# New Publications Offered by the AMS 

# Algebra and Algebraic Geometry 

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## Classical Galois Theory with Examples

Lisl Gaal

This book is strongly recommended to beginning graduate students who already have some background in abstract algebra ... The large number of partially or fully solved examples is its special feature.
-Mathematical Reviews
Contents: Prerequisites: 1.1 Group theory; 1.2 Permutations and permutation groups; 1.3 Fields; 1.4 Rings and polynomials; 1.5 Some elementary theory of equations; 1.6 Vector spaces; Fields: 2.1 Degree of an algebraic extension; 2.2 Isomorphisms of fields; 2.3 Automorphisms of fields; 2.4 Fixed fields; Fundamental theorem: 3.1 Splitting fields; 3.2 Normal extensions and groups of automorphisms; 3.3 Conjugate fields and elements; 3.4 Fundamental theorem; Applications: 4.1 Solvability of equations; 4.2 Solvable equations have solvable groups; 4.3 General equation of degree $n ; 4.4$ Roots of unity and cyclic equations; 4.5 How to solve a solvable equation; 4.6 Ruler-and-compass constructions; 4.7 Lagrange's theorem; 4.8 Resolvent of a polynomial; 4.9 Calculation of the Galois group; 4.10 Matrix solutions of equations; 4.11 Finite fields; 4.12 More applications; Bibliography; Index.

## AMS Chelsea Publishing

September 1998, 248 pages, Hardcover, ISBN 0-8218-1375-7, LC 73-649, 1991 Mathematics Subject Classification: 12-01, 12A55; 12F10, All AMS members \$18, List \$20, Order code CHEL/268.HN

Back in Print from the AMS

## The Theory of Matrices

## F. R. Gantmacher

This treatise, by one of Russia's leading mathematicians, gives in easily accessible form, a coherent account of matrix theory with a view to applications in mathematics, theoretical physics, statistics, electrical engineering, etc. The individual chapters have been kept as far as possible independent of each other, so that the reader acquainted with the contents of Chapter 1 can proceed immediately to the chapters of special interest.

Much of the material has been available until now only in the periodical literature.
Contents: Volume 1: I. Matrices and operations on matrices: 1. Matrices. Basic notation; 2. Addition and multiplication of rectangular matrices; 3 . Square matrices; 4. Compound matrices. Minors of the inverse matrix; II. The algorithm of Gauss and some of its applications: 1. Gauss's elimination method; 2. Mechanical interpretation of Gauss's algorithm; 3. Sylvester's determinant identity; 4. The decomposition of a square matrix into triangular factors; 5 . The partition of a matrix into blocks. The technique of operating with partitioned matrices. The generalized algorithm of Gauss; III. Linear operators in an $n$-dimensional vector space: 1 . Vector spaces; 2. A linear operator mapping an $n$-dimensional space into an $m$ dimensional space; 3. Addition and multiplication of linear operators; 4 . Transformation of coordinates; 5 . Equivalent matrices. The rank of an operator. Sylvester's inequality; 6. Linear operators mapping an $n$-dimensional space into itself; 7. Characteristic values and characteristic vectors of a linear operator; 8. Linear operators of simple structure; IV. The characteristic polynomial and the minimal polynomial of a matrix: 1. Addition and multiplication of matrix polynomials; 2. Right and left division of matrix polynomials; 3. The generalized Bézout theorem; 4. The characteristic polynomial of a matrix. The adjoint matrix; 5. The method of Faddeev for the simultaneous computation of the coefficients of the characteristic polynomial and of the adjoint matrix; 6. The minimal polynomial of a matrix; V. Functions of matrices: 1. Definition of a function of a matrix; 2. The Lagrange-Sylvester interpolation polynomial; 3. Other forms of the definition of $f(A)$. The components of the matrix $A ; 4$. Representation of functions of matrices by means of series; 5 . Application of a function of a matrix to the integration of a system of linear differential equations with constant coefficients; 6 . Stability of motion in the case of a linear system; VI. Equivalent transformations of polynomial matrices. Analytic theory of elementary divisors: 1. Elementary transformations of a polynomial matrix; 2. Canonical form of a $\lambda$-matrix; 3. Invariant polynomials and elementary divisors of a polynomial matrix; 4. Equivalence of linear binomials; 5. A criterion for similarity of matrices; 6 . The normal forms of a matrix; 7. The elementary divisors of the matrix $f(A) ; 8$. A general method of constructing the transforming matrix; 9. Another method of constructing a transforming matrix; VII. The structure of a linear operator in an $n$-dimensional space: 1 . The minimal polynomial of a vector and a space (with respect to a given linear operator); 2. Decomposition into invariant subspaces with co-prime minimal polynomials; 3. Congruence. Factor space; 4. Decomposition of a space into cyclic invariant subspaces; 5 . The normal form of a matrix; 6. Invariant polynomials. Elementary divisors; 7. The Jordan normal form of a matrix; 8. Krylov's method of trans-
forming the secular equation; VIII. Matrix equations: 1. The equation $A X=X B ; 2$. The special case $A=B$. Commuting matrices; 3. The equation $A X-X B=C$; 4 . The scalar equation $f(X)=0$; 5 . Matrix polynomial equations; 6 . The extraction of $m$-th roots of a non-singular matrix; 7. The extraction of $m$-th roots of a singular matrix; 8. The logarithm of a matrix; IX. Linear operators in a unitary space: 1 . General considerations; 2. Metrization of a space; 3. Gram's criterion for linear dependence of vectors; 4. Orthogonal projection; 5. The geometrical meaning of the Gramian and some inequalities; 6. Orthogonalization of a sequence of vectors; 7. Orthonormal bases; 8. The adjoint operator; 9 . Normal operators in a unitary space; 10. The spectra of normal, hermitian, and unitary operators; 11. Positive-semidefinite and positive-definite hermitian operators; 12. Polar decomposition of a linear operator in a unitary space. Cayley's formulas; 13. Linear operators in a euclidean space; 14. Polar decomposition of an operator and the Cayley formulas in a euclidean space; 15. Commuting normal operators; X. Quadratic and hermitian forms: 1. Transformation of the variables in a quadratic form; 2 . Reduction of a quadratic form to a sum of squares. The law of inertia; 3. The methods of Lagrange and Jacobi of reducing a quadratic form to a sum of squares; 4. Positive quadratic forms; 5 . Reduction of a quadratic form to principal axes; 6. Pencils of quadratic forms; 7. Extremal properties of the characteristic values of a regular pencil of forms; 8. Small oscillations of a system with $n$ degrees of freedom; 9 . Hermitian forms; 10. Hankel forms; Bibliography; Index; Volume 2: XI. Complex symmetric, skew-symmetric, and orthogonal matrices: 1 . Some formulas for complex orthogonal and unitary matrices; 2. Polar decomposition of a complex matrix; 3. The normal form of a complex symmetric matrix; 4 . The normal form of a complex skew-symmetric matrix; 5 . The normal form of a complex orthogonal matrix; XII. Singular pencils of matrices: 1. Introduction; 2. Regular pencils of matrices; 3. Singular pencils. The reduction theorem; 4 . The canonical form of a singular pencil of matrices; 5 . The minimal indices of a pencil. Criterion for strong equivalence of pencils; 6 . Singular pencils of quadratic forms; 7. Application to differential equations; XIII. Matrices with non-negative elements: 1 . General properties; 2. Spectral properties of irreducible non-negative matrices; 3. Reducible matrices; 4. The normal form of a reducible matrix; 5. Primitive and imprimitive matrices; 6. Stochastic matrices; 7. Limiting probabilities for a homogeneous Markov chain with a finite number of states; 8 . Totally nonnegative matrices; 9. Oscillatory matrices; XIV. Applications of the theory of matrices to the investigation of systems of linear differential equations: 1 . Systems of linear differential equations with variable coefficients. General concepts; 2. Lyapunov transformations; 3. Reducible systems; 4. The canonical form of a reducible system. Erugin's theorem; 5. The matricant; 6. The multiplicative integral. The infinitesimal calculus of Volterra; 7. Differential systems in a complex domain. General properties; 8. The multiplicative integral in a complex domain; 9. Isolated singular points; 10. Regular singularities; 11. Reducible analytic systems; 12. Analytic functions of several matrices and their application to the investigation of differential systems. The papers of Lappo-Danilevskií; XV. The problem of Routh-Hurwitz and related questions: 1. Introduction; 2. Cauchy indices; 3. Routh's algorithm; 4. The singular case. Examples; 5. Lyapunov's theorem; 6. The theorem of Routh-Hurwitz; 7. Orlando's formula; 8. Singular cases in the Routh-Hurwitz theorem; 9. The method of quadratic forms. Determination of the number of distinct real roots of a polynomial; 10. Infinite Hankel matrices of finite rank; 11. Determination of the index of an arbitrary rational fraction by the coefficients of numerator and denominator; 12. Another proof of the Routh-Hurwitz theorem; 13. Some supplements to the Routh-Hurwitz theorem. Stability criterion of Liénard and Chipart; 14. Some properties
of Hurwitz polynomials. Stieltjes' theorem. Representation of Hurwitz polynomials by continued fractions; 15. Domain of stability. Markov parameters; 16. Connection with the problem of moments; 17. Theorems of Markov and Chebyshev; 18. The generalized Routh-Hurwitz problem; Bibliography; Index.

## AMS Chelsea Publishing

Volume 1: September 1998, 384 pages, Hardcover, ISBN 0-8218-1376-5, 1991 Mathematics Subject Classification: 15-02, All AMS members \$35, List \$39, Order code CHEL/131.HN Volume 2: September 1998, 276 pages, Hardcover, ISBN 0-8284-0133-0, 1991 Mathematics Subject Classification: 15-02, All AMS members \$23, List \$25, Order code CHEL/133N Set: September 1998, 660 pages, Hardcover, ISBN 0-8218-13935, 1991 Mathematics Subject Classification: 15-02, All AMS members \$53, List \$59, Order code CHELGANTSETN


## Recent Progress in Algebra

Sang Geun Hahn, Korea Advanced Institute of Science \& Technology, Taejon, Hyo Chul Myung, Korea Institute for Advanced Study, Seoul, and Efim Zelmanov, Yale University, New Haven, CT, Editors

This volume presents the proceedings of the international conference on "Recent Progress in Algebra" that was held at the Korea Advanced Institute of Science and Technology (KAIST) and Korea Institute for Advanced Study (KIAS). It brought together experts in the field to discuss progress in algebra, combinatorics, algebraic geometry and number theory. This book contains selected papers contributed by conference participants. The papers cover a wide range of topics and reflect the current state of research in modern algebra.
Contents: G. W. Anderson, A double complex for computing the sign-cohomology of the universal ordinary distribution; G. Benkart, Down-up algebras and Witten's deformations of the universal enveloping algebra of $\mathfrak{s l}_{2}$; T. Chinburg, B. Erez, G. Pappas, and M. Taylor, Localizations of Grothendieck groups and Galois structure; I. V. Dolgachev, Invariant stable bundles over modular curves $\mathbf{X}(\mathbf{p})$; A. Elduque, Okubo algebras and twisted polynomials; E.-U. Gekeler, Some new results on modular forms for $\mathbf{G L}\left(2, \mathbb{F}_{q}[T]\right)$; H. C. Jung, Counting jump optimal linear extensions of some posets; M. Kosuda, The irreducible representations of categories; A. R. Magid, Prounipotent prolongation of algebraic groups; C. Martinez, Graded simple Jordan algebras and superalgebras; D. Moon, The centralizer algebra of the Lie superalgebra $\mathfrak{p}(n)$ and the decomposition of $V^{\otimes k}$ as a $\mathfrak{p}(n)$-module; I. Yu. Potemine, Drinfeld-Anderson motives and multicomponent KP hierarchy; Yu. G. Zarhin and B. J. J. Moonen, Weil classes and Rosati involutions on complex abelian varieties; E. Zelmanov, On some open problems related to the restricted Burnside problem.
Contemporary Mathematics, Volume 224
November 1998, 243 pages, Softcover, ISBN 0-8218-0972-5, LC 98-35282, 1991 Mathematics Subject Classification: 00B20, 05D05, 05E15, 05E25, 11G09, 11F11, 11F75, 11R18, 11R33, 17B10, 17B37, 17B65, 17B70, 17D05, 19A31, 20C15, 20C20, 20E18, 20F05, 20F50, Individual member \$33, List \$55, Institutional member \$44, Order code CONM/224N

Recommended Text


Vertex Algebras for Beginners

Second Edition

Victor Kac, Massachusetts Institute of Technology, Cambridge

## Very good introductional book on vertex algebras.

-Zentralblatt für Mathematik
Essential reading for anyone trying to learn about vertex algebras ... well worth buying for experts.
-Bulletin of the London Mathematical Society
This is an improved and expanded edition of Kac's original introduction to algebraic aspects of conformal field theory, which was published by the AMS in 1996. This revised edition is based on courses given by the author at MIT and at Rome University in spring 1997. New material is added, including the foundations of a rapidly growing area of algebraic conformal theory. Also, in some places, the exposition is significantly simplified.
This text will also be of interest to those working in mathematical physics.
Contents: Preface; Preface to the second edition; Wightman axioms and vertex algebras; Calculus of formal distributions; Local fields; Structure theory of vertex algebras; Examples of vertex algebras and their applications; Bibliography; Index.
University Lecture Series, Volume 10
November 1998, 201 pages, Softcover, ISBN 0-8218-1396-X, LC 98-41276, 1991 Mathematics Subject Classification: 17B69; 17B65, 81T05, 81T40, All AMS members \$23, List \$29, Order code ULECT/10.RN


> Chtoucas de Drinfeld et Conjecture de Ramanujan-Petersson

Laurent Lafforgue, Université de Paris Sud, Orsay, France

A publication of Société Mathématique de France.
This book discusses the RamanujanPetersson conjecture over function fields. This conjecture is proved for automorphic cuspidal representations of $G L_{r}$ when $r$ is odd, and a partial result is given when $r$ is even.

The proof consists of studying the stacks classifying Drinfeld's shtukas. In particular, it combines the Grothendieck-Lefschetz fixed point theorem, the Deligne purity theorem and a version of the Arthur-Selberg trace formula over function fields.

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

Contents: Introduction; $\mathcal{D}$-chtoucas: généralités; Chtoucas réductibles. Filtrations de Harder-Narasimhan; Description adélique des chtoucas. Nombres de Lefschetz; Le cas des $\mathcal{D}$ chtoucas de rang $r=1$; Calcul des nombres de Lefschetz en rang $r \geq 2$; Formule des traces d'Arthur-Selberg et conjecture de Ramanujan-Petersson; Bibliographie.
Astérisque, Number 243
November 1997, 329 pages, Softcover, 1991 Mathematics Subject Classification: 11G, 14G5, 11G09, 11F70, 11F60, 14F20, 11F72, Individual member \$81, List \$90, Order code AST/243N


> Fonctions Symétriques, Polynômes de Schubert et Lieux de Dégénerescence

Laurent Manivel, Université de Grenoble I, Institut Fourier, Saint Martin d'Hères Cedex, France

## A publication of Société Mathématique de France.

This course begins with two chapters of combinatorial nature. The first is devoted to symmetric functions and to the properties of Schur polynomials, studied using Young tableaux and the Knuth insertion algorithm. It is shown that these polynomials can be identified with the characters of the irreducible representations of the symmetric group.
The second chapter is a study of Schubert polynomials, as defined by A. Lascoux and M.-P. Schützenberger in terms of divided differences. These polynomials are associated with permutations. Their combinatorics is related to the Bruhat order on symmetric groups and to certain Hecke algebras of these groups.
The third and final chapter is of geometrical nature. Its main theme is the study of Schubert varieties inside Grassmannians and flag manifolds. The fact that the homology classes of these varieties can be represented by Schur or Schubert polynomials allows geometrical translation of most of the results of the first two chapters. And since these Schubert varieties are universal models for certain degeneracy loci of morphisms between vector bundles, expressions are deduced for the homology classes of these loci in terms of characteristic classes of the bundles involved. Text is in French.
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30\% discount from list.
Contents: Introduction; L'anneau des fonctions symétriques; Les polynômes de Schubert; Les variétés de Schubert; Une brève introduction à l'homologie singulière; Bibliographie; Index.
Cours Spécialisés-Collection SMF, Number 3
July 1998, 179 pages, Softcover, ISBN 2-85629-066-3,
1991 Mathematics Subject Classification: 05E05, 05E10, 14M15, 14N10, 20C30, 57T15, Individual member \$40, List \$44, Order code COSP/3N

## Analysis



# Algorithme de Schur, Espaces à Noyau Reproduisant et Théorie des Systèmes 

Daniel Alpay, Ben Gurion University, Beer-Sheva, Israel

## A publication of Société Mathématique de France.

The same positive functions (in the sense of reproducing kernel spaces) naturally appear in two different domains, namely the modeling of time-invariant dissipative linear systems and the theory of linear operators. The author uses the associated reproducing kernel Hilbert spaces to study the relationships between these domains. The inverse scattering problem plays a key role in the exposition. The reproducing kernel approach allows for more natural solutions to general cases, such as nonstationary systems, the case of non-positive metrics and the case of pairs of commuting nonself-adjoint operators. Text is in French.
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a $30 \%$ discount from list.
Contents: Introduction; Espaces à noyau reproduisant; Théorie des systèmes linéaires; Algorithme de Schur et problème de diffusion inverse; Modèles d'opérateurs; Interpolation; Le cas indéfini; Le cas non stationnaire; Surfaces de Riemann; Épilogue; Bibliographie; Index.
Panoramas et Synthèses, Number 6
July 1998, 189 pages, Softcover, ISBN 2-85629-067-1, 1991 Mathematics Subject Classification: 46E22, 93-02, Individual member \$40, List \$44, Order code PASY/6N


> Études Spectrales d'Opérateurs de Transfert et Applications
A. Broise, Université de Paris-Sud, Orsay, France, and F. Dal'bo and M. Peigné, Université de Rennes I, France

A publication of Société Mathématique de France.

Ce livre présente deux travails, le premier de Broise, et le deuxième de Dal'bo et Peigné.
La première partie, intitulée "Transformations dilatantes de l'intervalle et théorèmes limites," présente un travail de synthèse sur les transformations dilatantes de l'intervalle ayant une partition finie ou dénombrable. L'auteur montre l'existence de mesures invariantes absolument continues par
rapport à la mesure de Lebesgue pour une classe de transformations dilatantes plus large que celle étudiée habituellement.
Ensuite, Broise montre des théorèmes limites central et local et donne la vitesse de convergences et des conditions d'annulation de la variance basées sur les points périodiques de la transformation. On précise les théorèmes limites obtenus par des théorèmes de grands écarts. Enfin l'auteur montre comment s'appliquent ces théorèmes sur divers exemples de transformations.
La deuxième partie est intitulée "Comportement asymptotique du nombre de géodésiques fermées sur la surface modulaire en courbure non constante." Soit $\bar{g}_{\epsilon}$ une perturbation de la métrique hyperbolique sur $M=\mathbb{H}^{2} / P S L_{2}(\mathbb{Z})$, les auteurs démontrent que le nombre de géodésiques fermées sur ( $M, \bar{g}_{\epsilon}$ ) de longueur au plus $a$ est équivalent quand $a$ tend vers $+\infty$ à $e^{a \delta_{\epsilon}} / a \delta_{\epsilon}$ (où $\delta_{\epsilon}$ est l'exposant critique de la série de Poincaré associée à $P S L_{2}(\mathbb{Z})$ ). La démonstration de ce résultat repose sur un codage des géodésiques fermées de ( $M, \bar{g}_{\epsilon}$ ) relié au développement en fractions continues de réels et sur l'utilisation d'un théorème du renouvellement harmonique nécessitant une étude spectrale précise de l'opérateur de transfert mis en jeu. Les auteurs retrouvent également par cette méthode probabiliste la distribution asymptotique des constantes de Lévy des nombres quadratiques.
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30\% discount from list.
Contents: A. Broise, Transformations dilantantes de l'intervalle et théorèmes limites; F. Dal'bo and M. Peigné, Comportement asymptotique du nombre de géodésiques fermées sur la surface modulaire en courbure non constante.
Astérisque, Number 238
August 1998, 177 pages, Softcover, 1991 Mathematics Subject Classification: 60F05, 53C22; 28D05, 58F11, 60J05, 58E10, Individual member \$50, List \$55, Order code AST/238N

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## Introduction to Approximation Theory

## Second Edition

## E. W. Cheney

In this book, which is intended to be an introduction to the subject, the author steers a middle course between the various viewpoints. On the one hand, he presents his material within the framework of (elementary) functional analysis ... and on the other hand he treats various algorithms which prepare the way for the numerical solution of various types of approximation problems. One of the highlights of the book is Chapter V on rational approximation which is an important case of non-linear approximation ... The book concludes with a detailed and interesting section on historical notes and a lengthy bibliography. There are approximately 430 good exercises. The author has provided a usable and very versatile text which is certainly to be recommended.

## -Mathematical Reviews

E. W. Cheney's highly respected and well-known book ... covers an enormous amount of material ... [It] is written with a clarity and precision which those who are familiar with the author's many papers have come to expect. ... There is an appendix
which supplements each chapter with copious notes and serves to place the particular topic in historical perspective. ... [T]he notes are invaluable; their effect is to make a small book almost encyclopedic in character. ... In the quality of its exposition and the skill and craft manifest in its organization, the book is a classic with few competitors. Anyone involved with computer mathematics will want it nearby.
-Computing Reviews
This text will also be of interest to those working in applications.

Contents: Introduction: 1 Examples and prospectus; 2 Metric spaces; 3 Normed linear spaces; 4 Inner-product spaces; 5 Convexity; 6 Existence and unicity of best approximations; 7 Convex functions; The Tchebycheff Solution of Inconsistent Linear Equations: 1 Introduction; 2 Systems of equations with one unknown; 3 Characterization of the solution; 4 The special case; 5 Pólya's algorithm; 6 The ascent algorithm; 7 The descent algorithm; 8 Convex programming; Tchebycheff Approximation by Polynomials and Other Linear Families: 1 Introduction; 2 Interpolation; 3 The Weierstrass theorem; 4 General linear families; 5 the unicity problem; 6 Discretization errors: General theory; 7 Discretization: Algebraic polynomials. The inequalities of Markoff and Bernstein; 8 Algorithms; Leastsquares Approximation and Related Topics: 1 Introduction; 2 Orthogonal systems of polynomials; 3 Convergence of orthogonal expansions; 4 Approximation by series of Tchebycheff polynomials; 5 Discrete least-squares approximation; 6 The Jackson theorems; Rational Approximation: 1 Introduction; 2 Existence of best rational approximations; 3 The characterization of best approximations; 4 Unicity; Continuity of best-approximation operators; 5 Algorithms; 6 Padé Approximation and its generalizations; 7 Continued fractions; Some Additional Topics: 1 The Stone approximation theorem; 2 The Müntz theorem; 3 The converses of the Jackson theorems; 4 Polygonal approximation and bases in $C[a, b] ; 5$ The Kharshi-ladze-Lozinski theorems; 6 Approximation in the mean; Notes; References; Index.

## AMS Chelsea Publishing

September 1998, 259 pages, Hardcover, ISBN 0-8218-1374-9, LC 81-67708, 1991 Mathematics Subject Classification: 41-01, All AMS members \$26, List \$29, Order code CHEL/317.HN


# Operator Algebras and Operator Theory 

Liming Ge, Massachusetts Institute of Technology, Cambridge, Huaxin Lin, University of Oregon, Eugene, Zhong-Jin Ruan, University of Illinois, Urbana, Dianzhou Zhang, East China Normal University, Shanghai, and

Shuang Zhang, University of Cincinnati, OH, Editors

This volume contains the proceedings from the International Conference on Operator Algebras and Operator Theory held at the East China Normal University in Shanghai (China). Participants in the conference ranged from graduate students to postdocs to leading experts who came from around the world. Topics covered were $C^{*}$-algebras, von Neumann algebras, non-self-adjoint operator algebras, wavelets, operator spaces and
other related areas. This work consists of contributions from invited speakers and some mathematicians who were unable to attend. It presents important mathematical ideas while maintaining the uniqueness and excitement of this very successful event.
Contents: E. Berkson and T. A. Gillespie, Operator means and spectral decomposability in ergodic theory and Hilbert space operator theory; X. Chen and Q. Xu, Some remarks on Toeplitz operators on discrete groups; J. Cuntz, A general construction of bivariant $K$-theories on the category of $C^{*}$-algebras;
M. Dadarlat, Residually finite dimensional $C^{*}$-algebras; E. G. Effros and Z.-J. Ruan, $\mathcal{O} \mathcal{L}_{p}$ spaces; G. A. Elliott and X. Fang, Simple inductive limits of xsd*-algebras with building blocks from spheres of odd dimension; G. A. Elliott, G. Gong, and L. Li, Approximate divisibility of simple inductive limit C*-algebras; U. Haagerup and E. Størmer, On maximality of entropy in finite von Neumann algebras; D. Hadwin, Free entropy and approximate equivalence in von Neumann algebras; R. Ji, Bivariant Chern character and the analog Baum-Connes map; R. V. Kadison, Dual cones and TomitaTakesaki theory; Y. Kawahigashi, Subfactors and paragroup theory; A. Kumjian, Notes on $C^{*}$-algebras of graphs; D. R. Larson, Frames and wavelets from an operator theoretic point of view; $\mathbf{H}$. Lin, A classification theorem for infinite Toeplitz algebras; C. Pasnicu, AH algebras with the ideal property; Q. Lin and N. C. Phillips, Ordered K-theory for C*-algebras of minimal homeomorphisms; M. A. Rieffel, Questions on quantization; M. Rørdam, On sums of finite projections; A. J.-L. Sheu, Groupoid approach to quantum projective spaces; J. Tomiyama, Representations of topological dynamical systems and $\mathrm{C}^{*}$-algebras; S. Zhang, Purely infinite simple $C^{*}$-algebras arising from reduced group $C^{*}$-algebras.
Contemporary Mathematics, Volume 228
December 1998, 399 pages, Softcover, ISBN 0-8218-1093-6, LC 98-41143, 1991 Mathematics Subject Classification: 47A05, 47D15, 46L05, 46L10, 46L80, Individual member \$51, List \$85, Institutional member \$68, Order code CONM/228N

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## Introduction to Hilbert Space and the Theory of Spectral Multiplicity

 Second EditionPaul R. Halmos

The main purpose of this book is to present the so-called multiplicity theory and the theory of unitary equivalence, for arbitrary spectral measures, in separable or not separable Hilbert space ... The approach to this theory, as presented by the author, has much claim to novelty. By a skillful permutation of the fundamental ideas of Wecken and Nakano, and consistently referring to the simple situation in the finite-dimensional case, the author succeeds in presenting the theory in a clear and perspicuous form.
-Mathematical Reviews
Contents: The Geometry of Hilbert Space: 1. Linear functionals; 2. Bilinear functionals; 3. Quadratic forms; 4. Inner product and norm; 5. The inequalities of Bessel and Schwarz; 6. Hilbert space; 7. Infinite sums; 8 . Conditions for summability; 9. Examples of Hilbert space; 10. Subspaces; 11. Vectors in and out of subspaces; 12. Orthogonal complements; 13. Vector sums; 14. Bases; 15. A non-closed vector sum; 16. Dimension; 17. Boundedness; 18. Bounded bilinear functionals; The Algebra of Operators: 19. Operators; 20. Examples of operators; 21. Inverses; 22. Adjoints;
23. Invariance; 24. Hermitian operators; 25. Normal and unitary operators; 26. Projections; 27. Projections and subspaces; 28. Sums of projections; 29. Products and differences of projections; 30. Infima and suprema of projections; 31. The spectrum of an operator; 32. Compactness of spectra; 33. Transforms of spectra; 34. The spectrum of a Hermitian operator; 35. Spectral Heuristics; 36. Spectral measures; 37. Spectral integrals; 38. Regular spectral measures; 39. Real and complex spectral measures; 40. Complex spectral integrals; 41. Description of the spectral subspaces; 42. Characterization of the spectral subspaces; 43. The spectral theorem for Hermitian operators; 44. The spectral theorem for normal operators; The Analysis of Spectral Measures: 45. The Problem of unitary equivalence; 46. Multiplicity functions in finite-dimensional spaces; 47. Measures; 48. Boolean operations on measures; 49. Multiplicity functions; 50. The canonical example of a spectral measure; 51 . Finite-dimensional spectral measures; 52. simple finite-dimensional spectral measures; 53. The commutator of a set of projections; 54. Pairs of commutators; 55. Columns; 56. Rows; 57. Cycles; 58. Separable
projections; 59. Characterizations of rows; 60. Cycles and rows; 61. The existence of rows; 62 . Orthogonal systems; 63. The power of a maximal orthogonal system; 64. Multiplicities; 65. Measures from vectors; 66. Supspaces from measures; 67. The multiplicity function of a spectral measure; 69. Conclusion; References; Bibliography.

## AMS Chelsea Publishing

September 1998, 114 pages, Hardcover, ISBN 0-8218-1378-1, LC 57-12834, 1991 Mathematics Subject Classification: 46-01, 46CXX, All AMS members \$17, List \$19, Order code CHEL/82.HN

## Semi-Linear Diffraction of <br>  <br> Richard B. Melrose, Massachusetts Institute of Technology, Cambridge, Antonio Sá Barreto, Purdue University, West Lafayette, IN, and Maciej Zworski, University of Toronto, ON, Canada

## A publication of Société Mathématique de France.

In this volume, the authors study the conormal regularity of bounded solutions to semi-linear hyperbolic equations on domains with diffractive boundaries: $P u=f(x, u)$ in $X_{1} u\left\lceil\partial x=0, u \in \infty L_{l o}^{\infty} c(X)\right.$.
When $X_{-} \subset X$ and $X$ is the domain of influence of $X_{-}$the authors consider solutions such that singsupp $(u) \cap X_{-} \cap \partial X=\varnothing$ and further suppose that $u \upharpoonright_{X_{-}}$is conormal with respect to a smooth characteristic hypersurface, the incoming front.
For the linear equation, $f \equiv 0$, the singular support of $u$ is contained in the union of the incoming front and the reflected front obtained using the rules of geometrical optics; these two characteristic surfaces are tangent at the glancing set, the locus of points at which the incoming bicharacteristics are tangent to the boundary. The authors prove that in the semilinear case the only new singularities which may occur appear on the characteristic half-cone over the glancing set. The actual conormal regularity result presented in the paper is considerably more precise.

The authors' conclusions are best illustrated by taking for $P$ the constant coefficient wave equation with $X$ the product of $\mathbb{R}_{t}$ and the exterior of a strictly convex obstacle. Then $X_{-}=X \cap\{t>-T\}$ and for the initial data one can take locally an anti-derivative of the plane wave $\delta(t-\langle x, \omega\rangle)$ with $T$ appropriately large.
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a $30 \%$ discount from list.
Contents: Introduction and statement of results; Diffractive geometry; Resolution of singularities and the conormal spaces; Microlocally characterized spaces of distributions; Refined estimates in the past; The extension property; Estimates for the Dirichlet problem; Proof of the main theorem; Glancing hypersurfaces and $b$-geometry; $b$-Sobolev spaces; Bibliography.
Astérisque, Number 240
August 1998, 132 pages, Softcover, 1991 Mathematics Subject Classification: 35Lxx; 58G17, Individual member \$39, List \$43, Order code AST/240N

## Applications

## Differential Geometry and Control

## G. Ferreyra, Louisiana State University, Baton

| Proceedings of Symposia in |
| :--- |
| PURE MATHEMATICS |
| Volume 64 |
| Differential Geometry |
| and Control |
| G. Ferreyra |
| R. Gardner |
| H. Hermes |
| H. Sussmann |
| Editors |
| Ial Amerran Mathematcal society |

Rouge,
R. Gardner, University of North Carolina, Chapel Hill, H. Hermes, University of Colorado, Boulder, and H. Sussmann, Rutgers University, New Brunswick, NJ, Editors
This volume presents selections from talks given at the AMS Summer Research Institute on Differential Geometry and Control held at the University of Colorado (Boulder). Included articles were refereed according to the highest standards. This collection provides a coherent global perspective on recent developments and important open problems in geometric control theory. Readers will find in this book an excellent source of current challenging research problems and results.
This text will also be of interest to those working in geometry and topology.
Contents: G. R. Wilkens, Remembering the mathematics of Robert Brown Gardner; A. Agrachev, G. Stefani, and P. Zezza, A Hamiltonian approach to strong minima in optimal control; H. Airault, The Heisenberg group $H_{3}$ in terms of the orthonormal frame bundle $O\left(R^{2}\right)$ and the control of variation of the Heisenberg diffusion; V. Ayala and J. Tirao, Linear control systems on Lie groups and controllability; Z. Bartosiewicz, Real analytic geometry and local observability; E. Paw łuszewicz and Z. Bartosiewicz, External dynamic feedback equivalence of observable discrete-time control systems; R. M. Bianchini, Good needle-like variations; A. M. Bloch and P. E. Crouch, Representations of Dirac structures on vector spaces and nonlinear L-C circuits; B. Bonnard, M. Chyba, and I. Kupka, Non integrable geodesics in SR-Martinet geometry; V. F. Borisov, Singular
extremals of order 3 and chattering; J.-M. Coron, Some open problems in control theory; A. V. Dmitruk, Quadratic order conditions of a local minimum for singular extremals in a general optimal control problem; T. E. Duncan, Some solvable infinite time horizon stochastic control problems in hyperbolic three space; J. D. Lawson, Geometric control and Lie semigroup theory; U. Ledzewicz and H. Schättler, Analysis of abnormal extremals in optimal control; A. Marigo and A. Bicchi, Rolling bodies with regular surface: The holonomic case; V. Ramakrishna, On degenerate Monge-Ampere equations; F. Rampazzo, Lie brackets and impulsive controls: An unavoidable connection; Y. L. Sachkov, Survey on controllability of invariant systems on solvable Lie groups; G. R. Wilkens, Centro-affine geometry in the plane and feedback invariants of two-state scalar control systems; J. Yang, On hypersurfaces satisfying a basic equality. Proceedings of Symposia in Pure Mathematics, Volume 64 December 1998, 341 pages, Hardcover, ISBN 0-8218-0887-7, LC 98-38711, 1991 Mathematics Subject Classification: 49-XX, 53-XX, 93-XX; 22-XX, 60-XX, 35-XX, Individual member \$47, List $\$ 79$, Institutional member \$63, Order code PSPUM/64N

## Differential Equations

## Partial Differential Equations

## P. R. Garabedian

This book is a gem. It fills the gap between the standard introductory material on PDEs that an undergraduate is likely to encounter after a good ODE course (separation of variables, the basics of the second-order equations from mathematical physics) and the advanced methods (such as Sobolev spaces and fixed point theorems) that one finds in modern books. Although this is not designed as a textbook for applied mathematics, the approach is strongly informed by applications. For instance, there are many existence and uniqueness results, but they are usually approached via very concrete techniques.
The text contains the standard topics that one expects in an intermediate PDE course: the Dirichlet and Neumann problems, Cauchy's problem, characteristics, the fundamental solution, PDEs in the complex domain, plus a chapter on finite differences, on nonlinear fluid mechanics, and another on integral equations. It is an excellent text for advanced undergraduates or beginning graduate students in mathematics or neighboring fields, such as engineering and physics, where PDEs play a central role.

Contents: The method of power series; Equations of the first order; Classification of partial differential equations; Cauchy's problem for equations with two independent variables; Eigenvalue problems; Tricomi's problem; formulation of well posed problems; Finite differences; Fluid dynamics; Free boundary problems; Partial differential equations in the complex domain; The fundamental solution; Cauchy's problem in space of higher dimension; The Dirichlet and Neumann problems; Dirichlet's principle; Existence theorems of potential theory; Integral equations; Bibliography; Index.

## AMS Chelsea Publishing

September 1998, 672 pages, Hardcover, ISBN 0-8218-1377-3, LC 85-73601, 1991 Mathematics Subject Classification: 35-01, All AMS members \$41, List \$45, Order code CHEL/325.HN


Differential
Equations: La Pietra 1996
M. Giaquinta, University of Pisa, Italy, and J. Shatah and S. R. S. Varadhan, New York University, Courant Institute, $N Y$, Editors

This volume contains the proceedings of a conference held in celebration of the seventieth birthdays of Peter Lax and Louis Nirenberg at Villa La Pietra in Florence (Italy). Speakers from around the world gave talks on subjects related to the mathematical areas in which Lax and Nirenberg worked: analysis, partial differential equations, applied mathematics and scientific computing. The two men played seminal roles in these areas and had significant influence on the development of many other mathematicians. This volume gives testament to the major role played by Lax and Nirenberg in the development of mathematical analysis.
This text will also be of interest to those working in analysis and geometry and topology.
Contents: H. Brezis, Symmetry in nonlinear PDE's; L. Caffarelli and J. L. Vazquez, Viscosity solutions for the porous medium equation; D. Christodoulou, Symplectic geometry and partial differential equations; A. Grigor'yan and S.-T. Yau, Decomposition of a metric space by capacitors; H. Hofer and M. Kriener, Holomorphic curves in contact dynamics; H. R. Jauslin,
H. O. Kreiss, and J. Moser, On the forced Burgers equation with periodic boundary conditions; H. P. McKean, A novel aspect of action-angle variables; R. Melrose, Scattering theory for strictly pseudoconvex domains; P. Sarnak, A sample of Lax's contributions to classical analysis, linear partial differential equations and scattering theory; R. Schoen and J. Wolfson, Minimizing volume among Lagrangian submanifolds; F. Treves, Symplectic geometry and analytic hypo-ellipticity. Proceedings of Symposia in Pure Mathematics, Volume 65 December 1998, 219 pages, Hardcover, ISBN 0-8218-0610-6, LC 98-37249, 1991 Mathematics Subject Classification: 35-XX, 58-XX, 49Qxx, 28A12, 58Fxx, Individual member \$23, List $\$ 39$, Institutional member \$31, Order code PSPUM/65N


Shape, Smoothness and Invariant Stratification of an Attracting Set for Delayed Monotone Positive Feedback
Tibor Krisztin, University of Szeged, Bolyai Institute, Hungary, Hans-Otto Walther, Universität Giessen, Germany, and Jianhong Wu, York University, North York, ON, Canada

This book contains recent results about the global dynamics defined by a class of delay differential equations which model basic feedback mechanisms and arise in a variety of applications such as neural networks. The authors describe in detail
the geometric structure of a fundamental invariant set, which in special cases is the global attractor, and the asymptotic behavior of solution curves on it.

The approach makes use of advanced tools which in recent years have been developed for the investigation of infinitedimensional dynamical systems: local invariant manifolds and inclination lemmas for noninvertible maps, Floquet theory for delay differential equations, a priori estimates controlling the growth and decay of solutions with prescribed oscillation frequency, a discrete Lyapunov functional counting zeros, methods to represent invariant sets as graphs, and PoincaréBendixson techniques for classes of delay differential systems.
Several appendices provide the general results needed in the case study, so the presentation is self-contained. Some of the general results are not available elsewhere, specifically on smooth infinite-dimensional center-stable manifolds for maps. Results in the appendices will be useful for future studies of more complicated attractors of delay and partial differential equations.
Contents: Introduction; The delay differential equation and the hypotheses; The separatrix; The leading unstable set of the origin; Oscillation frequencies; Graph representations; Dynamics on $\bar{W}$ and disk representation of $\bar{W} \cap S$; Minimal linear instability of the periodic orbit $\mathcal{O}$; Smoothness of $W \cap S$ in case $\mathcal{O}$ is hyperbolic; Smoothenss of $W \cap S$ in case $\mathcal{O}$ is not hyperbolic; The unstable set of $\mathcal{O}$ contains the nonstationary points of $\operatorname{bd} W$; $\operatorname{bd} W$ contains the unstable set of the periodic orbit $\mathcal{O} ; H \cap \bar{W}$ is smooth near $p_{0}$; Smoothness of $\bar{W}, \operatorname{bd} W$ and $\bar{W} \cap S$; Homeomorphisms from bd $W$ onto the sphere and the cylinder; Homeomorphisms from $\bar{W}$ onto the closed ball and the solid cylinder; Resumé; Equivalent norms, invariant manifolds, Poincaré maps and asymptotic phases; Smooth center-stable manifolds for $C^{1}$-maps; Smooth generalized center-unstable manifolds for $C^{1}$-maps; Invariant cones close to neutrally stable fixed points with 1-dimensional center spaces; Unstable sets of periodic orbits; A discrete Lyapunov functional and a-priori estimates; Floquet multipliers for a class of linear periodic delay differential equations; Some results from topology; Bibliography; Index.
Fields Institute Monographs, Volume 11
December 1998, 245 pages, Hardcover, ISBN 0-8218-1074-X, LC 98-44070, 1991 Mathematics Subject Classification: 34K15; 58F12, 58F22, 34C30, Individual member \$41, List \$69, Institutional member $\$ 55$, Order code FIM/11N

## General and Interdisciplinary

## Matériaux pour l'Histoire des Mathématiques au XX Siècle

## A publication of the Société Mathématique de France

This volume presents many of the talks given at the Jean Dieudonné memorial conference held in Nice (France). These papers make a valuable contribution to the history of mathematics in the 20th century. Text is in French.
Contributors include: P. Deligne, B. Eckmann, L. Gårding, T. Hawkins, C. Houzel, J.-P. Kahane, Yu. I. Manin, G. Pisier, R. Remmert, N. Schappacher.

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Contents: P. Deligne, Quelques idées maîtresses de l'œuvre de A. Grothendieck; B. Eckmann, Naissance des fibrés et homotopie; L. Gårding, Hyperbolic equations in the twentieth century; T. Hawkins, From general relativity to group representations; C. Houzel, Histoire de la théorie des faisceaux; Photo de famille; J.-P. Kahane, Le mouvement brownien; Yu. I. Manin, Interrelations between mathematics and physics; G. Pisier, Problèmes de similarité pour les opérateurs sur l'espace de Hilbert; R. Remmert, From Riemann surfaces to complex spaces; N. Schappacher, On the history of Hilbert's twelfth problem; Index des noms propres.
Séminaires et Congrès, Number 3
April 1998, 282 pages, Softcover, ISBN 2-85629-065-5, 1991 Mathematics Subject Classification: 01A65, 14-03, 35-03, 55-03, 46-03, 17B10, 22E46, 60J65, Individual member \$50, List \$55, Order code SECO/3N


Mathematical Sciences Professional Directory, 1999
This annual directory provides a handy reference to various organizations in the mathematical sciences community. Listed in the directory are the following: officers and committee members of over thirty professional mathematical organizations (terms of office and other pertinent information are also provided in some cases); key mathematical sciences personnel of selected government agencies; academic departments in the mathematical sciences; mathematical units in nonacademic organizations; and alphabetic listings of colleges and universities. Current addresses, telephone numbers, and
electronic addresses for individuals are listed in the directory when provided.
March 1999, approximately 225 pages, Softcover, ISBN 0-8218-1090-1, 1991 Mathematics Subject Classification: 00, List \$50, Institutional member \$40, Order code PRODIR/99N


> Séminaire Bourbaki, Volume 1995/96, Exposés 805-819

## A publication of Société Mathéma-

 tique de France.This volume contains 15 survey lectures on topics of current interest: spaces of operators; classification of $C^{*}$-algebras; spectral geometry; group actions on trees; cohomology of spaces of automorphic foms; orbital integrals on certain symmetric spaces; the application of logic to algebraic geometry; resolution of singularities in algebraic geometry; quantum cohomology; subriemannian geometry; mathematical aspect of image analysis; and characteristic classes. Some articles are in French and some in English.
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Contents: Novembre 1995: C. Anantharaman-Delaroche, Classification des $C^{*}$-algèbres purement infinies nucléaires [d’après E. Kirchberg]; M. Audin, Cohomologie quantique; D. Bennequin, Monopôles de Seiberg-Witten et conjecture de Thom [d'après Kronheimer, Mrowka et Witten]; F. Paulin, Actions de groupes sur les arbres; J.-L. Waldspurger, Cohomologie des espaces de formes automorphes [d'après J. Franke]; Février 1996: P. Delorme, Inversion des intégrales orbitales sur certains espaces symétriques réductifs [d'après A. Bouaziz et P. Harinck]; J. B. Goode, H. L. M. (Hrushovski-LangMordell); D. Kotschick, The Seiberg-Witten invariants of symplectic four-manifolds [after C. H. Taubes]; J. M. Morel, La conjecture de Mumford-Shah en segmentation d'images; G. Pisier, Espaces d'opérateurs: une nouvelle dualité; Juin 1996: P. Berthelot, Altérations de variétés algébriques [d’après A. J. de Jong]; A. Connes, Brisure de symétrie spontanée et géométrie du point de vue spectral; I. Kupka, Géométrie sousriemannienne; C. Sabbah, Classes caractéristiques et théorèmes d'indice: point de vue microlocal; C. Soulé, Classes caractéristiques secondaires des fibrés plats.
November 1997, 424 pages, 1991 Mathematics Subject Classification: 46L35, 46L80, 53C15, 53C23, 53C80, 58D99, 32G13, 32G15, 81T30, 81T40, 14J30, 14J45, 14C20, 35Q60, 57M25, 57M50, 57R15, 58G40, 81T13, 81T60, 20E08, 20F32, 22E40, 11F75, 11G18, 22E46, 14G05, 03C45, 57R57, 58D27, 49Q05, 68U10, 35K65, 35K55, 65C20, 49L25, 46L05, 46M05, 46M10, 46B05, 14E15, 14B07, 14N05, 14H10, 14C17, 14F30, 14F20, 46L89, 53C07, 53C20, 53C22, 58A30, 58E10, 49K15, 35 H 05 , 35K10, 58G05, 58G10, 32C38, 32C35, 14C40, 32S60, 14C25, 57R20, Individual member \$99, List \$110, Order code AST/241N


Séminaire Bourbaki, Volume 1996/97, Exposés 820-834

## SÉMINAIRE BOURBAKI <br> VOLUME 1996/97 <br> EXPOSÉS 820-834 <br> A publication of the Société Mathématique de France

This volume contains fifteen survey lectures on topics of current interest. A highlight of the volume is the article by 1998 Fields Medalist M. Kontsevich on the work of R. Borcherds (also a 1998 Fields Medal recipient) on product formulas for modular forms. Other topics discussed in the book are celestial mechanics, holomorphic dynamical systems, boundary value problems, combinatorics, $p$-adic differential equations, algebraic geometry, hypergeometric functions, Riemannian geometry, motivic cohomology and arithmetical algebraic geometry.
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Contents: Novembre 1996: X. Buff, Ensembles de Julia de mesure positive; M. Kontsevich, Product formulas for modular forms on $O(2, n)$; F. Loeser, Exposants $P$-adiques et théorèmes d'indice pour les équations différentielles $P$-adiques; P. Pansu, Volume, courbure et entropie; M. Waldschmidt, Sur la nature arithmétique des valeurs de fonctions modulaires; Mars 1997: A. Abbes, Hauteurs et discrétude; N. Burq, Mesures semi-classiques et mesures de défaut; O. Debarre, Variétés de Fano; G. J. Heckman, Dunkl operators; A. Valette, Graphes de Ramanujan et applications; Juin 1997: J.-P. Bourguignon, Métriques d'Einstein-Kähler sur les variétés de Fano: obstructions et existence; J.-F. Boutot, Uniformisation $p$-adique des variétés de Shimura; A. Chenciner, A l'infini en temps fini; E. M. Friedlander, Motivic complexes of Suslin and Voevodsky; B. Kahn, La conjecture de Milnor.

Astérisque, Number 245
469 pages, Softcover, 1991 Mathematics Subject Classification: 58F23, 11F22, 11F12, 17B67, 12H25, 28D20, 58F17, 57M50, 53C35, 57E11, 11J91, 11F11, 14H52, 33B15, 33E05, 14Kxx, 11Gxx, 35L20, 35B27, 78A05, 14J45, 14C05, 14G05, 14D22, 14E20, 53C30, 53C07, 20G05, 22E46, 33C70, 05C35, 11F30, 22D10, 46L35, 53C25, 53C55, 58G30, 11G18, 14G35, 14L05, 70D05, 70F15, 70F10, 70H33, 19E15, 19F99, 14-02,ndividual member $\$ 81$, List $\$ 90$, Order code AST/245N


Recommended Text
How to Teach Mathematics, Second Edition
Steven G. Krantz, Washington University, St. Louis, MO

Praise for the First Edition ...
An original contribution to the educational literature on teaching mathematics at the post-secondary level. The book itself is an explicit proof of the author's claim "teaching can be rewarding, useful, and fun".
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This expanded edition of the original bestseller, How to Teach Mathematics, offers hands-on guidance for teaching mathematics in the modern classroom setting. Twelve appendices have been added that are written by experts who have a wide range of opinions and viewpoints on the major teaching issues.
Eschewing generalities, the award-winning author and teacher, Steven Krantz, addresses issues such as preparation, presentation, discipline, and grading. He also emphasizes
specifics-from how to deal with students who beg for extra points on an exam to mastering blackboard technique to how to use applications effectively. No other contemporary book addresses the principles of good teaching in such a comprehensive and cogent manner.
The broad appeal of this text makes it accessible to areas other than mathematics. The principles presented can apply to a variety of disciplines-from music to English to business. Lively and humorous, yet serious and sensible, this volume offers readers incisive information and practical applications.
Contents: Guiding principles; Practical matters; Spiritual matters; Difficult matters; A new beginning; Appendices: G. E. Andrews, The irrelevance of calculus reform: Ruminations of a sage-on-the-stage; R. Askey, Mathematical content; D. M. Bressoud, Personal thoughts on mature teaching; W. J. Davis, Remember the students; E. Dubinsky, Reflections on Krantz'sHow to Teach Mathematics A different view; D. Hughes Hallett, Are we encouraging our students to think mathematically?; D. Klein, Big business, race, and gender in mathematics reform; W. McCallum, Will this be on the exam?; K. C. Millett, Teaching or appearing to teach: What's the difference?; J. J. Uhl, Why (and how) I teach without long lectures; $\mathbf{H}$. Wu, The joy of lecturing-with a critique of the romantic tradition in education writing; S. Zucker, Teaching freshmen to learn mathematics; Bibliography; Index.

January 1999, approximately 363 pages, Softcover, ISBN 0-8218-1398-6, 1991 Mathematics Subject Classification: 00A25, 00A05, 00A20, All AMS members \$19, List \$24, Order code HTM/2N


# The Selected Works of V.S. Varadarajan 

V. S. Varadarajan, University of California, Los Angeles

V.S. Varadarajan has made significant contributions to a remarkably broad range of mathematical subjects which include probability theory, various mathematical aspects of quantum mechanics, harmonic analysis on reductive groups and symmetric spaces, and the modern theory of meromorphic differential equations. The papers included in this volume have been selected to highlight these contributions.
This text will also be of interest to those working in algebra and algebraic geometry and differential equations.
This book is jointly published by the AMS and the International Press.
Contents: Comments; Measures on topological spaces; Probability in physics on a theorem on simultaneous observability; Discrimination of Gaussian processes; Groups of automorphsism of Borel spaces; Representations of complex semisimple Lie groups and Lie algebras; On the ring of invariant polynomials on a semisimple Lie algebra; Spherical transforms on semisimple Lie groups; Asymptotic behaviour of eigen functions on a semisimple Lie group: The discrete spectrum; On an infinitesimal characterization of the discrete series; Spectra compact locally symmetric manifolds of negative curvature; Oscillatory integrals and their applications to harmonic analysis on semisimple Lie groups; Some remarks on meromorphic differential equations with simple singularities; Local moduli for meromorphic differential equations; The Eigenvalue problem on negatively curved compact locally symmetric manifolds; Hilbert space representations of the Poincaré group for the Landau gauge; The concept of a quantum semisimple group; Lorentz invariant distributions supported on the forward light cone; Universal deformations of reductive Lie algebras; Finite approximations to quantum systems; Variations on a theme of Schwinger and Weyl; Linear meromorphic differential equations: A modern point of view; Path integrals for a class of $p$-adic Schrödinger equaitons.
Collected Works, Volume 11
November 1998, 630 pages, Hardcover, ISBN 0-8218-1068-5, LC 98-36452, 1991 Mathematics Subject Classification: 01A75; 22E46, 35P20, 41A60, 34A20, 32G34, 81P10, 81Q99, 81T99, 60B05, 60G15, 28D15, 17B37, Individual member \$75, List \$125, Institutional member \$100, Order code CWORKS/11N

## Geometry and Topology



# Holomorphic Families of Immersions and Higher Analytic Torsion Forms 

Jean-Michel Bismut, Université de Paris Sud, Orsay, France<br>A publication of Société Mathématique de France.

This volume calculates the behavior of the higher analytic torsion forms of a Kähler fibration under composition of an immersion and a submersion. This extends a previous result by Lebeau and Bismut to the relative case. The result is compatible with the Riemann-Roch formula in Arakelov geometry conjectured by Gillet and Soulé.

This text will also be of interest to those working in differential equations and analysis.
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Contents: Introduction; Families of immersions and connections on the relative tangent bundle; Kähler fibrations, higher analytic torsion forms and anomaly formulas; Kähler fibrations, resolutions, and Bott-Chern currents; An identity on two parameters differential forms; The analytic torsion forms of a short exact sequence; A proof of Theorem 0.1; A new horizontal bundle on $V$ and the conjugate superconnection $\tilde{A}_{u, T}$; A Taylor expansion of the superconnection $\tilde{A}_{1, T}$ near $W$; The asymptotics of supertraces involving the operator $\exp \left(-B_{u, T}^{2}\right)$ for large values of $u, T$; The asymptotics of the metric $g_{T}^{H\left(Y,\left.\eta\right|_{Y}\right)}$ as $T \rightarrow+\infty$; The analysis of the two parameter semi-group $\exp \left(-A_{u, T}^{2}\right)$ in the range $\left.\left.u \in\right] 0,1\right], T \in\left[0, \frac{1}{u}\right]$; The analysis of the kernel of $\tilde{F}_{u}\left(A_{u, T / u}^{2}\right)$ for $T>0$ as $u \rightarrow 0$; The analysis of the two parameter operator $\exp \left(-A_{u, T}^{2}\right)$ in the range $u \in] 0,1], T \geq 1 / u$; A proof of Theorem 0.2 ; A new derivation of the asymptotics of the generalized supertraces associated to a short exact sequence; Bibliography.
Astérisque, Number 244
July 1998, 275 pages, Softcover, 1991 Mathematics Subject Classification: 33L10, 57R20, 58G10, Individual member \$50, List \$55, Order code AST/244N

