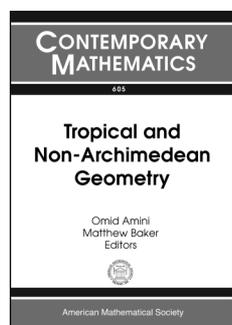


# New Publications Offered by the AMS

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## Algebra and Algebraic Geometry



### Tropical and Non-Archimedean Geometry

Omid Amini, *École Normale Supérieure, Paris, France*, Matthew Baker, *Georgia Institute of Technology, Atlanta, GA*, and Xander Faber, *University of Hawaii at Manoa, Honolulu, HI*, Editors

Over the past decade, it has become apparent that tropical geometry and non-Archimedean geometry should be studied in tandem; each subject has a great deal to say about the other.

This volume is a collection of articles dedicated to one or both of these disciplines. Some of the articles are based, at least in part, on the authors' lectures at the 2011 Bellairs Workshop in Number Theory, held from May 6–13, 2011, at the Bellairs Research Institute, Holetown, Barbados.

Lecture topics covered in this volume include polyhedral structures on tropical varieties, the structure theory of non-Archimedean curves (algebraic, analytic, tropical, and formal), uniformization theory for non-Archimedean curves and abelian varieties, and applications to Diophantine geometry. Additional articles selected for inclusion in this volume represent other facets of current research and illuminate connections between tropical geometry, non-Archimedean geometry, toric geometry, algebraic graph theory, and algorithmic aspects of systems of polynomial equations.

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

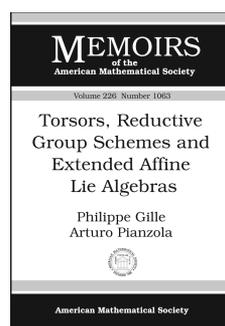
This book is co-published with the Centre de Recherches Mathématiques.

**Contents:** D. Maclagan, Polyhedral structures on tropical varieties; B. Osserman and J. Rabinoff, Lifting nonproper tropical intersections; K. Phillipson and J. M. Rojas, Fewnomial systems with many roots, and an adelic Tau conjecture; M. Nisse and F. Sottile, Non-Archimedean coamoebae; M. Baker, S. Payne, and J. Rabinoff, On the structure of non-Archimedean analytic curves; M. Papikian, Non-Archimedean uniformization and monodromy pairing; A. Chambert-Loir, Diophantine geometry and analytic spaces; F. Viviani, Tropicalizing vs. compactifying the Torelli

morphism; D. Perkinson, J. Perlman, and J. Wilmes, Primer for the algebraic geometry of sandpiles.

**Contemporary Mathematics**, Volume 605

January 2014, approximately 264 pages, Softcover, ISBN: 978-1-4704-1021-6, 2010 *Mathematics Subject Classification*: 14T05, 14G22, **AMS members US\$71.20**, List US\$89, Order code CONM/605



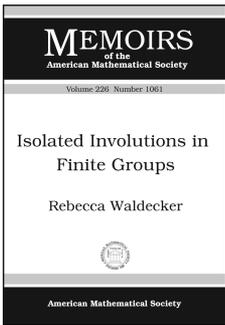
### Torsors, Reductive Group Schemes and Extended Affine Lie Algebras

Philippe Gille, *Ecole Normale Supérieure, Paris, France*, and Arturo Pianzola, *University of Alberta, Edmonton, Canada*

**Contents:** Introduction; Generalities on the algebraic fundamental group, torsors, and reductive group schemes; Loop, finite and toral torsors; Semilinear considerations; Maximal tori of group schemes over the punctured line; Internal characterization of loop torsors and applications; Isotropy of loop torsors; Acyclicity; Small dimensions; The case of orthogonal groups; Groups of type  $G_2$ ; Case of groups of type  $F_4$ ,  $E_8$  and simply connected  $E_7$  in nullity 3; The case of  $\mathrm{PGL}_d$ ; Invariants attached to EALAs and multiloop algebras; Appendix 1: Pseudo-parabolic subgroup schemes; Appendix 2: Global automorphisms of  $G$ -torsors over the projective line; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 226, Number 1063

October 2013, 112 pages, Softcover, ISBN: 978-0-8218-8774-5, LC 2013025512, 2010 *Mathematics Subject Classification*: 17B67, 11E72, 14L30, 14E20, **Individual member US\$43.80**, List US\$73, Institutional member US\$58.40, Order code MEMO/226/1063



## Isolated Involutions in Finite Groups

Rebecca Waldecker, *Martin-Luther-Universität Halle-Wittenberg, Germany*

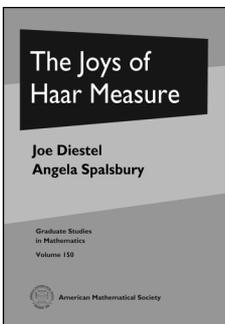
**Contents:** Introduction; Preliminaries; Isolated involutions; A minimal counter-example to Glauberman's  $Z^*$ -theorem; Balance and signalizer functors; Preparatory results for the

local analysis; Maximal subgroups containing  $C$ ; The 2-rank of  $O_{2',2}(C)$ ; Components of  $\bar{C}$  and the Soluble  $Z^*$ -theorem; Unbalanced components; The 2-rank of  $G$ ; The  $F^*$ -structure theorem; More involutions; The endgame; The final contradiction and the  $Z^*$ -theorem for  $\mathcal{K}_2$ -Groups; Bibliography; Index.

**Memoirs of the American Mathematical Society**, Volume 226, Number 1061

October 2013, 150 pages, Softcover, ISBN: 978-0-8218-8803-2, LC 2013025509, 2010 *Mathematics Subject Classification*: 20E25, 20E34, **Individual member US\$49.80**, List US\$83, Institutional member US\$66.40, Order code MEMO/226/1061

## Analysis



## The Joys of Haar Measure

Joe Diestel, *Kent State University, OH*, and Angela Spalsbury, *Youngstown State University, OH*

From the earliest days of measure theory, invariant measures have held the interests of geometers and analysts alike, with the Haar measure playing an especially delightful role. The aim of this book is to

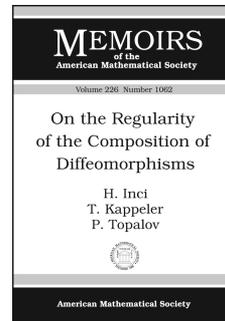
present invariant measures on topological groups, progressing from special cases to the more general. Presenting existence proofs in special cases, such as compact metrizable groups, highlights how the added assumptions give insight into just what the Haar measure is like; tools from different aspects of analysis and/or combinatorics demonstrate the diverse views afforded the subject. After presenting the compact case, applications indicate how these tools can find use. The generalization to locally compact groups is then presented and applied to show relations between metric and measure theoretic invariance. Steinlage's approach to the general problem of homogeneous action in the locally compact setting shows how Banach's approach and that of Cartan and Weil can be unified with good effect. Finally, the situation of a nonlocally compact Polish group is discussed briefly with the surprisingly unsettling consequences indicated.

The book is accessible to graduate and advanced undergraduate students who have been exposed to a basic course in real variables, although the authors do review the development of the Lebesgue measure. It will be a stimulating reference for students and professors who use the Haar measure in their studies and research.

**Contents:** Lebesgue measure in Euclidean space; Measures on metric spaces; Introduction to topological groups; Banach and measure; Compact groups have a Haar measure; Applications; Haar measure on locally compact groups; Metric invariance and Haar measure; Steinlage on Haar measure; Oxtoby's view of Haar measure; Appendix A; Appendix B; Bibliography; Author index; Subject index.

**Graduate Studies in Mathematics**, Volume 150

January 2014, approximately 327 pages, Hardcover, ISBN: 978-1-4704-0935-7, LC 2013027434, 2010 *Mathematics Subject Classification*: 28-XX, **AMS members US\$52**, List US\$65, Order code GSM/150



## On the Regularity of the Composition of Diffeomorphisms

H. Inci and T. Kappeler, *University of Zurich, Switzerland*, and P. Topalov, *Northeastern University, Boston, MA*

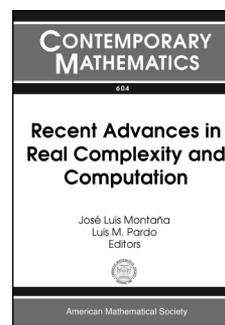
**Contents:** Introduction; Groups of diffeomorphisms on  $\mathbb{R}^n$ ; Diffeomorphisms

of a closed manifold; Differentiable structure of  $H^s(M, N)$ ; Appendix A; Appendix B; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 226, Number 1062

October 2013, 60 pages, Softcover, ISBN: 978-0-8218-8741-7, LC 2013025511, 2010 *Mathematics Subject Classification*: 58D17, 35Q31, 76N10, **Individual member US\$37.20**, List US\$62, Institutional member US\$49.60, Order code MEMO/226/1062

## Applications



## Recent Advances in Real Complexity and Computation

José Luis Montaña and Luis M. Pardo, *Universidad de Cantabria, Santander, Spain*, Editors

This volume is composed of six contributions derived from the lectures given during the UIMP-RSME Lluís Santaló

Summer School on "Recent Advances in Real Complexity and Computation", held July 16-20, 2012, in Santander, Spain.

The goal of this Summer School was to present some of the recent advances on Smale's 17th Problem: "Can a zero of  $n$  complex polynomial equations in  $n$  unknowns be found approximately, on the average, in polynomial time with a uniform algorithm?"

These papers cover several aspects of this problem: from numerical to symbolic methods in polynomial equation solving, computational complexity aspects (both worst and average cases and both upper and lower complexity bounds) as well as aspects of the underlying

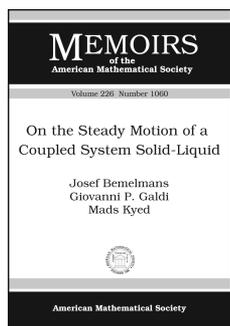
geometry of the problem. Some of the contributions also deal with either real or multiple solutions solving.

**Contents:** M. Baartse and K. Meer, Topics in real and complex number complexity theory; B. Bank, M. Giusti, and J. Heintz, Polar, bipolar and copolar varieties: Real solving and algebraic varieties with intrinsic complexity; C. Beltrán and M. Shub, The complexity and geometry of numerically solving polynomial systems; M. Giusti and J.-C. Yakoubsohn, Multiplicity hunting and approximating multiple roots of polynomials systems; J. Heintz, B. Kuijpers, and A. R. Paredes, On the intrinsic complexity of elimination problems in effective algebraic geometry; G. Malajovich, Newton iteration, conditioning and zero counting.

**Contemporary Mathematics**, Volume 604

January 2014, 185 pages, Softcover, ISBN: 978-0-8218-9150-6, LC 2013022512, 2010 *Mathematics Subject Classification*: 03D15, 14Qxx, 14Q20, 65-XX, 65H20, **AMS members US\$60.80**, List US\$76, Order code CONM/604

## Differential Equations



### On the Steady Motion of a Coupled System Solid-Liquid

**Josef Bemelmans**, *Rheinisch-Westfälische Technische Hochschule-Aachen, Germany*, **Giovanni P. Galdi**, *University of Pittsburgh, PA*, and **Mads Kyed**, *Technische Universität Darmstadt, Germany*

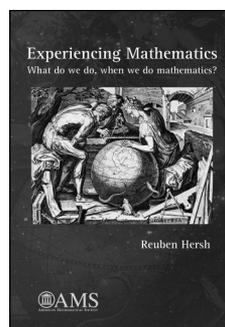
*This item will also be of interest to those working in mathematical physics.*

**Contents:** Introduction; Notation and preliminaries; Steady free motion: Definition and formulation of the problem; Main result; Approximating problem in bounded domains; Proof of main theorem; Bodies with symmetry; Appendix A. Isolated orientation; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 226, Number 1060

October 2013, 89 pages, Softcover, ISBN: 978-0-8218-8773-8, LC 2013025510, 2010 *Mathematics Subject Classification*: 35Q30, 76D05, 74B20, 74F10, 35R35, **Individual member US\$43.20**, List US\$72, Institutional member US\$57.60, Order code MEMO/226/1060

## General Interest



### Experiencing Mathematics

What do we do, when we do mathematics?

**Reuben Hersh**, *University of New Mexico, Albuquerque, NM*

Most mathematicians, when asked about the nature and meaning of mathematics, vacillate between the two unrealistic

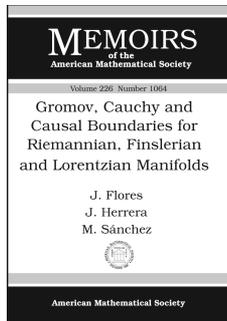
poles of Platonism and formalism. By looking carefully at what mathematicians really do when they are doing mathematics, Reuben Hersh offers an escape from this trap. This book of selected articles and essays provides an honest, coherent, and clearly understandable account of mathematicians' proof as it really is, and of the existence and reality of mathematical entities. It follows in the footsteps of Poincaré, Hadamard, and Polya. The pragmatism of John Dewey is a better fit for mathematical practice than the dominant "analytic philosophy". Dialogue, satire, and fantasy enliven the philosophical and methodological analysis.

Reuben Hersh has written extensively on mathematics, often from the point of view of a philosopher of science. His book with Philip Davis, *The Mathematical Experience*, won the National Book Award in science. Hersh is emeritus professor of mathematics at the University of New Mexico.

**Contents:** Overture; The ideal mathematician; Manifesto; Self-introduction; Mathematics has a front and a back; Chronology; References; *Mostly for the right hand*: Introduction to part 1; True facts about imaginary objects; Mathematical intuition (Poincaré, Polya, Dewey); To establish new mathematics, we use our mental models and build on established mathematics; How mathematicians convince each other or "The kingdom of math is within you"; On the interdisciplinary study of mathematical practice, with a real live case study; Wings, not foundations!; Inner vision, outer truth; Mathematical practice as a scientific problem; Proving is convincing and explaining; Fresh breezes in the philosophy of mathematics; Definition of mathematics; Introduction to "18 unconventional essays on the nature of mathematics"; *Mostly for the left hand*: Introduction to part 2; Rhetoric and mathematics; Math lingo vs. plain English: Double entendre; Independent thinking; The "origin" of geometry; The wedding; Mathematics and ethics; Ethics for mathematicians; Under-represented, then over-represented: A memoir of Jews in American mathematics; Paul Cohen and forcing in 1963; *Selected book reviews*: Introduction to part 3; Review of *Not exactly ... in praise of vagueness* by Kees van Deemter; Review of *How mathematicians think* by William Byers; Review of *The mathematician's brain* by David Ruelle; Review of *Perfect rigor* by Marsha Gessen; Review of *Letters to a young mathematician* by Ian Stewart; Review of *Number and numbers* by Alain Badiou; An amusing elementary example; Annotated research bibliography; Curriculum vitae; List of articles; Acknowledgments.

February 2014, approximately 257 pages, Softcover, ISBN: 978-0-8218-9420-0, LC 2013025483, 2010 *Mathematics Subject Classification*: 00A30, 00A35, 00B10, **AMS members US\$31.20**, List US\$39, Order code MBK/83

## Geometry and Topology



### Gromov, Cauchy and Causal Boundaries for Riemannian, Finslerian and Lorentzian Manifolds

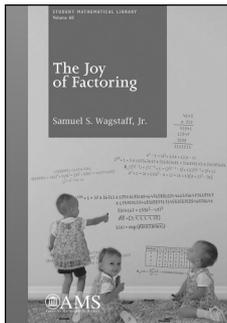
J. L. Flores and J. Herrera,  
*University of Malaga, Spain*, and  
M. Sánchez, *University of Granada, Spain*

**Contents:** Introduction; Preliminaries; Cauchy completion of a generalized metric space; Riemannian Gromov and Busemann completions; Finslerian completions; C-boundary of standard stationary spacetimes; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 226, Number 1064

October 2013, 76 pages, Softcover, ISBN: 978-0-8218-8775-2, LC 2013025504, 2010 *Mathematics Subject Classification*: 53C23, 53C50, 53C60, 83C75, **Individual member US\$41.40**, List US\$69, Institutional member US\$55.20, Order code MEMO/226/1064

## Number Theory



### The Joy of Factoring

Samuel S. Wagstaff, Jr., *Purdue University, West Lafayette, IN*

This book is about the theory and practice of integer factorization presented in a historic perspective. It describes about twenty algorithms for factoring and a dozen other number theory algorithms that support the factoring algorithms. Most algorithms are described both in words and in pseudocode to satisfy both number

theorists and computer scientists. Each of the ten chapters begins with a concise summary of its contents.

The book starts with a general explanation of why factoring integers is important. The next two chapters present number theory results that are relevant to factoring. Further on there is a chapter discussing, in particular, mechanical and electronic devices for factoring, as well as factoring using quantum physics and DNA molecules. Another chapter applies factoring to breaking certain cryptographic algorithms. Yet another chapter is devoted to practical vs. theoretical aspects of factoring. The book contains more than 100 examples illustrating various algorithms and theorems. It also contains more than 100 interesting exercises to test the reader's understanding. Hints or answers are given for about a third of the exercises. The book concludes with a dozen suggestions of possible new methods for factoring integers.

This book is written for readers who want to learn more about the best methods of factoring integers, many reasons for factoring, and some history of this fascinating subject. It can be read by anyone who has taken a first course in number theory.

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

**Contents:** Why factor integers?; Number theory review; Number theory relevant to factoring; How are factors used?; Simple factoring algorithms; Continued fractions; Elliptic curves; Sieve algorithms; Factoring devices; Theoretical and practical factoring; Answers and hints for exercises; Bibliography; Index.

**Student Mathematical Library**, Volume 68

November 2013, 293 pages, Softcover, ISBN: 978-1-4704-1048-3, LC 2013026680, 2010 *Mathematics Subject Classification*: 11A51, 11Y05, 11Y11, 11Y16; 11A25, 11A55, 11B68, 11N35, **AMS members US\$39.20**, List US\$49, Order code STML/68