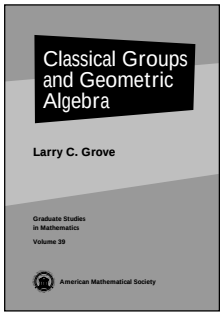
New Publications Offered by the AMS

Algebra and Algebraic Geometry



Classical Groups and Geometric Algebra

Larry C. Grove, *University of Arizona, Tucson*

"Classical groups", named so by Hermann Weyl, are groups of matrices or quotients of matrix groups by small normal subgroups.

Thus the story begins, as Weyl suggested, with "Her All-embracing Majesty", the general linear group $GL_n(V)$ of all invertible linear transformations of a vector space V over a field F. All further groups discussed are either subgroups of $GL_n(V)$ or closely related quotient groups.

Most of the classical groups consist of invertible linear transformations that respect a bilinear form having some geometric significance, e.g., a quadratic form, a symplectic form, etc. Accordingly, the author develops the required geometric notions, albeit from an algebraic point of view, as the end results should apply to vector spaces over more-or-less arbitrary fields, finite or infinite.

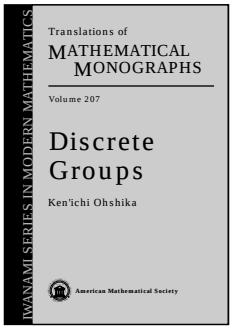
The classical groups have proved to be important in a wide variety of venues, ranging from physics to geometry and far beyond. In recent years, they have played a prominent role in the classification of the finite simple groups.

This text provides a single source for the basic facts about the classical groups and also includes the required geometrical background information from the first principles. It is intended for students who have completed standard courses in linear algebra and abstract algebra. The author, L. C. Grove, is a well-known expert who has published extensively in the subject area.

Contents: Permutation actions; The basic linear groups; Bilinear forms; Symplectic groups; Symmetric forms and quadratic forms; Orthogonal geometry (char $F \neq 2$); Orthogonal groups (char $F \neq 2$), I; $O(V)$, V Euclidean; Clifford algebras (char $F \neq 2$); Orthogonal groups (char $F \neq 2$), II; Hermitian forms and unitary spaces; Unitary groups; Orthogonal geometry (char $F = 2$); Clifford algebras (char $F = 2$); Orthogonal groups (char $F = 2$); Further developments; Bibliography; List of notation; Index.

Graduate Studies in Mathematics, Volume 39

October 2001, 169 pages, Hardcover, ISBN 0-8218-2019-2, LC 2001046251, 2000 *Mathematics Subject Classification*: 20G15, 20G40, 11E57; 11E39, 11E88, 51N30, Order code GSM/39N



Discrete Groups

Ken'ichi Ohshika, *Osaka University, Japan*

This book deals with geometric and topological aspects of discrete groups. The main topics are hyperbolic groups due to Gromov, automatic group theory, invented and developed by Epstein, whose subjects are groups that can be manipulated by computers, and Kleinian group theory, which enjoys the longest tradition and the richest content within the theory of discrete subgroups of Lie groups.

What is common among these three classes of groups is that when seen as geometric objects, they have the properties of a negatively curved space rather than a positively curved space. Since Kleinian groups are groups acting on a hyperbolic space of constant negative curvature, the technique employed to study them is that of hyperbolic manifolds, typical examples of negatively curved manifolds. Although hyperbolic groups in the sense of Gromov are much more general objects than Kleinian groups, one can apply for them arguments and techniques that are quite similar to those used for Kleinian groups. Automatic groups are further general objects, including groups having properties of spaces of curvature 0. Still, relationships between automatic groups and hyperbolic groups are examined here using ideas inspired by the study of hyperbolic manifolds. In all of these three topics, there is a "soul" of negative curvature upholding the theory. The volume would make a fine textbook for a graduate-level course in discrete groups.

Contents: Basic notions for infinite groups; Hyperbolic groups; Automatic groups; Kleinian groups; Prospects; Bibliography; Index.

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

October 2001, approximately 207 pages, Softcover, ISBN 0-8218-2080-X, 2000 *Mathematics Subject Classification*: 20F65, 20F67, 20F69, 57M07, 57M50, 57S30, 30F40; 46E25, 20C20, Order code MMONO-OHSHIKAN

Analysis

Rudiments de dynamique holomorphe

François Berteloot, *Université Paul Sabatier (Toulouse III), France*, and **Volker Mayer**, *Université de Lille I, France*

A publication of the Société Mathématique de France.

This book is an introduction to rational iteration theory. In the first four chapters, the authors deal with the classical theory. The basic properties of the Julia set and its complement, the Fatou set, are presented; the highest points of the treatment are the classification of the components of the Fatou set and Sullivan's non-wandering theorem.

The second part of the book studies several topics in more detail. The authors begin by considering at length two classes of rational maps: the chaotic maps and the hyperbolic maps. In the closing chapters, they include respectively a study of holomorphic families of rational maps with a view to discussing Fatou's famous problem concerning the density of hyperbolic maps and an exposition of the methods of potential theory, touching on questions of ergodicity, which may serve as a preparation for generalizations in higher dimensions.

A number of the developments treated here appear for the first time in book form. Several original proofs are presented.

Contents: Introduction; La dichotomie dynamique de Fatou et Julia; Dynamiques locales et composantes de Fatou; Ensemble de Julia; Classification des composantes de Fatou; Fractions rationnelles chaotiques; Fractions rationnelles hyperboliques; Familles holomorphes de fractions rationnelles; Le point de vu potentialiste; Mesure et dimension de Hausdorff; Applications quasiconformes et structures conformes; Quelques points de théorie du potentiel; Bibliographie; Index.

Cours Spécialisés—Collection SMF, Number 7

May 2001, 160 pages, Softcover, ISBN 2-86883-521-X, 2000 *Mathematics Subject Classification*: 37F50, 37F15, 30C62, 37F45, 37A25, 31A05, **Individual member $30**, List $33, Order code COSP/7N

Differential Equations

Les systèmes hamiltoniens et leur intégrabilité

Michèle Audin, *Université Louis Pasteur et CNRS, Strasbourg, France*

A publication of the Société Mathématique de France.

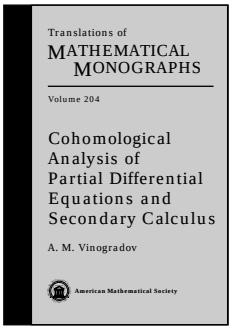
This book presents some modern techniques in the theory of integrable systems viewed as variations on the theme of action-angle coordinates. These techniques include analytical methods coming from the Galois theory of differential equations, as well as more classical algebro-geometric methods related to Lax equations. Many examples are given.

Contents: Introduction; Introduction aux systèmes intégrables; Variables action-angles; Intégrabilité et groupes de Galois; Une introduction aux èquations de Lax; *Appendix:* Ce qu'il faut savoir en théorie de Galois différentielle; Ce qu'il faut savoir sur les courbes algèbriques; Bibliographie; Index.

Cours Spécialisés—Collection SMF, Number 8

May 2001, 160 pages, Softcover, ISBN 2-86883-522-8, 2000 *Mathematics Subject Classification*: 70H06, 53C15, 12Hxx, 34A30, 14H10, 14Pxx, **Individual member $30**, List $33, Order code COSP/8N

Differential Equations



Cohomological Analysis of Partial Differential Equations and Secondary Calculus

A. M. Vinogradov, *University of Salerno, Baronossi (SA), Italy*

This book is dedicated to fundamentals of a new theory, which is an analog of affine algebraic geometry for (nonlinear) partial differential equations. This theory grew up from the classical geometry of PDE's originated by S. Lie and his followers by incorporating some nonclassical ideas from the theory of integrable systems, the formal theory of PDE's in its modern cohomological form given by D. Spencer and H. Goldschmidt and differential calculus over commutative algebras (Primary Calculus). The main result of this synthesis is Secondary Calculus on diffieties, new geometrical objects which are analogs of algebraic varieties in the context of (nonlinear) PDE's.

Secondary Calculus surprisingly reveals a deep cohomological nature of the general theory of PDE's and indicates new directions of its further progress. Recent developments in quantum

field theory showed Secondary Calculus to be its natural language, promising a nonperturbative formulation of the theory.

In addition to PDE's themselves, the author describes existing and potential applications of Secondary Calculus ranging from algebraic geometry to field theory, classical and quantum, including areas such as characteristic classes, differential invariants, theory of geometric structures, variational calculus, control theory, etc. This book, focused mainly on theoretical aspects, forms a natural dipole with *Symmetries and Conservation Laws for Differential Equations of Mathematical Physics*, Volume 182 in this same series, Translations of Mathematical Monographs, and shows the theory "in action".

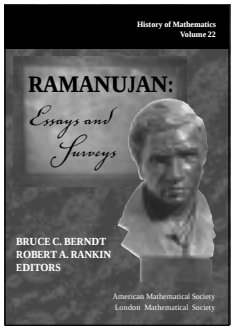
This item will also be of interest to those working in algebra and algebraic geometry.

Contents: From symmetries of partial differential equations to Secondary Calculus; Elements of differential calculus in commutative algebras; Geometry of finite-order contact structures and the classical theory of symmetries of partial differential equations; Geometry of infinitely prolonged differential equations and higher symmetries; C-spectral sequence and some applications; Introduction to Secondary Calculus; Bibliography; Index.

Translations of Mathematical Monographs, Volume 204

November 2001, approximately 264 pages, Hardcover, ISBN 0-8218-2922-X, LC 2001046087, 2000 *Mathematics Subject Classification*: 35A30, 37K10; 37Jxx, 58J10, **Individual member $53**, List $89, Institutional member $71, Order code MMONO/204N

General and Interdisciplinary



Ramanujan: Essays and Surveys

Bruce C. Berndt, *University of Illinois, Urbana-Champaign, IL*, and **Robert A. Rankin**, *University of Glasgow, Scotland*, Editors

This book contains essays on Ramanujan and his work that were written especially for this volume. It also includes important survey articles in areas influenced by Ramanujan's mathematics. Most of the articles in the book are nontechnical, but even those that are more technical contain substantial sections that will engage the general reader.

The book opens with the only four existing photographs of Ramanujan, presenting historical accounts of them and information about other people in the photos. This section includes an account of a cryptic family history written by his younger brother, S. Lakshmi Narasimhan. Following are articles on Ramanujan's illness by R. A. Rankin, the British physician D. A. B. Young, and Nobel laureate S. Chandrasekhar. They present a study of his symptoms, a convincing diagnosis of the cause of his death, and a thorough exposition of Ramanujan's life as a patient in English sanitariums and nursing homes.

Following this are biographies of S. Janaki (Mrs. Ramanujan) and S. Narayana Iyer, Chief Accountant of the Madras Port Trust Office, who first communicated Ramanujan's work to the *Journal of the Indian Mathematical Society*. The last half of the book begins with a section on "Ramanujan's Manuscripts and Notebooks". Included is an important article by G. E. Andrews on Ramanujan's lost notebook.

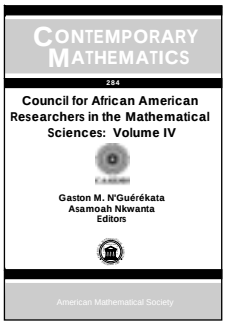
The final two sections feature both nontechnical articles, such as Jonathan and Peter Borwein's "Ramanujan and pi", and more technical articles by Freeman Dyson, Atle Selberg, Richard Askey, and G. N. Watson.

This volume complements the book *Ramanujan: Letters and Commentary*, Volume 9, in the AMS series, History of Mathematics. For more on Ramanujan, see these AMS publications *Ramanujan: Twelve Lectures on Subjects Suggested by His Life and Work*, Volume 136.H, and *Collected Papers of Srinivasa Ramanujan*, Volume 159.H, in the AMS Chelsea Publishing series.

Contents: R. A. Rankin, Commentary (by R. A. R.); *The life of Ramanujan:* The four photographs of Ramanujan; The books studied by Ramanujan in India; The influence of Carr's synopsis on Ramanujan; The notebooks of Srinivasa Ramanujan; A recently discovered letter giving Ramanujan's examination scores; On Ramanujan; The Ramanujan family record; *Ramanujan's illness:* Ramanujan as a patient; Ramanujan's illness; An incident in the life of S. Ramanujan, F.R.S.: Conversations with G. H. Hardy, F.R.S. and J. E. Littlewood, F.R.S. and their sequel; *S. Janaki:* S. Janaki Ammal (Mrs. Ramanujan); Conversation "I didn't understand his work, but I knew his worth"; *S. Narayana Iyer:* A short biography of S. Narayana Iyer; The distribution of primes; Some theorems in summation; *E. H. Neville:* Srinivasa Ramanujan; University lectures in Madras; *Ramanujan's manuscripts and notebooks:* Ramanujan's manuscripts and notebooks; Ramanujan's manuscripts and notebooks, II; An overview of Ramanujan's notebooks; An introduction to Ramanujan's "lost" notebook; *Nontechnical articles on Ramanujan's work:* Ramanujan and pi; π related developments since 1988; Reflections around the Ramanujan centenary; The problems submitted by Ramanujan to the Journal of the Indian Mathematical Society; *Somewhat more technical articles on Ramanujan's work:* A walk through Ramanujan's garden; Ramanujan and hypergeometric and basic hypergeometric series; The final problem: An account of the mock theta functions.

History of Mathematics

December 2001, 347 pages, Hardcover, ISBN 0-8218-2624-7, LC 2001045097, 2000 *Mathematics Subject Classification*: 01A61; 11P83, 11P82, 33C05, 33C20, 11A99, 33D15, 11–03, 33–03, **All AMS members $63**, List $79, Order code HMATH-BERNDT2N



Council for African American Researchers in the Mathematical Sciences: Volume IV

Gaston M. N'Guérékata and **Asamoah Nkwanta**, *Morgan State University, Baltimore, MD*, Editors

This volume contains selected papers from the Sixth Conference for African American Researchers in the Mathematical

Sciences (CAARMS), held at Morgan State University in Baltimore (MD). The CAARMS organizes this annual conference showcasing the current research primarily, but not exclusively, of African Americans in the mathematical sciences. Since the first conference in 1995, significant numbers of researchers have presented their current work in technical talks, and graduate students have presented their work in organized poster sessions.

Research topics include mathematics (number theory, analysis, topology, differential equations, algebra, combinatorics, etc.), mathematical physics, mathematical biology, operations research, probability and statistics, and computer science. In addition to the invited talks, tutorials and group discussions on various topics are organized to stimulate, nurture, and encourage increased participation by African Americans and other underrepresented groups in the mathematical sciences. These events create an ideal forum for mentoring and networking where attendees can meet researchers and graduate students who are interested in the same fields.

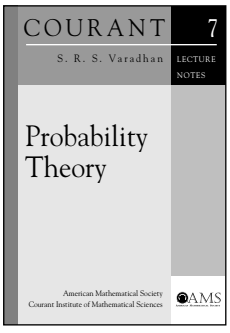
For volumes based on previous CAARMS proceedings, see *African Americans in Mathematics*, Volume 34, in the AMS Series in Discrete Mathematics and Theoretical Computer Science, *African Americans in Mathematics II*, Volume 252, and *Council for African American Researchers in the Mathematical Sciences: Volume III*, Volume 275, in the AMS series, Contemporary Mathematics.

Contents: *Research articles:* **K. M. Lewis**, Hyponormality and a family of Toeplitz operators on the Bergman space; **E. Goins**, A ternary algebra with applications to binary quadratic forms; **I. Assani**, Spectral characterization of ergodic dynamical systems; **C. Castillo-Chavez** and **A.-A. Yakubu**, Epidemics on attractors; **K. F. Sellers**, A definition of vague coherent systems; **M. C. Jackson**, Spatial data analysis for discrete data on a lattice; **C. R. Handy**, New perspectives in moment-wavelet analysis from quantum operator theory: Scalets and local quantization; *Historical articles:* **J. L. Houston**, Numbers that count–Persons who impact, mathematically!.

Contemporary Mathematics, Volume 284

November 2001, 135 pages, Softcover, ISBN 0-8218-2793-6, 2000 *Mathematics Subject Classification*: 01A30, 37A30, 28D05, 92B05, 92B99, 81Q99, 03B05, 03E72, 90B10, 47A15, **Individual member $26**, List $44, Institutional member $35, Order code CONM/284N

Probability



Probability Theory

S. R. S. Varadhan, *New York University - Courant Institute of Mathematical Sciences*

This volume presents topics in probability theory covered during a first-year graduate course given at the Courant Institute of Mathematical Sciences. The necessary background material in measure theory is developed, including the standard topics, such as extension theorem, construction of measures, integration, product spaces, Radon-Nikodym theorem, and conditional expectation.

In the first part of the book, characteristic functions are introduced, followed by the study of weak convergence of probability distributions. Then both the weak and strong limit theorems for sums of independent random variables are proved, including the weak and strong laws of large numbers, central limit theorems, laws of the iterated logarithm, and the Kolmogorov three series theorem. The first part concludes with infinitely divisible distributions and limit theorems for sums of uniformly infinitesimal independent random variables.

The second part of the book mainly deals with dependent random variables, particularly martingales and Markov chains. Topics include standard results regarding discrete parameter martingales and Doob's inequalities. The standard topics in Markov chains are treated, i.e., transience, and null and positive recurrence. A varied collection of examples is given to demonstrate the connection between martingales and Markov chains.

Additional topics covered in the book include stationary Gaussian processes, ergodic theorems, dynamic programming, optimal stopping, and filtering. A large number of examples and exercises is included. The book is a suitable text for a first-year graduate course in probability.

Contents: Measure theory; Weak convergence; Independent sums; Dependent random variables; Martingales; Stationary stochastic processes; Dynamic programming and filtering; Bibliography; Index.

Courant Lecture Notes, Volume 7

October 2001, 167 pages, Softcover, ISBN 0-8218-2852-5, LC 2001045216, 2000 *Mathematics Subject Classification*: 60–01, **All AMS members $19**, List $24, Order code CLN/7N

Previously Announced Publications

The Schur Algorithm, Reproducing Kernel Spaces and System Theory

Daniel Alpay, *Ben-Gurion University of the Negev, Beersheva, Israel*

From a review of the French edition:

This excellent survey showing a rich interplay between functional analysis, complex analysis and systems science is very informative and can be highly recommended to functional analysts curious about the systems science impact of their discipline or to theoretically inclined systems scientists, in particular those involved in the realization theory.

—Zentralblatt für Mathematik

The class of Schur functions consists of analytic functions on the unit disk that are bounded by 1. The Schur algorithm associates to any such function a sequence of complex constants, which is much more useful than the Taylor coefficients. There is a generalization to matrix-valued functions and a corresponding algorithm. These generalized Schur functions have important applications to the theory of linear operators, to signal processing and control theory, and to other areas of engineering.

In this book, Alpay looks at matrix-valued Schur functions and their applications from the unifying point of view of spaces with reproducing kernels. This approach is used here to study the relationship between the modeling of time-invariant dissipative linear systems and the theory of linear operators. The inverse scattering problem plays a key role in the exposition. The point of view also allows for a natural way to tackle more

general cases, such as nonstationary systems, non-positive metrics, and pairs of commuting nonself-adjoint operators. This is the English translation of a volume originally published in French by the Société Mathématique de France. Translated by Stephen S. Wilson.

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

SMF/AMS Texts and Monographs, Volume 5

August 2001, 150 pages, Softcover, ISBN 0-8218-2155-5, LC 2001031602, 2000 *Mathematics Subject Classification*: 46E22, 93–02, **All AMS members $39**, List $49, Order code SMFAMS/5RT110

Recommended Text

Theta Constants, Riemann Surfaces and the Modular Group

An Introduction with Applications to Uniformization Theorems, Partition Identities and Combinatorial Number Theory

Hershel M. Farkas, *The Hebrew University, Jerusalem, Israel*, and **Irwin Kra**, *State University of New York, Stony Brook*

There are incredibly rich connections between classical analysis and number theory. For instance, analytic number theory contains many examples of asymptotic expressions derived from estimates for analytic functions, such as in the proof of the Prime Number Theorem. In combinatorial number theory, exact formulas for number-theoretic quantities are derived from relations between analytic functions. Elliptic functions, especially theta functions, are an important class of such functions in this context, which had been made clear already in Jacobi's *Fundamenta nova*. Theta functions are also classically connected with Riemann surfaces and with the modular group $\Gamma = \mathrm{PSL}(2,\mathbb{Z})$, which provide another path for insights into number theory.

Farkas and Kra, well-known masters of the theory of Riemann surfaces and the analysis of theta functions, uncover here interesting combinatorial identities by means of the function theory on Riemann surfaces related to the principal congruence subgroups $\Gamma(k)$. For instance, the authors use this approach to derive congruences discovered by Ramanujan for the partition function, with the main ingredient being the construction of the same function in more than one way. The authors also obtain a variant on Jacobi's famous result on the number of ways that an integer can be represented as a sum of four squares, replacing the squares by triangular numbers and, in the process, obtaining a cleaner result.

The recent trend of applying the ideas and methods of algebraic geometry to the study of theta functions and number theory has resulted in great advances in the area. However, the authors choose to stay with the classical point of view. As a result, their statements and proofs are very concrete. In this book the mathematician familiar with the algebraic geometry approach to theta functions and number theory will find many interesting ideas as well as detailed explanations and derivations of new and old results.

Highlights of the book include systematic studies of theta constant identities, uniformizations of surfaces represented by subgroups of the modular group, partition identities, and Fourier coefficients of automorphic functions.

Prerequisites are a solid understanding of complex analysis, some familiarity with Riemann surfaces, Fuchsian groups, and elliptic functions, and an interest in number theory. The book contains summaries of some of the required material, particularly for theta functions and theta constants.

Readers will find here a careful exposition of a classical point of view of analysis and number theory. Presented are numerous examples plus suggestions for research-level problems. The text is suitable for a graduate course or for independent reading.

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

Graduate Studies in Mathematics, Volume 37

October 2001, 531 pages, Hardcover, ISBN 0-8218-1392-7, LC 2001035711, 2000 *Mathematics Subject Classification*: 30F35, 30F30, 11F20, 11F25, 11F30, 11P81, 11P82, 11P83, 14H42, 14H45, 14H55, 20H10, **All AMS members $55**, List $69, Order code GSM/37RT110

Recommended Text

Linear Algebra and Differential Equations

Alexander Givental, *University of California, Berkeley*

This is based on the course, "Linear Algebra and Differential Equations", taught by the author to sophmore students at UC Berkeley.

From the Introduction: "We accept the currently acting syllabus as an outer constraint … but otherwise we stay rather far from conventional routes.

"In particular, at least half of the time is spent to present the entire agenda of linear algebra and its applications in the 2*D* environment; Gaussian elimination occupies a visible but supporting position; abstract vector spaces intervene only in the review section. Our eye is constantly kept on *why?*, and very few facts (the fundamental theorem of algebra, the uniqueness and existence theorem for solutions of ordinary differential equations, the Fourier convergence theorem, and the higher-dimensional Jordan normal form theorem) are stated and discussed without proof."

Specific material in the book is organized as follows: Chapter 1 discusses geometry on the plane, including vectors, analytic geometry, linear transformations and matrices, complex numbers, and eigenvalues. Chapter 2 presents differential equations (both ODEs and PDEs), Fourier series, and the Fourier method. Chapter 3 discusses classical problems of linear algebra, matrices and determinants, vectors and linear systems, Gaussian elimination, quadratic forms, eigenvectors, and vector spaces. The book concludes with a sample final exam.

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

Berkeley Mathematical Lecture Notes, Volume 11

August 2001, 132 pages, Softcover, ISBN 0-8218-2850-9, 2000 *Mathematics Subject Classification*: 15–01; 34–01, 35–01, 51–01, **All AMS members $15**, List $19, Order code BMLN/11RT110

Supplementary Reading

Smooth Ergodic Theory and Its Applications

Anatole Katok, *Pennsylvania State University, University Park,* **Rafael de la Llave**, *University of Texas at Austin*, and **Yakov Pesin** and **Howard Weiss**, *Pennsylvania State University, University Park*, Editors

During the past decade, there have been several major new developments in smooth ergodic theory, which have attracted substantial interest to the field from mathematicians as well as scientists using dynamics in their work. In spite of the impressive literature, it has been extremely difficult for a student—or even an established mathematician who is not an expert in the area—to acquire a working knowledge of smooth ergodic theory and to learn how to use its tools.

Accordingly, the AMS Summer Research Institute on Smooth Ergodic Theory and Its Applications (Seattle, WA) had a strong educational component, including ten mini-courses on various aspects of the topic that were presented by leading experts in the field. This volume presents the proceedings of that conference.

Smooth ergodic theory studies the statistical properties of differentiable dynamical systems, whose origin traces back to the seminal works of Poincaré and later, many great mathematicians who made contributions to the development of the theory. The main topic of this volume, smooth ergodic theory, especially the theory of nonuniformly hyperbolic systems, provides the principle paradigm for the rigorous study of complicated or *chaotic* behavior in deterministic systems. This paradigm asserts that if a non-linear dynamical system exhibits sufficiently pronounced exponential behavior, then global properties of the system can be deduced from studying the linearized system. One can then obtain detailed information on topological properties (such as the growth of periodic orbits, topological entropy, and dimension of invariant sets including attractors), as well as statistical properties (such as the existence of invariant measures, asymptotic behavior of typical orbits, ergodicity, mixing, decay of correlations, and measure-theoretic entropy). Smooth ergodic theory also provides a foundation for numerous applications throughout mathematics (e.g., Riemannian geometry, number theory, Lie groups, and partial differential equations), as well as other sciences.

This volume serves a two-fold purpose: first, it gives a useful gateway to smooth ergodic theory for students and nonspecialists, and second, it provides a state-of-the-art report on important current aspects of the subject. The book is divided into three parts: lecture notes consisting of three long expositions with proofs aimed to serve as a comprehensive and self-contained introduction to a particular area of smooth ergodic theory; thematic sections based on mini-courses or surveys held at the conference; and original contributions presented at the meeting or closely related to the topics that were discussed there.

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

Contributors include: L. Barreira, Ya. Pesin, M. Brin, D. Dolgopyat, H. Hu, A. Katok, E. A. Robinson, Jr., R. de la Llave, V. Baladi, K. Burns, C. Pugh, M. Shub, A. Wilkinson, Y. Kifer, M. Pollicott, J. Schmeling, H. Weiss, G. Świątek, M. P. Wojtkowski, P. Eberlein, G. Knieper, B. Kalinin, D. Kleinbock, K. Schmidt, L. H. Eliasson, J. Pöschel, M. Levi, J. Moser, J. Buzzi, M. Guysinsky, V. Niţică, F. Xavier, N. Peyerimhoff, A. Windsor, and M. Jakobson.

October 2001, 867 pages, Hardcover, ISBN 0-8218-2682-4, LC 2001041216, 2000 *Mathematics Subject Classification*: 11-XX, 28-XX, 34Cxx, 34Dxx, 37-XX, 53-XX, 70-XX, **Individual member $98**, List $164, Institutional member $131, Order code PSPUM-PESINRT110

Geometric Asymptotics for Nonlinear PDE. I

V. P. Maslov, *Moscow State University, Russia*, and **G. A. Omel'yanov**, *Moscow Institute of Electronic Engineering, Russia*

The study of asymptotic solutions to nonlinear systems of partial differential equations is a very powerful tool in the analysis of such systems and their applications in physics, mechanics, and engineering. In the present book, the authors propose a new powerful method of asymptotic analysis of solutions, which can be successfully applied in the case of the so-called "smoothed shock waves", i.e., nonlinear waves which vary fast in a neighborhood of the front and slowly outside of this neighborhood. The proposed method, based on the study of geometric objects associated to the front, can be viewed as a generalization of the geometric optics (or WKB) method for linear equations. This volume offers to a broad audience a simple and accessible presentation of this new method.

The authors present many examples originating from problems of hydrodynamics, nonlinear optics, plasma physics, mechanics of continuum, and theory of phase transitions (free boundary problems). In the examples, characterized by smoothing of singularities due to dispersion or diffusion, asymptotic solutions in the form of distorted solitons, kinks, breathers, or smoothed shock waves are constructed. By a unified rule, a geometric picture is associated with each physical problem that allows for obtaining tractable asymptotic formulas and provides a geometric interpretation of the physical process. Included are many figures illustrating the various physical effects.

Translations of Mathematical Monographs, Volume 202

August 2001, 285 pages, Hardcover, ISBN 0-8218-2109-1, LC 2001040045, 2000 *Mathematics Subject Classification*: 35Qxx, 76L05, **Individual member $59**, List $99, Institutional member $79, Order code MMONO/202RT110