



PUBLICATIONS

of the American Mathematical Society

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Mathematics Everywhere

Martin Aigner and Ehrhard Behrends, *Freie Universität Berlin, Germany*, Editors

Translated by Philip G. Spain

We often may not realize it, but mathematics is all around us in daily life. This collection of writings from a group of renowned mathematicians takes readers on a fascinating journey into the world of the mathematics that characterizes much of our daily activities.

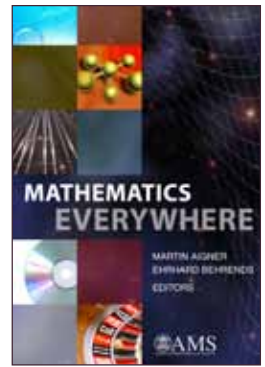
Based on lectures delivered at Urania in Germany, the book consists of 23 articles that each look at a particular real-world application of mathematics. Covering topics that range from traffic routing to the stock exchange to electronic money to climate change, the authors make the mathematics understandable and highly enjoyable. A common thread throughout the book is that unlike any other science, mathematics is at once the purest science and the most applicable.

Also covered in the book are a number of hot topics that have recently gained prominence, including Fermat's theorem, Kepler's packing problem, and the solution of the Poincaré conjecture. The overall result is a panorama of classical and current topics that illustrate the strong presence of mathematics in our culture.

The detailed presentations in the various articles make this book ideal for readers with a college education in science or engineering. The authors as a group convey that mathematics is often our only available tool for truly understanding the problems we confront everywhere.

READERSHIP: Undergraduates, graduate students, and research mathematicians interested in mathematical trends and topics in the world around us.

2010; 330 pp.; softcover; ISBN: 978-0-8218-4349-9; List US\$49; AMS members US\$39.20; Order code: MBK/72



Modelling in Healthcare

The Complex Systems Modelling Group (CSMG), The IRMACS Center, Simon Fraser University, Burnaby, BC, Canada

The move to deliver high-quality healthcare services while controlling escalating costs has led to the development and application of mathematical models to guide healthcare decisionmaking. This book offers informed advice on the benefits and limitations of the modeling process, using content that is understandable among modelers, administrators and clinicians alike.

Presented by the Complex Systems Modelling Group at Simon Fraser University in Canada, this book examines the processes now being used to answer questions such as how a community's changing demographics will affect long-term demand for health services. It discusses modeling's potential for developing evidence-based answers to the complex questions affecting modern healthcare.

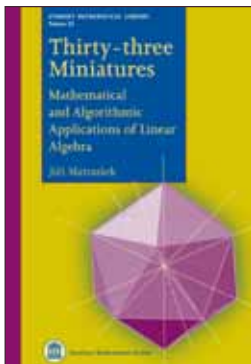
The authors believe the book will assist in furthering a healthy relationship between academic modelers and healthcare policymakers. They believe that modelers must take into account the non-mathematical aspects of healthcare, while policymakers should not view mathematical models as mystical crystal balls.

Each chapter of the book can be read without having read earlier chapters. The presentation is self-contained, accessible to anyone with a solid background in high school mathematics. The book will benefit anyone interested in broadening their knowledge of modeling's benefits and potential drawbacks when applied to healthcare.

READERSHIP: Anyone interested in mathematics and healthcare.

2010; 218 pp.; hardcover; ISBN: 978-0-8218-4969-9; List US\$69; AMS members US\$55.20; All Individuals US\$59; Order code: MBK/74





Thirty-three Miniatures

Mathematical and Algorithmic Applications of Linear Algebra

Jiří Matoušek, *Charles University, Prague, Czech Republic*

This book takes an innovative approach to the subject of mathematical applications of linear algebra by presenting many interesting problems and theorems as a collection of independent issues. The author has collected intriguing applications of linear algebra and has organized them into complete expositions of a result, each a self-contained presentation of fewer than 10 pages.

Topics covered in these presentations include well-known mathematical gems such as Hamming codes, the matrix-tree theorem, the Lovasz bound on the Shannon capacity, and a counterexample to Borsuk's conjecture. Also covered are some less popular but equally beautiful results, such as fast associativity testing, a lemma of Steinitz on ordering vectors, a monotonicity result for integer partitions, and a bound for set pairs via exterior products.

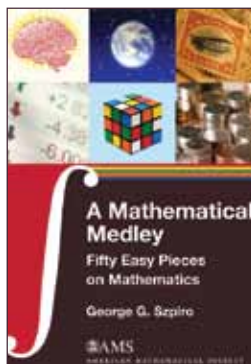
Each chapter covers a single main result with motivation and full proof, and can be read independently of all other chapters. The author, a recipient of a European Mathematical Society prize for young mathematicians, has designed each item in the collection to be covered conveniently in a 90-minute lecture.

These applications, mainly in combinatorics, geometry and algorithms, require of the reader only a modest background in linear algebra. Some chapters can enliven a basic course in linear algebra with their intriguing applications, while the book as a whole can serve as the main text for a special-topics course on linear algebraic methods.

READERSHIP: Undergraduates, graduate students and research mathematicians interested in combinatorics, graph theory, theoretical computer science, and geometry.

Student Mathematical Library, Volume 53

2010; 182 pp.; softcover; ISBN: 978-0-8218-4977-4; List US\$36; AMS members US\$28.80; Order code: STML/53



A Mathematical Medley

Fifty Easy Pieces on Mathematics

George G. Szpiro, *Neue Zürcher Zeitung, Zurich, Switzerland*

Mathematics is a thriving subject and an important element in modern conveniences ranging from cell phones to transactions over the Internet, but it remains an esoteric subject to many of the people whom it benefits. This collection of short articles from journalist George Szpiro demonstrates that mathematics can be made intelligible to general readers who have little formal background in the subject.

These 50 articles, nearly all of which appeared in the Swiss newspaper *Neue Zürcher Zeitung*, are each about 600 to 800 words long and are generally about mathematics or mathematicians. Covered topics include a number of recently solved mathematical problems, important research published in scientific journals, and mathematical observations that explain details of contemporary life.

Szpiro also includes a number of anecdotes about mathematicians' lives, as well as stories about famous old problems. The easy-to-read stories are organized into chapter headings such as "math for math's sake," "training the brain," and "money, and making it."

Unlike some collections of stories that use mathematical reasoning to analyze another subject, the articles in this collection focus on the mathematics itself. The author, a winner of the DMV Media Prize for his newspaper columns, is able to make this material accessible to the non-specialist.

READERSHIP: This book is intended for true general readers who are interested in any sort of mathematics.

2010; 236 pp.; softcover; ISBN: 978-0-8218-4928-6; List US\$35; AMS members US\$28; Order code: MBK/73

◆ An Introductory Course on Mathematical Game Theory

Julio González-Díaz, *Universidade de Santiago de Compostela, Spain*, **Ignacio García-Jurado**, *Universidad de Coruña, Spain*, and **M. Gloria Fiestras-Janeiro**, *Universidade de Vigo, Spain*

Game theory, the mathematical theory of interactive decision situations, has captured interest in fields as varied as psychology, computer science, biology and political science. This book departs from other works on game theory in that its substance lies in the mathematics presented, offering an up-to-date course that is addressed to mathematicians and economists.

The book is self-contained, providing a formal description of classic game-theoretic concepts together with rigorous proofs of the field's main results. The structure of the presentation proves helpful for readers who are seeking a deep knowledge of game theory's essential elements.

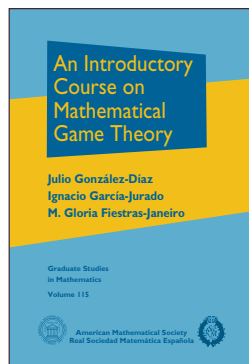
The authors offer a thorough treatment of cooperative games, a subtle topic that has often been left out of other books on game theory. The authors' overall style is distinctively concise, while offering motivations and interpretations of the theory to make the book accessible to a wide audience.

Game theory has advanced because of cooperation between mathematicians and economists. This book helps illustrate how this interaction between mathematics and social sciences continues to produce challenging problems that are relevant to a wide diversity of the scientific community.

READERSHIP: Advanced undergraduates and graduate students interested in game theory.

Graduate Studies in Mathematics, Volume 115

2010; 324 pp.; hardcover; ISBN: 978-0-8218-5151-7; List US\$62; AMS members US\$49.60; Order code: GSM/115



◆ Differential Topology

Victor Guillemin, *Massachusetts Institute of Technology, Cambridge, MA*, and **Alan Pollack**

Differential Topology provides an elementary and intuitive introduction to the study of smooth manifolds. In the years since its first publication, Guillemin and Pollack's book has become a standard text on the subject. It is a jewel of mathematical exposition, judiciously picking exactly the right mixture of detail and generality to display the richness within.

The text is mostly self-contained, requiring only undergraduate analysis and linear algebra. By relying on a unifying idea—transversality—the authors are able to avoid the use of big machinery or ad hoc techniques to establish the main results. In this way, they present intelligent treatments of important theorems, such as the Lefschetz fixed-point theorem, the Poincaré–Hopf index theorem, and Stokes theorem.

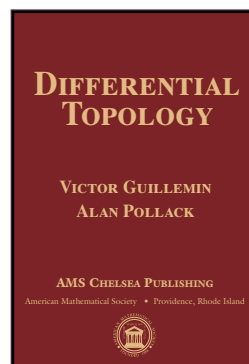
The book has a wealth of exercises of various types. Some are routine explorations of the main material. In others, the students are guided step-by-step through proofs of fundamental results, such as the Jordan-Brouwer separation theorem. An exercise section in Chapter 4 leads the student through a construction of de Rham cohomology and a proof of its homotopy invariance.

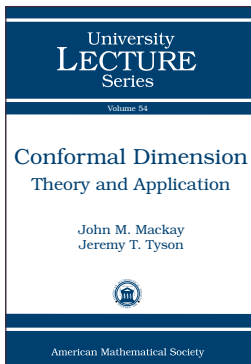
The book is suitable for either an introductory graduate course or an advanced undergraduate course.

READERSHIP: Undergraduate and graduate students interested in differential topology

AMS Chelsea Publishing, Volume 370

2010; 222 pp.; hardcover; ISBN: 978-0-8218-5193-7; List US\$40; AMS members US\$36; Order code: CHEL/370.H





Conformal Dimension

Theory and Application

John M. Mackay and Jeremy T. Tyson, *University of Illinois at Urbana-Champaign, IL*

Conformal dimension measures the extent to which the Hausdorff dimension of a metric space can be lowered by quasimetric deformations. Introduced by Pansu in 1989, this concept has proved extremely fruitful in a diverse range of areas, including geometric function theory, conformal dynamics, and geometric group theory.

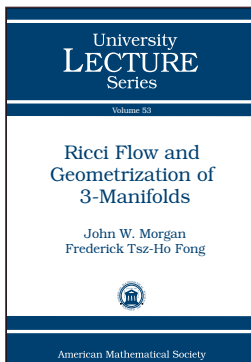
This survey leads the reader from the definitions and basic theory through to active research applications in geometric function theory, Gromov hyperbolic geometry, and the dynamics of rational maps, amongst other areas. It reviews the theory of dimension in metric spaces and of deformations of metric spaces. It summarizes the basic tools for estimating conformal dimension and illustrates their application to concrete problems of independent interest. Numerous examples and proofs are provided.

Working from basic definitions through to current research areas, this book can be used as a guide for graduate students interested in this field, or as a helpful survey for experts. Background needed for a potential reader of the book consists of a working knowledge of real and complex analysis on the level of first- and second-year graduate courses.

READERSHIP: Graduate students and research mathematicians interested in geometric function theory.

University Lecture Series, Volume 54

2010; 143 pp.; softcover; ISBN: 978-0-8218-5229-3; List US\$41; AMS members US\$32.80; Order code: ULECT/54



Ricci Flow and Geometrization of 3-Manifolds

John W. Morgan, *Stony Brook University, NY*, and **Frederick Tsz-Ho Fong**, *Stanford University, CA*

This book provides an important, less technical introduction to a major advance in geometry and topology. It gives an introductory overview of how to use Ricci flow and Ricci flow with surgery to establish the Poincaré Conjecture and the more general Geometrization Conjecture for all 3-dimensional manifolds.

Based on notes from lectures delivered by John Morgan at Stanford University in 2009, the book presents material that is mostly geometric and analytic in nature. An important ingredient is understanding singularity development for 3-dimensional Ricci flows and for 3-dimensional Ricci flows with surgery, as this is crucial for extending Ricci flows with surgery so that they are defined for all positive time.

The authors present the subject's major geometric and analytic results without getting bogged down in excessive detail. This allows the reader to grasp the structure of the arguments and some of the key ideas, leading the way for tackling more detailed treatments.

The book will appeal to graduates and researchers interested in geometric flows and low-dimensional manifold topology, as well as anyone interested in the solution of major mathematical problems.

READERSHIP: Graduate students and research mathematicians interested in differential equations and topology.

University Lecture Series, Volume 53

2010; 150 pp.; softcover; ISBN: 978-0-8218-4963-7; List US\$41; AMS members US\$32.80; Order code: ULECT/53

A Celebration of the Mathematical Legacy of Raoul Bott

P. Robert Kotiuga, *Boston University, MA*, Editor

A June 2008 CRM conference co-organized by the Clay Mathematics Institute chronicled Raoul Bott's profound impact on topology and on the interactions among mathematics, physics and technology. The tremendous amount of enthusiasm that was generated from the conference has been channeled into this book, a collection of contributions from three generations of Bott's students, co-authors and kindred spirits.

The book covers six decades of Bott's research, identifies his enduring mathematical legacy, and discusses the consequences of his work for emerging fields. His application of Morse theory to the problem of computing geodesics on Lie groups, and the Bott periodicity theorem for the stable homotopy groups of the classical Lie groups, helped propel him into becoming one of the most influential topologists of the 20th century.

The contributions of Bott's colleagues for this book can be read independently. The book is divided into four sections, each starting with accessible reminiscences before proceeding into more involved papers.

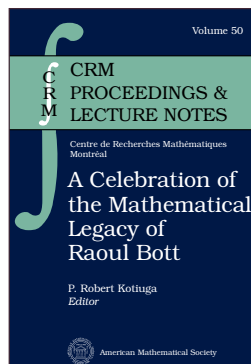
The book carries appeal for a wide audience, from undergraduates interested in truth and beauty to anyone interested in the account of a six-decade odyssey from engineering student to inspiring mathematician. This work shows how the mathematics that Bott mastered lives in current research, including emerging applications to mathematical physics.

READERSHIP: Undergraduates, graduate students and research mathematicians interested in the life and work of Raoul Bott.

Titles in this series are co-published with the Centre de Recherches Mathématiques.

CRM Proceedings & Lecture Notes, Volume 50

2010; 403 pp.; softcover; ISBN: 978-0-8218-4777-0; List US\$125; AMS members US\$100; Order code: CRMP/50



Eisenstein Series and Automorphic L -Functions

Freydoon Shahidi, *Purdue University, West Lafayette, IN*

Theory of Eisenstein series is one of the fundamental tools for studying automorphic forms, and is a critical part of the Langlands program. In this book, one of the originators of the Langlands-Shahidi method, which is the most important method of studying infinite-dimensional representations of algebraic groups, offers a comprehensive account of the theory.

The book's first two chapters offer general information about reductive groups, their L -groups, basic representation theory, and the basic properties of automorphic L -functions. The method is developed in chapters 3 to 9; this section covers the calculation of constant and non-constant terms of Eisenstein series, proofs of functional equations, and careful definitions of the local L -functions and root numbers at every prime using the method.

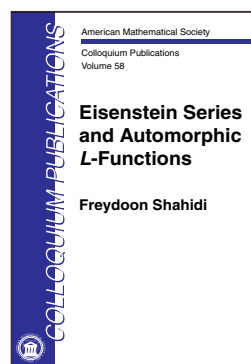
Several chapters are supplemented with appendices. In addition, the book includes a number of examples, some with full details, and a number of exercises.

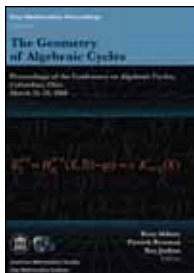
Information gathered from the Langlands-Shahidi method, when combined with the converse theorems of Cogdell and Piatetski-Shapiro, has been essential to the establishment of a number of new cases of Langlands functoriality conjecture, as some of these cases cannot be established through any other method. This book will appeal to graduate students and researchers interested in the Langlands program in automorphic forms and its connections with number theory.

READERSHIP: Graduate students and research mathematicians interested in automorphic forms and L -functions, number theory, and representation theory.

Colloquium Publications, Volume 58

2010; approximately 207 pp.; hardcover; ISBN: 978-0-8218-4989-7; List US\$55; AMS members US\$44; Order code: COLL/58





Algebra and Algebraic Geometry

The Geometry of Algebraic Cycles

Reza Akhtar, *Miami University, Oxford, OH*,
Patrick Brosnan, *University of British Columbia, Vancouver, B.C., Canada*, and **Roy Joshua**, *Ohio State University, Columbus, OH*, Editors

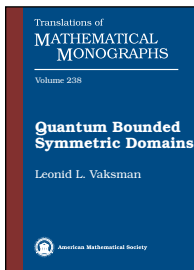
The subject of algebraic cycles has its roots in the study of divisors, extending as far back as the nineteenth century. Since then, and in particular in recent years, algebraic cycles have made a significant impact on many fields of mathematics, among them number theory, algebraic geometry, and mathematical physics. The present volume contains articles on all of the above aspects of algebraic cycles. It also contains a mixture of both research papers and expository articles, so that it would be of interest to both experts and beginners in the field.

READERSHIP: Graduate students and research mathematicians interested in algebraic geometry.

Titles in this series are co-published with the Clay Mathematics Institute (Cambridge, MA).

Clay Mathematics Proceedings, Volume 9

2010; 187 pp.; softcover; ISBN: 978-0-8218-5191-3; List US\$52; AMS members US\$41.60; Order code: CMIP/9



Quantum Bounded Symmetric Domains

Leonid L. Vaksman

Translated by Olga Bershtein and Sergey D. Sinel'shchikov

This book provides exposition of the basic theory of quantum bounded symmetric domains. The area became active in the late 1990s at a junction of noncommutative complex analysis and extensively developing theory of quantum groups. It is well known that the classical bounded symmetric domains involve a large number of nice constructions and results of the theory of C^* -algebras, theory of functions and functional analysis, representation theory of real reductive Lie groups, harmonic analysis, and special functions. In a surprising advance of the theory of quantum bounded symmetric domains, it turned out that many classical problems admit elegant quantum analogs. Some of those are expounded in the book. Anyone with an interest in the subject will welcome this unique treatment of quantum groups.

READERSHIP: Graduate students and research mathematicians interested in representation theory and noncommutative geometry.

Translations of Mathematical Monographs, Volume 238

2010; 256 pp.; hardcover; ISBN: 978-0-8218-4909-5; List US\$105; AMS members US\$84; Order code: MMONO/238

Analysis

Nonlinear Analysis and Optimization I

Nonlinear Analysis

Arie Leizarowitz, *Technion-Israel Institute of Technology, Haifa, Israel*, **Boris S. Mordukhovich**, *Wayne State University, Detroit, MI*, and **Itai Shafir** and **Alexander J. Zaslavski**, *Technion-Israel Institute of Technology, Haifa, Israel*, Editors

This volume is the first of two volumes representing leading themes of current research in nonlinear analysis and optimization. The articles are written by prominent researchers in these two areas and bring the readers, advanced graduate students and researchers alike, to the frontline of the vigorous research in these important fields of mathematics.

READERSHIP: Graduate students and research mathematicians interested in nonlinear analysis and its applications.

This book is co-published with Bar-Ilan University (Ramat-Gan, Israel).

Contemporary Mathematics, Volume 513

2010; 263 pp.; softcover; ISBN: 978-0-8218-4834-0; List US\$89; AMS members US\$71.20; Order code: CONM/513

Nonlinear Analysis and Optimization II

Optimization

Arie Leizarowitz, *Technion-Israel Institute of Technology, Haifa, Israel*, **Boris S. Mordukhovich**, *Wayne State University, Detroit, MI*, and **Itai Shafir** and **Alexander J. Zaslavski**, *Technion-Israel Institute of Technology, Haifa, Israel*, Editors

This volume is the second of two volumes representing leading themes of current research in nonlinear analysis and optimization. The articles are written by prominent researchers in these two areas and bring the readers, advanced graduate students and researchers alike, to the frontline of the vigorous research in these important fields of mathematics.

READERSHIP: Graduate students and research mathematicians interested in nonlinear analysis, optimization, and applications.

This book is co-published with Bar-Ilan University (Ramat-Gan, Israel).

Contemporary Mathematics, Volume 514

2010; 290 pp.; softcover; ISBN: 978-0-8218-4835-7; List US\$89; AMS members US\$71.20; Order code: CONM/514

Hilbert Spaces of Analytic Functions

Javad Mashreghi, *Université Laval, Montréal, QC, Canada*, **Thomas Ransford**, *Université Laval, Québec, QC, Canada*, and **Kristian Seip**, *Norwegian University of Science and Technology, Trondheim, Norway*, Editors

Hilbert spaces of analytic functions are currently a very active field of complex analysis. The Hardy space is the most senior member of this family. However, other classes of analytic functions such as the classical Bergman space, the Dirichlet space, the de Branges-Rovnyak spaces, and various spaces of entire functions, have been extensively studied. These spaces have been exploited in different fields of mathematics and also in physics and engineering. For example, de Branges used them to solve the Bieberbach conjecture. Modern control theory is another place that heavily exploits the techniques of analytic function theory. This book grew out of a workshop held in December 2008 at the CRM in Montréal and provides an account of the latest developments in the field of analytic function theory.

READERSHIP: Graduate students and research mathematicians interested in analytic function theory.

Titles in this series are co-published with the Centre de Recherches Mathématiques.

CRM Proceedings & Lecture Notes, Volume 51

2010; 214 pp.; softcover; ISBN: 978-0-8218-4879-1; List US\$99; AMS members US\$79.20; Order code: CRMP/51

Differentiable Measures and the Malliavin Calculus

Vladimir I. Bogachev, *Moscow State University, Russia*

This book provides the reader with the principal concepts and results related to differential properties of measures on infinite dimensional spaces. In the finite dimensional case such properties are described in terms of densities of measures with respect to Lebesgue measure. In the infinite dimensional case new phenomena arise. For the first time a detailed account is given of the theory of differentiable measures, initiated by S. V. Fomin in the 1960s; since then the method has found many various important applications. Differentiable properties are described for diverse concrete classes of measures arising in applications, for example, Gaussian, convex, stable, Gibbsian, and for distributions of random processes. Sobolev classes for measures on finite and infinite dimensional spaces are discussed in detail. Finally, we present the main ideas and results of the Malliavin calculus—a powerful method to study smoothness properties of the distributions of nonlinear functionals on infinite dimensional spaces with measures.

READERSHIP: Graduate students and research mathematicians interested in measure theory and random processes.

Mathematical Surveys and Monographs, Volume 164

2010; 488 pp.; hardcover; ISBN: 978-0-8218-4993-4; List US\$113; AMS members US\$90.40; Order code: SURV/164

Applications

Topological Quantum Computation



Zhenghan Wang, *Microsoft, Santa Barbara, CA*

Topological quantum computation is a computational paradigm based on topological phases of matter, which are governed by topological quantum field theories. In this approach, information is stored in the lowest energy states of many-anyon systems and processed by braiding non-abelian anyons. The computational answer is accessed by bringing anyons together and observing the result. Besides its theoretical esthetic appeal, the practical merit of the topological approach lies in its error-minimizing hypothetical hardware: topological phases of matter are fault-avoiding or deaf to most local noises, and unitary gates are implemented with exponential accuracy. Experimental realizations are pursued in systems such as fractional quantum Hall liquids and topological insulators.

This book expands on the author's CBMS lectures on knots and topological quantum computing and is intended as a primer for mathematically inclined graduate students. With an emphasis on introducing basic notions and current research, this book gives the first coherent account of the field, covering a wide range of topics.

READERSHIP: Graduate students and research mathematicians interested in quantum computers, topological quantum field theory.

A co-publication of the AMS and CBMS.

CBMS Regional Conference Series in Mathematics, Number 112

2010; 115 pp.; softcover; ISBN: 978-0-8218-4930-9; List US\$34; AMS members US\$27.20; All Individuals US\$27.20; Order code: CBMS/112

Mathematics in Finance

Santiago Carrillo Menéndez and José Luis Fernández Pérez, *Universidad Autónoma de Madrid, Spain*, Editors

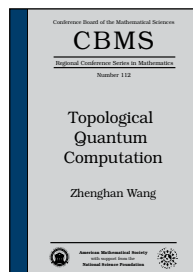
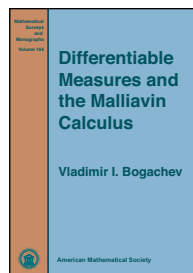
This volume contains survey papers on mathematical finance based on some courses given at the “Lluís Santaló” Summer School of the Real Sociedad Matemática Española, held in July 2007 at the Universidad Internacional Menéndez Pelayo, Santander (Spain). The primary topics are pathwise approximations of stochastic differential equations, Hedge funds, and credit derivatives.

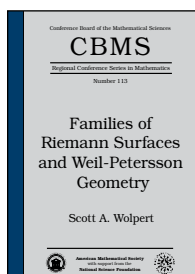
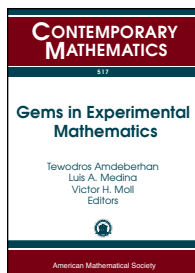
READERSHIP: Graduate students and research mathematicians interested in mathematical finance.

A co-publication of the AMS and Real Sociedad Matemática Española (RSME).

Contemporary Mathematics, Volume 515

2010; 146 pp.; softcover; ISBN: 978-0-8218-4673-5; List US\$59; AMS members US\$47.20; Order code: CONM/515





Gems in Experimental Mathematics



Tewodros Amdeberhan, *Tulane University, New Orleans, LA*, **Luis A. Medina**, *University of Puerto Rico, San Juan, PR*, and **Victor H. Moll**, *Tulane University, New Orleans, LA*, Editors

These proceedings reflect the special session on Experimental Mathematics held January 5, 2009, at the Joint Mathematics Meetings in Washington, DC as well as some papers specially solicited for this volume.

Experimental Mathematics is a recently structured field of Mathematics that uses the computer and advanced computing technology as a tool to perform experiments. These include the analysis of examples, testing of new ideas, and the search of patterns to suggest results and to complement existing analytical rigor.

The development of a broad spectrum of mathematical software products, such as *Mathematica*® and *Maple*™, has allowed mathematicians of diverse backgrounds and interests to use the computer as an essential tool as part of their daily work environment.

This volume reflects a wide range of topics related to the young field of Experimental Mathematics. The use of computation varies from aiming to exclude human input in the solution of a problem to traditional mathematical questions for which computation is a prominent tool.

READERSHIP: Graduate students and research mathematicians interested in computational aspects of mathematics.

Contemporary Mathematics, Volume 517

2010; 413 pp.; softcover; ISBN: 978-0-8218-4869-2; List US\$115; AMS members US\$92; Order code: CONM/517

Differential Equations

Nonlinear Partial Differential Equations and Related Topics

Dedicated to Nina N. Uraltseva

Arina A. Arkhipova and **Alexander I. Nazarov**, *St. Petersburg State University, Russia*, Editors

This book contains papers that engage a wide set of classical and modern topics in partial differential equations, including linear and nonlinear equations, variational problems, the Navier–Stokes system, and the Boltzmann equation. The results include existence and uniqueness theorems, qualitative properties of solutions, a priori estimates, and nonexistence theorems.

READERSHIP: Graduate students and research mathematicians interested in differential equations.

American Mathematical Society Translations—Series 2 (Advances in the Mathematical Sciences), Volume 229

2010; 252 pp.; hardcover; ISBN: 978-0-8218-4997-2; List US\$119; AMS members US\$95.20; Order code: TRANS2/229

Geometry and Topology

Families of Riemann Surfaces and Weil-Petersson Geometry

Scott A. Wolpert, *University of Maryland, College Park, MD*

This book is the companion to the CBMS lectures of Scott Wolpert at Central Connecticut State University. The lectures span across areas of research progress on deformations of hyperbolic surfaces and the geometry of the Weil-Petersson metric. The book provides a generally self-contained course for graduate students and postgraduates. The exposition also offers an update for researchers; material not otherwise found in a single reference is included.

A unified approach is provided for an array of results. The exposition covers Wolpert's work on twists, geodesic-lengths and the Weil-Petersson symplectic structure; Wolpert's expansions for the metric, its Levi-Civita connection and Riemann tensor. The exposition also covers Brock's twisting limits, visual sphere result and pants graph quasi isometry, as well as the Brock-Masur-Minsky construction of ending laminations for Weil-Petersson geodesics. The rigidity results of Masur-Wolf and Daskalopoulos-Wentworth, following the approach of Yamada, are included. The book concludes with a generally self-contained treatment of the McShane-Mirzakhani length identity, Mirzakhani's volume recursion, approach to Witten-Kontsevich theory by hyperbolic geometry, and prime simple geodesic theorem.

Lectures begin with a summary of the geometry of hyperbolic surfaces and approaches to the deformation theory of hyperbolic surfaces. General expositions are included on the geometry and topology of the moduli space of Riemann surfaces, the $CAT(0)$ geometry of the augmented Teichmüller space, measured geodesic and ending laminations, the deformation theory of the prescribed curvature equation, and the Hermitian description of Riemann tensor. New material is included on estimating orbit sums as an approach for the potential theory of surfaces.

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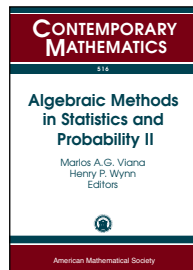
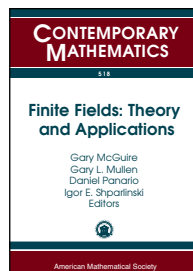
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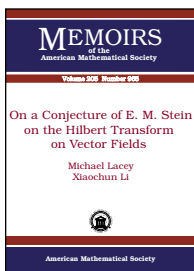
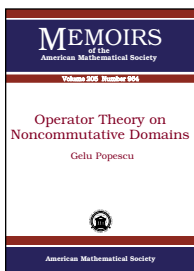
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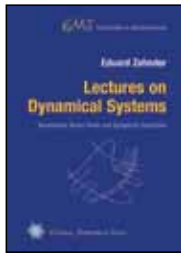
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