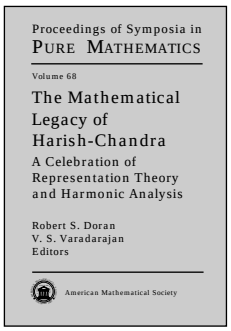
New Publications Offered by the AMS

Algebra and Algebraic Geometry



The Mathematical Legacy of Harish-Chandra

A Celebration of Representation Theory and Harmonic Analysis

Robert S. Doran, *Texas Christian University, Fort Worth*, and **V. S. Varadarajan**, *University of California, Los Angeles*, Editors

Harish-Chandra was a mathematician of great power, vision, and remarkable ingenuity. His profound contributions to the representation theory of Lie groups, harmonic analysis, and related areas left researchers a rich legacy that continues today. This book presents the proceedings of an AMS Special Session entitled, "Representation Theory and Noncommutative Harmonic Analysis: A Special Session Honoring the Memory of Harish-Chandra", which marked 75 years since his birth and 15 years since his untimely death at age 60.

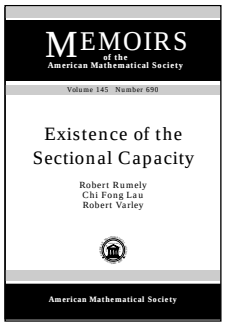
Contributions to the volume were written by an outstanding group of internationally known mathematicians. Included are expository and historical surveys and original research papers. The book also includes talks given at the IAS Memorial Service in 1983 by colleagues who knew Harish-Chandra well. Also reprinted are two articles entitled, "Some Recollections of Harish-Chandra", by A. Borel, and "Harish-Chandra's c-Function: A Mathematical Jewel", by S. Helgason. In addition, an expository paper, "An Elementary Introduction to Harish-Chandra's Work", gives an overview of some of his most basic mathematical ideas with references for further study.

This volume offers a comprehensive retrospective of Harish-Chandra's professional life and work. Personal recollections give the book particular significance. Readers should have an advanced-level background in the representation theory of Lie groups and harmonic analysis.

Contents: V. S. Varadarajan, Harish-Chandra, his work, and its legacy; **A. Borel**, Some recollections of Harish-Chandra; **S. Helgason**, Harish-Chandra memorial talk; **R. P. Langlands**, Harish-Chandra memorial talk; **G. D. Mostow**, Harish-Chandra memorial talk; **V. S. Varadarajan**, Harish-Chandra memorial talk; **R. A. Herb**, An elementary introduction to Harish-Chandra's work; **J. Arthur**, Stabilization of a family of differential equations; **D. Barbasch**, Orbital integrals of nilpotent orbits; **P. F. Baum**, **N. Higson**, and **R. J. Plymen**, Representation theory of p-adic groups: A view from operator algebras; **W. Casselman**, **H. Hecht**, and **D. Miličić**, Bruhat filtrations and Whittaker vectors for real groups; **S. DeBacker** and **P. J. Sally, Jr.**, Germs, characters, and the Fourier transforms of nilpotent orbits; **H. Ding**, **K. I. Gross**, **R. A. Kunze**, and **D. St. P. Richards**, Bessel functions on boundary orbits and singular holomorphic representations; **B. Gross** and **N. Wallach**, Restriction of small discrete series representations to symmetric subgroups; **S. Helgason**, Harish-Chandra's c-function. A mathematical jewel; **R. A. Herb**, Two-structures and discrete series character formulas; **R. E. Howe**, Harish-Chandra homomorphisms; **P. E. T. Jorgensen** and **G. Ólafsson**, Unitary representations and Osterwalder-Schrader duality; **A. W. Knapp**, Intertwining operators and small unitary representations; **R. A. Kunze**, On some problems in analysis suggested by representation theory; **R. L. Lipsman**, Distributional reciprocity and generalized Gelfand pairs; **A. Moy**, Displacement functions on the Bruhat-Tits building; **F. Murnaghan**, Germs of characters of admissible representations; **B. Speh**, Seiberg-Witten equations on locally symmetric spaces; **J. A. Wolf** and **R. Zierau**, Holomorphic double fibration transforms.

Proceedings of Symposia in Pure Mathematics, Volume 68

May 2000, 549 pages, Hardcover, ISBN 0-8218-1197-5, 2000 *Mathematics Subject Classification*: 05C38, 11S37, 15A15, 17B15, 19K99, 22Exx, 19Kxx, 32F10, 32M10, 44A20, 46L60, 47B49, 58D27, 81R05, 81R30, 43–XX, **Individual member $66**, List $110, Institutional member $88, Order code PSPUM/68N



Existence of the Sectional Capacity

Robert Rumely, *University of Georgia, Athens*, **Chi Fong Lau**, *DKB Financial Products, Ltd., Hong Kong*, and **Robert Varley**, *University of Georgia, Athens*

Contents: Introduction; The standard hypothesis; The definition of the sectional capacity; Reductions; Existence of the monic basis for very ample line bundles; Zaharjuta's construction; Local capacities; Existence of the global sectional

capacity; A positivity criterion; Base change; Pullbacks; Products; Continuity, Part I; Continuity, Part II; Local capacities of sets; Approximation theorems; Appendix A. Ample divisors and cohomology; Appendix B. A lifting lemma; Appendix C. Bounds for volumes of convex bodies; Bibliography.

Memoirs of the American Mathematical Society, Volume 145, Number 690

May 2000, 130 pages, Softcover, ISBN 0-8218-2058-3, LC 00-020861, 2000 *Mathematics Subject Classification*: 14G40, 11G35; 31C15, **Individual member $26**, List $44, Institutional member $35, Order code MEMO/145/690N

Tores et variétés abéliennes complexes

Olivier Debarre, *Université Louis Pasteur et CNRS, Strasbourg, France*

A publication of Société Mathématique de France.

This book takes the classical theory of complex tori and complex abelian varieties as an excuse to go through more modern aspects of complex algebraic and analytic geometry. Starting with complex elliptic curves, it moves on to the higher-dimensional case, giving characterizations from different points of view of those complex tori which are abelian varieties, i.e. those that can be holomorphically embedded in a projective space. Standard theorems about abelian varieties are proved, and moduli spaces are discussed. The last chapter includes new results on the geometry and topology of some subvarieties of a complex torus. Text is in French.

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

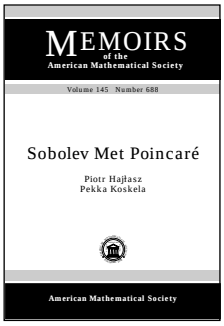
Co-published by the Société Mathematique de France and EDP-Sciences.

Contents: Introduction; Réseaux et tores complexes; Courbes elliptiques; Formes différentielles et cohomologie de de Rham; Fonctions thêta et diviseurs; Fibrés en droites, cohomologie des faisceaux et première classe de Chern; Variétés abéliennes; Espaces de modules; Sous-variétés d'un tore complexe; Bibliographie; Index.

Cours Spécialisés—Collection SMF, Number 6

December 1999, 125 pages, Softcover, ISBN 2-86883-427-2, 2000 *Mathematics Subject Classification*: 14–01, 14K20, 14K25, 14H52, 18F20, 32Qxx, 32Q15, 32C18, 32G13, 55N10, 55Q52, 58A10, 58A12, **Individual member $28**, List $31, Order code COSP/6N

Analysis



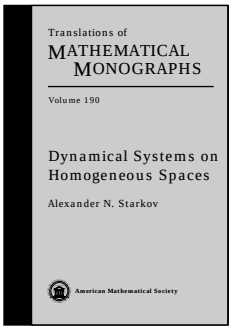
Sobolev Met Poincaré

Piotr Hajlasz, *Warsaw University, Poland*, and **Pekka Koskela**, *University of Jyväskyla, Finland*

Contents: Introduction; What are Poincaré and Sobolev inequalities?; Poincaré inequalities, pointwise estimates, and Sobolev classes; Examples and necessary conditions; Sobolev type inequalities by means of Riesz potentials; Trudinger inequality; A version of the Sobolev embedding theorem on spheres; Rellich-Kondrachov; Sobolev classes in John domains; Poincaré inequality: examples; Carnot–Carathéodory spaces; Graphs; Applications to PDE and nonlinear potential theory; Appendix; References.

Memoirs of the American Mathematical Society, Volume 145, Number 688

May 2000, 101 pages, Softcover, ISBN 0-8218-2047-8, LC 00-020856, 2000 *Mathematics Subject Classification*: 46E35, **Individual member $26**, List $43, Institutional member $34, Order code MEMO/145/688N



Dynamical Systems on Homogeneous Spaces

Alexander N. Starkov, *Moscow State University, Russia*

A homogeneous flow is a dynamical system generated by the action of a closed subgroup H of a Lie group G on a homogeneous space of G. The study of such systems is of great significance because they constitute an algebraic model for more general and more complicated systems. Also, there are abundant applications to other fields of mathematics, most notably to number theory.

The present book gives an extensive survey of the subject. In the first chapter the author discusses ergodicity and mixing of homogeneous flows. The second chapter is focused on unipotent flows, for which substantial progress has been made during the last 10–15 years. The culmination of this progress was M. Ratner's celebrated proof of far-reaching conjectures of Raghunathan and Dani. The third chapter is devoted to the dynamics of nonunipotent flows. The final chapter discusses applications of homogeneous flows to number theory, mainly to the theory of Diophantine approximations. In particular, the author describes in detail the famous proof of the Oppenheim-Davenport conjecture using ergodic properties of homogeneous flows.

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

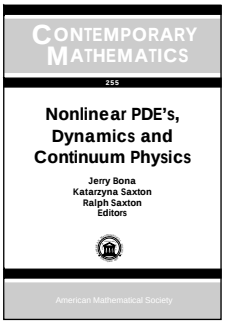
Contents: Preliminaries; Ergodicity and mixing of homogeneous flows; Dynamics of unipotent flows; Dynamics of

nonunipotent flows; Applications to number theory; References; Index.

Translations of Mathematical Monographs, Volume 190

April 2000, 243 pages, Hardcover, ISBN 0-8218-1389-7, LC 00-022001, 2000 *Mathematics Subject Classification*: 37A17; 11H55, 22E40, 37–02, 37A45, **Individual member $57**, List $95, Institutional member $76, Order code MMONO/190N

Differential Equations



Nonlinear PDE's, Dynamics and Continuum Physics

Jerry Bona, *University of Texas, Austin*, **Katarzyna Saxton**, *Loyola University, New Orleans, LA*, and **Ralph Saxton**, *University of New Orleans, LA*, Editors

This volume contains the refereed proceedings of the conference on Nonlinear Partial Differential Equations, Dynamics and Continuum Physics which was held at Mount Holyoke College in Massachusetts, from July 19th to July 23rd, 1998. Models examined derive from a wide range of applications, including elasticity, thermoviscoelasticity, granular media, fluid dynamics, gas dynamics and conservation laws. Mathematical topics include existence theory and stability/instability of traveling waves, asymptotic behavior of solutions to nonlinear wave equations, effects of dissipation, mechanisms of blow-up, well-posedness and regularity, and fractal solutions.

The text will be of interest to graduate students and researchers working in nonlinear partial differential equations and applied mathematics.

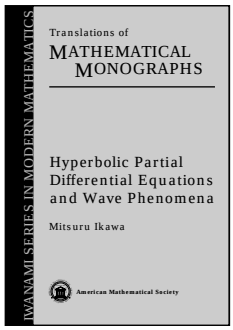
This item will also be of interest to those working in mathematical physics.

Contents: H. Chen, Travelling-waves for generalized KdV-Burgers equations; **S. R. Choudhury**, Some analytical coherent structures of the long-wave equations; **W. Domański**, Weakly nonlinear elastic plane waves in a cubic crystal; **M. L. Frankel** and **V. Roytburd**, On dynamics of exothermic interfaces; **P.-A. Gremaud**, **J. V. Matthews**, and **M. Shearer**, Similarity solutions for granular flows in hoppers; **T. Hagen** and **M. Renardy**, Stability issues in nonisothermal elongational flow; **L. Hsiao** and **R. Pan**, The damped *P*-system with boundary effects; **B. L. Keyfitz** and **C. A. Mora**, Prototypes for nonstrict hyperbolicity in conservation laws; **S. Kichenassamy**, Stability of blow-up patterns for nonlinear wave equations; **M. Kovalyov**, Slowly decaying solutions of KdV; **I. Rodnianski**, Fractal solutions of the Schrödinger equation; **J. Shatah** and **W. Strauss**, Spectral condition for abstract instability; **A. Tovbis**, On approximation of stable and unstable manifolds and the Stokes phenomenon; **S. J. Watson**, A priori bounds in one-dimensional nonlinear thermoviscoelasticity; **R. Young**, Periodic solutions to conservation laws.

Contemporary Mathematics, Volume 255

May 2000, approximately 264 pages, Softcover, ISBN 0-8218-1052-9, LC 00-021428, 2000 *Mathematics Subject Classification*: 34–XX, 35–XX, 37–XX, 47–XX, 74–XX, 76–XX, 81–XX, **Individual member $39**, List $65, Institutional member $52, Order code CONM/255N

Supplementary Reading



Hyperbolic Partial Differential Equations and Wave Phenomena

Mitsuru Ikawa, *Kyoto University, Japan*

The familiar wave equation is the most fundamental hyperbolic partial differential equation. Other hyperbolic equations, both linear and nonlinear, exhibit many wave-like phenomena. The primary theme of this book is the mathematical investigation of such wave phenomena.

The exposition begins with derivations of some wave equations, including waves in an elastic body, such as those observed in connection with earthquakes. Certain existence results are proved early on, allowing the later analysis to concentrate on properties of solutions. The existence of solutions is established using methods from functional analysis. Many of the properties are developed using methods of asymptotic solutions. The last chapter contains an analysis of the decay of the local energy of solutions. This analysis shows, in particular, that in a connected exterior domain, disturbances gradually drift into the distance and the effect of a disturbance in a bounded domain becomes small after sufficient time passes.

The book is geared toward a wide audience interested in PDEs. Prerequisite to the text are some real analysis and elementary functional analysis. It would be suitable for use as a text in PDEs or mathematical physics at the advanced undergraduate and graduate level.

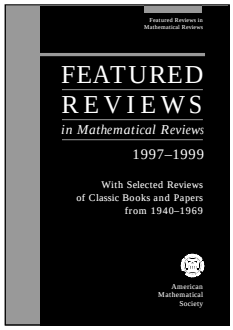
This item will also be of interest to those working in mathematical physics.

Contents: Wave phenomena and hyperbolic equations; The existence of a solution for a hyperbolic equation and its properties; The construction of asymptotic solutions; Local energy of the wave equation; Perspectives on current research in mathematics; Bibliography; Solutions to the exercises; Index.

Translations of Mathematical Monographs (*Iwanami Series in Modern Mathematics*)

March 2000, approximately 194 pages, Softcover, ISBN 0-8218-1021-9, 2000 *Mathematics Subject Classification*: 35L10; 35L20, 35P25, **All AMS members $26**, List $32, Order code MMONO-IKAWAN

General and Interdisciplinary



Featured Reviews in Mathematical Reviews 1997–1999

With Selected Reviews of Classic Books and Papers from 1940–1969

Donald G. Babbitt, *Publisher, American Mathematical Society, Providence, RI*, and **Jane Kister**, *Executive Editor, Mathematical Reviews, Ann Arbor, MI*, Editors

This second volume of *Featured Reviews* makes available special detailed reviews of some of the most important mathematical articles and books published from 1997 through 1999. Also included are excellent reviews of several classic books and articles published prior to 1970. Among those reviews, for example, are the following: **Homological Algebra** by Henri Cartan and Samuel Eilenberg, reviewed by G. Hochschild, **Faisceaux algébriques cohérents** by Jean-Pierre Serre, reviewed by C. Chevalley, and **On the Theory of General Partial Differential Operators** by Lars Hörmander, reviewed by J. L. Lions. In particular, those seeking information on current developments outside their own area of expertise will find the volume very useful.

By identifying some of the best publications, papers, and books that have had or are expected to have a significant impact in applied and pure mathematics, this volume will serve as a comprehensive guide to important new research across all fields covered by MR.

Contents: Reviews in logic, computer science and number theory; Reviews in algebra and algebraic geometry; Reviews in analysis; Reviews in geometry and topology; Reviews in differential equations and applied mathematics; Reviews in probability and mathematical physics; Selected reviews published 1940–1969; Author index; Reviewer index.

May 2000, 754 pages, Softcover, ISBN 0-8218-2166-0, 2000 *Mathematics Subject Classification*: 00–XX, **Individual member $41**, List $69, Institutional member $55, Order code FREV/2N

Also of Interest:

Featured Reviews in Mathematical Reviews 1995–1996

Reviews of Outstanding Recent Books and Papers

Donald G. Babbitt, *Publisher, American Mathematical Society, Providence, RI*, and **Jane E. Kister**, *Associate Executive Editor, Mathematical Reviews, Ann Arbor, MI*, Editors

This collection of reprints of Featured Reviews published in *Mathematical Reviews* (MR) makes widely available peer reviews of some of the best mathematics published 1994–1996.

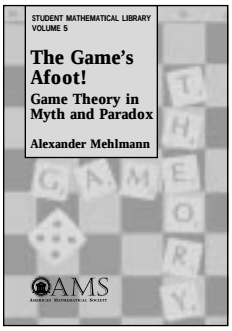
Featured Reviews were introduced in MR at the beginning of 1995 in part to provide some guidance to the current research-level literature. With the exponential growth of publications in mathematical research in the first half-century of MR, it had become essentially impossible for the users of MR to identify the most important new research-level books and papers, especially in fields outside of users' own expertise. This first volume identifies some of the papers and books of significant importance published in 1994–1996 in areas of pure or applied mathematics. All of the papers reviewed in this book contain interesting ideas or applications, a deep synthesis of existing ideas, or any combination of these. The book is illustrated with photos. The volume leads readers to important research across all fields covered by MR.

Contents: Logic, combinatorics, and number theory; Algebra and algebraic geometry; Analysis; Geometry and topology; Differential equations and applied mathematics; Probability and mathematical physics; Author index; Reviewer index.

1997, 380 pages, Softcover, ISBN 0-8218-0771-4, 2000 *Mathematics Subject Classification*: 00–XX, **All AMS members $31**, List $39, Order code FREV/1N

Special Set Price

2000, Softcover, ISBN 0-8218-2631-X, 2000 *Mathematics Subject Classification*: 00–XX, **Individual member $52**, List $86, Institutional member $69, Order code FREVSETN



The Game's Afoot! Game Theory in Myth and Paradox

Alexander Mehlmann, *Vienna University of Technology, Austria*

Reviews of the German edition:

The author, well known for various imaginative, entertaining and instructive writings in the area of game theory, and for his game-theoretic excursions into classical literature, has now brought out this delightful little book on the basics of noncooperative games … [The book is] rewarding reading for a rather wide variety of reasonably well-educated persons. The reader will gain an appreciation for the mathematical modelling of conflict in economics, the social sciences and biology, and get a glimpse of game-theoretic analysis of conflict in some of the classical literature.

—Zentralblatt für Mathematik

Through the amusing exposition of the material, overflowing with jokes and general culture, the new book by Alexander Mehlmann has become bedtime reading for me … It is a pleasure to see such things as the Dilemma of the Arms Race, Goethe's Mephisto, the Chain-Store Paradox, and the Madness of Odysseus brought under one game-theoretic roof.

—Eric Lessing (from a translation of What I am reading" in Die Presse

It all started with von Neumann and Morgenstern half a century ago. Their *Theory of Games and Economic Behavior* gave birth to a whole new area of mathematics concerned with the formal problems of rational decision as experienced by multiple agents. Now, game theory is all around us, making its way even into regular conversations. In the present book, Mehlmann presents mathematical foundations and concepts illustrated via social

quandaries, mock political battles, evolutionary confrontations, economic struggles, and literary conflict. Most of the standard models—the prisoners' dilemma, the arms race, evolution, duels, the game of chicken, etc.—are here. Many non-standard examples are also here: the Legend of Faust, shootouts in the movies, the Madness of Odysseus, to name a few.

The author uses familiar formulas, fables, and paradoxes to guide readers through what he calls the "hall of mirrors of strategic decision-making". His light-hearted excursion into the world of strategic calculation shows that even deep insights into the nature of strategic thought can be elucidated by games, puzzles and diversions.

Originally written in German and published by Vieweg-Verlag, this AMS edition is a translation tailored for the English-speaking reader. It offers an intriguing look at myths and paradoxes through the lens of game theory, bringing the mathematics into sharper focus at the same time. This book is a must for those who wish to consider game theory from a different perspective: one that embraces science, literature, and real-life conflict.

The Game's Afoot! would make an excellent book for an undergraduate course in game theory. It can also be used for independent study or as supplementary course reading. The connections to literature, films and everyday life also make it highly suitable as a text for a challenging course for non-majors. Its refreshing style and amusing combination of game theoretic analysis and cultural issues even make it appealing as recreational reading.

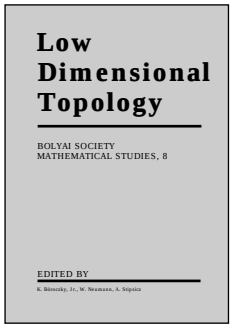
Contents: *The glass bead game:* Introduction; Games, form(ula)s, and scholars; Equilibrium and game as metaphor; In the forest of game trees; Games against time; *The myths of game theory:* Introduction; The prisoner's dilemma; Paradoxes of backward induction; Strategic accents of game-theoretic scholasticism; Odysseus goes to war; A postlude in rhyme; Games in the network of networks; References; Index.

Student Mathematical Library, Volume 5

April 2000, 159 pages, Softcover, ISBN 0-8218-2121-0, LC 00-020915, 2000 *Mathematics Subject Classification*: 91–01, 91A05, 91A40, 97A20, 97A90, **All AMS members $21**, List $26, Order code STML/5N

Geometry and Topology

Independent Study



Low Dimensional Topology

K. Böröczky, Jr., *Hungarian Academy of Sciences, Budapest, Hungary*, **W. Neumann**, *University of Melbourne, Parkville, Australia*, and **A. Stipsicz**, *Eötvös Loránd University, Budapest, Hungary*, Editors

A publication of János Bolyai Mathematical Society.

This proceedings volume contains the notes of five lectures given at the Summer School on Low Dimensional Topology held at the Hungarian Institute of Sciences (Budapest). Topics discussed and presented in this book are "Differential Topology of 4-dimensional Manifolds" by J. Morgan, "The Link of Surface Singularities" by A. Némethi, "Nonpositively Curved Spaces" by M. Davis, "Geometry of 3-manifolds" by W. D. Neumann, and "Some Topological Invariants of Isolated Hypersurface Singularities" by A. Némethi. Each lecture was accompanied by tutorials presenting important examples for the presented theory.

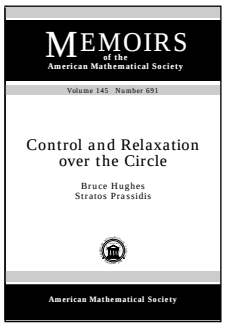
The articles in this book offer a comprehensive and up-to-date introduction to each field.

Distributed worldwide, except in Eastern and Western Europe, by the AMS.

Contents: Introduction; **M. Davis** and **G. Moussong**, Notes on nonpositively curved polyhedra; **J. W. Morgan**, Smooth invariants of 4-manifolds; **W. D. Neumann**, Notes on geometry and 3-manifolds; **A. Némethi**, Normal surface singularities; **A. Némethi**, Some topological invariants of isolated hypersurface singularities.

Bolyai Society Mathematical Studies, Volume 8

February 1999, 413 pages, Hardcover, ISBN 963-8022-92-2, 2000 *Mathematics Subject Classification*: 57Mxx; 53C23, 57R57, 57S30, 32S50, **All AMS members $61**, List $76, Order code BSMS/8N



Control and Relaxation over the Circle

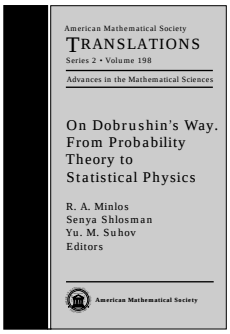
Bruce Hughes and **Stratos Prassidis**, *Vanderbilt University, Nashville, TN*

Contents: Introduction and statement of results; Moduli spaces of manifolds and maps; Wrapping-up and unwrapping as simplicial maps; Relaxation as a simplicial map; The Whitehead spaces; Torsion and a higher sum theorem; Nil as a geometrically defined simplicial set; Transfers; Completion of the proof; Comparison with the lower algebraic nil groups; Appendix A. Controlled homotopies on mapping tori; Bibliography.

Memoirs of the American Mathematical Society, Volume 145, Number 691

May 2000, 96 pages, Softcover, ISBN 0-8218-2069-9, LC 00-020860, 2000 *Mathematics Subject Classification*: 19D10, 19D35, 57N20, 55R99; 19A99, 19B99, 57N15, 57N37, **Individual member $25**, List $42, Institutional member $34, Order code MEMO/145/691N

Mathematical Physics



On Dobrushin's Way. From Probability Theory to Statistical Physics

R. A. Minlos, *Russian Academy of Sciences, Moscow, Russia*, **Senya Shlosman**, *CPT/CNRS, Marseille, France*, and **Yu. M. Suhov**, *Russian Academy of Sciences, Moscow*, Editors

R. Dobrushin worked in several branches of mathematics (probability theory, information theory), but his deepest influence was on mathematical physics. He was one of the founders of the rigorous study of statistical physics. When Dobrushin began working in that direction in the early sixties, only a few people worldwide were thinking along the same lines. Now there is an army of researchers in the field. This collection is devoted to the memory of R.L. Dobrushin. The authors who contributed to this collection knew him quite well and were his colleagues.

The title, "On Dobrushin's Way", is meant to stress the fact that the current development of mathematical physics is evolving along the lines that Dobrushin foresaw. His ideas and methods are extensively employed today.

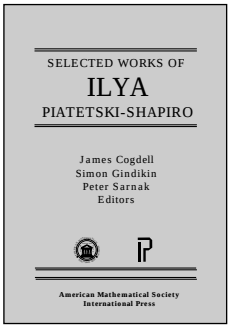
Beyond research papers, this volume contains a short biography. Recollections from his contemporaries and younger colleagues are also included. This short biographical section sketches for readers a bit of Dobrushin's personality.

Contents: **N. Angelescu**, **R. A. Minlos**, and **V. A. Zagrebnov**, The lower spectral branch of the generator of the stochastic dynamics for the classical Heisenberg model; **C. Boldrighini**, **R. A. Minlos**, and **A. Pellegrinotti**, Random walk in a fluctuating random environment with Markov evolution; **S. Brassesco**, **E. Presutti**, **V. Sidoravicius**, and **M. E. Vares**, Ergodicity and exponential convergence of a Glauber+Kawasaki process; **A. van Enter**, **C. Maes**, **R. H. Schonmann**, and **S. Shlosman**, The Griffiths singularity random field; **A. van Enter**, **C. Maes**, and **S. Shlosman**, Dobrushin's program on Gibbsianity restoration: Weakly Gibbs and almost Gibbs random fields; **G. L. Eyink** and **H. Spohn**, Space-time invariant states of the ideal gas with finite number, energy, and entropy density; **B. M. Gurevich** and **A. A. Tempelman**, Hausdorff dimension and pressure in the DLR thermodynamic formalism; **V. Yu. Kaloshin** and **Ya. G. Sinai**, Nonsymmetric simple random walks along orbits of ergodic automorphisms; **F. I. Karpelevich**, **E. A. Pechersky**, and **Yu. M. Suhov**, The Cramér transform and large deviations on three-dimensional Lobachevsky space; **F. I. Karpelevich** and **A. N. Rybko**, Thermodynamical limit for symmetric closed queuing networks; **V. A. Malyshev**, Random infinite spin graph evolution; **F. Martinelli**, An elementary approach to finite size conditions for the decay of covariances in lattice spin models; **S. Nanda**, **C. M. Newman**, and **D. L. Stein**, Dynamics of Ising spin systems at zero temperature; **S. A. Pirogov**, Peierls argument for the anisotropic Ising model; **M. Zahradník**, Contour methods and Pirogov-Sinai theory for continuous spin lattice models; **R. Minlos**, **A. M. Vershik**, **N. D. Vvedenskaya**, **Yu. D. Apresyan**, **S. Gindikin**, **V. M. Tikhomirov**, **Yu. Suhov**, **L. N. Vaserstein**, **M.-F. Chen**, and **S. Shlosman**, Recollections.

American Mathematical Society Translations—Series 2 (*Advances in the Mathematical Sciences*), Volume 198

April 2000, 243 pages, Hardcover, ISBN 0-8218-2150-4, LC 91-640741, 2000 *Mathematics Subject Classification*: 60K35, 82Bxx, **Individual member $59**, List $99, Institutional member $79, Order code TRANS2/198N

Number Theory



Selected Works of Ilya Piatetski-Shapiro

James Cogdell, *Oklahoma State University, Stillwater*, **Simon Gindikin**, *Rutgers University, Piscataway, NJ*, and **Peter Sarnak**, *Princeton University, NJ*, Editors

This selection of papers of I. Piatetski-Shapiro represents almost 50 years of his mathematical activity. Included are many of his major papers in harmonic analysis, number theory, discrete groups, bounded homogeneous domains, algebraic geometry, automorphic forms, and automorphic L-functions.

The papers in the volume are intended as a representative and accurate reflection of both the breadth and depth of Piatetski-Shapiro's work in mathematics. Some of his early works, such as those on the prime number theorem and on sets of uniqueness for trigonometric series, appear for the first time in English. Also included are several commentaries by his close colleagues. This volume offers an elegant representation of the contributions made by this renowned mathematician.

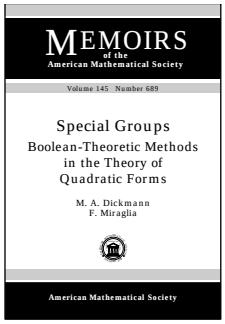
This item will also be of interest to those working in algebra and algebraic geometry.

Contents: *Autobiographical papers:* **I. Piatetski-Shapiro**, Étude on life and automorphic forms in the Soviet Union; *Early papers in harmonic analysis and number theory:* **I. I. Piatetski-Shapiro**, On the problem of uniqueness of the expansion of a function into a trigonometric series; **I. I. Piatetski-Shapiro**, On the distribution of prime numbers in sequences of the form $[f(n)]$; **I. I. Piatetski-Shapiro**, An addition to the work "On the problem of uniqueness of the expansion of a function into a trigonometric series"; **P. Sarnak**, Early papers in harmonic analysis and number theory; *Automorphic functions and discrete groups:* **I. I. Piatetskii-Shapiro**, Abelian modular functions; **I. I. Piatetskii-Shapiro**, On an estimate of the dimension of the space of automorphic forms for certain types of discrete groups; **I. I. Piatetski-Shapiro**, Discrete subgroups of the group of analytic automorphisms of the |polycylinder and automorphic forms; **I. M. Gel'fand** and **I. I. Pyateckiĭ-Šapiro**, Theory of representations and theory of automorphic functions; **I. M. Gelfand** and **I. I. Pjateckiĭ-Šapiro**, Automorphic functions and representation theory; **I. I. Pjateckiĭ-Šapiro**, Automorphic functions and arithmetic groups; **I. I. Pjateckiĭ-Šapiro**, On reduction modulo a prime of fields of modular functions; **M. Gromov** and **I. Piatetski-Shapiro**, Non-arithmetic groups in Lobachevsky spaces; **P. Sarnak**, Automorphic functions and

discrete groups; *Bounded homogeneous domains:* **I. I. Piatetski-Shapiro**, Some questions of harmonic analysis in homogeneous cones; **I. I. Piatetskii-Shapiro**, On a problem proposed by E. Cartan; **I. Pyateckiĭ-Šapiro**, Classification of bounded homogeneous domains in n-dimensional complex space; **I. Pjatetskiĭ-Šapiro**, Bounded homogeneous domains in n-dimensional complex space; **I. Pjateckiĭ-Šapiro**, Regions of the type of the upper half-plane in the theory of functions of several complex variables; **B. Vinberg**, **S. G. Gindikin**, and **I. I. Pjateckiĭ-Šapiro**, Classification and canonical realization of complex bounded homogeneous domains; **S. Gindikin**, The work of Piatetski-Shapiro on complex homogeneous bounded domains; *Applied Mathematics:* **I. I. Pyatetskii-Shapiro**, **O. N. Stavskaya**, and **A. L. Toom**, Automatic control in biological systems; **J. Cogdell** and **S. Gindikin**, Piatetski-Shapiro's work in applied mathematics; *Algebraic geometry:* **I. I. Pjateckiĭ-Šapiro** and **I. R. Šafarevič**, A Torelli theorem for algebraic surfaces of type $K3$; **I. I. Pjateckiĭ-Šapiro**, Interrelations between the Tate and Hodge conjectures for abelian varieties; **I. I. Pjateckiĭ-Šapiro** and **I. R. Šafarevič**, The arithmetic of K3 surfaces; **P. Deligne**, On the algebraic geometry papers of Piatetski-Shapiro; *Automorphic L-functions:* **I. I. Pjateckij-Šapiro**, On the Weil-Jacquet-Langlands theorem; **I. I. Pjateckij-Šapiro**, Euler subgroups; **S. S. Gelbart** and **I. I. Piatetski-Shapiro**, Automorphic L-functions of half-integral weight; **I. Piatetski-Shapiro**, Tate theory for reductive groups and distinguished representations; **H. Jacquet**, **I. I. Piatetski-Shapiro**, and **J. Shalika**, Automorphic forms on GL(3) I; **H. Jacquet**, **I. I. Piatetski-Shapiro**, and **J. Shalika**, Automorphic forms on GL(3) II; **H. Jacquet**, **I. I. Piatetski-Shapiro**, and **J. Shalika**, Relèvement cubique non normal; **H. Jacquet**, **I. I. Piatetskii-Shapiro**, and **J. A. Shalika**, Rankin-Selberg convolutions; **I. Piatetski-Shapiro** and **S. Rallis**, L-functions of automorphic forms on simple classical groups; **S. J. Patterson** and **I. I. Piatetski-Shapiro**, A cubic analogue of the cuspidal theta representations; **I. Piatetski-Shapiro** and **S. Rallis**, A new way to get Euler products; **I. Piatetski-Shapiro**, **S. Rallis**, and **G. Schiffmann**, L functions for the group G_2; **J. W. Cogdell** and **I. I. Piatetski-Shapiro**, Converse theorems for GL_n; **J. Cogdell**, **S. Gelbart**, and **S. Rallis**, The work of Piatetski-Shapiro on L-functions; *Theta lifts and applications to generalized Ramanujan conjectures:* **R. Howe** and **I. I. Piatetski-Shapiro** A counterexample to the "Generalized Ramanujan conjecture" for (quasi-) split groups; **I. Piatetski-Shapiro**, Cuspidal automorphic representations associated to parabolic subgroups and Ramanujan conjecture; **I. I. Piatetski-Shapiro**, On the Saito-Kurokawa lifting; **J.-S. Li**, **I. Piatetski-Shapiro**, and **P. Sarnak**, Poincaré series for $SO(n,1)$; **J. W. Cogdell** and **I. I. Piatetski-Shapiro**, Unitarity and functoriality; **R. Howe** and **P. Sarnak**, Theta lifts and applications to generalized Ramanujan conjectures.

Collected Works, Volume 15

June 2000, approximately 856 pages, Hardcover, ISBN 0-8218-0930-X, LC 00-021429, 2000 *Mathematics Subject Classification*: 11–XX, 14–XX, 22–XX, 32–XX, 42–XX, 90–XX, **Individual member $82**, List $136, Institutional member $109, Order code CWORKS/15N



Special Groups

Boolean-Theoretic Methods in the Theory of Quadratic Forms

M. A. Dickmann, *University of Paris VII, France*, and **F. Miraglia**, *University of Sao Paulo, Brazil*

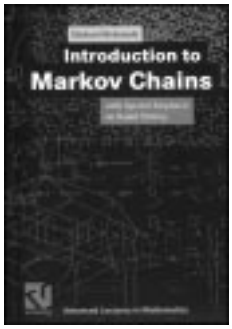
This item will also be of interest to those working in algebra and algebraic geometry.

Contents: Special groups; Pfister forms, saturated subgroups and quotients; The space of orders of a reduced group. Duality; Boolean algebras and reduced special groups; Embeddings; Special groups of continuous functions; Horn-Tarski and Stiefel-Whitney invariants; Algebraic K-theory of fields and special groups; Marshall's conjecture for pythagorean fields; The category of special groups; Some model theory of special groups; Appendix A. The universal theory of reduced special groups; Appendix B. Table of references for [DM1] and [DM2]; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 145, Number 689

May 2000, 247 pages, Softcover, ISBN 0-8218-2057-5, LC 00-020862, 2000 *Mathematics Subject Classification*: 11E81, 06E99; 11E70, 11E04, 11E10, 12D15, 12J15, 12G05, 03C60, 03C65, **Individual member $35**, List $59, Institutional member $47, Order code MEMO/145/689N

Probability



Introduction to Markov Chains

With Special Emphasis on Rapid Mixing

Ehrhard Behrends, *Free University of Berlin, Germany*,

A publication of Vieweg Verlag.

What is a Markov chain? What methods are there for proving that a given chain is rapidly mixing? Why should it be interesting to know these things? The purpose of this book is to answer these three questions. It is written for readers who have never before met Markov chains, but have some familiarity with elementary probability theory and linear algebra.

This book starts with a naive description of a Markov chain as a memoryless random walk on a finite set. This is complemented by a rigorous definition in the framework of probability theory. The most important results from the theory of homogeneous Markov chains on finite state spaces are then developed.

Here, chains are called rapidly mixing if all of the associated walks, regardless of where they began, behave similarly after comparatively few steps: that is, it is impossible from observing the chain to get information on the starting position or the number of steps so far. To investigate this phenomenon, the author thoroughly discusses methods proposed in recent

decades. Many examples are included to illustrate methods applied in the book.

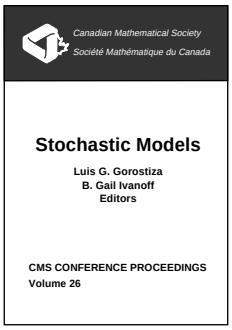
The book is self-contained with emphasis on extensive motivation of the ideas. The exposition is complemented by many exercises.

The AMS is exclusive distributor in North America, and non-exclusive distributor worldwide except in Germany, Switzerland, Austria, and Japan.

Contents: *Part I. Finite Markov Chains (the background):* Markov chains: how to start?; Examples of Markov chains; How linear algebra comes into play; The fundamental notions in connection with Markov chains; Transient states; An analytical lemma; Irreducible Markov chains; Notes and remarks; *Part II. Rapidly Mixing Chains:* Perron-Frobenius theory; Rapid mixing: a first approach; Conductance; Stopping times and the strong Markov property; Coupling methods; Strong uniform times; Markov chains on finite groups I (commutative groups); Markov chains on finite groups II (arbitrary groups); Notes and remarks; *Part III. Rapidly Mixing Chains: Applications:* Random generation and counting; Markov random fields; Potentials, Gibbs fields, and the Ising model; The Metropolis sampler and simulated annealing; Notes and remarks; Bibliography; Index.

Vieweg Advanced Lectures in Mathematics

November 1999, 232 pages, Softcover, ISBN 3-528-06986-4, 2000 *Mathematics Subject Classification*: 60J10, 60J20, 60–02, **All AMS members $38**, List $42, Order code VWALM/6N



Stochastic Models

Luis G. Gorostiza, *Centro de Investigacion y de Estudios Avanzados, Mexico City, Mexico*, and **B. Gail Ivanoff**, *University of Ottawa, ON, Canada*, Editors

This book presents the refereed proceedings of the International Conference on Stochastic Models held in Ottawa (ON, Canada) in honor of Professor Donald A. Dawson. Contributions to the volume were written by students and colleagues of Professor Dawson, many of whom are eminent researchers in their own right.

A main theme of the book is the development and study of the Dawson-Watanabe "superprocess", a fundamental building block in modelling interaction particle systems undergoing reproduction and movement. The volume also contains an excellent review article by Professor Dawson and a complete list of his work.

This comprehensive work offers a wide assortment of articles on Markov processes, branching processes, mathematical finance, filtering, queueing networks, time series, and statistics. It should be of interest to a broad mathematical audience.

Members of the Canadian Mathematical Society may order at the AMS member price.

Contents: D. A. Dawson, Stochastic models of evolving information systems; **M. Birkner** and **A. Wakolbinger**, A comparison of free branching and stepping stone models; **D. Blount** and **A. Bose**, Fourier analysis applied to super stable and related processes; **J. T. Cox**, **A. Klenke**, and **E. A. Perkins**, Convergence to equilibrium and linear systems duality; **M. Csörgő** and **B. Szyszkowicz**, Weighted quantile processes and their applications to change-point analysis; **C. D. Cutler**, Embedding theorems, scaling structures and determinism in time series; **S. N. Evans**, Kingman's coalescent as a random metric space; **S. Feng**, The behaviour near the boundary of some degenerate diffusions under random perturbation; **K. Fleischmann** and **C. Mueller**, Finite time extinction of catalytic branching processes; **J. Gärtner** and **S. A. Molchanov**, Moment asymptotics and Lifshitz tails for the parabolic Anderson model; **L. G. Gorostiza** and **Z.-H. Li**, High-density fluctuations of immigration branching particle systems; **A. Greven**, On phase-transitions in spatial branching systems with interaction; **A. Greven** and **K. J. Hochberg**, New behavioral patterns for two-level branching systems; **B. G. Ivanoff** and **E. Merzbach**, Set-indexed Markov processes; **I. Jeon** and **P. March**, Condensation transition for zero range invariant measures; **A. Klenke**, A review on spatial catalytic branching; **M. A. Kouritzin**, Exact infinite dimensional filters and explicit solutions; **R. J. Kulperger**, SDE estimation: Effects of misspecified diffusion functions; **T. G. Kurtz**, Particle representations for measure-valued population processes with spatially varying birth rates; **B. MacGibbon**, **E. Gourdin**, **B. Jaumard**, and **P. Kempthorne**, Minimax estimation of exponential family means over ℓ_p bodies under quadratic loss; **W. A. Massey** and **R. Srinivasan**, Steady state analysis with heavy traffic limits for semi-open networks; **R. Norvaiša** and **D. M. Salopek**, Estimating the Orey index of a Guassian stochastic process with stationary increments: An application to financial data set; **B. Remillard**, Large deviations estimates for occupation time integrals of Brownian motion; **D. Sankoff** and **M. Blanchette**, Comparitive genomics via phylogenetic invariants for Jukes-Cantor semigroups; **B. Schmuland**, Some exceptional configurations; **V. Vinogradov**, On a conjecture of B. Jørgensen and A. D. Wentzell: From extreme stable laws to Tweedie exponential dispersion models; **H. Wang**, Valuation of a barrier European option on jump-diffusion underlying stock price.

Conference Proceedings, Canadian Mathematical Society, Volume 26

April 2000, 450 pages, Softcover, ISBN 0-8218-1063-4, LC 00-022164, 2000 *Mathematics Subject Classification*: 60–06, 60G99, **Individual member $59**, List $99, Institutional member $79, Order code CMSAMS/26N

Previously Announced Publications

The Arithmetic and Geometry of Algebraic Cycles

B. Brent Gordon, *University of Oklahoma, Norman*, **James D. Lewis**, *University of Alberta, Edmonton, AB, Canada*, **Stefan Müller-Stach**, *Universität Essen, Germany*, **Shuji Saito**, *Tokyo Institute of Technology, Oh-Okayama, Meguro-ku, Japan*, and **Noriko Yui**, *Queen's University, Kingston, ON, Canada*, Editors

The NATO ASI/CRM Summer School at Banff offered a unique, full, and in-depth account of the topic, ranging from introductory courses by leading experts to discussions of the latest developments by all participants. The papers have been organized into three categories: cohomological methods; Chow groups and motives; and arithmetic methods.

The immense recent progress in the theory of algebraic cycles is based on its many interactions with several other areas of mathematics. This conference was the first to focus on both arithmetic and geometric aspects of algebraic cycles. It brought

together leading experts to speak from their various points of view. A unique opportunity was created to explore and view the depth and the breadth of the subject. This volume presents the intriguing results. This item will also be of interest to those working in number theory.

CRM Proceedings & Lecture Notes, Volume 24

January 2000, 432 pages, Softcover, ISBN 0-8218-1954-2, LC 99-057916, 2000 *Mathematics Subject Classification*: 11Gxx, 14C30, 14C35, 14C25, 14C17, 14F05, 14F10, 14F42, 14F43, 14F20, 14G35, 19Dxx, 19Fxx, **Individual member $66**, List $110, Institutional member $88, Order code CRMP/24RT004

Discrete Mathematical Chemistry

Pierre Hansen, *GERARD, Montreal, PQ, Canada*, **Patrick Fowler**, *University of Exeter, England*, and **Maolin Zheng**, *Lexis-Nexis, Mianmisburg, OH*, Editors

This volume contains the proceedings from the first DIMACS meeting on discrete mathematical chemistry held at Rutgers University (New Brunswick, NJ). The contributions reflect the presentations and spotlight the breadth of current research on the topic. Much of the volume reflects the combined mathematical and physical interest in the new molecules, fullerenes.

The interdisciplinary nature of the contributions pays testament to the fact that "real" chemistry and "real" mathematics do indeed interact.

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

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 51

June 2000, 392 pages, Hardcover, ISBN 0-8218-0987-3, LC 99-059470, 2000 *Mathematics Subject Classification*: 05C50; 92E10, **Individual member $59**, List $99, Institutional member $79, Order code DIMACS/51RT004

Independent Study

The Semicircle Law, Free Random Variables and Entropy

Fumio Hiai, *Tohoku University, Aoba-ku, Sendai, Japan*, and **Dénes Petz**, *Technical University of Budapest, Hungary*

The book treats free probability theory, which has been extensively developed since the early eighties. The emphasis is put on entropy and the random matrix model approach. It is a unique presentation demonstrating the extensive interrelation between the topics.

The book is the first essentially full-scale presentation on free probability theory and includes improvements of results and proofs in current literature. The combinatorial aspects of the specialized topics are emphasized; many examples are given. The book would be a suitable text for graduate courses in free probability theory.

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

Mathematical Surveys and Monographs, Volume 77

May 2000, 376 pages, Hardcover, ISBN 0-8218-2081-8, LC 99-088288, 2000 *Mathematics Subject Classification*: 46L54; 15A52, 60F10, 94A17, 46N50, 60J65, 81S25, 05A17, **Individual member $53**, List $89, Institutional member $71, Order code SURV/77RT004

KP or mKP

Noncommutative Mathematics of Lagrangian, Hamiltonian, and Integrable Systems

Boris A. Kupershmidt, *University of Tennessee Space Institute, Tullahoma*

This book develops a theory that can be viewed as a noncommutative counterpart of the following topics: dynamical systems in general and integrable systems in particular; Hamiltonian formalism; variational calculus, both in continuous space and discrete. The text is self-contained and includes a large number of exercises. Many different specific models are analyzed extensively and motivations for the new notions are provided.

Mathematical Surveys and Monographs, Volume 78

May 2000, 600 pages, Hardcover, ISBN 0-8218-1400-1, LC 99-058841, 2000 *Mathematics Subject Classification*: 37J35, 37Kxx, 46L55; 35Q53, 49N45, 58J42, **Individual member $65**, List $109, Institutional member $87, Order code SURV/78RT004

Independent Study

Essays on Numbers and Figures

V. V. Prasolov, *Independent University of Moscow, Russia*

This is the English translation of the book originally published in Russian. It contains 20 essays, each dealing with a separate mathematical topic. The topics range from brilliant mathematical statements with interesting proofs, to simple and effective methods of problem-solving, to interesting properties of polynomials, to exceptional points of the triangle. Many of the topics have a long and interesting history. The author has lectured on them to students worldwide.

Mathematical World, Volume 16

January 2000, 75 pages, Softcover, ISBN 0-8218-1944-5, LC 99-058690, 2000 *Mathematics Subject Classification*: 00A99, **All AMS members $12**, List $15, Order code MAWRLD/16RT004