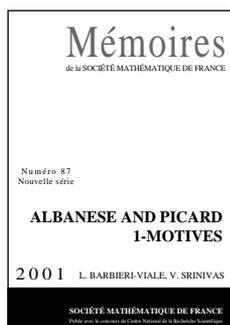


# New Publications Offered by the AMS

## Algebra and Algebraic Geometry



### Albanese and Picard 1-Motives

L. Barbieri-Viale, *Università degli Studi di Roma "La Sapienza", Rome, Italy*, and V. Srinivas, *Tata Institute of Fundamental Research, Mumbai, India*

*A publication of the Société Mathématique de France.*

This volume gives a nice summary of current work in the theory of 1-motives. The authors present the following: Let  $X$  be an  $n$ -dimensional algebraic variety over a field of characteristic zero. They describe algebraically defined Deligne 1-motives  $\text{Alb}^+(X)$ ,  $\text{Alb}^-(X)$ ,  $\text{Pic}^+(X)$  and  $\text{Pic}^-(X)$  which generalize the classical Albanese and Picard varieties of a smooth projective variety. Computed are Hodge,  $\ell$ -adic, and De Rham realizations, proving Deligne's conjecture for  $H^{2n-1}$ ,  $H_{2n-1}$ ,  $H^1$  and  $H_1$ .

Investigated are functoriality, universality, homotopical invariance and invariance under formation of projective bundles. The authors compare the cohomological and homological 1-motives for normal schemes. For proper schemes, they obtain an Abel-Jacobi map from Albanese 1-motive, which is the universal regular homomorphism to semi-abelian varieties. By using this universal property, they obtain "motivic" Gysin maps for projective local complete intersection morphisms.

The volume is suitable for advanced graduate students and researchers interested in algebraic geometry.

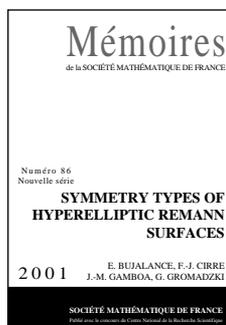
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a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

**Contents:** Introduction; Preliminaries on 1-motives; Homological Picard 1-motive:  $\text{Pic}^-$ ; Cohomological Albanese 1-motive:  $\text{Alb}^+$ ; Cohomological Picard 1-motive:  $\text{Pic}^+$ ; Homological

Albanese 1-motive:  $\text{Alb}^-$ ; Motivic Abel-Jacobi and Gysin maps; Rationality questions; Appendix. Picard functors; Bibliography.

**Mémoires de la Société Mathématique de France**, Number 87

March 2002, 104 pages, Softcover, ISBN 2-85629-113-9, 2000 *Mathematics Subject Classification*: 14F42, 14C30, 32S35, 19E15, **Individual member \$30**, List \$33, Order code SMFMEM/87N



### Symmetry Types of Hyperelliptic Riemann Surfaces

E. Bujalance and F.-J. Cirre, *Universidad Nacional de Educación a Distancia, Madrid, Spain*, J.-M. Gamboa, *Universidad Complutense de Madrid, Spain*, and G. Gromadzki, *University of Gdańsk, Poland*

*A publication of the Société Mathématique de France.*

This monograph presents original material in the theory of Riemann surfaces. A compact Riemann surface  $X$  is symmetric if it admits an anti-analytic involution  $\tau : X \rightarrow X$ . Such an involution is called a real structure. Two real structures are isomorphic if they are conjugate in the full group  $\text{Aut}^\pm X$  of analytic and anti-analytic automorphisms of  $X$ . In this memoir, the authors classify the real structures of all symmetric hyperelliptic Riemann surfaces of genus  $g \geq 2$  up to isomorphism. The topological invariants of each isomorphism class are also computed. They also give the list of groups which act as the full group of analytic and anti-analytic automorphisms of such surfaces. Moreover, the complex algebraic curve associated to any such Riemann surface is described in terms of polynomial equations. They also find an explicit formula for a real structure in each isomorphism class.

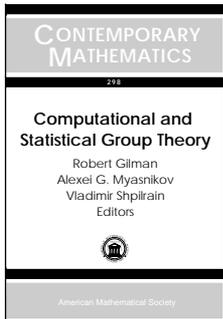
The book is suitable for advanced graduate students and researchers interested in algebraic geometry and Riemann surfaces.

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

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.

**Contents:** Introduction; Preliminaries; Automorphism groups of symmetric hyperelliptic Riemann surfaces; Symmetry types of hyperelliptic Riemann surfaces; Bibliography.

**Mémoires de la Société Mathématique de France**, Number 86  
March 2002, 122 pages, Softcover, ISBN 2-85629-112-0, 2000 *Mathematics Subject Classification*: 14Hxx, 30Fxx; 20Fxx, 20Hxx, **Individual member \$30**, List \$33, Order code SMFMEM/86N



## Computational and Statistical Group Theory

**Robert Gilman**, *Stevens Institute of Technology, Hoboken, NJ*, **Alexei G. Myasnikov**, *New York City*, and **Vladimir Shpilrain**, *City College of New York (CUNY)*, Editors

This book gives a nice overview of the diversity of current trends in computational and statistical group theory. It presents the latest research and a number of specific topics, such as growth, black box groups, measures on groups, product replacement algorithms, quantum automata, and more. It includes contributions by speakers at AMS Special Sessions at The University of Nevada (Las Vegas) and the Stevens Institute of Technology (Hoboken, NJ).

It is suitable for graduate students and research mathematicians interested in group theory.

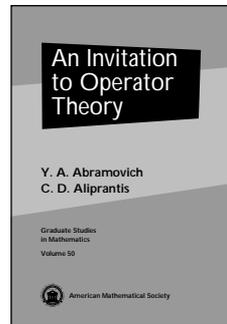
**Contents:** **R. C. Alperin** and **G. A. Noskov**, Uniform growth, actions on trees and  $GL_2$ ; **A. V. Borovik**, Centralisers of involutions in black box groups; **A. V. Borovik**, **A. G. Myasnikov**, and **V. Shpilrain**, Measuring sets in infinite groups; **E. M. Freden**, Quantum one-way automata and finitely generated groups; **R. I. Grigorchuk** and **A. Żuk**, Spectral properties of a torsion-free weakly branch group defined by a three state automaton; **T. Jitsukawa**, Malnormal subgroups of free groups; **C. R. Leedham-Green** and **S. H. Murray**, Variants of product replacement; **D. V. Osin**, Weakly amenable groups; **C. C. Sims**, The Knuth-Bendix procedure for strings and large rewriting systems.

**Contemporary Mathematics**, Volume 298

September 2002, 124 pages, Softcover, ISBN 0-8218-3158-5, LC 2002074632, 2000 *Mathematics Subject Classification*: 20-XX, 43A05, 43A07, 57Mxx, 60B15, 68Wxx, **Individual member \$23**, List \$39, Institutional member \$31, Order code CONM/298N

## Analysis

Recommended Text



## An Invitation to Operator Theory

**Y. A. Abramovich**, *Indiana University-Purdue University, Indianapolis*, and **C. D. Aliprantis**, *Purdue University, West Lafayette, IN*

This book offers a comprehensive and reader-friendly exposition of the theory of linear operators on Banach

spaces and Banach lattices using their topological and order structures and properties. Abramovich and Aliprantis give a unique presentation that includes many new and very recent developments in operator theory and also draws together results which are spread over the vast literature. For instance, invariant subspaces of positive operators and the Daugavet equation are presented in monograph form for the first time.

The authors keep the discussion self-contained and use exercises to achieve this goal. The book contains over 600 exercises to help students master the material developed in the text. The exercises are of varying degrees of difficulty and play an important and useful role in the exposition. They help to free the proofs of the main results of some technical details but provide students with accurate and complete accounts of how such details ought to be worked out. The exercises also contain a considerable amount of additional material that includes many well-known results whose proofs are not readily available elsewhere.

The companion volume, *Problems in Operator Theory*, also by Abramovich and Aliprantis, is available from the AMS as Volume 51 in the Graduate Studies in Mathematics series, and it contains complete solutions to all exercises in *An Invitation to Operator Theory*.

The solutions demonstrate explicitly technical details in the proofs of many results in operator theory, providing the reader with rigorous and complete accounts of such details. Finally, the book offers a considerable amount of additional material and further developments. By adding extra material to many exercises, the authors have managed to keep the presentation as self-contained as possible. The best way of learning mathematics is by doing mathematics, and the book *Problems in Operator Theory* will help achieve this goal.

Prerequisites to each book are the standard introductory graduate courses in real analysis, general topology, measure theory, and functional analysis. *An Invitation to Operator Theory* is suitable for graduate or advanced courses in operator theory, real analysis, integration theory, measure theory, function theory, and functional analysis. *Problems in Operator Theory* is a very useful supplementary text in the above areas. Both books will be of great interest to researchers and students in mathematics, as well as in physics, economics, finance, engineering, and other related areas, and will make an indispensable reference tool.

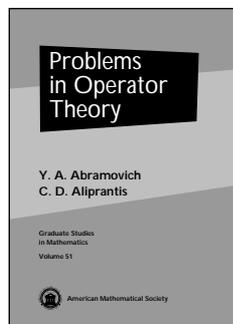
**Contents:** Odds and ends; Basic operator theory; Operators on  $AL$ - and  $AM$ -spaces; Special classes of operators; Integral operators; Spectral properties; Some special spectra; Positive

matrices; Irreducible operators; Invariant subspaces; The Daugavet equation; Bibliography; Index.

**Graduate Studies in Mathematics, Volume 50**

October 2002, 530 pages, Hardcover, ISBN 0-8218-2146-6, LC 2002074420, 2000 *Mathematics Subject Classification*: 46Axx, 46Bxx, 46Gxx, 47Axx, 47Bxx, 47Cxx, 47Dxx, 47Lxx, 28Axx, 28Exx, 15A48, 15A18, **All AMS members \$55**, List \$69, Order code GSM/50N

**Set:** Volume 50 and Volume 51, 916 pages, Hardcover, ISBN 0-8218-3333-2, **All AMS members \$79**, List \$99, Order code GSMSETN



## Problems in Operator Theory

**Y. A. Abramovich**, *Indiana University-Purdue University, Indianapolis*, and **C. D. Aliprantis**, *Purdue University, West Lafayette, IN*

This is one of the few books available in the literature that contains problems devoted entirely to the theory of

operators on Banach spaces and Banach lattices. The book contains complete solutions to the more than 600 exercises in the companion volume, *An Invitation to Operator Theory*, Volume 50 in the AMS series Graduate Studies in Mathematics, also by Abramovich and Aliprantis.

The exercises and solutions contained in this volume serve many purposes. First, they provide an opportunity to the readers to test their understanding of the theory. Second, they are used to demonstrate explicitly technical details in the proofs of many results in operator theory, providing the reader with rigorous and complete accounts of such details. Third, the exercises include many well-known results whose proofs are not readily available elsewhere. Finally, the book contains a considerable amount of additional material and further developments. By adding extra material to many exercises, the authors have managed to keep the presentation as self-contained as possible.

The book can be very useful as a supplementary text to graduate courses in operator theory, real analysis, function theory, integration theory, measure theory, and functional analysis. It will also make a nice reference tool for researchers in physics, engineering, economics, and finance.

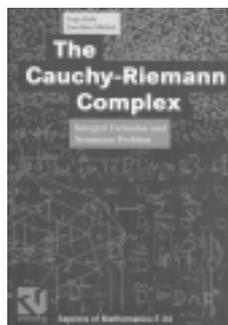
**Contents:** Odds and ends; Basic operator theory; Operators on  $AL$ - and  $AM$ -spaces; Special classes of operators; Integral operators; Spectral properties; Some special spectra; Positive matrices; Irreducible operators; Invariant subspaces; The Daugavet equation; Bibliography; Index.

**Graduate Studies in Mathematics, Volume 51**

October 2002, 386 pages, Hardcover, ISBN 0-8218-2147-4, LC 2002074421, 2000 *Mathematics Subject Classification*: 46Axx, 46Bxx, 46Gxx, 47Axx, 47Bxx, 47Cxx, 47Dxx, 47Lxx, 28Axx, 28Exx, 15A48, 15A18, **All AMS members \$39**, List \$49, Order code GSM/51N

**Set:** Volume 50 and Volume 51, 916 pages, Hardcover, ISBN 0-8218-3333-2, **All AMS members \$79**, List \$99, Order code GSMSETN

### Supplementary Reading



## The Cauchy-Riemann Complex

### Integral Formulae and Neumann Problem

**Ingo Lieb**, *Universität Bonn, Germany*, and **Joachim Michel**, *Université du Littoral, Calais, France*

*A publication of the Vieweg Verlag.*

Distributed by the AMS for the respected publishing house of Vieweg Verlag, this book presents complex analysis of several variables from the point of view of Cauchy-Riemann equations and integral representations. Some of the material has not yet been covered in other texts.

The method of integral representations is developed to establish classical results of complex analysis, both elementary and advanced, as well as subtle existence and regularity theorems for Cauchy-Riemann equations on complex manifolds. These results are applied to important questions in function theory.

Prerequisites for reading the text are basic theory of functions of several complex variables and a strong background in classical analysis, in particular distributions and integration theory. The book is a suitable text for advanced graduate courses and research seminars on several complex variables.

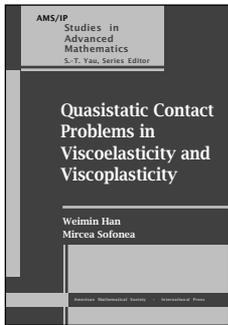
The AMS is exclusive distributor in North America. Vieweg Verlag Publications are available worldwide from the AMS outside of Germany, Switzerland, Austria, and Japan.

**Contents:** Introduction; The Bochner-Martinelli-Koppelman formula; Cauchy-Fantappiè forms; Strictly pseudoconvex domains in  $\mathbb{C}^n$ ; Strictly pseudoconvex manifolds; The  $\bar{\partial}$ -Neumann problem; Integral representations for the  $\bar{\partial}$ -Neumann problem; Regularity properties of admissible operators; Regularity of the  $\bar{\partial}$ -Neumann problem and applications; Bibliography; Notations; Index.

**Vieweg Aspects of Mathematics**

June 2002, 362 pages, Hardcover, ISBN 3-528-06954-6, 2000 *Mathematics Subject Classification*: 32Wxx; 32A26, **All AMS members \$62**, List \$69, Order code VWAM/34N

# Applications



## Quasistatic Contact Problems in Viscoelasticity and Viscoplasticity

Weimin Han, *University of Iowa, Iowa City*, and  
Mircea Sofonea, *Université de Perpignan, France*

Phenomena of contact between deformable bodies or between deformable and rigid bodies abound in industry and in everyday life. A few simple examples are brake pads with wheels, tires on roads, and pistons with skirts. Common industrial processes such as metal forming and metal extrusion involve contact evolutions. Because of the importance of contact processes in structural and mechanical systems, considerable effort has been put into modeling and numerical simulations.

This book introduces readers to a mathematical theory of contact problems involving deformable bodies. It covers mechanical modeling, mathematical formulations, variational analysis, and the numerical solution of the associated formulations. The authors give a complete treatment of some contact problems by presenting arguments and results in modeling, analysis, and numerical simulations.

Variational analysis of the models includes existence and uniqueness results of weak solutions, as well as results of continuous dependence of the solution on the data and parameters. Also discussed are links between different mechanical models.

In carrying out the variational analysis, the authors systematically use results on elliptic and evolutionary variational inequalities, convex analysis, nonlinear equations with monotone operators, and fixed points of operators.

Prerequisites include basic functional analysis, variational formulations of partial differential equation problems, and numerical approximations. The text is suitable for graduate students and researchers in applied mathematics, computational mathematics, and computational mechanics.

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

Titles in this series are copublished with International Press, Cambridge, MA.

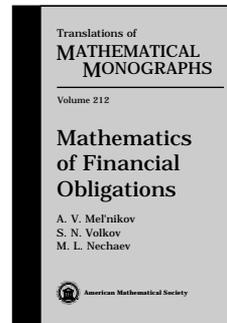
**Contents:** *Nonlinear variational problems and numerical approximation:* Preliminaries of functional analysis; Function spaces and their properties; Introduction to finite difference and finite element approximations; Variational inequalities; *Mathematical modelling in contact mechanics:* Preliminaries of contact mechanics of continua; Constitutive relations in solid mechanics; Background on variational and numerical analysis in contact mechanics; Contact problems in elasticity; *Contact problems in viscoelasticity:* A frictionless contact problem; Bilateral contact with slip dependent friction; Frictional contact with normal compliance; Frictional contact with normal damped response; Other viscoelastic contact problems; *Contact problems in viscoplasticity:* A Signorini contact

problem; Frictionless contact with dissipative potential; Frictionless contact between two viscoplastic bodies; Bilateral contact with Tresca's friction law; Other viscoelastic contact problems; Bibliography; Index.

AMS/IP Studies in Advanced Mathematics, Volume 30

November 2002, 442 pages, Hardcover, ISBN 0-8218-3192-5, LC 2002027716, 2000 *Mathematics Subject Classification:* 74-02, 74M15, 74M10, 74S05, 74B05, 74B20, 74Cxx, 74Dxx; 65M06, 65M12, 65M15, 65M60, 65N12, 65N15, 65N30, 49J40, All AMS members \$63, List \$79, Order code AMSIP/30N

**Independent Study**



## Mathematics of Financial Obligations

A. V. Mel'nikov, S. N. Volkov,  
and M. L. Nechaev, *Steklov Institute of Mathematics, Moscow, Russia*

Contemporary finance and actuarial calculations have become so mathematically complex that a rigorous exposition is required for an accurate and complete presentation. This volume delivers just that. It gives a comprehensive and up-to-date methodology for financial pricing and modelling. Also included are special cases useful for practical applications.

Beyond the traditional areas of hedging and investment on complete markets (the Black-Scholes and Cox-Ross-Rubinstein models), the book includes topics that are not currently available in monograph form, such as incomplete markets, markets with constraints, imperfect forms of hedging, and the convergence of calculations in finance and insurance.

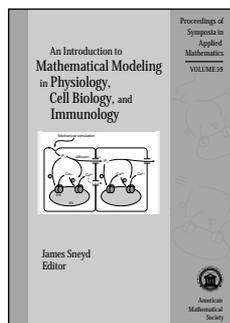
The book is geared toward specialists in finance and actuarial mathematics, practitioners in the financial and insurance business, students, and post-docs in corresponding areas of study. Readers should have a foundation in probability theory, random processes, and mathematical statistics.

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

**Contents:** Financial systems: Innovations and the risk calculus; Random processes and the stochastic calculus; Hedging and investment in complete markets; Hedging and incomplete markets; Markets with structural constraints and transaction costs; Imperfect forms of hedging; Dynamic contingent claims and American options; Analysis of "bond" contingent claims; Economics of insurance and finance: Convergence of quantitative methods of calculations; Bibliographical notes; Bibliography; Subject index.

Translations of Mathematical Monographs, Volume 212

September 2002, 194 pages, Hardcover, ISBN 0-8218-2945-9, LC 2002074395, 2000 *Mathematics Subject Classification:* 91-02, 91B24, 91B28, 91B26; 91B30, 91B82, 60H30, 60G40, 60G44, 60G42, 62P20, 60G48, Individual member \$47, List \$79, Institutional member \$63, Order code MMONO/212N



## An Introduction to Mathematical Modeling in Physiology, Cell Biology, and Immunology

**James Sneyd, Massey University, Auckland, New Zealand, Editor**

In many respects, biology is the new frontier for applied mathematicians. This book demonstrates the important role mathematics plays in the study of some biological problems. It introduces mathematics to the biological sciences and provides enough mathematics for bioscientists to appreciate the utility of the modelling approach.

The book presents a number of diverse topics, such as neurophysiology, cell biology, immunology, and human genetics. It examines how research is done, what mathematics is used, what the outstanding questions are, and how to enter the field. Also given is a brief historical survey of each topic, putting current research into perspective.

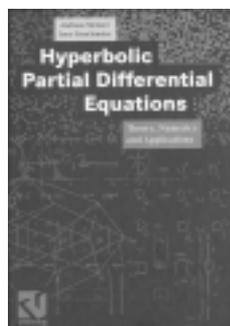
The book is suitable for mathematicians and biologists interested in mathematical methods in biology.

**Contents:** **D. Terman**, Dynamics of singularly perturbed neuronal networks; **D. Tranchina**, Mathematics in visual neuroscience: The retina; **J. P. Keener**, Arrhythmias by dimension; **J. Sneyd**, Calcium excitability; **K. Lange** and **B. Redelings**, Disease gene dynamics in a population isolate; **A. S. Perelson** and **P. W. Nelson**, Modeling viral infections; Index.

**Proceedings of Symposia in Applied Mathematics, Volume 59**

November 2002, approximately 192 pages, Hardcover, ISBN 0-8218-2816-9, LC 2002071734, 2000 *Mathematics Subject Classification*: 92C05, 92C20, 92C30, 92C37; 92D10, 92D30, **All AMS members \$39**, List \$49, Order code PSAPM/59N

## Differential Equations



## Hyperbolic Partial Differential Equations Theory, Numerics and Applications

**Andreas Meister, Medical University of Lübeck, Germany, and Jens Struckmeier, University of Hamburg, Germany**

*A publication of the Vieweg Verlag.*

This book introduces the fundamental properties of hyperbolic partial differential equations with applications to

mathematical modelling. Based on a summer school held at the Technical University of Hamburg-Harburg (Germany), it includes articles from leading experts in mathematics, physics, and engineering. It gives a unique presentation of concepts regarding the numerical treatment of hyperbolic partial differential equations—from basic algorithms through actual research. Numerical methods discussed include central and upwind schemes for structured and unstructured grids based on ENO and WENO reconstructions, pressure correction methods like SIMPLE and PISO, as well as asymptotic-induced algorithms for low Mach number flows.

This book is another top selection available through the AMS for the renowned publisher, Vieweg Verlag. It is written for graduate students, mathematicians, physicists, and engineers interested in partial differential equations and related applications.

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

The AMS is exclusive distributor in North America. Vieweg Verlag Publications are available worldwide from the AMS outside of Germany, Switzerland, Austria, and Japan.

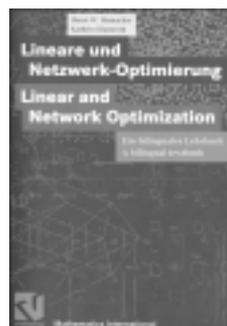
**Contents:** Hyperbolic conservation laws and industrial applications; Bibliography; Central schemes and systems of balance laws; Bibliography; Methods on unstructured grids, WENO and ENO recovery techniques; Bibliography; Pressure-correction methods for all flow speeds; Bibliography; Computational fluid dynamics and aeroacoustics for low Mach number flow; Bibliography.

### Vieweg Monographs

June 2002, 320 pages, Hardcover, ISBN 3-528-03188-3, 2000 *Mathematics Subject Classification*: 65-01; 35-01, 35Lxx, 65Mxx, 65Nxx, **All AMS members \$36**, List \$40, Order code VW/10N

## Discrete Mathematics and Combinatorics

### Supplementary Reading



## Linear and Network Optimization A Bilingual Textbook

**Horst W. Hamacher, University of Kaiserslautern, Germany, and Kathrin Klamroth, University of Applied Sciences, Dresden, Germany**

*A publication of the Vieweg Verlag.*

This book outlines the basic concepts of linear optimization and some classic, polynomially solvable network optimization problems. Principal topics include the simplex method, Karmarkar's algorithm, and network flow problems.

One unique feature is that it is written in both German and English. So teaching mathematical optimization can be combined with introducing English as a technical language or vice versa. This is particularly useful for students preparing

for a language exam in a Ph.D. program. This bilingual edition also allows readers of either language to read this book.

Another addition to the respected Vieweg Verlag titles available from the AMS, this book would make a nice supplementary text for courses in operations research, network optimization, or linear optimization. It is geared toward advanced undergraduates, graduate students, and research mathematicians.

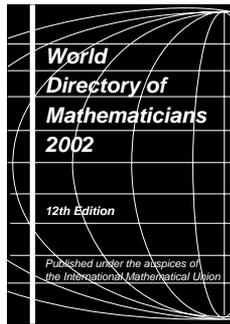
The AMS is exclusive distributor in North America. Vieweg Verlag Publications are available worldwide from the AMS outside of Germany, Switzerland, Austria, and Japan.

**Contents:** Introduction and applications; The simplex method; Duality and further variations of the simplex method; Interior point methods: Karmarkar's projective algorithm; Introduction to graph theory and shortest spanning trees; Shortest path problems; Network flow problems; Matchings; References; Stichwortverzeichnis; Index.

#### Vieweg Monographs

June 2002, 240 pages, Softcover, ISBN 3-528-03155-7, 2000 *Mathematics Subject Classification*: 90-01; 90B10, 90C05, 90C35, **All AMS members \$19**, List \$21, Order code VW/11N

## General and Interdisciplinary



### World Directory of Mathematicians 2002

*A publication of the International Mathematical Union.*

*From a review for a previous edition:*

*What is most impressive about this directory is its scope and size. It includes worldwide organizations of every type in the mathematical sciences. This title will be especially useful to academic libraries that*

*support graduate programs in mathematics.*

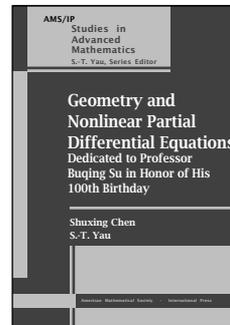
—*American Reference Books Annual*

This edition of the *World Directory of Mathematicians* incorporates updates and corrections to the 1998 edition and includes over 3,300 more names. This valuable reference tool contains the names and addresses of over 57,000 mathematicians from 71 countries. This edition includes an appendix for the first time. Listings for the directory are arranged both alphabetically and geographically and are based on information supplied by National Committees for Mathematics (or corresponding organizations). Libraries, mathematics departments, and individuals will find this most recent edition to be a valuable resource for its extensive coverage of the international mathematical community.

Published by the International Mathematical Union.

June 2002, 1248 pages, Softcover, 2000 *Mathematics Subject Classification*: 00-XX, **All AMS members \$56**, List \$70, Order code WRLDIR/12N

## Geometry and Topology



### Geometry and Nonlinear Partial Differential Equations

**Shuxing Chen**, *Fudan University, Shanghai, People's Republic of China*, and **S.-T. Yau**, *Harvard University, Cambridge, MA*, Editors

This book presents the proceedings of a conference on geometry and nonlinear partial differential equations dedicated to Professor Buqing Su in honor of his one-hundredth birthday. It offers a look at current research by Chinese mathematicians in differential geometry and geometric areas of mathematical physics.

It is suitable for advanced graduate students and research mathematicians interested in geometry, topology, differential equations, and mathematical physics.

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

Titles in this series are copublished with International Press, Cambridge, MA.

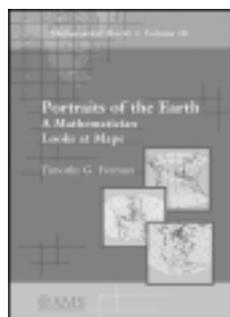
**Contents:** C. Gu, The address on the celebration for the 100th birthday of Professor Su Buqing; B.-L. Chen and X.-P. Zhu, A property of Kähler-Ricci solitons on complete complex surfaces; S. Chen and Y.-G. Wang, Propagation of singularities in compressible viscous fluids; Q. Ding, The Landau-Lifshitz equation and its gauge equivalent structure; Z. Jiang, D. Fang, H. Liu, and D. Moss, General flattened Jaffe models for galaxies; L. Ji, Scattering matrices and geodesics of locally symmetric spaces; J. Li, A note on enumerating rational curves in a K3 surface; S. Jin and X. Li, Multi-phase computations of the semiclassical limit of the Schrödinger equation; B. Lian, K. Liu, and S.-T. Yau, Towards a mirror principle for higher genus; F. Lin and T.-C. Lin, Vortices in two-dimensional Bose-Einstein condensates; Z. Liu, Sample path properties of Gaussian processes; L. Peng, Wavelets on the Heisenberg group; Y.-B. Shen, On complete submanifolds with parallel mean curvature vector; S.-L. Tan, Triple covers on smooth algebraic varieties; W. Wang, Osculating CR manifolds by nilpotent Lie groups in the theory of several complex variables; Y. Wang, Dynamics of commuting holomorphic maps; Y. Yang, H. Chen, and W. Liu, Different behaviour for the solutions of 1-dimensional chemotaxis model with exponential growth; S. T. Yau, Some progress in classical general relativity; H. Yin, Long shock for supersonic flow past a curved cone; X. Zhang, A compactness theorem for Yang-Mills connections; X. Zhang, The positive mass theorem in general relativity; X.-Y. Zhou, Extension theorems for special holomorphic functions.

AMS/IP Studies in Advanced Mathematics, Volume 29

September 2002, 237 pages, Softcover, ISBN 0-8218-3294-8, LC 2002027761, 2000 *Mathematics Subject Classification*: 34Axx, 47Jxx, 76Bxx, 70Kxx, **All AMS members \$47**, List \$59, Order code AMSIP/29N

**Recommended Text**

**Supplementary Reading**



## Portraits of the Earth A Mathematician Looks at Maps

**Timothy G. Feeman, Villanova  
University, PA**

*Every map is a tool, a product of human effort and creativity, that represents some aspects of our world or universe ... [This] course was powered by the belief that by exploring*

*the mathematical ideas involved in creating and analyzing maps, students would see how mathematics could help them to understand and explain their world.*

—from the Preface

*Portraits of the Earth* exemplifies the AMS's mission to bring the power and vitality of mathematical thought to the nonexpert. It is designed to teach students to think logically and to analyze the technical information that they so readily encounter every day.

Maps are exciting, visual tools that we encounter on a daily basis: from street maps to maps of the world accompanying news stories to geologic maps depicting the underground structure of the earth. This book explores the mathematical ideas involved in creating and analyzing maps, a topic that is rarely discussed in undergraduate courses. It is the first modern book to present the famous problem of mapping the earth in a style that is highly readable and mathematically accessible to most students. Feeman's writing is inviting to the novice, yet also interesting to readers with more mathematical experience. Through the visual context of maps and mapmaking, students will see how contemporary mathematics can help them to understand and explain the world.

Topics explored are the shape and size of the earth, basic spherical geometry, and why one can't make a perfect flat map of the planet. The author discusses different attributes that maps can have and determines mathematically how to design maps that have the desired features. The distortions that arise in making world maps are quantitatively analyzed. There is an in-depth discussion on the design of numerous map projections—both historical and contemporary—as well as conformal and equal-area maps. Feeman looks at how basic map designs can be modified to produce maps with any center, and he indicates how to generalize methods to produce maps of arbitrary surfaces of revolution. Also included are end-of-chapter exercises and laboratory projects. Particularly interesting is a chapter that explains how to use Maple® add-on software to make maps from geographic data points.

This book would make an excellent text for a basic undergraduate mathematics or geography course and would be especially appealing to the teacher who is interested in exciting visual applications in the classroom. It would also serve nicely as supplementary reading for a course in calculus, linear algebra, or differential geometry. Prerequisites include a solid grasp of trigonometry and basic calculus.

*This item will also be of interest to those working in applications and general and interdisciplinary areas.*

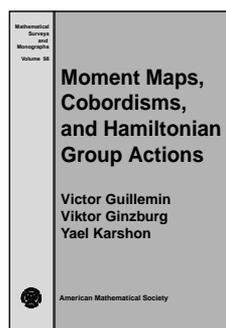
©Waterloo Maple, Inc., Ontario, Canada.

**Contents:** Geodesy—measuring the earth; Map projections; Scale factors; Distances and shortest paths on the sphere; Angles, triangles, and area on a sphere; Curvature of surfaces; Classical projections; Equal-area maps; Conformal maps; Analysis of map distortion; Oblique perspectives; Other worlds: Maps of surfaces of revolution; Appendix A. Aspects of thematic cartography: Symbolization, data classification, and thematic maps; Appendix B. Laboratory projects; Appendix C. Portraits of the earth: How the maps in this book were produced; Bibliography; Index.

**Mathematical World**, Volume 18

October 2002, approximately 136 pages, Softcover, ISBN 0-8218-3255-7, LC 2002027950, 2000 *Mathematics Subject Classification*: 00-01, 26A06, 51M09, 86A30; 00A69, 51-01, 51M25, 86-04, **All AMS members \$21**, List \$26, Order code MAWRD/18N

**Supplementary Reading**



## Moment Maps, Cobordisms, and Hamiltonian Group Actions

**Victor Guillemin,**  
*Massachusetts Institute of  
Technology, Cambridge,*  
**Viktor Ginzburg,** *University of  
California, Santa Cruz,* and

**Yael Karshon,** *The Hebrew University of  
Jerusalem, Israel*

This research monograph presents many new results in a rapidly developing area of great current interest. Guillemin, Ginzburg, and Karshon show that the underlying topological thread in the computation of invariants of G-manifolds is a consequence of a linearization theorem involving equivariant cobordisms. The book incorporates a novel approach and showcases exciting new research.

During the last 20 years, “localization” has been one of the dominant themes in the area of equivariant differential geometry. Typical results are the Duistermaat-Heckman theory, the Berline-Vergne-Atiyah-Bott localization theorem in equivariant de Rham theory, and the “quantization commutes with reduction” theorem and its various corollaries. To formulate the idea that these theorems are all consequences of a single result involving equivariant cobordisms, the authors have developed a cobordism theory that allows the objects to be non-compact manifolds. A key ingredient in this non-compact cobordism is an equivariant-geometrical object which they call an “abstract moment map”. This is a natural and important generalization of the notion of a moment map occurring in the theory of Hamiltonian dynamics.

The book contains a number of appendices that include introductions to proper group-actions on manifolds, equivariant cohomology, Spin<sup>c</sup>-structures, and stable complex structures. It is geared toward graduate students and research mathematicians interested in differential geometry. It is also suitable for topologists, Lie theorists, combinatorists, and theoretical physicists. Prerequisite is some expertise in calculus on mani-

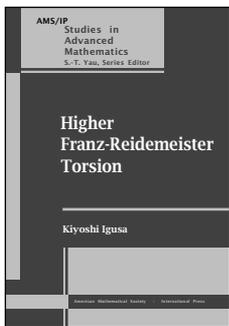
## Supplementary Reading

folds and basic graduate-level differential geometry. physicists. Prerequisite is some expertise in calculus on manifolds and basic graduate-level differential geometry.

**Contents:** Introduction; *Part 1. Cobordism:* Hamiltonian cobordism; Abstract moment maps; The linearization theorem; Reduction and applications; *Part 2. Quantization:* Geometric quantization; The quantum version of the linearization theorem; Quantization commutes with reduction; *Part 3. Appendices:* Signs and normalization conventions; Proper actions of Lie groups; Equivariant cohomology; Stable complex and Spin<sup>c</sup> structures; Assignments and abstract moment maps; Assignment cohomology; Non-degenerate abstract moment maps; Characteristic numbers, non-degenerate cobordisms, and non-virtual quantization; The Kawasaki Riemann-Roch formula; Cobordism invariance of the index of a transversally elliptic operator; Bibliography; Index.

**Mathematical Surveys and Monographs, Volume 98**

October 2002, 350 pages, Hardcover, ISBN 0-8218-0502-9, LC 2002074590, 2000 *Mathematics Subject Classification:* 53Dxx, 57Rxx, 55N91, 57S15, **Individual member \$47**, List \$79, Institutional member \$63, Order code SURV/98N



## Higher Franz-Reidemeister Torsion

Kiyoshi Igusa, *Brandeis University, Waltham, MA*

The book is devoted to the theory of topological higher Franz-Reidemeister torsion in  $K$ -theory. The author defines the higher Franz-Reidemeister torsion based on Volodin's  $K$ -theory and Borel's regulator map. He

describes its properties and generalizations and studies the relation between the higher Franz-Reidemeister torsion and other torsions used in  $K$ -theory: Whitehead torsion and Ray-Singer torsion. He also presents methods of computing higher Franz-Reidemeister torsion, illustrates them with numerous examples, and describes various applications of higher Franz-Reidemeister torsion, particularly for the study of homology of mapping class groups.

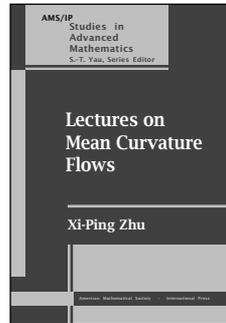
Packed with up-to-date information, the book provides a unique research and reference tool for specialists working in algebraic topology and  $K$ -theory.

Titles in this series are copublished with International Press, Cambridge, MA.

**Contents:** Cocycles in Volodin  $K$ -theory; Spaces of matrices and higher Franz-Reidemeister torsion; A model for the Whitehead spaces; Morse theory and filtered chain complexes; Homotopy type of the Whitehead space; The framing principle and Bökstedt's theorem; Proof of complexified Bökstedt theorem; Framed graphs; Bibliography; Index.

**AMS/IP Studies in Advanced Mathematics, Volume 31**

October 2002, approximately 392 pages, Hardcover, ISBN 0-8218-3170-4, LC 2002027975, 2000 *Mathematics Subject Classification:* 19D10; 55R40, 57R45, 19F27, **All AMS members \$63**, List \$79, Order code AMSIP/31N



## Lectures on Mean Curvature Flows

Xi-Ping Zhu, *Zhongshan University, Guangzhou, People's Republic of China*

"Mean curvature flow" is a term that is used to describe the evolution of a hypersurface whose normal velocity is given by the mean curvature. In the simplest case of a convex closed curve

on the plane, the properties of the mean curvature flow are described by Gage-Hamilton's theorem. This theorem states that under the mean curvature flow, the curve collapses to a point, and if the flow is diluted so that the enclosed area equals  $\pi$ , the curve tends to the unit circle.

In this book, the author gives a comprehensive account of fundamental results on singularities and the asymptotic behavior of mean curvature flows in higher dimensions. Among other topics, he considers in detail Huisken's theorem (a generalization of Gage-Hamilton's theorem to higher dimension), evolution of non-convex curves and hypersurfaces, and the classification of singularities of the mean curvature flow.

Because of the importance of the mean curvature flow and its numerous applications in differential geometry and partial differential equations, as well as in engineering, chemistry, and biology, this book can be useful to graduate students and researchers working in these areas. The book would also make a nice supplementary text for an advanced course in differential geometry.

Prerequisites include basic differential geometry, partial differential equations, and related applications.

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

Titles in this series are copublished with International Press, Cambridge, MA.

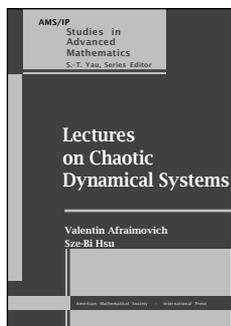
**Contents:** The curve shortening flow for convex curves; The short time existence and the evolution equation of curvatures; Contraction of convex hypersurfaces; Monotonicity and self-similar solutions; Evolution of embedded curves or surfaces (I); Evolution of embedded curves and surfaces (II); Evolution of embedded curves and surfaces (III); Convexity estimates for mean convex surfaces; Li-Yau estimates and type II singularities; The mean curvature flow in Riemannian manifolds; Contracting convex hypersurfaces in Riemannian manifolds; Definition of center of mass for isolated gravitating systems; References; Index.

**AMS/IP Studies in Advanced Mathematics, Volume 32**

October 2002, approximately 160 pages, Hardcover, ISBN 0-8218-3311-1, 2000 *Mathematics Subject Classification:* 53C44; 35K55, 52A20, 53C20, 53C21, 58J35, **All AMS members \$31**, List \$39, Order code AMSIP/32N

# Mathematical Physics

Independent Study



## Lectures on Chaotic Dynamical Systems

Valentin Afraimovich, *San Luis Potosi State University, Mexico*, and Sze-Bi Hsu, *Tsing-Hua University, Hsinchu, Taiwan*

This book is devoted to chaotic nonlinear dynamics. It presents a consistent, up-to-date introduction to

the field of strange attractors, hyperbolic repellers, and nonlocal bifurcations. The authors keep the highest possible level of "physical" intuition while staying mathematically rigorous. In addition, they explain a variety of important nonstandard algorithms and problems involving the computation of chaotic dynamics.

The book will help readers who are not familiar with nonlinear dynamics to understand and enjoy sophisticated modern monographs on dynamical systems and chaos. Intended for courses in either mathematics, physics, or engineering, prerequisites are calculus, differential equations, and functional analysis.

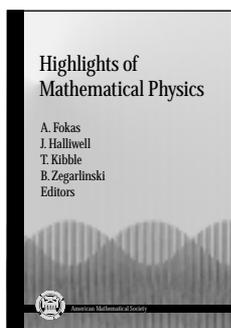
Titles in this series are copublished with International Press, Cambridge, MA.

**Contents:** Basic concepts; Zero-dimensional dynamics; One-dimensional dynamics; Two-dimensional dynamics; Systems with 1.5 degrees of freedom; Systems generated by three-dimensional vector fields; Lyapunov exponents; Appendix; Bibliography; Index.

AMS/IP Studies in Advanced Mathematics, Volume 28

November 2002, approximately 288 pages, Hardcover, ISBN 0-8218-3168-2, LC 2002074423, 2000 *Mathematics Subject Classification*: 37-XX, **All AMS members \$39**, List \$49, Order code AMSIP/28N

Supplementary Reading



## Highlights of Mathematical Physics

A. Fokas, *Cambridge University, UK*, and J. Halliwell, T. Kibble, and B. Zegarlinski, *Imperial College, London, UK*, Editors

This volume presents state-of-the-art research in mathematical physics addressed to a broad spectrum of readers, including graduate students, researchers, and others interested in this topic. Contributors to the volume participated in the 13th International Congress on Mathematical Physics held at Imperial College (London, UK). The contributions include, in particular, pedagogical lectures presented at the Young Researchers Symposium (YRS) held in

association with the Congress, as well as public lectures given at the Congress, and the contributions from the winners of the Henri Poincaré prize.

**Contents:** A. Ashtekar, The second black body problem: interface of general relativity, quantum theory and statistical mechanics; M. Atiyah, On the unreasonable effectiveness of physics in mathematics; L. J. Biven, Weak-wave turbulence: a tragic super-hero of turbulence theory; A. Connes, Noncommutative geometry year 2000; A. Ekert, Quantum computation; L. Faddeev, Advent of the Yang-Mills field; G. Jona-Lasinio, Cross fertilization in theoretical physics: the case of condensed matter and particle physics; J. P. Keating, Random matrices and the Riemann zeta-function; V. V. Kisil, Meeting Descartes and Klein somewhere in a noncommutative space; R. Kotecky, Phase transitions: on a crossroads of probability and analysis; S. A. Levin, Exploring the complex adaptive nature of ecosystems; H. A. Posch and W. Thirring, The classical three-body problem - where is abstract mathematics, physical intuition, computational physics most powerful?; D. Ruelle, Irreversibility revisited; G. 't Hooft, A confrontation with infinity; H.-T. Yau, Quantum dynamics of many-body systems.

November 2002, 271 pages, Hardcover, ISBN 0-8218-3223-9, LC 200207669, 2000 *Mathematics Subject Classification*: 00B15; 70-01, 81-01, 92-01, **All AMS members \$39**, List \$49, Order code HMPN