New Publications Offered by the AMS

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Algebra and Algebraic Geometry

The Reductive Subgroups of $F_4$

David I. Stewart, New College, Oxford, United Kingdom

Contents: Introduction; Overview; General Theory; Reductive subgroups of $F_4$; Appendices; Bibliography.

Applications

Graph Partitioning and Graph Clustering

David A. Bader, Georgia Institute of Technology, Atlanta, GA, and Henning Meyerhenke, Peter Sanders, and Dorothea Wagner, Karlsruhe Institute of Technology, Germany, Editors

Graph partitioning and graph clustering are ubiquitous subtasks in many applications where graphs play an important role. Generally speaking, both techniques aim at the identification of vertex subsets with many internal and few external edges. To name only a few, problems addressed by graph partitioning and graph clustering algorithms are:

- What are the communities within an (online) social network?
- How do I speed up a numerical simulation by mapping it efficiently onto a parallel computer?
- How must components be organized on a computer chip such that they can communicate efficiently with each other?
- What are the segments of a digital image?
- Which functions are certain genes (most likely) responsible for?

The 10th DIMACS Implementation Challenge Workshop was devoted to determining realistic performance of algorithms where worst case analysis is overly pessimistic and probabilistic models are too unrealistic. Articles in the volume describe and analyze various experimental data with the goal of getting insight into realistic algorithm performance in situations where analysis fails. This item will also be of interest to those working in discrete mathematics and combinatorics.

Mathematics in Image Processing

Hongkai Zhao, University of California, Irvine, CA, Editor

The theme of the 2010 PCMI Summer School was Mathematics in Image Processing in a broad sense, including mathematical theory, analysis, computation algorithms and applications. In image processing, information needs to be processed, extracted and analyzed from visual content, such as photographs or videos. These demands include standard tasks such as compression and denoising, as well as high-level understanding and analysis, such as recognition and classification. Centered on the theme of mathematics in image processing, the summer school covered quite a wide spectrum of topics in this field. The summer school is particularly timely and exciting due to the very recent advances and developments in the mathematical theory and computational methods for sparse representation.

This volume collects three self-contained lecture series. The topics are multi-resolution based wavelet frames and applications to image processing, sparse and redundant representation modeling of images and simulation of elasticity, biomechanics, and virtual surgery. Recent advances in image processing, compressed sensing and sparse representation are discussed.

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

Contents: H. Zhao, Introduction; B. Dong and Z. Shen, MRA-based wavelet frames and applications; M. Elad, Five lectures on sparse and redundant representations modelling of images; J. M. Teran, J. L. Hellrung, Jr., and J. Hegemann, Simulation of elasticity, biomechanics, and virtual surgery.

IAS/Park City Mathematics Series, Volume 19


Global Regularity for the Yang-Mills Equations on High Dimensional Minkowski Space

Joachim Krieger, University of Pennsylvania, Philadelphia, PA, and Jacob Sterbenz, University of California, San Diego, La Jolla, CA

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

Contents: Introduction; Some gauge-theoretic preliminaries; Reduction to the “main a-priori estimate”; Some analytic preliminaries; Proof of the main a-priori estimate; Reduction to approximate half-wave operators; Construction of the half-wave operators; Fixed time $L^2$ estimates for the parametrix; The dispersive estimate; Decomposable function spaces and some applications; Completion of the proof; Bibliography.

Memoirs of the American Mathematical Society, Volume 223, Number 1047


Discrete Mathematics and Combinatorics

Elliptic Partial Differential Equations with Almost-Real Coefficients

Ariel Barton, University of Minnesota, Minneapolis, MN

Contents: Introduction; Definitions and the main theorem; Useful theorems; The fundamental solution; Properties of layer potentials; Boundedness of layer potentials; Invertibility of layer potentials and other properties; Uniqueness of solutions; Boundary data in $H^1(\partial V)$; Concluding remarks; Bibliography.

Memoirs of the American Mathematical Society, Volume 223, Number 1051


The Poset of $k$-Shapes and Branching Rules for $k$-Schur Functions

Thomas Lam, University of Michigan, Ann Arbor, MI, Luc Lapointe, Universidad de Talca, Chile, Jennifer Morse, Drexel University, Philadelphia, PA, and Mark Shimozono, Virginia Polytechnic Institute and State University, Blacksburg, VA

Contents: Introduction; The poset of $k$-shapes; Equivalence of paths in the poset of $k$-shapes; Strips and tableaux for $k$-shapes; Pushout of...
strips and row moves; Pushout of strips and column moves; Pushout sequences; Pushouts of equivalent paths are equivalent; Pullbacks; Appendix A. Tables of branching polynomials; Bibliography.

Memoirs of the American Mathematical Society, Volume 223, Number 1050

Mathematics Subject Classification: 05E05, 05E10; 14N10, Individual member US$43.20, List US$72, Institutional member US$57.60, Order code MEMO/223/1050

Geometry and Topology

Characterization and the Topological Rigidity of Nöbeling Manifolds

Andrzej Nagórko, University of Warsaw, Poland

Contents: Introduction and preliminaries: Introduction; Preliminaries; Reducing the proof of the main results to the construction of n-regular and n-semiregular \( N_n \)-covers: Approximation within an \( N_n \)-cover; Constructing closed \( N_n \)-covers; Carrier and nerve theorems; Anticanonical maps and semiregularity; Extending homeomorphisms by the use of a “brick partitionings” technique; Proof of the main results; Constructing n-semiregular and n-regular \( N_n \)-covers: Basic constructions in \( N_n \)-spaces; Core of a cover; Proof of Theorem 6.7; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 223, Number 1048

Mathematics Subject Classification: 54-XX, Individual member US$41.40, List US$69, Institutional member US$55.20, Order code MEMO/223/1048

A note to readers: Half of this book is in English and half is in French.

About 20 years ago Gross and Prasad formulated a conjecture determining the restriction of an irreducible admissible representation of the group \( G = SO(n) \) over a local field to a subgroup of the form \( G' = SO(n-1) \). The conjecture stated that for a given pair of generic \( L \)-packets of \( G \) and \( G' \), there is a unique non-trivial pairing, up to scalars, between precisely one member of each packet, where \( G \) and \( G' \) are allowed to vary among inner forms; moreover, the relevant members of the \( L \)-packets are determined by an explicit formula involving local root numbers. For non-archimedean local fields this conjecture has now been proved by Waldspurger and Mœglin, using a variety of methods of local representation theory; the Plancherel formula plays an important role in the proof. There is also a global conjecture for automorphic representations, which involves the central critical value of \( L \)-functions.

This volume is the first of two volumes devoted to the conjecture and its proof for non-archimedean local fields. It contains two long articles by Gan, Gross, and Prasad, formulating extensions of the original Gross-Prasad conjecture to more general pairs of classical groups including metaplectic groups, and providing examples for low rank unitary groups and for representations with restricted ramification. It also includes two articles by Waldspurger: a short article deriving the local multiplicity one conjecture for special orthogonal groups from the results of Aizenbud-Gourevitch-Rallis-Schiffmann on orthogonal groups and a long article (which appeared in Compositio Mathematica in 2010) completing the first part of the proof of the Gross-Prasad conjecture by extending an integral formula relating multiplicities in the restriction problem to harmonic analysis from supercuspidal representations to general tempered representations here.

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

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.
The conjecture of Gross and Prasad determines, under some assumptions, the restriction of an irreducible admissible representation of a group $G = \text{SO}(n)$ over a local field to a subgroup of the form $G' = \text{SO}(n-1)$. For two generic $L$-packets (more precisely two generic Vogan’s $L$-packets), the first for $G$, the second for $G'$, the conjecture states that there is a unique pair $(\pi, \pi')$ in the product of the two packets such that $\pi'$ appears in the restriction of $\pi$. Moreover, the parametrization of $\pi$ and $\pi'$ (in the usual parametrization of $L$-packets) is given by an explicit formula involving some $c$-factors.

In this second volume of Astérisque devoted to the conjecture, the authors give its proof when the base field is non-archimedean. In the first paper, they consider an irreducible admissible and self-dual representation of a group $GL(N)$. They prove that the value at the center of symmetry of its $c$-factor is given by an integral formula in which the character of an extension of the representation to the twisted $GL(N)$ appears. The second paper proves the conjecture for tempered representations. It is a consequence of the stabilization, in the sense of endoscopy theory, of the two integral formulas proved in the first paper above and in volume 346. Here the authors use some properties of $L$-packets that are still conjectural, but were probably proved by Arthur. In the last paper with Mœglin, they extend the result to non-tempered generic $L$-packets. It follows from the following fact that they prove that the elements in these $L$-packets are irreducible induced representations from tempered representations.

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.

Contents: J.-L. Waldspurger, Calcul d’une valeur d’un facteur $c$ par une formule intégrale; J.-L. Waldspurger, La conjecture locale de Gross-Prasad pour les représentations tempérées des groupes spéciaux orthogonaux; C. Mœglin and J.-L. Waldspurger, La conjecture locale de Gross-Prasad pour les groupes spéciaux orthogonaux: le cas général; References.
New AMS-Distributed Publications

Number Theory

Séminaire Bourbaki
Volume 2010/2011
Exposés 1027-1042

A note to readers: This book is in French.
As in the preceding volumes of this seminar, at which more than one thousand talks have been presented, this volume includes sixteen survey lectures on topics of current interest: three lectures on analysis and geometry, three about algebraic geometry, three on diophantine geometry, two related to Langlands’ program, two about group theory, one on algebraic topology, one related to Ising’s model, and two about mathematical physics.

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 348