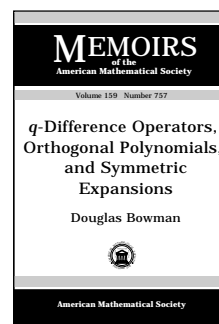
Distributed worldwide, except in Japan, by the American Mathematical Society.

**Contents:** M. Broué, Reflection groups, braid groups, Hecke algebras, finite reduction groups; W. E. Stochastic hydrodynamics; W. T. Gowers, Arithmetic progressions in sparse sets; J. Kollár, The topology of real algebraic varieties; O. Schramm, Scaling limits of random processes and the outer boundary of planar Brownian motion.

**International Press**

December 2001, 253 pages, Hardcover, ISBN 1-57146-079-9, 2000 *Mathematics Subject Classification*: 00B20, **All AMS members \$38**, List \$48, Order code INPR/48N

## Analysis



## $q$ -Difference Operators, Orthogonal Polynomials, and Symmetric Expansions

Douglas Bowman, *University of Illinois, Urbana*

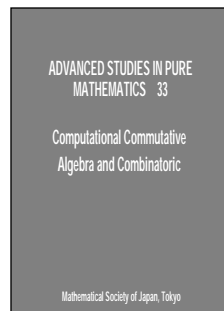
*This item will also be of interest to those working in discrete mathematics and combinatorics.*

**Contents:** Introduction and preliminaries; New results and connections with current research; Vector operator identities and simple applications; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 159, Number 757

September 2002, 56 pages, Softcover, ISBN 0-8218-2774-X, LC 2002025581, 2000 *Mathematics Subject Classification*: 33D70, 05A30; 33D45, **Individual member \$25**, List \$42, Institutional member \$34, Order code MEMO/159/757N

# Discrete Mathematics and Combinatorics



## Computational Commutative Algebra and Combinatorics

**Takayuki Hibi**, *Osaka University, Japan*, Editor

*A publication of the Mathematical Society of Japan.*

This volume constitutes the proceedings of the International Conference on “Computational Commutative Algebra and Combinatorics” held in Osaka, Japan. It contains excellent survey articles and research papers on various topics related to the theme of the conference. Of particular interest are two survey articles, “Algebraic Shifting” by Gil Kalai and “Generic Initial Ideals and Graded Betti Numbers” by Jürgen Herzog.

The volume is suitable for graduate students and research mathematicians interested in discrete mathematics.

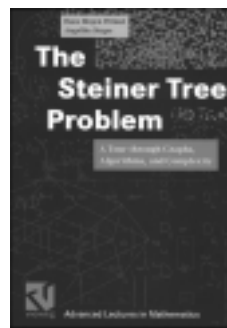
Published for the Mathematical Society of Japan by Kinokuniya, Tokyo, and distributed worldwide, except in Japan, by the AMS.

**Contents:** **W. Bruns** and **J. Gubeladze**, Polyhedral algebras, arrangements of toric varieties, and their groups; **A. M. Duval**, Algebraic shifting and spectral sequences; **V. Gasharov**, **I. Peeva**, and **V. Welker**, Coordinate subspace arrangements and monomial ideals; **J. Herzog**, Generic initial ideals and graded Betti numbers; **G. Kalai**, Algebraic shifting; **K. Masuda**, Certain moduli of algebraic  $G$ -vector bundles over affine  $G$ -varieties; **M. Miyanishi**, Completely parametrized  $A_1^1$ -fibrations on the affine plane; **M. Petkovšek**, **J. Pommerheim**, and **I. Swanson**, The Zarankiewicz problem via Chow forms; **C. Procesi**, Notes on the topology of hyperplane arrangements and braid groups; **V. Srinivas**, Some geometric methods in commutative algebra.

**Advanced Studies in Pure Mathematics**, Volume 33

March 2002, 276 pages, Hardcover, ISBN 4-931469-17-5, 2000 *Mathematics Subject Classification*: 05-06; 13-06, **All AMS members \$69**, List \$86, Order code ASPM/33N

Independent Study



## The Steiner Tree Problem

### A Tour Through Graphs, Algorithms, and Complexity

**Hans-Jürgen Promel**, *Humboldt University, Berlin, Germany*, and **Angelika Steger**, *Technische Universität München, Munich, Germany*

*A publication of the Vieweg Verlag.*

In recent years, algorithmic graph theory has become increasingly important as a link between discrete mathematics and theoretical computer science. This textbook introduces students of mathematics and computer science to the interrelated fields of graphs theory, algorithms and complexity. No specific prior knowledge is assumed.

The central theme of the book is a geometrical problem dating back to Jakob Steiner. This problem, now called the Steiner problem, was initially of importance only within the context of land surveying. In the last decade, however, applications as diverse as VLSI-layout and the study of phylogenetic trees have lead to a significant rise in the level of interest to this problem. The resulting progress has uncovered fascinating connections to and among graph theory, the study of algorithms, and complexity theory. This single problem thus serves to bind and motivate these areas. The book’s topics include: exact algorithms, computational complexity, approximation algorithms, the use of randomness, limits of approximability.

A fundamental feature of the book is that each chapter ends with an “excursion” into some related area. These excursions reinforce the concepts and methods introduced for the Steiner problem by putting them in a broader context. The book is geared toward graduate students, research mathematicians, and computer scientists interested in discrete mathematics.

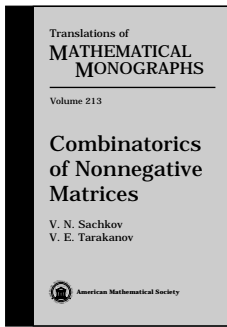
The AMS is exclusive distributor in North America. Vieweg Verlag Publications are available worldwide from the AMS outside of Germany, Switzerland, Austria, and Japan.

**Contents:** Basics I: Graphs; Basics II: Algorithms; Basics III: Complexity; Special terminal sets; Exact algorithms; Approximation algorithms; More on approximation algorithms; Randomness helps; Limits of approximability; Geometric Steiner problems; Bibliography; Index; Symbol index.

**Vieweg Advanced Lectures in Mathematics**

February 2002, 241 pages, Softcover, ISBN 3-528-06762-4, 2000 *Mathematics Subject Classification*: 05Cxx, 68Rxx, 68Wxx, 68Qxx, **All AMS members \$27**, List \$30, Order code VWALM/3N

## Supplementary Reading



## Combinatorics of Nonnegative Matrices

V. N. Sachkov and  
V. E. Tarakanov, *Steklov  
Institute of Mathematics,  
Moscow, Russia*

The variety of combinatorial properties of nonnegative matrices is widely discussed in the mathematical literature, and there are many papers on this topic. However, there are few monographs devoted to these properties of nonnegative matrices. This book fills that gap and presents a summary of the existing material. It provides a good entry point into the subject and includes exercises to aid students.

The authors focus on the relation of matrices with nonnegative elements to various mathematical structures studied in combinatorics. In addition to applications in graph theory, Markov chains, tournaments, and abstract automata, the authors consider relations between nonnegative matrices and structures such as coverings and minimal coverings of sets by families of subsets. They also give considerable attention to the study of various properties of matrices and to the classes formed by matrices with a given structure.

The authors discuss enumerative problems using both combinatorial and probabilistic methods. It also considers extremal problems related to matrices and problems where nonnegative matrices provide suitable investigative tools.

This book was developed for the most part as a theoretical research text, keeping in mind applications of nonnegative matrices. Among the applications, the most significant included are in the theory of Markov chains, in linear programming for constructing and analyzing economic models, and in information theory for designing reliable information devices. The book is suitable for specialists in these areas of engineering and the applied sciences.

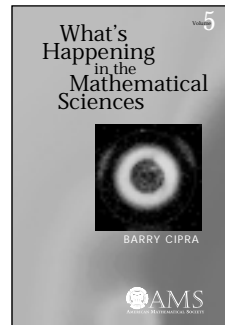
The book contains some classical theorems and a significant number of results not previously published in monograph form, including results obtained by the authors in the last few years. It is appropriate for graduate students and researchers interested in combinatorics and its applications.

**Contents:** Matrices and Configurations; Ryser classes; Nonnegative matrices and extremal combinatorial problems; Asymptotic methods in the study of nonnegative matrices; Totally indecomposable, chainable, and prime matrices; Sequences of nonnegative matrices; Bibliography; Index.

**Translations of Mathematical Monographs, Volume 213**

September 2002, 269 pages, Hardcover, ISBN 0-8218-2788-X, LC 2002074392, 2000 *Mathematics Subject Classification*: 05-02; 05C50, 15-02, 15A48, 93-02, **Individual member \$59**, List \$99, Institutional member \$79, Order code MMONO/213N

## General and Interdisciplinary



## What's Happening in the Mathematical Sciences

Barry Cipra

*Reviews of the Previous Volumes:*

*This lively presentation of an amazingly wide spectrum of happenings in mathematics is impressive ... [this book] should be presented to a wide audience even outside mathematics, which could be fascinated by the ideas, concepts and beauty of the mathematical topics.*

—*European Mathematical Society Newsletter*

*The articles are very well written, and usually include quotes from the mathematicians who were involved in the work in question, giving the whole thing a more "human" feel. This book offers professionals a way to keep abreast of what's going on in the field and also gives us a way to share with our students and colleagues some of the excitement of doing mathematics. Don't miss it.*

—*MAA Online*

*An excellent source of information. Through his writing, diagrams, and sidebars, Cipra offers historical background, mathematical connections, and insight into the world of research mathematics. Throughout the book, he connects modern mathematical ideas to important applications in computer science, physics, biology, security codes, and art. He also presents in each chapter an intriguing blend of historical and contemporary mathematics. An excellent resource for high school mathematics teachers and their students.*

—*Mathematics Teacher*

*The perennial task of bringing mathematics before the general public attracts expositors wielding a diversity of strategies who pursue goals that range from enticing further study and inducing appreciation to merely diminishing fear. Cipra's *What's Happening in the Mathematical Sciences* surveys late-breaking mathematical news. Though he includes material on such familiar topics as computer chess, chaos, Escher, and cryptosystems, he also discusses less familiar territory such as quantum computers, automated theorem provers, and algorithmic algebraic geometry. Here undergraduates might easily make their first acquaintance with a topic that could shape the course of their future studies and, beyond that, their professional lives. An essential acquisition.*

—*CHOICE*

*Stylish format ... largely accessible to laymen ... This publication is one of the snappier examples of a growing genre from scientific societies seeking to increase public understanding of their work and its societal value.*

—*Science & Government Report*

*The topics chosen and the lively writing fill a notorious gap—to make the ideas, concepts and beauty of mathematics more visible for the general public ... well-illustrated ... Congratulations to Barry Cipra.*

—*Zentralblatt MATH*

*Continued*

Mathematicians like to point out that mathematics is universal. In spite of this, most people continue to view it as either mundane (balancing a checkbook) or mysterious (cryptography). This fifth volume of the What's Happening series contradicts that view by showing that mathematics is indeed found everywhere—in science, art, history, and our everyday lives.

Here is some of what you'll find in this volume:

- **Mathematics and Science**
  - **Mathematical biology:** Mathematics was key to cracking the genetic code. Now, new mathematics is needed to understand the three-dimensional structure of the proteins produced from that code.
  - **Celestial mechanics and cosmology:** New methods have revealed a multitude of solutions to the three-body problem. And other new work may answer one of cosmology's most fundamental questions: What is the size and shape of the universe?
- **Mathematics and Everyday Life**
  - **Traffic jams:** New models are helping researchers understand where traffic jams come from—and maybe what to do about them!
  - **Small worlds:** Researchers have found a short distance from theory to applications in the study of small world networks.
- **Elegance in Mathematics**
  - **Beyond Fermat's Last Theorem:** Number theorists are reaching higher ground after Wiles' astounding 1994 proof: new developments in the elegant world of elliptic curves and modular functions.
  - **The Millennium Prize Problems:** The Clay Mathematics Institute has offered a million dollars for solutions to seven important and difficult unsolved problems.

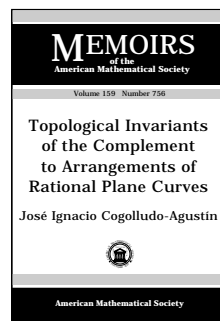
These are just some of the topics of current interest that are covered in this latest volume of What's Happening in the Mathematical Sciences. The book has broad appeal for a wide spectrum of mathematicians and scientists, from high school students through advanced-level graduates and researchers.

**Contents:** Introduction; New heights for number theory; Nothing to sphere but sphere itself; A mathematical twist to protein folding; Finite math; The mathematics of traffic jams; Rewriting history; It's a small, big, small, big world; A celestial *Pas de Trois*; Think and grow rich; Ising on the cake.

**What's Happening in the Mathematical Sciences**, Volume 5

August 2002, 95 pages, Softcover, ISBN 0-8218-2904-1, 2000 *Mathematics Subject Classification*: 00A06, **All AMS members \$15**, List \$19, Order code HAPPENING/5N

## Geometry and Topology



### Topological Invariants of the Complement to Arrangements of Rational Plane Curves

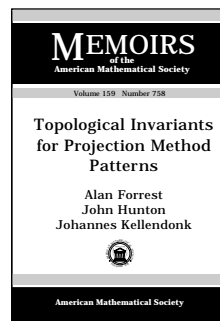
José Ignacio Cogolludo-Agustín, *Madrid, Spain*

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

**Contents:** Preliminaries; Ring structure of  $H^*(\mathbb{P}^2 \setminus \mathcal{R}; \mathbb{C})$ ; Generalized Aomoto complexes; Characteristic varieties, local systems and rational arrangements; Examples; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 159, Number 756

September 2002, 75 pages, Softcover, ISBN 0-8218-2942-4, LC 2002025580, 2000 *Mathematics Subject Classification*: 32S50, 14Q05, 14B05, 14F45, 14H30, 14H45, 55N25, 32Q55, 32S20, **Individual member \$28**, List \$46, Institutional member \$37, Order code MEMO/159/756N



### Topological Invariants for Projection Method Patterns

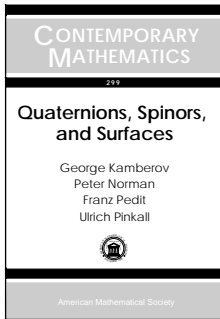
Alan Forrest, *Glasgow, Scotland*, John Hunton, *University of Leicester, England*, and Johannes Kellendonk, *Cardiff University, Wales*

**Contents:** General introduction; Topological spaces and dynamical systems; Groupoids,  $C^*$ -algebras, and their invariants; Approaches to Calculation I: Cohomology for codimension one; Approaches to Calculation II: Infinitely generated cohomology; Approaches to Calculation III: Cohomology for small codimension; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 159, Number 758

September 2002, 120 pages, Softcover, ISBN 0-8218-2965-3, LC 2002025582, 2000 *Mathematics Subject Classification*: 52C23; 19E20, 37Bxx, 46Lxx, 55Txx, 82D25, **Individual member \$30**, List \$50, Institutional member \$40, Order code MEMO/159/758N

## Recommended Text



## Quaternions, Spinors, and Surfaces

George Kamberov, *Stevens Institute of Technology, Hoboken, NJ*, Peter Norman and Franz Pedit, *University of Massachusetts, Amherst*, and Ulrich Pinkall, *Technische Universität, Berlin, Germany*

Many problems in pure and applied mathematics boil down to determining the shape of a surface in space or constructing surfaces with prescribed geometric properties. These problems range from classical problems in geometry, elasticity, and capillarity to problems in computer vision, medical imaging, and graphics. There has been a sustained effort to understand these questions, but many problems remain open or only partially solved. These include determining the shape of a surface from its metric and mean curvature (Bonnet's problem), determining an immersion from the projectivised Gauss map (Christoffel's problem) and its applications to the computer vision problem on recovering shape from shading, the construction of surfaces with prescribed curvature properties, constructing extremal surfaces and interfaces, and representing surface deformations. This book studies these questions by presenting a theory applying to both global and local questions and emphasizing conformal immersions rather than isometric immersions.

### The book offers:

- A unified and comprehensive presentation of the quaternionic and spinor approach to the theory of surface immersions in three and four dimensional space.
- New geometric invariants of surfaces in space and new open problems.
- A new perspective and new results on the classical geometric problems of surface and surface shape recognition and surface representation.
- A source of problems to motivate research and dissertations.
- Applications in computer vision and computer graphics.
- Proofs of many results presented by the authors at colloquia, conferences, and congresses over the past two years.

This book describes how to use quaternions and spinors to study conformal immersions of Riemann surfaces into  $\mathbb{R}^3$ . The first part develops the necessary quaternionic calculus on surfaces, its application to surface theory and the study of conformal immersions and spinor transforms. The integrability conditions for spinor transforms lead naturally to Dirac spinors and their application to conformal immersions. The second part presents a complete spinor calculus on a Riemann surface, the definition of a conformal Dirac operator, and a generalized Weierstrass representation valid for all surfaces. This theory is used to investigate first, to what extent a surface is determined by its tangent plane distribution, and second, to what extent curvature determines the shape.

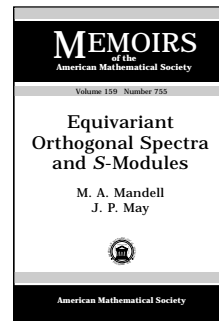
The book is geared toward graduate students and research mathematicians interested in differential geometry and geometric analysis and its applications, computer science, computer vision, and computer graphics.

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

**Contents:** *Conformal immersions via quaternions:* Quaternionic calculus and immersions; Applications; *Surfaces and Dirac spinors:* Spinor algebra; Dirac spinors and conformal immersions; Bibliography; Glossary of symbols; Index.

**Contemporary Mathematics**, Volume 299

October 2002, approximately 152 pages, Softcover, ISBN 0-8218-1928-3, LC 2002026151, 2000 *Mathematics Subject Classification:* 55-XX, All AMS members \$31, List \$39, Order code CONM/299N



## Equivariant Orthogonal Spectra and $S$ -Modules

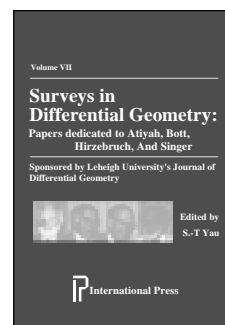
M. A. Mandell and J. P. May, *University of Chicago, IL*

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

**Contents:** Introduction; Orthogonal spectra and  $S$ -modules; Equivariant orthogonal spectra; Model categories of orthogonal  $G$ -spectra; Orthogonal  $G$ -spectra and  $S_G$ -modules; "Change" functors for orthogonal  $G$ -spectra; "Change" functors for  $S_G$ -modules and comparisons; Bibliography; Index of notation.

**Memoirs of the American Mathematical Society**, Volume 159, Number 755

September 2002, 108 pages, Softcover, ISBN 0-8218-2936-X, LC 2002025579, 2000 *Mathematics Subject Classification:* 55P42, 55P43, 55P91; 18A25, 18E30, 55P48, 55U35, **Individual member \$29**, List \$49, Institutional member \$39, Order code MEMO/159/755N



## Surveys in Differential Geometry: Papers Dedicated to Atiyah, Bott, Hirzebruch, and Singer

S. T. Yau, *Harvard University, Cambridge, MA*

**A publication of the International Press.**

This volume arose from a conference dedicated to four remarkable mathematicians: M. Atiyah, R. Bott, F. Hirzebruch, and I. Singer. These men were a source of inspiration and mentors to the participants and speakers at the conference.

There are several articles included, among them are articles on the geometry of classical particles by Atiyah, Hirzebruch's research on singularities by E. Brieskorn, moment map and diffeomorphisms by Donaldson, Dirac charge quantization by Daniel Freed, the fixed point theorem and number theory by Hirzebruch, complex Lagrangian submanifolds by Hitchin, Riemannian manifolds by Peter Li, the mirror principle by Lian, Liu, and Yau, Seiberg-Witten invariants by Taubes, topological

field theories by Vafa, and Yang-Mills and string theory by Witten.

The book is suitable for graduate students and research mathematicians interested in differential geometry.

Distributed worldwide, except in Japan, by the American Mathematical Society.

**Contents:** M. Atiyah, The geometry of classical particles; E. Brieskorn, Singularities in the work of Friedrich Hirzebruch; C. Ciliberto and G. van der Geer, The moduli space of abelian varieties and the singularities of the theta divisor; R. L. Cohen, E. Lupercio, and G. B. Segal, Holomorphic spheres in loop groups and Bott periodicity; S. K. Donaldson, Moment map and diffeomorphisms; D. S. Freed, Dirac charge quantization and generalized differential cohomology; D. Goldfeld and S. Zhang, The holomorphic kernel of the Rankin-Selberg convolution; V. Guillemin and C. Zara, Equivariant de Rham theory and graphs; F. R. Harvey and H. B. Lawson, Jr., Morse theory and Stokes' theorem; F. Hirzebruch, The Atiyah-Bott-Singer fixed point theorem and number theory; N. J. Hitchin, The moduli space of complex Lagrangian submanifolds; R. V. Kadison, Which Singer is that?; P. Li, Curvature and function theory on Riemannian manifolds; B. H. Lian, K. Liu, and S.-T. Yau, Mirror principle. III; B. H. Lian, K. Liu, and S.-T. Yau, Mirror principle. IV; Yu. I. Manin, Three constructions of Frobenius manifolds: A comparative study; R. Penrose, On Ricci-flat twistor theory; W. Schmid and K. Vilonen, On the geometry of nilpotent orbits; C. H. Taubes, Seiberg-Witten invariants, self-dual harmonic 2-forms and the Hofer-Wysocki-Zehnder formalism; C. Vafa, Unifying themes in topological field theories; E. Witten, Noncommutative Yang-Mills theory and string theory.

**International Press**

December 2001, 696 pages, Hardcover, ISBN 1-57146-069-1, 2000 *Mathematics Subject Classification*: 53Axx, All AMS members \$52, List \$65, Order code INPR/49N

“metamathematical” methods, using the method of forcing and other tools related to axiomatic set theory. However, in the present book, the author uses “elementary” (mainly combinatorial) methods to study properties of algebras on a set. Presenting new and original material, the book is written in a clear and readable style and illustrated by many examples and figures.

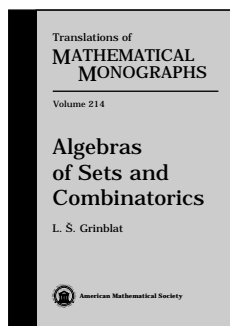
The book will be useful to researchers and graduate students working in set theory, mathematical logic, and combinatorics.

**Contents:** Introduction; Main results; The main idea; Finite sequences of algebras (1). Proof of Theorems 2.1 and 2.2; Countable sequences of algebras (1). Proof of Theorem 2.4; Proof of the Gitik-Shelah theorem, and more from set theory; Proof of Theorems 1.17, 2.7, 2.8; Theorems on almost  $\sigma$ -algebras. Proof of Theorem 2.9; Finite sequences of algebras (2). The function  $g(n)$ ; A description of the class of functions  $\Psi_{\aleph}^*$ ; The general problem. Proof of Theorems 2.15 and 2.20; Proof of Theorems 2.21(1,3), 2.24; The inverse problem; Finite sequences of algebras (3). Proof of Theorems 2.27, 2.31, 2.36, 2.38; Preliminary notions and lemmas; Finite sequences of algebras (4). Proof of Theorems 2.39(1,2), 2.45(1,2); Countable sequences of algebras (2). Proof of Theorems 2.29, 2.32, 2.46; A refinement of theorems on  $\sigma$ -algebras. Proof of Theorems 2.34, 2.44; Semistructures and structures of sets. Proof of Theorem 2.48; Final comments. Generalization of Theorem 2.1; Appendix: On a question of Grinblat by S. Shelah; Bibliography; Index.

**Translations of Mathematical Monographs, Volume 214**

October 2002, approximately 264 pages, Hardcover, ISBN 0-8218-2765-0, 2000 *Mathematics Subject Classification*: 03E05; 28A05, 54D35, **Individual member \$59**, List \$99, Institutional member \$79, Order code MMONO/214N

## Logic and Foundations



### Algebras of Sets and Combinatorics

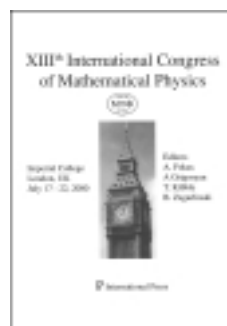
L. Š. Grinblat, *College of Judea and Samaria, Ariel, Israel*

An algebra  $A$  on a set  $X$  is a family of subsets of this set closed under the operations of union and difference of two subsets. The main topic of the book is the study of various algebras and families of algebras on an

abstract set  $X$ . The author shows how this is related to famous problems by Lebesgue, Banach, and Ulam on the existence of certain measures on abstract sets, with corresponding algebras being algebras of measurable subsets with respect to these measures. In particular it is shown that for a certain algebra not to coincide with the algebra of all subsets of  $X$  is equivalent to the existence of a nonmeasurable set with respect to a given measure.

Although these questions don't seem to be related to mathematical logic, many results in this area were proved by

## Mathematical Physics



### XIIIth International Congress of Mathematical Physics

A. Fokas, A. Grigoryan, T. Kibble, and B. Zegarlinski, *Imperial College of Science and Technology, London, UK*

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The book is suitable for graduate students and research mathematicians interested in mathematical physics.

Distributed worldwide, except in Japan, by the American Mathematical Society.

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#### International Press

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