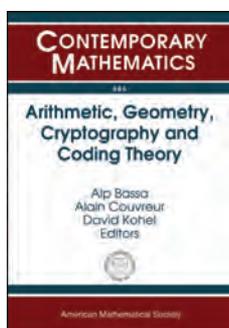


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## Algebra and Algebraic Geometry



### Arithmetic, Geometry, Cryptography and Coding Theory

**Alp Bassa**, *Bogazici University, Istanbul, Bebek, Turkey*, **Alain Couvreur**, *Ecole Polytechnique, Palaiseau, France*, and **David Kohel**, *Aix-Marseille Université, France*, Editors

This volume contains the proceedings of the 15th International Conference on Arithmetic, Geometry, Cryptography, and Coding Theory (AGCT), held at the Centre International de Rencontres Mathématiques in Marseille, France, from May 18–22, 2015.

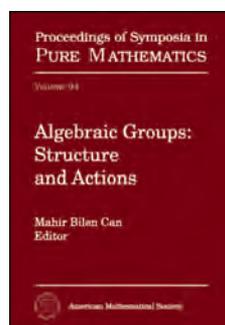
Since the first meeting almost 30 years ago, the biennial AGCT meetings have been one of the main events bringing together researchers interested in explicit aspects of arithmetic geometry and applications to coding theory and cryptography. This volume contains original research articles reflecting recent developments in the field.

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

**Contents:** **N. Anbar**, **P. Beelen**, and **N. Nguyen**, The exact limit of some cubic towers; **S. Dib** and **F. Rodier**, Error-correction capability of Reed-Muller codes; **Y. Aubry** and **A. Iezzi**, Optimal and maximal singular curves; **E. Férard**, An infinite class of Kasami functions that are not APN infinitely often; **R. Lercier** and **M. Olive**, Covariant algebra of the binary nonic and the binary decimic; **S. Ballet**, **J. Peltant**, **M. Rambaud**, and **J. Sijsling**, On some bounds for symmetric tensor rank of multiplication in finite fields; **S. Haloui**, Codes from Jacobian surfaces; **E. Nart** and **C. Ritzenthaler**, A new proof of a Thomae-like formula for non hyperelliptic genus 3 curves; **M. Datta** and **S. R. Ghorpade**, Remarks on the Tsfasman-Boguslavsky Conjecture and higher weights of projective Reed-Muller codes; **J. P. Hansen**, Secret sharing schemes with strong multiplication and a large number of players from toric varieties; **V. Vitse**, Field extensions and index calculus on algebraic curves.

**Contemporary Mathematics**, Volume 686

April 2017, approximately 196 pages, Softcover, ISBN: 978-1-4704-2810-5, 2010 *Mathematics Subject Classification*: 11T71, 11G20, 11G25, 14G15, 14H40, 94A60, 94B27, **AMS members US\$88.80**, List US\$111, Order code CONM/686



### Algebraic Groups: Structure and Actions

**Mahir Bilen Can**, *Tulane University, New Orleans, LA*, Editor

This volume contains the proceedings of the 2015 Clifford Lectures on Algebraic Groups: Structures and Actions, held from March 2–5, 2015, at Tulane University, New Orleans, Louisiana.

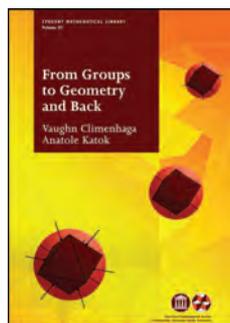
This volume consists of six articles on algebraic groups, including an enhanced exposition of the classical results of Chevalley and Rosenlicht on the structure of algebraic groups; an enhanced survey of the recently developed theory of pseudo-reductive groups; and an exposition of the recently developed operational  $K$ -theory for singular varieties. In addition, there are three research articles containing previously unpublished foundational results on birational automorphism groups of algebraic varieties; solution of Hermite-Joubert problem over  $p$ -closed fields; and cohomological invariants and applications to classifying spaces.

The old and new results presented in these articles will hopefully become cornerstones for the future development of the theory of algebraic groups and applications. Graduate students and researchers working in the fields of algebraic geometry, number theory, and representation theory will benefit from this unique and broad compilation of fundamental results on algebraic group theory.

**Contents:** **D. Anderson**, Computing torus-equivariant  $K$ -theory of singular varieties; **J. Blanc**, Algebraic structures of groups of birational transformations; **M. Brassil** and **Z. Reichstein**, The Hermite-Joubert problem over  $p$ -closed fields; **M. Brion**, Some structure theorems for algebraic groups; **B. Conrad** and **G. Prasad**, Structure and classification of pseudo-reductive groups; **A. S. Merkurjev**, Invariants of algebraic groups and retract rationality of classifying spaces.

**Proceedings of Symposia in Pure Mathematics**, Volume 94

April 2017, 294 pages, Hardcover, ISBN: 978-1-4704-2601-9, LC 2016021970, 2010 *Mathematics Subject Classification*: 12F10, 14C15, 14C35, 14C40, 14E07, 14E08, 14J70, 14L15, 14L30, 14M17, 14M25, 20G15, **AMS members US\$100.80**, List US\$126, Order code PSPUM/94



## From Groups to Geometry and Back

Vaughn Climenhaga, *University of Houston, TX*, and Anatole Katok, *Pennsylvania State University, University Park, PA*

Groups arise naturally as symmetries of geometric objects, and so groups can be used to understand geometry and topology. Conversely, one can study

abstract groups by using geometric techniques and ultimately by treating groups themselves as geometric objects. This book explores these connections between group theory and geometry, introducing some of the main ideas of transformation groups, algebraic topology, and geometric group theory.

The first half of the book introduces basic notions of group theory and studies symmetry groups in various geometries, including Euclidean, projective, and hyperbolic. The classification of Euclidean isometries leads to results on regular polyhedra and polytopes; the study of symmetry groups using matrices leads to Lie groups and Lie algebras.

The second half of the book explores ideas from algebraic topology and geometric group theory. The fundamental group appears as yet another group associated to a geometric object and turns out to be a symmetry group using covering spaces and deck transformations. In the other direction, Cayley graphs, planar models, and fundamental domains appear as geometric objects associated to groups. The final chapter discusses groups themselves as geometric objects, including a gentle introduction to Gromov's theorem on polynomial growth and Grigorchuk's example of intermediate growth.

The book is accessible to undergraduate students (and anyone else) with a background in calculus, linear algebra, and basic real analysis, including topological notions of convergence and connectedness.

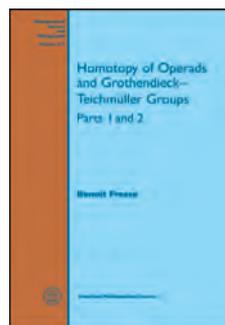
This book is a result of the MASS course in algebra at Penn State University in the fall semester of 2009.

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

**Contents:** Elements of group theory; Symmetry in the Euclidean world; Groups of isometries of planar and spatial objects; Groups of matrices: Linear algebra and symmetry in various geometries; Fundamental group: A different kind of group associated to geometric objects; From groups to geometric objects and back; Groups at large scale; Hints to selected exercises; Suggestions for projects and further reading; Bibliography; Index.

**Student Mathematical Library**, Volume 81

May 2017, approximately 433 pages, Softcover, ISBN: 978-1-4704-3479-3, LC 2016043600, 2010 *Mathematics Subject Classification*: 20-01, 51-01; 20F65, 22E40, 22F50, 51M05, 51M10, 54H15, 57M10, 57M60, **All Individuals US\$46.40**, List US\$58, Institutional member US\$46.40, Order code STML/81



## Homotopy of Operads and Grothendieck-Teichmüller Groups

Parts 1 and 2

Benoit Fresse, *Université de Lille 1, Villeneuve d'Ascq, France*

The Grothendieck-Teichmüller group was defined by Drinfeld in quantum group theory with insights coming from the Grothendieck program in Galois theory. The ultimate goal of this book set is to explain that this group has a topological interpretation as a group of homotopy automorphisms associated to the operad of little 2-discs, which is an object used to model commutative homotopy structures in topology.

The first part of this two-part set gives a comprehensive survey on the algebraic aspects of this subject. The book explains the definition of an operad in a general context, reviews the definition of the little discs operads, and explains the definition of the Grothendieck-Teichmüller group from the viewpoint of the theory of operads. In the course of this study, the relationship between the little discs operads and the definition of universal operations associated to braided monoidal category structures is explained. Also provided is a comprehensive and self-contained survey of the applications of Hopf algebras to the definition of a rationalization process, the Malcev completion, for groups and groupoids.

Most definitions are carefully reviewed in the book; it requires minimal prerequisites to be accessible to a broad readership of graduate students and researchers interested in the applications of operads.

The ultimate goal of the second part of the book is to explain that the Grothendieck-Teichmüller group, as defined by Drinfeld in quantum group theory, has a topological interpretation as a group of homotopy automorphisms associated to the little 2-disc operad. To establish this result, the applications of methods of algebraic topology to operads must be developed. This volume is devoted primarily to this subject, with the main objective of developing a rational homotopy theory for operads.

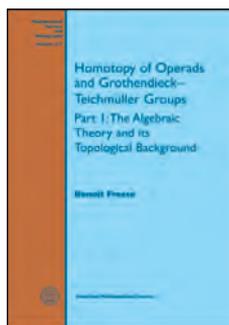
The book starts with a comprehensive review of the general theory of model categories and of general methods of homotopy theory. The definition of the Sullivan model for the rational homotopy of spaces is revisited, and the definition of models for the rational homotopy of operads is then explained. The applications of spectral sequence methods to compute homotopy automorphism spaces associated to operads are also explained. This approach is used to get a topological interpretation of the Grothendieck-Teichmüller group in the case of the little 2-disc operad.

This volume is intended for graduate students and researchers interested in the applications of homotopy theory methods in operad theory. It is accessible to readers with a minimal background in classical algebraic topology and operad theory.

*Each volume in this set is sold separately. For a description of each volume, see the New Publication entries that follow.*

**Mathematical Surveys and Monographs**, Volume 217

**Set:** May 2017, approximately 1278 pages, Hardcover, ISBN: 978-1-4704-3480-9, LC 2016032055, 2010 *Mathematics Subject Classification*: 55P48, 18G55, 55P10, 55P62, 57T05, 20B27, 20F36, **AMS members US\$200**, List US\$250, Order code SURV/217



## Homotopy of Operads and Grothendieck–Teichmüller Groups

Part 1: The Algebraic Theory and its Topological Background

Benoit Fresse, *Université de Lille 1, Villeneuve d'Ascq, France*

The Grothendieck–Teichmüller group was defined by Drinfeld in quantum group theory with insights coming from the Grothendieck program in Galois theory. The ultimate goal of this book is to explain that this group has a topological interpretation as a group of homotopy automorphisms associated to the operad of little 2-discs, which is an object used to model commutative homotopy structures in topology.

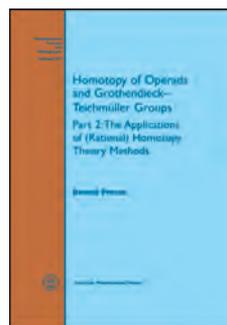
This volume gives a comprehensive survey on the algebraic aspects of this subject. The book explains the definition of an operad in a general context, reviews the definition of the little discs operads, and explains the definition of the Grothendieck–Teichmüller group from the viewpoint of the theory of operads. In the course of this study, the relationship between the little discs operads and the definition of universal operations associated to braided monoidal category structures is explained. Also provided is a comprehensive and self-contained survey of the applications of Hopf algebras to the definition of a rationalization process, the Malcev completion, for groups and groupoids.

Most definitions are carefully reviewed in the book; it requires minimal prerequisites to be accessible to a broad readership of graduate students and researchers interested in the applications of operads.

**Contents:** *From operads to Grothendieck–Teichmüller groups. The general theory of operads:* The basic concepts of the theory of operads; The definition of operadic composition structures revisited; Symmetric monoidal categories and operads; *Braids and  $E_n$ -operads:* The little discs model of  $E_n$ -operads; Braids and the recognition of  $E_2$ -operads; The magma and parenthesized braid operators; *Hopf algebras and the Malcev completion:* Hopf algebras; The Malcev completion for groups; The Malcev completion for groupoids and operads; *The operadic definition of the Grothendieck–Teichmüller group:* The Malcev completion of the braid operads and Drinfeld's associators; The Grothendieck–Teichmüller group; A glimpse at the Grothendieck program; *Appendices:* Trees and the construction of free operads; The cotriple resolution of operads; Glossary of notation; Bibliography; Index.

**Mathematical Surveys and Monographs**, Volume 217

May 2017, approximately 563 pages, Hardcover, ISBN: 978-1-4704-3481-6, LC 2016032055, 2010 *Mathematics Subject Classification:* 55P48; 18G55, 55P10, 55P62, 57T05, 20B27, 20F36, **AMS members US\$108**, List US\$135, Order code SURV/217.1



## Homotopy of Operads and Grothendieck–Teichmüller Groups

Part 2: The Applications of (Rational) Homotopy Theory Methods

Benoit Fresse, *Université de Lille 1, Villeneuve d'Ascq, France*

The ultimate goal of this book is to explain that the Grothendieck–Teichmüller group, as defined by Drinfeld in quantum group theory, has a topological interpretation as a group of homotopy automorphisms associated to the little 2-disc operad. To establish this result, the applications of methods of algebraic topology to operads must be developed. This volume is devoted primarily to this subject, with the main objective of developing a rational homotopy theory for operads.

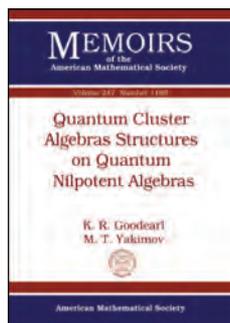
The book starts with a comprehensive review of the general theory of model categories and of general methods of homotopy theory. The definition of the Sullivan model for the rational homotopy of spaces is revisited, and the definition of models for the rational homotopy of operads is then explained. The applications of spectral sequence methods to compute homotopy automorphism spaces associated to operads are also explained. This approach is used to get a topological interpretation of the Grothendieck–Teichmüller group in the case of the little 2-disc operad.

This volume is intended for graduate students and researchers interested in the applications of homotopy theory methods in operad theory. It is accessible to readers with a minimal background in classical algebraic topology and operad theory.

**Contents:** *Homotopy theory and its applications to operads. General methods of homotopy theory:* Model categories and homotopy theory; Mapping spaces and simplicial model categories; Simplicial structures and mapping spaces in general model categories; Cofibrantly generated model categories; *Modules, algebras, and the rational homotopy of spaces:* Differential graded modules, simplicial modules, and cosimplicial modules; Differential graded algebras, simplicial algebras, and cosimplicial algebras; Models for the rational homotopy of spaces; *The (rational) homotopy of operads:* The model category of operads in simplicial sets; The homotopy theory of (Hopf) cooperads; Models for the rational homotopy of (non-unitary) operads; The homotopy theory of (Hopf)  $\Lambda$ -cooperads; Models for the rational homotopy of unitary operads; *Applications of the rational homotopy to  $E_n$ -operads:* Complete Lie algebras and rational models of classifying spaces; Formality and rational models of  $E_n$ -operads; *The computation of homotopy automorphism spaces of operads:* Introduction to the results of the computations for the  $E_n$ -operads; *The applications of homotopy spectral sequences:* Homotopy spectral sequences and mapping spaces of operads; Applications of the cotriple cohomology of operads; Applications of the Koszul duality of operads; *The case of  $E_n$ -operads:* The applications of the Koszul duality for  $E_n$ -operads; The interpretation of the result of the spectral sequence in the case of  $E_2$ -operads; *Conclusion: A survey of further research on operadic mapping spaces and their applications:* Graph complexes and  $E_n$ -operads; From  $E_n$ -operads to embedding spaces; *Appendices:* Cofree cooperads and the bar duality of operads; Glossary of notation; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 217

May 2017, approximately 715 pages, Hardcover, ISBN: 978-1-4704-3482-3, LC 2016032055, 2010 *Mathematics Subject Classification*: 55P48; 18G55, 55P10, 55P62, 57T05, 20B27, 20F36, **AMS members US\$108**, List US\$135, Order code SURV/217.2



## Quantum Cluster Algebras Structures on Quantum Nilpotent Algebras

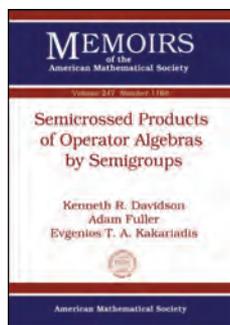
**K. R. Goodearl**, *University of California, Santa Barbara*, and **M. T. Yakimov**, *Louisiana State University, Baton Rouge*

**Contents:** Introduction; Quantum cluster algebras; Iterated skew polynomial algebras and noncommutative UFDs; One-step mutations in CGL extensions; Homogeneous prime elements for subalgebras of symmetric CGL extensions; Chains of mutations in symmetric CGL extensions; Division properties of mutations between CGL extension presentations; Symmetric CGL extensions and quantum cluster algebras; Quantum groups and quantum Schubert cell algebras; Quantum cluster algebra structures on quantum Schubert cell algebras; Bibliography; Index.

**Memoirs of the American Mathematical Society**, Volume 247, Number 1169

April 2017, 119 pages, Softcover, ISBN: 978-1-4704-3694-0, 2010 *Mathematics Subject Classification*: 16T20; 13F60, 17B37, 14M15, **Individual member US\$45**, List US\$75, Institutional member US\$60, Order code MEMO/247/1169

## Analysis



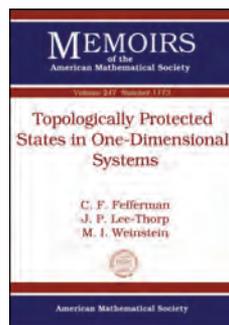
## Semicrossed Products of Operator Algebras by Semigroups

**Kenneth R. Davidson**, *University of Waterloo, ON, Canada*, **Adam Fuller**, *Ohio University, Athens*, and **Evgenios T. A. Kakariadis**, *Newcastle University, Newcastle upon Tyne, UK*

**Contents:** Introduction; Preliminaries; Semicrossed products by abelian semigroups; Nica-covariant semicrossed products; Semicrossed products by non-abelian semigroups; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 247, Number 1168

April 2017, 97 pages, Softcover, ISBN: 978-1-4704-2309-4, 2010 *Mathematics Subject Classification*: 47A20, 47L25, 47L65, 46L07, **Individual member US\$45**, List US\$75, Institutional member US\$60, Order code MEMO/247/1168



## Topologically Protected States in One-Dimensional Systems

**C. F. Fefferman**, *Princeton University, New Jersey*, **J. P. Lee-Thorp**, *Columbia University, New York, NY*, and **M. I. Weinstein**, *Columbia University, New York, NY*

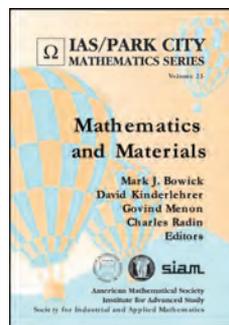
*This item will also be of interest to those working in mathematical physics.*

**Contents:** Introduction and outline; Floquet-Bloch and Fourier analysis; Dirac points of 1D periodic structures; Domain wall modulated periodic Hamiltonian and formal derivation of topologically protected bound states; Main Theorem—Bifurcation of topologically protected states; Proof of the Main Theorem; Appendix A. A variant of Poisson summation; Appendix B. 1D Dirac points and Floquet-Bloch eigenfunctions; Appendix C. Dirac points for small amplitude potentials; Appendix D. Genericity of Dirac points - 1D and 2D cases; Appendix E. Degeneracy lifting at Quasi-momentum zero; Appendix F. Gap opening due to breaking of inversion symmetry; Appendix G. Bounds on leading order terms in multiple scale expansion; Appendix H. Derivation of key bounds and limiting relations in the Lyapunov-Schmidt reduction; References.

**Memoirs of the American Mathematical Society**, Volume 247, Number 1173

April 2017, 118 pages, Softcover, ISBN: 978-1-4704-2323-0, **Individual member US\$45**, List US\$75, Institutional member US\$60, Order code MEMO/247/1173

## Applications



## Mathematics and Materials

**Mark J. Bowick**, *Syracuse University, NY*, **David Kinderlehrer**, *Carnegie Mellon University, Pittsburgh, PA*, **Govind Menon**, *Brown University, Providence, RI*, and **Charles Radin**, *University of Texas at Austin, TX*, Editors

Articles in this volume are based on lectures presented at the Park City summer school on “Mathematics and Materials” in July 2014. The central theme is a description of material behavior that is rooted in statistical mechanics. While many presentations of mathematical problems in materials science begin with continuum mechanics, this volume takes an alternate approach. All the lectures present unique pedagogical introductions to the rich variety of material behavior that emerges from the interplay

of geometry and statistical mechanics. The topics include the order-disorder transition in many geometric models of materials including nonlinear elasticity, sphere packings, granular materials, liquid crystals, and the emerging field of synthetic self-assembly. Several lectures touch on discrete geometry (especially packing) and statistical mechanics.

The problems discussed in this book have an immediate mathematical appeal and are of increasing importance in applications, but are not as widely known as they should be to mathematicians interested in materials science. The volume will be of interest to graduate students and researchers in analysis and partial differential equations, continuum mechanics, condensed matter physics, discrete geometry, and mathematical physics.

*This volume is a co-publication of the AMS, IAS/Park City Mathematics Institute, and Society for Industrial and Applied Mathematics (SIAM).*

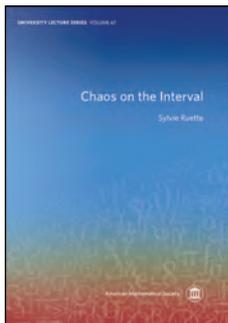
Titles in this series are co-published with the Institute for Advanced Study/Park City Mathematics Institute. Members of the Mathematical Association of America (MAA) and the National Council of Teachers of Mathematics (NCTM) receive a 20% discount from list price. *NOTE: This discount does not apply to volumes in this series co-published with the Society for Industrial and Applied Mathematics (SIAM).*

**Contents:** V. Elser, Three lectures on statistical mechanics; H. Cohn, Packing, coding, and ground states; A. A. Lee and D. Frenkel, Entropy, probability and packing; M. P. Brenner, Ideas about self assembly; P. Palfy-Muhoray, M. V. Pevnyi, E. G. Virga, and X. Zheng, The effects of particle shape in orientationally ordered soft materials; R. Kotecký, Statistical mechanics and nonlinear elasticity; P. Bella, A. Giunti, and F. Otto, Quantitative stochastic homogenization: Local control of homogenization error through corrector.

IAS/Park City Mathematics Series, Volume 23

May 2017, approximately 354 pages, Hardcover, ISBN: 978-1-4704-2919-5, LC 2016030010, 2010 *Mathematics Subject Classification*: 82B05, 35Q70, 82B26, 74N05, 51P05, 52C17, 52C23, **AMS members US\$83.20**, List US\$104, Order code PCMS/23

## Differential Equations



### Chaos on the Interval

Sylvie Ruelle, *Université Paris-Sud, Orsay, France*

The aim of this book is to survey the relations between the various kinds of chaos and related notions for continuous interval maps from a topological point of view. The papers on this topic are numerous and widely scattered in the literature; some of them are little known, difficult to find, or originally published in

Russian, Ukrainian, or Chinese. Dynamical systems given by the iteration of a continuous map on an interval have been broadly studied because they are simple but nevertheless exhibit complex behaviors. They also allow numerical simulations, which enabled the discovery of some chaotic phenomena. Moreover, the “most interesting” part of some higher-dimensional systems can be of

lower dimension, which allows, in some cases, boiling it down to systems in dimension one.

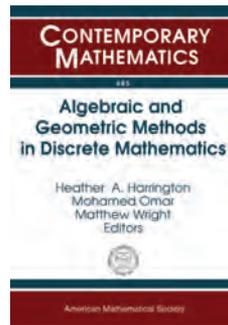
Some of the more recent developments such as distributional chaos, the relation between entropy and Li-Yorke chaos, sequence entropy, and maps with infinitely many branches are presented in book form for the first time. The author gives complete proofs and addresses both graduate students and researchers.

**Contents:** Notation and basic tools; Links between transitivity, mixing and sensitivity; Periodic points; Topological entropy; Chaos in the sense of Li-Yorke, scrambled sets; Other notions related to Li-Yorke pairs: Generic and dense chaos, distributional chaos; Chaotic subsystems; Appendix: Some background in topology; Bibliography; Notation; Index.

University Lecture Series, Volume 67

April 2017, 215 pages, Softcover, ISBN: 978-1-4704-2956-0, LC 2016042280, 2010 *Mathematics Subject Classification*: 37E05, **AMS members US\$43.20**, List US\$54, Order code ULECT/67

## Discrete Mathematics and Combinatorics



### Algebraic and Geometric Methods in Discrete Mathematics

Heather A. Harrington, *University of Oxford, United Kingdom*, Mohamed Omar, *Harvey Mudd College, Claremont, CA*, and Matthew Wright, *St. Olaf College, Northfield, MN*, Editors

This volume contains the proceedings of the AMS Special Session on Algebraic and Geometric Methods in Applied Discrete Mathematics, held on January 11, 2015, in San Antonio, Texas.

The papers present connections between techniques from “pure” mathematics and various applications amenable to the analysis of discrete models, encompassing applications of combinatorics, topology, algebra, geometry, optimization, and representation theory. Papers not only present novel results, but also survey the current state of knowledge of important topics in applied discrete mathematics.

Particular highlights include: a new computational framework, based on geometric combinatorics, for structure prediction from RNA sequences; a new method for approximating the optimal solution of a sum of squares problem; a survey of recent Helly-type geometric theorems; applications of representation theory to voting theory and game theory; a study of fixed points of tensors; and exponential random graph models from the perspective of algebraic statistics with applications to networks.

This volume was written for those trained in areas such as algebra, topology, geometry, and combinatorics who are interested in tackling problems in fields such as biology, the social sciences, data analysis, and optimization. It may be useful not only for experts, but also for students who wish to gain an applied or interdisciplinary perspective.

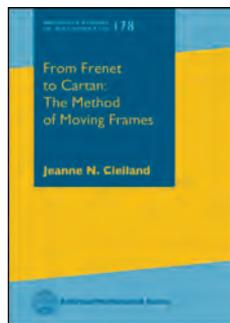
This item will also be of interest to those working in applications.

**Contents:** H. Abo, A. Seigal, and B. Sturmfels, Eigenconfigurations of tensors; A. A. Ahmadi and G. Hall, Sum of squares basis pursuit with linear and second order cone programming; N. Amenta, J. A. De Loera, and P. Soberón, Helly's theorem: New variations and applications; K.-D. Crisman and M. E. Orrison, Representation theory of the symmetric group in voting theory and game theory; R. Davidson, J. Rusinko, Z. Vernon, and J. Xi, Modeling the distribution of distance data in Euclidean space; E. Drellich, A. Gainer-Dewar, H. A. Harrington, Q. He, C. Heitsch, and S. Poznanović, Geometric combinatorics and computational molecular biology: Branching polytopes for RNA sequences; D. Haws, J. Cussens, and M. Studený, Polyhedral approaches to learning Bayesian networks; C. J. Hillar and S. E. Marzen, Neural network coding of natural images with applications to pure mathematics; B. Kuture, O. Leong, C. Loa, M. Sondjaja, and F. E. Su, Proving Tucker's Lemma with a volume argument; C. O'Neill and R. Pelayo, Factorization invariants in numerical monoids; S. Petrović, A survey of discrete methods in (algebraic) statistics for networks.

Contemporary Mathematics, Volume 685

April 2017, 278 pages, Softcover, ISBN: 978-1-4704-2321-6, LC 2016042006, 2010 *Mathematics Subject Classification:* 00B20, 13P25, 20C30, 46N30, 51D20, 52B05, 62-07, 62P10, 65C60, 91B12, AMS members US\$88.80, List US\$111, Order code CONM/685

## Geometry and Topology



### From Frenet to Cartan: The Method of Moving Frames

Jeanne N. Clelland, *University of Colorado, Boulder, CO*

The method of moving frames originated in the early nineteenth century with the notion of the Frenet frame along a curve in Euclidean space. Later, Darboux

expanded this idea to the study of surfaces. The method was brought to its full power in the early twentieth century by Elie Cartan, and its development continues today with the work of Fels, Olver, and others.

This book is an introduction to the method of moving frames as developed by Cartan, at a level suitable for beginning graduate students familiar with the geometry of curves and surfaces in Euclidean space. The main focus is on the use of this method to compute local geometric invariants for curves and surfaces in various 3-dimensional homogeneous spaces, including Euclidean, Minkowski, equi-affine, and projective spaces. Later chapters include applications to several classical problems in differential geometry, as well as an introduction to the nonhomogeneous case via moving frames on Riemannian manifolds.

The book is written in a reader-friendly style, building on already familiar concepts from curves and surfaces in Euclidean space. A special feature of this book is the inclusion of detailed guidance regarding the use of the computer algebra system Maple® to perform many of the computations involved in the exercises.

An excellent and unique graduate level exposition of the differential geometry of curves, surfaces and higher-dimensional submanifolds of homogeneous spaces based on the powerful and elegant method of moving frames. The treatment is self-contained and illustrated through a large number of examples and exercises, augmented by Maple code to assist in both concrete calculations and plotting. Highly recommended.

—Niky Kamran, *McGill University*

The method of moving frames has seen a tremendous explosion of research activity in recent years, expanding into many new areas of applications, from computer vision to the calculus of variations to geometric partial differential equations to geometric numerical integration schemes to classical invariant theory to integrable systems to infinite-dimensional Lie pseudo-groups and beyond. Cartan theory remains a touchstone in modern differential geometry, and Clelland's book provides a fine new introduction that includes both classic and contemporary geometric developments and is supplemented by Maple symbolic software routines that enable the reader to both tackle the exercises and delve further into this fascinating and important field of contemporary mathematics.

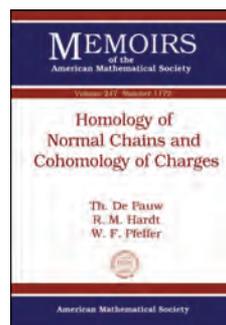
Recommended for students and researchers wishing to expand their geometric horizons.

—Peter Olver, *University of Minnesota*

**Contents:** Background material: Assorted notions from differential geometry; Differential forms; Curves and surfaces in homogeneous spaces via the method of moving frames: Homogeneous spaces; Curves and surfaces in Euclidean space; Curves and surfaces in Minkowski space; Curves and surfaces in equi-affine space; Curves and surfaces in projective space; Applications of moving frames: Minimal surfaces in  $\mathbb{E}^3$  and  $\mathbb{A}^3$ ; Pseudospherical surfaces in Bäcklund's theorem; Two classical theorems; Beyond the flat case: Moving frames on Riemannian manifolds: Curves and surfaces in elliptic and hyperbolic spaces; The nonhomogeneous case: Moving frames on Riemannian manifolds; Bibliography; Index.

Graduate Studies in Mathematics, Volume 178

April 2017, 414 pages, Hardcover, ISBN: 978-1-4704-2952-2, LC 2016041073, 2010 *Mathematics Subject Classification:* 22F30, 53A04, 53A05, 53A15, 53A20, 53A55, 53B25, 53B30, 58A10, 58A15, AMS members US\$58.40, List US\$73, Order code GSM/178



### Homology of Normal Chains and Cohomology of Charges

Th. De Pauw, *Université Denis Diderot, Paris, France*, R. M. Hardt, *Rice University, Houston, TX*, and W. F. Pfeffer, *University of California, Davis*

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

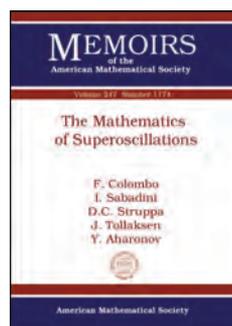
**Contents:** Introduction; Notation and preliminaries; Rectifiable chains; Lipschitz chains; Flat norm and flat chains; The lower semicontinuity of slicing mass; Supports of flat chains; Flat chains of finite mass; Supports of flat chains of finite mass;

Measures defined by flat chains of finite mass; Products; Flat chains in compact metric spaces; Localized topology; Homology and cohomology;  $q$ -bounded pairs; Dimension zero; Relation to the Čech cohomology; Locally compact spaces; References.

**Memoirs of the American Mathematical Society**, Volume 247, Number 1172

April 2017, 115 pages, Softcover, ISBN: 978-1-4704-2335-3, 2010 *Mathematics Subject Classification*: 49Q15, 55N35, **Individual member US\$45**, List US\$75, Institutional member US\$60, Order code MEMO/247/1172

## Mathematical Physics



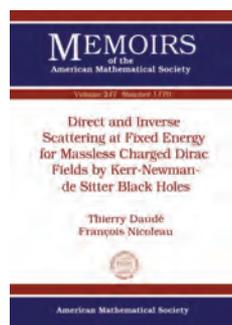
### The Mathematics of Superoscillations

**F. Colombo**, *Politecnico di Milano, Italy*, **I. Sabadini**, *Polytechnic Institute of Milan, Italy*, **D. C. Struppa**, *Chapman University, Orange, CA*, **J. Tollaksen**, *Chapman University, Orange, CA*, and **Y. Aharonov**, *Chapman University, Orange, CA*

**Contents:** Introduction; Physical motivations; Basic mathematical properties of superoscillating sequences; Function spaces of holomorphic functions with growth; Schrödinger equation and superoscillations; Superoscillating functions and convolution equations; Superoscillating functions and operators; Superoscillations in  $SO(3)$ ; Bibliography; Index.

**Memoirs of the American Mathematical Society**, Volume 247, Number 1174

April 2017, 107 pages, Softcover, ISBN: 978-1-4704-2324-7, **Individual member US\$45**, List US\$75, Institutional member US\$60, Order code MEMO/247/1174



### Direct and Inverse Scattering at Fixed Energy for Massless Charged Dirac Fields by Kerr-Newman-de Sitter Black Holes

**Thierry Daudé**, *Université de Cergy-Pontoise, France*, and **François Nicoleau**, *Université de Nantes, France*

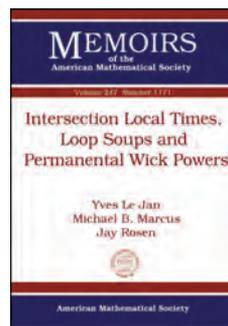
**Contents:** Introduction; Kerr-Newman-de-Sitter black holes; The massless charged Dirac equation; The direct scattering problem; Uniqueness results in the inverse scattering problem at fixed energy; The angular equation and partial inverse result; The radial equation: complexification of the angular momentum; Large  $z$

asymptotics of the scattering data; The inverse scattering problem; Appendix A. Growth estimate of the eigenvalues  $\mu_{kl}(\lambda)$ ; Appendix B. Limiting Absorption principles and scattering theory for  $H_0$  and  $H$ ; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 247, Number 1170

April 2017, 113 pages, Softcover, ISBN: 978-1-4704-2376-6, 2010 *Mathematics Subject Classification*: 81U40, 35P25; 58J50, **Individual member US\$45**, List US\$75, Institutional member US\$60, Order code MEMO/247/1170

## Probability and Statistics



### Intersection Local Times, Loop Soups and Permanent Wick Powers

**Yves Le Jan**, *Université Paris-Sud, Orsay, France*, **Michael B. Marcus**, *City College, CUNY, New York, NY*, and **Jay Rosen**, *College of Staten Island, CUNY, New York, NY*

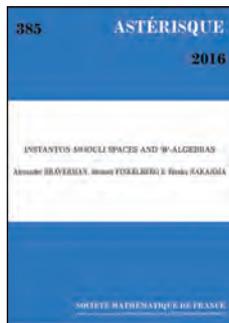
**Contents:** Introduction; Loop measures and renormalized intersection local times; Continuity of intersection local time processes; Loop soup and permanent chaos; Isomorphism Theorem I; Permanent Wick powers; Poisson chaos decomposition, I; Loop soup decomposition of permanent Wick powers; Poisson chaos decomposition, II; Convolutions of regularly varying functions; References.

**Memoirs of the American Mathematical Society**, Volume 247, Number 1171

April 2017, 78 pages, Softcover, ISBN: 978-1-4704-3695-7, 2010 *Mathematics Subject Classification*: 60K99, 60J55; 60G17, **Individual member US\$45**, List US\$75, Institutional member US\$60, Order code MEMO/247/1171

# New AMS-Distributed Publications

## Algebra and Algebraic Geometry



### Instanton Moduli Spaces and $W$ -Algebras

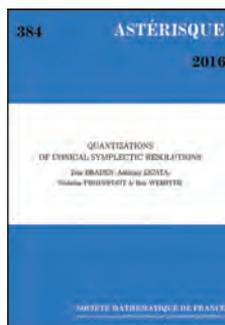
**Alexander Braverman**, *Brown University, Providence, RI, and University of Toronto and Perimeter Institute of Theoretical Physics, Waterloo, Ontario, Canada*, **Michael Finkelberg**, *National Research University Higher School of Economics, Moscow, Russia*, and **Hiraku Nakajima**, *Kyoto University, Japan*

The authors describe the (equivariant) intersection cohomology of certain moduli spaces (“framed Uhlenbeck spaces”) together with some structures on them (e.g., the Poincaré pairing) in terms of representation theory of some vertex operator algebras ( $W$ -algebras”).

A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

**Astérisque**, Number 385

December 2016, 128 pages, Softcover, ISBN: 978-2-85629-848-0, 2010 *Mathematics Subject Classification*: 14C05, 14D21, 14J60, **AMS members US\$41.60**, List US\$52, Order code AST/385



### Quantizations of Conical Symplectic Resolutions

**Tom Braden**, *University of Massachusetts, Amherst, MA*, **Anthony Licata**, *Australian National University, Canberra, Australia*, **Nicholas Proudfoot**, *University of Oregon, Eugene, OR*, and **Ben Webster**, *University of Virginia, Charlottesville, VA*

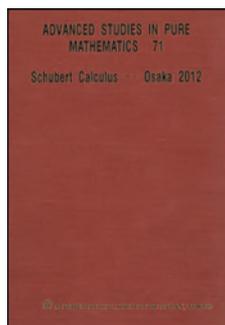
The authors re-examine some topics in representation theory of Lie algebras and Springer theory in a more general context, viewing the universal enveloping algebra as an example of the section ring of a quantization of a conical symplectic resolution. Many familiar features from the classical theory survive, including analogues of Beilinson-Bernstein localization and Bernstein-Gelfand-Gelfand category  $\mathcal{O}$ .

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

A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

**Astérisque**, Number 384

December 2016, 179 pages, Softcover, ISBN: 978-2-85629-845-9, 2010 *Mathematics Subject Classification*: 53D55, 16G99, 14M99, 17B10, **AMS members US\$48**, List US\$60, Order code AST/384



### Schubert Calculus Osaka 2012

**Hiroshi Naruse**, *University of Yamanashi, Japan*, **Takeshi Ikeda**, *Okayama University of Science, Japan*, **Mikiya Masuda**, *Osaka City University, Japan*, and **Toshiyuki Tanisaki**, *Osaka City University, Japan*, Editors

This volume contains the proceedings of the 5th MSJ Seasonal Institute on Schubert Calculus, held at Osaka City University, from September 17–27, 2012. It is recommended for all researchers and graduate students who are interested in Schubert calculus and its many connections and applications to related areas of mathematics, such as geometric representation theory, combinatorial aspects of algebraic varieties arising in Lie theory, and equivariant topology.

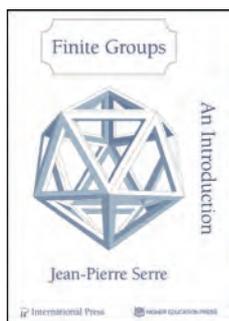
Alain Lascoux, one of the pioneers of modern Schubert calculus and a contributor to this volume, passed away during the time of the editing process of the proceedings. This volume is dedicated to him.

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

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

Advanced Studies in Pure Mathematics, Volume 71

December 2016, 518 pages, Hardcover, ISBN: 978-4-86497-038-9, 2010 *Mathematics Subject Classification*: 14N15; 05E05, 05E10, 20G05, **AMS members US\$123.20**, List US\$154, Order code ASPM/71



## Finite Groups: An Introduction

Jean-Pierre Serre, *College of France, Paris, France*

This is a hardcover version—with some revisions—of a previously distributed book (INPR/99, ISBN: 978-1-57146-320-3).

Finite group theory is remarkable for the simplicity of its statements—and the difficulty of their proofs. It is essential in several branches of mathematics, notably number theory.

This book is a short introduction to the subject, written both for beginners and for mathematicians at large. There are ten chapters. Each chapter is followed by a series of exercises.

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

**International Press of Boston, Inc.**

December 2016, 190 pages, Hardcover, ISBN: 978-1-57146-327-2, 2010 *Mathematics Subject Classification*: 20-XX; 20-01, **AMS members US\$63.20**, List US\$79, Order code INPR/100

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Mathematical Modelling Workshop at School of Mathematics, University of Nairobi, Kenya, February 2015. Photo by Arthur Muchela

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