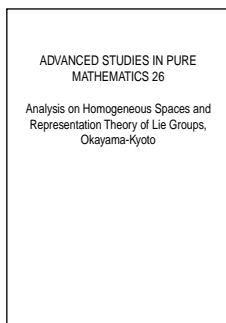


# New Publications Offered by the AMS

## New Series from the AMS!

The AMS is pleased to announce a new series entitled, Courant Lecture Notes. This series features books in mathematics and theoretical computer science written by the faculty and visitors of the Courant Institute of Mathematical Sciences at New York University (New York City). Most of the books originate from graduate courses and minicourses offered at the institute. See page 806.

## Algebra and Algebraic Geometry



### Analysis on Homogeneous Spaces and Representation Theory of Lie Groups, Okayama-Kyoto

Toshiyuki Kobayashi,  
*University of Tokyo, Japan*,  
Masaki Kashiwara, *RIMS*,  
Toshihiko Matsuki and

Kyo Nishiyama, *Kyoto University, Japan*, and  
Toshio Oshima, *University of Tokyo, Japan*,  
Editors

A publication of the *Mathematical Society of Japan*.

This volume is an outgrowth of the activities of the RIMS Research Project, which presented symposia offering both individual lectures on specialized topics and expository courses on current research. The subjects therein reflect very active areas in the representation theory of Lie groups. Also included are various topical interactions with geometry of homogeneous spaces, automorphic forms, quantum groups, special functions, discrete groups, differential equations, etc. Comprising results from some of today's most active areas of research, this volume will serve as an excellent up-to-date guide to the representation theory of Lie groups.

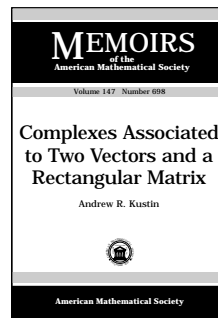
Published for the Mathematical Society of Japan by Kinokuniya, Tokyo, and distributed worldwide, except in Japan, by the AMS.

**Contents:** J. Adams, Characters of non-linear groups; E. Balslev and A. Venkov, Selberg's eigenvalue conjecture and the Siegel zeros for Hecke  $L$ -series; Y. Benoist, Propriétés asymptotiques des groupes linéaires (II); T. Hayata, H. Koseki, and T. Oda, Matrix coefficients of the principal  $P_j$ -series and the middle discrete series of  $SU(2, 2)$ ; R. Howe,  $K$ -type struc-

ture in the principal series of  $GL_3, \mathbb{I}$ ; T. Kobayashi, Discretely decomposable restrictions of unitary representations of reductive Lie groups—examples and conjectures; B. Kostant, On  $\wedge_{\mathfrak{g}}$  for a semisimple Lie algebra  $\mathfrak{g}$ , as an equivariant module over the symmetric algebra  $S(\mathfrak{g})$ ; O. Mathieu, Tilting modules and their applications; E.-C. Tan, On the theta lift for the trivial representation; T. Tanisaki, Hypergeometric systems and Radon transforms for Hermitian symmetric spaces; G. Tomanov, Orbits on homogeneous spaces of arithmetic origin and approximations; D. A. Vogan, Jr., A Langlands classification for unitary representations; M. Wakimoto, Modular transformation of twisted characters of admissible representations and fusion algebras associated to non-symmetric transformation matrices; Symposia.

Advanced Studies in Pure Mathematics, Volume 26

April 2000, 359 pages, Hardcover, ISBN 4-314-10138-5, 2000 *Mathematics Subject Classification*: 22Exx; 11Fxx, 17Bxx, 20Gxx, 43-XX, 53Cxx, **Individual member \$58**, List \$96, Institutional member \$77, Order code ASPM/26N



### Complexes Associated to Two Vectors and a Rectangular Matrix

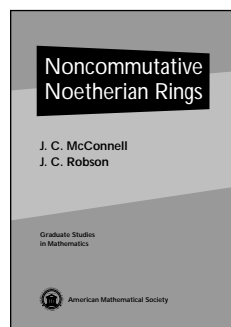
Andrew R. Kustin, *University of South Carolina, Columbia*

**Contents:** Preliminary results; The complex  $\mathbb{I}^{(z)}$ ; Properties of the complexes  $\mathbb{I}^{(z)}$ ; The complex  $\mathbb{M}^{(z)}$ ; The functor  $\mathcal{M}(p, q, r)$ ; Binomial coefficients; The proof of Theorems 4.5 and 4.8; Exactness; The case  $g = f - 1$ ; References.

*Memoirs of the American Mathematical Society*, Volume 147, Number 698

September 2000, 81 pages, Softcover, ISBN 0-8218-2073-7, LC 00-034996, 2000 *Mathematics Subject Classification*: 13D25, **Individual member \$25**, List \$42, Institutional member \$34, Order code MEMO/147/698N

**Advance Notice**  
**Recommended Text**



## Noncommutative Noetherian Rings

J. C. McConnell and  
J. C. Robson, *University of Leeds, England*

*From reviews of the first edition ...*

*A model of mathematical writing, as perfectly written a mathematics book as I have seen ... It can be profitably read by non-experts ... an almost*

*perfectly conceived account of major developments and general methods ... will remain a basic reference for many years ...*

—*Bulletin of the AMS*

*Very thorough and illuminating ... A veritable tour de force, encompassing a wide range of topics in some depth ... very easy to find information in this book ... full of illuminating examples which throw a light on [the theory].*

—*Proceedings of the Edinburgh Mathematical Society*

*Self-contained, comprehensive ... The creation of this valuable resource is a service to mathematics ...*

—*Mathematical Reviews*

*An intrinsically interesting branch of algebra ... Until ... this book there has been no attempt to provide an overview of, and a general reference for, the most important developments in the theory. The ... authors set out to fill this gap and have succeeded admirably ... easy to read and use ... well written ... An essential possession for any serious worker in the area.*

—*Zentralblatt für Mathematik*

*An account of noncommutative Noetherian rings, giving the theory as far as it exists but with constant emphasis on constructions and examples. [This is] a daunting task but the authors have succeeded well ... highly readable ... well indexed ... will rapidly become the standard text in the field and will stimulate further progress.*

—*Bulletin of the LMS*

*An abundance of well-organized material ... a must for those in the area.*

—*International Mathematical News*

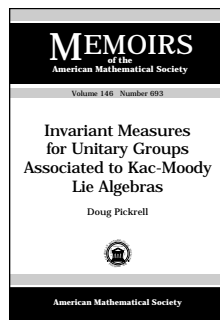
This is a reprinted edition of a work that was considered the definitive account in the subject area upon its initial publication by J. Wiley & Sons in 1987. It presents, within a wider context, a comprehensive account of noncommutative Noetherian rings. The author covers the major developments from the 1950s, stemming from Goldie's theorem and onward, including applications to group rings, enveloping algebras of Lie algebras, PI rings, differential operators, and localization theory. The book is not restricted to Noetherian rings, but discusses wider classes of rings where the methods apply more generally. In the current edition, some errors were corrected, a number of arguments have been expanded, and the references were brought up to date. This reprinted edition will continue to be a valuable and stimulating work for readers interested in ring theory and its applications to other areas of mathematics.

**Contents:** Preliminaries; *Basic theory:* Some Noetherian rings; Quotient rings and Goldie's theorem; Structure of semiprime Goldie rings; Semiprime ideals in Noetherian rings; Some Dedekind-like rings; *Dimensions:* Krull dimension; Global

dimension; Gelfand-Kirillov dimension; *Extensions:* The Nullstellensatz; Prime ideals in extension rings; Stability;  $K_0$  and extension rings; *Examples:* Polynomial identity rings; Enveloping algebras of Lie algebras; Rings of differential operators on algebraic varieties; References; Index of notation; Index.

### Graduate Studies in Mathematics

January 2001, approximately 616 pages, Hardcover, ISBN 0-8218-2169-5, LC 00-034990, All AMS members \$58, List \$72, Order code GSM-MCCONNELLN



## Invariant Measures for Unitary Groups Associated to Kac-Moody Lie Algebras

Doug Pickrell, *University of Arizona, Tucson*

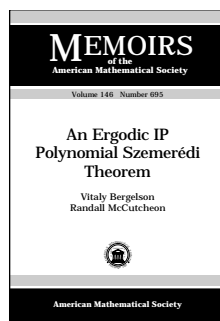
**Contents:** General introduction; *Part I. General Theory:* The formal completions of  $G(A)$  and  $G(A)/B$ ; Measures on the formal flag space;

*Part II. Infinite Classical Groups:* Introduction for Part II; Measures on the formal flag space; The case  $\mathfrak{g} = \mathfrak{sl}(\infty, \mathbb{C})$ ; The case  $\mathfrak{g} = \mathfrak{sl}(2\infty, \mathbb{C})$ ; The cases  $\mathfrak{g} = \mathfrak{o}(2\infty, \mathbb{C}), \mathfrak{o}(2\infty + 1, \mathbb{C}), \mathfrak{sp}(\infty, \mathbb{C})$ ; *Part III. Loop Groups:* Introduction for Part III; Extensions of loop groups; Completions of loop groups; Existence of the measures  $\nu_{\beta,k}, \beta > 0$ ; Existence of invariant measures; *Part IV. Diffeomorphisms of  $S^1$ :* Introduction for Part IV; Completions and classical analysis; The extension  $\hat{D}$  and determinant formulas; The measures  $\nu_{\beta,c,h}, \beta > 0, c, h \geq 0$ ; On existence of invariant measures; Concluding comments; acknowledgements; References.

**Memoirs of the American Mathematical Society, Volume 146, Number 693**

July 2000, 125 pages, Softcover, ISBN 0-8218-2068-0, LC 00-036256, 2000 *Mathematics Subject Classification:* 58D20, 22E65, 22E67, **Individual member \$26**, List \$44, Institutional member \$35, Order code MEMO/146/693N

## Analysis



## An Ergodic IP Polynomial Szemerédi Theorem

Vitaly Bergelson, *Ohio State University, Columbus*, and  
Randall McCutcheon, *University of Maryland, College Park*

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

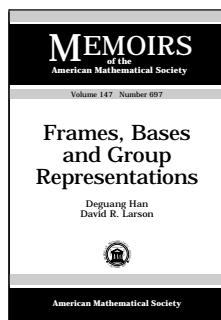
and combinatorics.

**Contents:** Introduction; Formulation of main theorem; Preliminaries; Primitive extensions; Relative polynomial mixing;

Completion of the proof; Measure-theoretic applications; Combinatorial applications; For future investigation; Appendix: Multiparameter weakly mixing PET; References; Index of notation; Index.

**Memoirs of the American Mathematical Society**, Volume 146, Number 695

July 2000, 106 pages, Softcover, ISBN 0-8218-2657-3, LC 00-036258, 2000 *Mathematics Subject Classification*: 28D05; 05A17, 05D10, 11B05, 11B83, **Individual member \$26**, List \$43, Institutional member \$34, Order code MEMO/146/695N



## Frames, Bases and Group Representations

Deguang Han, *McMaster University, Hamilton, ON, Canada*, and David R. Larson, *Texas A & M University, College Station*

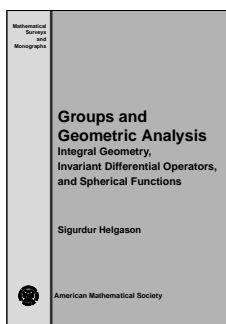
**Contents:** Introduction; Basic theory for frames; Complementary frames

and disjointness; Frame vectors for unitary systems; Gabor type unitary systems; Frame wavelets, super-wavelets and frame sets; Frame representations for groups; Concluding remarks; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 147, Number 697

September 2000, 94 pages, Softcover, ISBN 0-8218-2067-2, LC 00-034995, 2000 *Mathematics Subject Classification*: 46N99, 47N40, 47N99, 42C99; 47-XX, 47C05, 46B28, **Individual member \$25**, List \$42, Institutional member \$34, Order code MEMO/147/697N

### Recommended Text



## Groups and Geometric Analysis Integral Geometry, Invariant Differential Operators, and Spherical Functions

Sigurdur Helgason,  
*Massachusetts Institute of  
Technology, Cambridge*

*From reviews for the original edition ...*

*The book is excellent both as a text and as a reference work; it will clearly become another instant classic.*

—*American Scientist*

*This volume makes an excellent companion to the author's Differential Geometry, Lie Groups, and Symmetric Spaces, putting to work many of the abstract concepts developed in the earlier volume. The introductory material and large number of*

*exercises (with answers!) will make the book quite appropriate for students. Researchers will find numerous useful references on geometric analysis, along with proofs, connections with other parts of mathematics, and valuable historical remarks.*

*This book, like the author's previous work on differential geometry, will no doubt inspire considerable further research and become the standard text on the subjects it covers.*

—*Mathematical Reviews*

*Few treatises today can lay claim to being "aere perennius", but all of Helgason's books certainly do with a vengeance ... [He] sets a model of style and clarity that has not been matched since Enriques's Geometria proiettiva. This is the kind of mathematics that will live forever.*

—*Bulletin of Mathematical Books*

*A most valuable contribution to Lie theory and to the interplay between geometry and analysis. It is remarkable that the beautiful theory in Chapter IV can be presented in a textbook form with complete proofs.*

—*Bulletin of the London Mathematical Society*

*The diversity of subjects treated is great. Nevertheless the author has managed to achieve coherence of presentation by clearly putting forward a few main themes and basic problems. The first third of the book is suitable as a text for beginning graduate students; the book is also an excellent source of reference for experts. No doubt it will become a new standard in the field.*

—*CWI Quarterly*

This volume, the second of Helgason's impressive three books on Lie groups and the geometry and analysis of symmetric spaces, is an introduction to group-theoretic methods in analysis on spaces with a group action.

The first chapter deals with the three two-dimensional spaces of constant curvature, requiring only elementary methods and no Lie theory. It is remarkably accessible and would be suitable for a first-year graduate course. The remainder of the book covers more advanced topics, including the work of Harish-Chandra and others, but especially that of Helgason himself. Indeed, the exposition can be seen as an account of the author's tremendous contributions to the subject.

Chapter I deals with modern integral geometry and Radon transforms. The second chapter examines the interconnection between Lie groups and differential operators. Chapter IV develops the theory of spherical functions on semisimple Lie groups with a certain degree of completeness, including a study of Harish-Chandra's  $c$ -function. The treatment of analysis on compact symmetric spaces (Chapter V) includes some finite-dimensional representation theory for compact Lie groups and Fourier analysis on compact groups. Each chapter ends with exercises (with solutions given at the end of the book!) and historical notes.

This book, which is new to the AMS publishing program, is an excellent example of the author's well-known clear and careful writing style. It has become the standard text for the study of spherical functions and invariant differential operators on symmetric spaces.

Sigurdur Helgason was awarded the Steele Prize for *Groups and Geometric Analysis* and the companion volume, *Differential Geometry, Lie Groups and Symmetric Spaces*.

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

**Contents:** Geometric Fourier analysis on spaces of constant curvature; Integral geometry and Radon transforms; Invariant differential operators; Invariants and harmonic polynomials;

## New Publications Offered by the AMS

Spherical functions and spherical transforms; Analysis on compact symmetric spaces; Appendix; Some details; Bibliography; Symbols frequently used; Index; Errata.

### Mathematical Surveys and Monographs

September 2000, approximately 572 pages, Hardcover, ISBN 0-8218-2673-5, LC 00-034997, 2000 *Mathematics Subject Classification*: 22E30, 22-02, 43A85, 53-02, 53C65, 22E46, 53C35, 58C35, 43A77, 43A90, 35C15, 44A12, 51M10, 58J70, All AMS members \$45, List \$56, Order code SURV-HELGASON2N

Back in Print from the AMS

A Classic

## Lectures on the Calculus of Variations and Optimal Control Theory

L. C. Young

*A considerable number of heretofore unpublished results developed by the author are found ... The book is an important contribution to the calculus of variations and optimal control theory. It is most appropriate that the theory of generalized curves should be presented ... by its founder. The book is well written with an unusual and lively style. It is filled with historical remarks and with comments which enlarge one's outlook on the role of mathematics and mathematicians in our society ... This book should be mastered by anyone who wishes to become an expert in this field.*

—*Mathematical Reviews*

This book is divided into two parts. The first addresses the simpler variational problems in parametric and nonparametric form. The second covers extensions to optimal control theory.

The author opens with the study of three classical problems whose solutions led to the theory of calculus of variations. They are the problem of geodesics, the brachistochrone, and the minimal surface of revolution. He gives a detailed discussion of the Hamilton-Jacobi theory, both in the parametric and nonparametric forms. This leads to the development of sufficiency theories describing properties of minimizing extremal arcs.

Next, the author addresses existence theorems. He first develops Hilbert's basic existence theorem for parametric problems and studies some of its consequences. Finally, he develops the theory of generalized curves and "automatic" existence theorems.

In the second part of the book, the author discusses optimal control problems. He notes that originally these problems were formulated as problems of Lagrange and Mayer in terms of differential constraints. In the control formulation, these constraints are expressed in a more convenient form in terms of control functions. After pointing out the new phenomenon that may arise, namely, the lack of controllability, the author develops the maximum principle and illustrates this principle by standard examples that show the switching phenomena that may occur. He extends the theory of geodesic coverings to optimal control problems. Finally, he extends the problem to generalized optimal control problems and obtains the corresponding existence theorems.

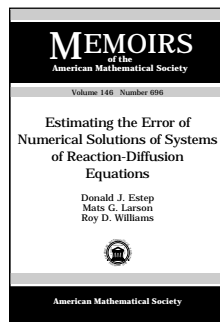
**Contents:** *Volume I. Lectures on the Calculus of Variations:* Generalities and typical problems; The method of geodesic coverings; Duality and local embedding; Embedding in the large; Hamiltonians in the large, convexity, inequalities and functional analysis; Existence theory and its consequences;

Generalized curves and flows; Appendix I: Some further basic notions of convexity and integration; Appendix II: The variational significance and structure of generalized flows; *Volume II. Optimal Control Theory:* The nature of control problems; Naive optimal control theory; The application of standard variational methods to optimal control; Generalized optimal control; References; Index.

### AMS Chelsea Publishing

August 2000, 337 pages, Hardcover, ISBN 0-8218-2690-5, LC 79-57387, 2000 *Mathematics Subject Classification*: 49-02, All AMS members \$31, List \$34, Order code CHEL/304.HN

## Differential Equations



## Estimating the Error of Numerical Solutions of Systems of Reaction-Diffusion Equations

Donald J Estep, *Georgia Institute of Technology, Atlanta*, Mats G. Larson, *Chalmers University of Technology,*

*Goteborg, Sweden*, and Roy D. Williams, *California Institute of Technology, Pasadena*

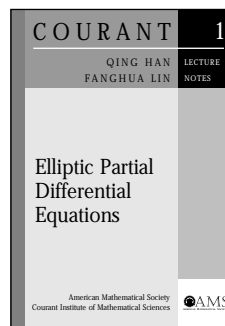
**Contents:** Introduction; A framework for a posteriori error estimation; The size of the residual errors and stability factors; Computational error estimation; Preservation of invariant rectangles under discretization; Details of the analysis in Chapter 2; Details of the analysis in Chapter 3; Details of the analysis in Chapter 5; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 146, Number 696

July 2000, 109 pages, Softcover, ISBN 0-8218-2072-9, LC 00-036259, 2000 *Mathematics Subject Classification*: 65M12, 65M15, 35K57; 65M20, 65M60, 35B35, 35B50, 35B65,

**Individual member \$26**, List \$43, Institutional member \$34, Order code MEMO/146/696N

Independent Study



## Elliptic Partial Differential Equations

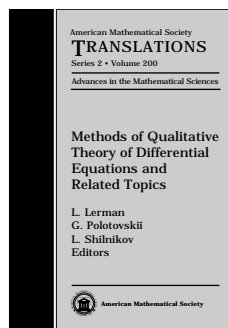
Qing Han, *University of Notre Dame, IN*, and Fanghua Lin, *New York University, Courant Institute, NY*

This volume is based on PDE courses given by the authors at the Courant Institute and at the University of Notre Dame (IN). Presented are basic methods for obtaining various a priori estimates for second-order equations of elliptic type with particular emphasis on maximal principles, Harnack inequalities, and their applications. The equations considered

in the book are linear; however, the presented methods also apply to nonlinear problems.

**Contents:** Harmonic functions; Maximum principles; Weak solutions, part I; Weak solutions, part II; Viscosity solutions; Bibliography.

August 2000, 123 pages, Softcover, ISBN 0-8218-2691-3, 2000 *Mathematics Subject Classification*: 35-XX, All AMS members \$16, List \$20, Order code CLN/1N



## Methods of Qualitative Theory of Differential Equations and Related Topics

L. Lerman, *Research Institute for Applied Mathematics and Cybernetics, Nizhni Novgorod, Russia*, G. Polotovskii, *Nizhni*

*Novgorod State University, Russia*, and L. Shilnikov, *Research Institute for Applied Mathematics and Cybernetics, Nizhni Novgorod, Russia*, Editors

Dedicated to the memory of Professor E. A. Leontovich-Andronova, this book was composed by former students and colleagues who wished to mark her contributions to the theory of dynamical systems. A detailed introduction by Leontovich-Andronova's close colleague, L. Shilnikov, presents biographical data and describes her main contribution to the theory of bifurcations and dynamical systems.

The main part of the volume is composed of research papers presenting the interests of Leontovich-Andronova, her students and her colleagues. Included are articles on traveling waves in coupled circle maps, bifurcations near a homoclinic orbit, polynomial quadratic systems on the plane, foliations on surfaces, homoclinic bifurcations in concrete systems, topology of plane controllability regions, separatrix cycle with two saddle-foci, dynamics of 4-dimensional symplectic maps, torus maps from strong resonances, structure of 3 degree-of-freedom integrable Hamiltonian systems, splitting separatrices in complex differential equations, Shilnikov's bifurcation for  $C^1$ -smooth systems and "blue sky catastrophe" for periodic orbits.

**Contents:** L. P. Shilnikov, Evgeniya Aleksandrovna Leontovich-Andronova (1905–1996); V. Afraimovich and M. Courbage, On the abundance of traveling waves in coupled expanding circle maps; S. A. Alekseeva and L. P. Shilnikov, On cusp-bifurcations of periodic orbits in systems with a saddle-focus homoclinic curve; S. Aranson, V. Medvedev, and E. Zhuzhoma, Collapse and continuity of geodesic frameworks of surface foliations; V. N. Belykh, Homoclinic and heteroclinic linkages in concrete systems: Nonlocal analysis and model maps; A. A. Binstein and G. M. Polotovskii, On the mutual arrangement of a conic and a quintic in the real projective plane; N. N. Butenina, The structure of the boundary curve for planar controllability domains; V. V. Bykov, Orbit structure in a neighborhood of a separatrix cycle containing two saddle-foci; N. Gavrilov and A. Shilnikov, Example of a blue sky catastrophe; S. V. Gonchenko, Dynamics and moduli of  $\Omega$ -conjugacy of 4D-diffeomorphisms with a structurally unstable homoclinic orbit to a saddle-focus fixed point; V. Z. Grines and R. V. Plykin, Topological classification of amply situated attractors of  $A$ -diffeomorphisms of surfaces;

M. V. Shashkov and D. V. Turaev, A proof of Shilnikov's theorem for  $C^1$ -smooth dynamical systems; L. P. Shilnikov and D. V. Turaev, A new simple bifurcation of a periodic orbit of "blue sky catastrophe" type; V. P. Tareev, On the splitting of the complex loop of a separatrix.

American Mathematical Society Translations—Series 2 (*Advances in the Mathematical Sciences*), Volume 200

August 2000, 196 pages, Hardcover, ISBN 0-8218-2663-8, LC 91-640741, 2000 *Mathematics Subject Classification*: 34Cxx, 37Cxx; 14H99, Individual member \$53, List \$89, Institutional member \$71, Order code TRANS2/200N

## General and Interdisciplinary

### Assistantships and Graduate Fellowships, 2000

*Review of the previous annual edition:*

*This directory is a tool for undergraduate mathematics majors seeking information about graduate programs in mathematics. Although most of the information can be gleaned from the Internet, the usefulness of this directory*

*for the prospective graduate student is the consistent format for comparing different mathematics graduate programs without the hype. Published annually, the information is up-to-date, which is more than can be said of some Websites. Support for graduate students in mathematics is a high priority of the American Mathematical Society, which also provides information for fellowships and grants they offer as well as support from other societies and foundations. The book is highly recommended for academic and public libraries.*

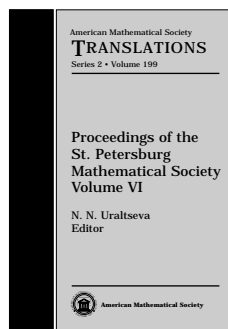
—American Reference Books Annual

This publication is an indispensable source of information for students seeking support for graduate study in the mathematical sciences. Providing data from a broad range of academic institutions, it is also a valuable resource for mathematical sciences departments and faculty.

*Assistantships and Graduate Fellowships* brings together a wealth of information about resources available for graduate study in mathematical sciences departments in the U.S. and Canada. Information on the number of faculty, graduate students, and degrees awarded (bachelor's, master's, and doctoral) is listed for each department when available. Stipend amounts and the number of awards available are given, as well as information about foreign language requirements. Numerous display advertisements from mathematical sciences departments throughout the country provide additional information.

Also listed are sources of support for graduate study and travel, summer internships, and graduate study in the U.S. for foreign nationals. Finally, a list of reference publications for fellowship information makes *Assistantships and Graduate Fellowships* a centralized and comprehensive resource.

October 2000, approximately 169 pages, Softcover, ISBN 0-8218-2638-7, 2000 *Mathematics Subject Classification*: 00-XX, Individual member \$12, List \$20, Order code ASST/2000N



## Proceedings of the St. Petersburg Mathematical Society Volume VI

N. N. Uraltseva, *St. Petersburg State University, Russia*, Editor

This collection presents new results in algebra, functional analysis, and mathematical physics. In particular, evolution and spectral problems

related to small motions of viscoelastic fluid are considered. Specific areas covered in the book include functional equations and functional operator equations from the point of view of the  $C^*$ -algebraic approach, the existence of an isomorphism between certain ideals regarded as Galois modules, spectral problems in singularly perturbed domains, scattering theory, the existence of bounded solutions to the equation  $\operatorname{div} u = f$  in a plane domain, and a compactification of a locally compact group. Also given is an historic overview of the mathematical seminars held at St. Petersburg State University. The results, ideas, and methods given in the book will be of interest to a broad range of specialists.

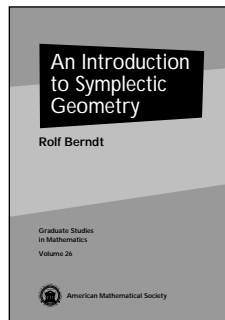
**Contents:** T. Ya. Azizov, N. D. Kopachevskii, and L. D. Orlova, Evolution and spectral problems related to small motions of viscoelastic fluid; A. B. Antonevich and A. V. Lebedev, Functional equations and functional operator equations. A  $C^*$ -algebraic approach; M. V. Bondarko and S. V. Vostokov, Isomorphism of ideals regarded as Galois modules of complete discrete valuation fields with residue field of positive characteristic; I. V. Kamotskii and S. A. Nazarov, Spectral problems in singularly perturbed domains and selfadjoint extensions of differential operators; V. A. Sloushch, Discrete spectrum in gaps of the spectrum under strong perturbations of fixed sign; N. D. Filonov, On bounded solutions to the equation  $\operatorname{div} u = f$  in a plane domain; B. Ya. Shteinberg, Compactification of a locally compact group and the Noethericity of convolution operators with coefficients on quotient groups; N. S. Ermo-laeva, Prehistory of seminars at the St. Petersburg/Petrograd/Leningrad University.

**American Mathematical Society Translations—Series 2, Volume 199**

July 2000, 238 pages, Hardcover, ISBN 0-8218-2112-1, 2000 *Mathematics Subject Classification:* 01Axx, 11Sxx, 22Dxx, 34Kxx, 35Pxx, 35Qxx, 47Lxx, 47Axx, 47Gxx, **Individual member \$59**, List \$99, Institutional member \$79, Order code TRANS2/199N

## Geometry and Topology

Recommended Text



## An Introduction to Symplectic Geometry

Rolf Berndt, *University of Hamburg, Germany*

Symplectic geometry is a central topic of current research in mathematics. Indeed, symplectic methods are key ingredients in the study of dynamical systems, differential equations, algebraic geometry, topology, mathematical physics and representations of Lie groups.

This book is a true introduction to symplectic geometry, assuming only a general background in analysis and familiarity with linear algebra. It starts with the basics of the geometry of symplectic vector spaces. Then, symplectic manifolds are defined and explored. In addition to the essential classic results, such as Darboux's theorem, more recent results and ideas are also included here, such as symplectic capacity and pseudoholomorphic curves. These ideas have revolutionized the subject. The main examples of symplectic manifolds are given, including the cotangent bundle, Kähler manifolds, and coadjoint orbits. Further principal ideas are carefully examined, such as Hamiltonian vector fields, the Poisson bracket, and connections with contact manifolds.

Berndt describes some of the close connections between symplectic geometry and mathematical physics in the last two chapters of the book. In particular, the moment map is defined and explored, both mathematically and in its relation to physics. He also introduces symplectic reduction, which is an important tool for reducing the number of variables in a physical system and for constructing new symplectic manifolds from old. The final chapter is on quantization, which uses symplectic methods to take classical mechanics to quantum mechanics. This section includes a discussion of the Heisenberg group and the Weil (or metaplectic) representation of the symplectic group.

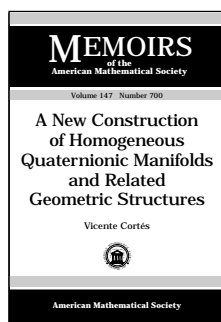
Several appendices provide background material on vector bundles, on cohomology, and on Lie groups and Lie algebras and their representations.

Berndt's presentation of symplectic geometry is a clear and concise introduction to the major methods and applications of the subject, and requires only a minimum of prerequisites. This book would be an excellent text for a graduate course or as a source for anyone who wishes to learn about symplectic geometry.

**Contents:** Some aspects of theoretical mechanics; Symplectic algebra; Symplectic manifolds; Hamiltonian vectorfields and the Poisson bracket; The moment map; Quantization; Differentiable manifolds and vector bundles; Lie groups and Lie algebras; A little cohomology theory; Representations of groups; Bibliography; Index; Symbols.

**Graduate Studies in Mathematics, Volume 26**

September 2000, approximately 224 pages, Hardcover, ISBN 0-8218-2056-7, LC 00-033139, 2000 *Mathematics Subject Classification:* 53C15, 53Dxx, 20G20, 81S10, **All AMS members \$29**, List \$36, Order code GSM/26N



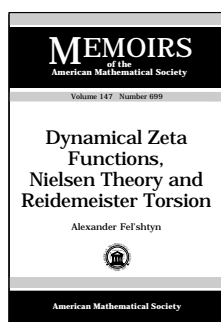
## A New Construction of Homogeneous Quaternionic Manifolds and Related Geometric Structures

Vicente Cortés, *University of Bonn, Germany*

**Contents:** Introduction; Extended Poincaré algebras; The homogeneous quaternionic manifold  $(M, Q)$  associated to an extended Poincaré algebra; Bundles associated to the quaternionic manifold  $(M, Q)$ ; Homogeneous quaternionic supermanifolds associated to superextended Poincaré algebras; Appendix. Supergeometry; Bibliography.

*Memoirs of the American Mathematical Society*, Volume 147, Number 700

September 2000, 63 pages, Softcover, ISBN 0-8218-2111-3, LC 00-034993, 2000 *Mathematics Subject Classification*: 53C30; 53C25, **Individual member \$23**, List \$38, Institutional member \$30, Order code MEMO/147/700N



## Dynamical Zeta Functions, Nielsen Theory and Reidemeister Torsion

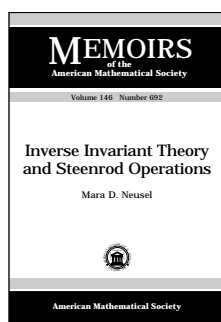
Alexander Fel'shtyn, *University of Greifswald, Germany*

**Contents:** Introduction; Nielsen fixed point theory; The Reidemeister zeta function; The Nielsen zeta function;

Reidemeister and Nielsen zeta functions modulo normal subgroup, minimal dynamical zeta functions; Congruences for Reidemeister and Nielsen numbers; The Reidemeister torsion.

*Memoirs of the American Mathematical Society*, Volume 147, Number 699

September 2000, 146 pages, Softcover, ISBN 0-8218-2090-7, LC 00-034994, 2000 *Mathematics Subject Classification*: 58-XX; 55M20, 57Q10, **Individual member \$28**, List \$47, Institutional member \$38, Order code MEMO/147/699N



## Inverse Invariant Theory and Steenrod Operations

Mara D. Neusel, *Yale University, New Haven, CT*

**Contents:** Introduction; The  $\Delta$ -theorem; Some field theory over the Steenrod Algebra; The integral closure theorem and the unstable part; The inseparable closure; The embedding theorem I; Noetherianess, the embed-

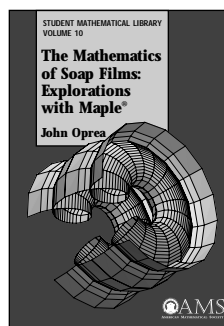
ding theorem II and Turkish delights; The Galois embedding

theorem, the little imbedding theorem and a bit more; The big imbedding theorem, Thom classes, Turkish delights II and reverse Landweber-Stong conjecture; Technical stuff; References.

*Memoirs of the American Mathematical Society*, Volume 146, Number 692

July 2000, 157 pages, Softcover, ISBN 0-8218-2091-5, LC 00-036255, 2000 *Mathematics Subject Classification*: 13A50, 55S10; 55-XX, 13-XX, **Individual member \$28**, List \$47, Institutional member \$38, Order code MEMO/146/692N

### Recommended Text



## The Mathematics of Soap Films: Explorations with Maple®

John Oprea, *Cleveland State University, OH*

Nature tries to minimize the surface area of a soap film through the action of surface tension. The process can be understood mathematically by using

differential geometry, complex analysis, and the calculus of variations. This book employs ingredients from each of these subjects to tell the mathematical story of soap films.

The text is fully self-contained, bringing together a mixture of types of mathematics along with a bit of the physics that underlies the subject. The development is primarily from first principles, requiring no advanced background material from either mathematics or physics.

Through the Maple® applications, the reader is given tools for creating the shapes that are being studied. Thus, you can "see" a fluid rising up an inclined plane, create minimal surfaces from complex variables data, and investigate the "true" shape of a balloon. Oprea also includes descriptions of experiments and photographs that let you see real soap films on wire frames.

The theory of minimal surfaces is a beautiful subject, which naturally introduces the reader to fascinating, yet accessible, topics in mathematics. Oprea's presentation is rich with examples, explanations, and applications. It would make an excellent text for a senior seminar or for independent study by upper-division mathematics or science majors.

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

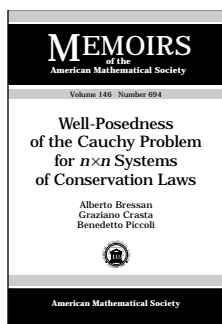
© Waterloo Maple, Inc., Ontario, Canada.

**Contents:** Surface tension; A quick trip through differential geometry and complex variables; The mathematics of soap films; The calculus of variations and shape; Maple, soap films and minimal surfaces; Bibliography; Index.

*Student Mathematical Library*, Volume 10

September 2000, approximately 277 pages, Softcover, ISBN 0-8218-2118-0, LC 00-041614, 2000 *Mathematics Subject Classification*: 49-01, 49-04, 49Q05, 53-01, 53-04, 53A10, **All AMS members \$23**, List \$29, Order code STML/10N

# Mathematical Physics



## Well-Posedness of the Cauchy Problem for $n \times n$ Systems of Conservation Laws

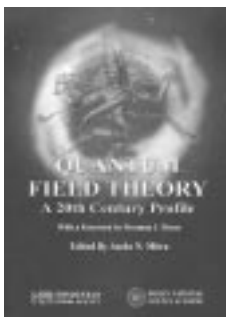
**Alberto Bressan**, *School International Superior di Studi Avanzati, Trieste, Italy*,  
**Graziano Crasta**, *University of Modena, Italy*, and  
**Benedetto Piccoli**, *University of Salerno, Italy*

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

**Contents:** Introduction; Outline of the proof; Construction of local semigroups; Restarting procedures; Proof of Proposition 2.4; Proof of Proposition 2.5; Proof of Proposition 2.7; Proof of Proposition 2.10; Proof of Proposition 2.15; Completion of the proof; Appendix; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 146, Number 694

July 2000, 134 pages, Softcover, ISBN 0-8218-2066-4, LC 00-036257, 2000 *Mathematics Subject Classification*: 35L65,  
**Individual member \$28**, List \$46, Institutional member \$37,  
 Order code MEMO/146/694N



## Quantum Field Theory A Twentieth Century Profile

**Asoke N. Mitra**, Editor

*A publication of the Hindustan Book Agency.*

“After serving his apprenticeship as a field theorist at Cornell University ...

Dr. Mitra sacrificed his chance of a brilliant research career in America in order to serve his country and his people. I deeply respect that choice, and I rejoice that his sacrifice was not made in vain. After a fruitful career as a pioneer and teacher of modern science in India, he now stands at the center of the vibrant scientific community that he helped to create. This volume is, among other things, a monument to his vision.”

—*From the Foreword by Freeman Dyson*

Quantum Field Theory (QFT) may be the single most important concept in physics to be discovered in the twentieth century. This volume reflects the multidimensional impact of QFT on the evolution of physics in the last century. Dr. Asoke Mitra, editor for the volume and former student and colleague of Freeman Dyson, gathers here a selection of articles in the areas where the impact of QFT has been especially pronounced: from particle physics to string theory and extending to facets of astrophysics and the physics of condensed matter.

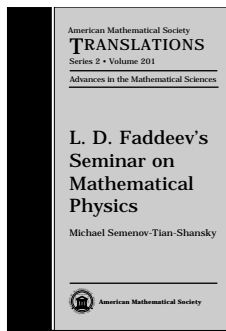
The wide range of topics covered makes this volume more than just an introductory text on QFT. Contributors include V. Gribov, M. Moshinsky, K. Nishijima, J. Schwarz, D. Shirkov, E. Witten and many more renowned experts in their respective fields. This book makes an excellent reference work for a broad spectrum of readers, from postdocs in key areas of QFT to specialists in currently evolving areas.

Published jointly by the Hindustan Book Agency (India) and the Indian National Science Academy. Distributed worldwide except in India by the American Mathematical Society.

**Contents:** *Editor's Summary:* **A. N. Mitra**, Dimensions of field theory—from particles to strings; *Part A: Basic Structure of QFT:* **D. V. Shirkov**, Evolution of the Bogoliubov renormalization group; **S. Szpigel** and **R. J. Perry**, The similarity renormalization group; **V. Novikov**, Quantum field theory and the standard model—bird's eye view; **P. K. Kabir**, Broken reflection symmetries; **D. Boyanovsky** and **H. J. de Vega**, Dynamics of symmetry breaking out of equilibrium—from condensed matter to QCD and the early universe; **V. N. Gribov**, Orsay lectures on confinement; **K. Nishijima** and **M. Chaichian**, An essay on color confinement; *Part B: Topological Aspects of QFT:* **R. Kaul**, Topological quantum field theories—a meeting ground for physicists and mathematicians; **E. Witten**, Quantum field theory and the Jones polynomial; **H. Banerjee**, Chiral anomalies in field theories; **W.-M. Zhang**, Coherent states in field theory; **N. Mukunda**, Pancharatnam, Bargmann and Berry phases—a retrospective; **J. Schechter** and **H. Weigel**, The Skyrme model for baryons; *Part C: Formal Methods in QFT:* **R. Ramanathan**, Euclidean methods in quantum field theory; **A. Das**, Topics in finite temperature field theory; **B. M. Sodermark**, Integrable models and the Toda lattice hierarchy; **P. P. Srivastava**, Perspectives of light-front quantized field theory—some new results; **D. S. Kulshreshtha**, Gauge symmetry in chiral electrodynamics; **L. Lusanna**, Towards a unified description of the four interactions in terms of Dirac-Bergmann observables; *Part D: Extension of QFT Frontiers:* **R. N. Mohapatra**, Supersymmetry and particle physics; **N. Sakai**, Supersymmetry in field theory; **W. Nahm**, Conformal field theory: A bridge over troubled waters; **J. H. Schwarz**, Superstring theory—an overview; **J. Maharana**, Recent developments in string theory; **L. Bonora**, Yang-Mills theory and matrix string theory; *Part E: QFT in 2 + 1 Dimensions:* **A. Khare**, Fractional statistics and Chern-Simons field theory in 2 + 1 dimensions; **R. Rajaraman**, Chern Simons field and composite bosons in the quantum hall system; *Part F: Methods of Strong Interactions in QFT:* **O. Pene**, Hadrons from QCD—achievements and prospects; **L. S. Kisslinger**, QCD sum rules in hadronic and nuclear physics; **V. A. Karmanov**, Light-front dynamics; **A. N. Mitra**, 3D-4D interlinkage of B-S amplitudes—unified view of  $Q\bar{Q}$  and  $QQQ$  dynamics; **M. Moshinsky**, The harmonic oscillator in quantum theory—a powerful bridge in physics; *Conclusion:* **D. Home**, Modern perspectives on foundations of quantum mechanics.

### Hindustan Book Agency

March 2000, 900 pages, Hardcover, ISBN 81-85931-25-9,  
 2000 *Mathematics Subject Classification*: 81-XX, **All AMS members \$71**, List \$89, Order code HIN/4N



## L. D. Faddeev's Seminar on Mathematical Physics

Michael Semenov-Tian-Shansky, *Steklov Mathematical Institute, St. Petersburg, Russia*, Editor

Professor L. D. Faddeev's seminar at Steklov Mathematical Institute (St. Petersburg, Russia) has a long history of over 30 years of intensive work which shaped modern mathematical physics. This collection, honoring Professor Faddeev's 65th anniversary, has been prepared by his students and colleagues.

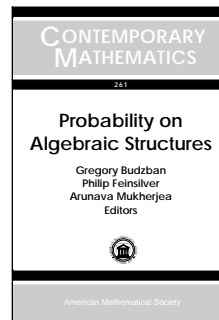
Topics covered in the volume include classical and quantum integrable systems (both analytic and algebraic aspects), quantum groups and generalizations, quantum field theory, and deformation quantization. Included is a history of the seminar highlighting important developments, such as the invention of the quantum inverse scattering method and of quantum groups. The book will serve nicely as a comprehensive, up-to-date resource on the topic.

**Contents:** M. Semenov-Tian-Shansky, Some personal historic notes on our seminar; E. Meinrenken and A. Alekseev, An elementary derivation of certain classical dynamical  $r$ -matrices; I. Ya. Arefeva and O. A. Rytchkov, Incidence matrix description of intersection  $p$ -brane solutions; A. I. Bobenko and Yu. B. Suris, A discrete time Lagrange top and discrete elastic curves; A. M. Budylin and V. S. Buslaev, The Gelfand-Levitan-Marchenko equation and the long-time asymptotics of the solutions of the nonlinear Schrödinger equation; R. M. Kashaev and A. Yu. Volkov, From the tetrahedron equation to universal  $R$ -matrices; A. N. Kirillov, On some quadratic algebras; V. Korepin and N. Slavnov, Quantum inverse scattering method and correlation functions; A. Losev, N. Nekrasov, and S. Shatashvili, Testing Seiberg-Witten solution; J. M. Maillet and J. S. de Santos, Drinfeld twists and algebraic Bethe Ansatz; V. B. Matveev, Darboux transformations, covariance theorems and integrable systems; A. L. Pirozerski and M. A. Semenov-Tian-Shansky, Generalized  $q$ -deformed Gelfand-Dickey structures on the group of  $q$ -pseudodifference operators; A. K. Pogrebkov, On time evolutions associated with the nonstationary Schrödinger equation; N. Reshetikhin and L. A. Takhtajan, Deformation quantization of Kähler manifolds; E. K. Sklyanin, Canonicity of Bäcklund transformation:  $r$ -matrix approach. I; F. A. Smirnov, Quasi-classical study of form factors in finite volume; V. Tarasov, Completeness of the hypergeometric solutions of the  $qKZ$  equation at level zero.

**American Mathematical Society Translations—Series 2** (*Advances in the Mathematical Sciences*), Volume 201

August 2000, approximately 319 pages, Hardcover, ISBN 0-8218-2133-4, LC 91-640741, 2000 *Mathematics Subject Classification*: 00B30, 37K10, 17B37, 53D55, 35Q99; 81T15, 81T30, 81R50, **Individual member \$65**, List \$109, Institutional member \$87, Order code TRANS2/201N

## Probability



## Probability on Algebraic Structures

Gregory Budzban and Philip Feinsilver, *Southern Illinois University, Carbondale*, and Arunava Mukherjea, *University of South Florida, Tampa*, Editors

This volume presents results from an AMS Special Session held on the topic in Gainesville (FL). Papers included are written by an international group of well-known specialists who offer an important cross-section of current work in the field. In addition there are two expository papers that provide an avenue for non-specialists to comprehend problems in this area.

The breadth of research in this area is evident by the variety of articles presented in the volume. Results concern probability on Lie groups and general locally compact groups. Generalizations of groups appear as hypergroups, abstract semigroups, and semigroups of matrices. Work on symmetric cones is included. Lastly, there are a number of articles on the current progress in constructing stochastic processes on quantum groups.

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

**Contents:** *Lie groups, topological groups:* S. G. Dani and R. Shah, Contractible measures in Lévy's measures on Lie groups; P. Feinsilver and R. Schott, Lie response to signals with noise; W. Jaworski, On shifted convolution powers and concentration functions in locally compact groups; M. McCrudden and S. Walker, Embedding infinitely divisible probabilities on subsemigroups of Lie groups; D. Neuen-schwander,  $s$ -stable semigroups on simply connected step 2-nilpotent Lie groups; *Hypergroups:* H. Heyer, The covariance distribution of a generalized random field over a commutative hypergroup; C. Rentzsch and M. Voit, Lévy processes on commutative hypergroups; *Symmetric cones, Wishart distributions:* G. Letac, Symmetric cones as Gelfand pairs: Probabilistic applications; G. Letac and H. Massam, Representations of the Wishart distributions; *Quantum groups, quantum probability:* L. Accardi, Quantum probability: An historical survey; U. Franz, Lévy processes on quantum groups; V. K. Dobrev, H.-D. Doebner, U. Franz, and R. Schott, Lévy processes on  $U_q(\mathfrak{g})$  as infinitely divisible representations; *Semigroups, matrices, applications:* G. Budzban and A. Mukherjea, A semi-group approach to the road coloring problem; G. Högnäs, On some one-dimensional stochastic population models; Z. J. Jurek, Three algebraic problems in probability theory; A. Mukherjea, Products of i.i.d.  $d \times d$  real matrices: Convergence in direction.

**Contemporary Mathematics**, Volume 261

June 2000, 238 pages, Softcover, ISBN 0-8218-2027-3, LC 00-034992, 2000 *Mathematics Subject Classification*: 60B15; 43A05, 81R20, **Individual member \$35**, List \$59, Institutional member \$47, Order code CONM/261N

## Previously Announced Publications

**New and Noteworthy**

### Mathematics: Frontiers and Perspectives

V. Arnold, *University of Paris IX, France*, and *Steklov Mathematical Steklov Mathematical Institute, Moscow, Russia*, M. Atiyah, *University of Edinburgh, Scotland*, P. Lax, *New York University-Courant Institute, NY*, and B. Mazur, *Harvard University, Cambridge, MA*, Editors

“The twentieth century has transformed mathematics from a cottage industry run by a few semi-amateurs into a worldwide industry run by an army of professionals ...”

—*from the Preface by M. Atiyah*

This remarkable book is a celebration of the state of mathematics at the end of the millennium. Produced under the auspices of the International Mathematical Union (IMU), the volume was born as part of the activities observing the World Mathematical Year 2000.

The volume consists of 30 articles written by some of the most influential mathematicians of our time. Authors of 15 contributions were recognized in various years by the IMU as recipients of the Fields Medal, from K. F. Roth (Fields Medalist, 1958) to W. T. Gowers (Fields Medalist, 1998). The articles offer valuable reflections about the amazing mathematical progress we have witnessed in this century and insightful speculations about the possible development of mathematics over the next century.

Some articles formulate important problems, challenging future mathematicians. Others pay explicit homage to the famous set of Hilbert Problems posed one hundred years ago, giving enlightening commentary. Yet other papers offer a deeply personal perspective, allowing singular insight into the minds and hearts of people doing mathematics today.

*Mathematics: Frontiers and Perspectives* is a unique volume that pertains to a broad mathematical audience of various backgrounds and levels of interest. It offers readers true and unequalled insight into the wonderful world of mathematics at this important juncture: the turn of the millennium.

The work is one of those rare volumes that can be browsed, and if you do simply browse through it, you get a wonderful sense of mathematics today. Yet it also can be intensely studied on a detailed technical level for gaining insight into some of the great problems on which mathematicians are currently working.

Individual members of mathematical societies of the IMU member countries can purchase this volume at the AMS member price when buying directly from the AMS.

**Contributors include:** A. Baker, G. Wüstholtz, J. Bourgain, S.-S. Chern, A. Connes, S. K. Donaldson, W. T. Gowers, V. F. R. Jones, D. Kazhdan, F. Kirwan, P.-L. Lions, A. J. Majda, Yu. I. Manin, G. Margulis, D. McDuff, S. Mori, D. Mumford, R. Penrose, K. F. Roth, D. Ruelle, P. Sarnak, S. Smale, R. P. Stanley, C. Vafa, A. Wiles, E. Witten, S.-T. Yau, V. I. Arnold, P. D. Lax, and B. Mazur.

August 2000, 459 pages, Softcover, ISBN 0-8218-2697-2, LC 99-047980, 2000 *Mathematics Subject Classification*: 00B10; 00B15, **All AMS members \$31**, List \$39, Order code MFP.SRT008

### The Backward Shift on the Hardy Space

Joseph A. Cima, *University of North Carolina, Chapel Hill*, and William T. Ross, *University of Richmond, VA*

Shift operators on Hilbert spaces of analytic functions play an important role in the study of bounded linear operators on Hilbert spaces since they often serve as models for various classes of linear operators. For example, “parts” of direct sums of the backward shift operator on the classical Hardy space  $H^2$  model certain types of contraction operators and potentially have connections to understanding the invariant subspaces of a general linear operator.

This book is a thorough treatment of the characterization of the backward shift invariant subspaces of the well-known Hardy spaces  $H^p$ . The characterization of the backward shift invariant subspaces of  $H^p$  for  $1 < p < \infty$  was done in a 1970 paper of R. Douglas, H. S. Shapiro, and A. Shields, and the case  $0 < p \leq 1$  was done in a 1979 paper of A. B. Aleksandrov which is not well known in the West. This material is pulled together in this single volume and includes all the necessary background material needed to understand (especially for the  $0 < p < 1$  case) the proofs of these results.

Several proofs of the Douglas-Shapiro-Shields result are provided so readers can get acquainted with different operator theory and theory techniques: applications of these proofs are also provided for understanding the backward shift operator on various other spaces of analytic functions. The results are thoroughly examined. Other features of the volume include a description of applications to the spectral properties of the backward shift operator and a treatment of some general real-variable techniques that are not taught in standard graduate seminars. The book includes references to works by Duren, Garnett, and Stein for proofs and a bibliography for further exploration in the areas of operator theory and functional analysis.

**Mathematical Surveys and Monographs**, Volume 79

July 2000, 199 pages, Hardcover, ISBN 0-8218-2083-4, LC 00-028032, 2000 *Mathematics Subject Classification*: 47B38; 46E10, 46E15, **Individual member \$29**, List \$49, Institutional member \$39, Order code SURV/79RT008

### Some Current Topics on Nonlinear Conservation Laws

**Lectures at the Morningside Center of Mathematics, 1**

Ling Hsiao, *Institute of Mathematics, Academia Sinica, Beijing, People's Republic of China*, and Zhouping Xin, *New York University, Courant Institute, NY*, Editors

This volume resulted from a year-long program at the Morningside Center of Mathematics at the Academia Sinica in Beijing. It presents an overview of nonlinear conservation laws and introduces developments in this expanding field. Xin's introductory overview of the subject is followed by lecture notes of leading experts who have made fundamental contributions to this field of research. A. Bressan's theory of  $L^1$ -well-posedness for entropy weak solutions to systems of nonlinear hyperbolic conservation laws in the class of viscosity solutions is one of the most important results in the past two decades; G. Chen discusses weak convergence methods and various applications to many problems; P. Degond details mathematical modelling of semi-conductor devices; B. Perthame describes the theory of asymptotic equivalence

between conservation laws and singular kinetic equations; Z. Xin outlines the recent development of the vanishing viscosity problem and nonlinear stability of elementary wave—a major focus of research in the last decade; and the volume concludes with Y. Zheng's lecture on incompressible fluid dynamics.

This collection of lectures represents previously unpublished expository and research results of experts in nonlinear conservation laws and is an excellent reference for researchers and advanced graduate students in the areas of nonlinear partial differential equations and nonlinear analysis.

Titles in this series are co-published with International Press, Cambridge, MA.

**Contributors include:** A. Bressan, G.-Q. Chen, P. Degond, B. Perthame, Z. Xin, and Y. Zheng.

**AMS/IP Studies in Advanced Mathematics**, Volume 15

May 2000, 226 pages, Softcover, ISBN 0-8218-1965-8, LC 00-025164, 2000 *Mathematics Subject Classification*: 35-02, 35L65, 35L67; 35L60, 35L80, 76N10, 76P05, 46N20, 35Q30, **All AMS members \$34**, List \$42, Order code AMSIP/15RT008

### Recommended Text

## Number Theory

### Algebraic Numbers and Functions

**Helmut Koch**, *Humboldt-University, Berlin, Germany*

Algebraic number theory is one of the most refined creations in mathematics. It has been developed by some of the leading mathematicians of this and previous centuries. The primary goal of this book is to present the essential elements of algebraic number theory, including the theory of normal extensions up through a glimpse of class field theory. Following the example set for us by Kronecker, Weber, Hilbert and Artin, algebraic functions are handled here on an equal footing with algebraic numbers. This is done on the one hand to demonstrate the analogy between number fields and function fields, which is especially clear in the case where the ground field is a finite field. On the other hand, in this way one obtains an introduction to the theory of 'higher congruences' as an important element of "arithmetic geometry".

Early chapters discuss topics in elementary number theory, such as Minkowski's geometry of numbers, public-key cryptography and a short proof of the Prime Number Theorem, following Newman and Zagier. Next, some of the tools of algebraic number theory are introduced, such as ideals, discriminants and valuations. These results are then applied to obtain results about function fields, including a proof of the Riemann-Roch Theorem and, as an application of cyclotomic fields, a proof of the first case of Fermat's Last Theorem. There are a detailed exposition of the theory of Hecke  $L$ -series, following Tate, and explicit applications to number theory, such as the Generalized Riemann Hypothesis. Chapter 9 brings together the earlier material through the study of quadratic number fields. Finally, Chapter 10 gives an introduction to class field theory.

The book attempts as much as possible to give simple proofs. It can be used by a beginner in algebraic number theory who wishes to see some of the true power and depth of the subject. The book is suitable for two one-semester courses, with the first four chapters serving to develop the basic material. Chapters 6 through 9 could be used on their own as a second semester course.

**Graduate Studies in Mathematics**, Volume 24

June 2000, 368 pages, Hardcover, ISBN 0-8218-2054-0, LC 00-022320, 2000 *Mathematics Subject Classification*: 11Rxx, 11Sxx, 11Mxx, **All AMS members \$47**, List \$59, Order code GSM/24RT008

## Differential Equations and Mathematical Physics

**Rudi Weikard and Gilbert Weinstein**, *University of Alabama, Birmingham*, Editors

This volume contains the proceedings of the 1999 International Conference on Differential Equations and Mathematical Physics. The contributions selected for this volume represent some of the most important presentations by scholars from around the world on developments in this area of research. The papers cover topics in the general area of linear and nonlinear differential equations and their relation to mathematical physics, such as multiparticle Schrödinger operators, stability of matter, relativity theory, fluid dynamics, spectral and scattering theory including inverse problems.

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

Titles in this series are co-published with International Press, Cambridge, MA.

**Contributors include:** A. A. Balinsky, W. D. Evans, R. Bartnik, R. D. Benguria, M. C. Depassier, B. K. Berger, M. Sh. Birman, T. A. Suslina, T. Bodineau, B. Helffer, R. Brummelhuis, M. B. Ruskai, E. Werner, D. Chae, O. Yu. Imanuvilov, M. Christ, A. Kiselev, Y. Last, D. Christodoulou, L. Erdős, J. P. Solovej, R. Froese, I. Herbst, F. Gesztesy, H. Holden, M. Griesemer, G. A. Hagedorn, A. Joye, R. Hempel, K. Lienau, A. M. Hinz, P. D. Hislop, T. Hupfer, H. Leschke, S. Warzel, W. Karwowski, V. Koshmanenko, Y. V. Kurylev, M. Lassas, Y. Li, E. H. Lieb, M. Loss, J. Yngvason, M. Ohmiya, Y. Pinchover, T. C. Sideris, H. Siedentop, J. A. Smoller, J. B. Temple, S. B. Sontz, G. Teschl, V. Tkachenko, M. M. Tom, C. Tretter, J. A. Viaclovsky, R. Weder, and G. Wolanski.

**AMS/IP Studies in Advanced Mathematics**, Volume 16

June 2000, 461 pages, Softcover, ISBN 0-8218-2157-1, LC 00-025797, 2000 *Mathematics Subject Classification*: 34-06, 35-06, **All AMS members \$47**, List \$59, Order code AMSIP/16RT008