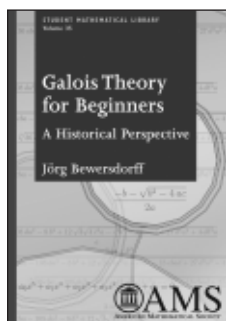


New Publications Offered by the AMS

Algebra and Algebraic Geometry



Galois Theory for Beginners A Historical Perspective Jörg Bewersdorff

Translated by David Kramer.

Galois theory is the culmination of a centuries-long search for a solution to the classical problem of solving algebraic equations by radicals. In this book, Bewersdorff follows the

historical development of the theory, emphasizing concrete examples along the way. As a result, many mathematical abstractions are now seen as the natural consequence of particular investigations.

Few prerequisites are needed beyond general college mathematics, since the necessary ideas and properties of groups and fields are provided as needed. Results in Galois theory are formulated first in a concrete, elementary way, then in the modern form. Each chapter begins with a simple question that gives the reader an idea of the nature and difficulty of what lies ahead. The applications of the theory to geometric constructions, including the ancient problems of squaring the circle, duplicating the cube, and trisecting an angle, and the construction of regular n -gons are also presented.

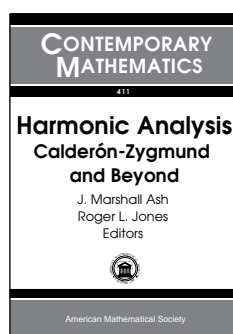
This book is suitable for undergraduates and beginning graduate students.

Contents: Cubic equations; Casus irreducibilis: The birth of the complex numbers; Biquadratic equations; Equations of degree n and their properties; The search for additional solution formulas; Equations that can be reduced in degree; The construction of regular polygons; The solution of equations of the fifth degree; The Galois group of an equation; Algebraic structures and Galois theory; Epilogue; Index.

Student Mathematical Library, Volume 35

October 2006, 180 pages, Softcover, ISBN-10: 0-8218-3817-2, ISBN-13: 978-0-8218-3817-4, LC 2006048423, 2000
Mathematics Subject Classification: 12-01; 12F10,
All AMS members US\$28, List US\$35, Order code STML/35

Analysis



Harmonic Analysis Calderón-Zygmund and Beyond

J. Marshall Ash and Roger L. Jones, *DePaul University, Chicago, IL*, Editors

Starting in the early 1950's, Alberto Calderón, Antoni Zygmund, and their students developed a program in harmonic analysis with far-reaching

consequences. The title of these proceedings reflects this broad reach. This book came out of a DePaul University conference honoring Stephen Vági upon his retirement in 2002. Vági was a student of Calderón in the 1960's, when Calderón and Zygmund were at their peak.

Two authors, Kenig and Gatto, were students of Calderón; one, Muckenhoupt, was a student of Zygmund. Two others studied under Zygmund's student Elias Stein. The remaining authors all have close connections with the Calderón-Zygmund school of analysis.

This book should interest specialists in harmonic analysis and those curious to see it applied to partial differential equations and ergodic theory.

In the first article, Adam Korányi summarizes Vági's work. Four additional articles cover various recent developments in harmonic analysis: Eduardo Gatto studies spaces with doubling and non-doubling measures; Cora Sadosky, product spaces; Benjamin Muckenhoupt, Laguerre expansions; and Roger Jones, singular integrals. Charles Fefferman and Carlos Kenig present applications to partial differential equations and Stephen Wainger gives an application to ergodic theory. The final article records some interesting open questions from a problem session that concluded the conference.

Contents: A. Korányi, The work of Stephen Vági; A. E. Gatto, On fractional calculus associated to doubling and non-doubling measures; C. Fefferman, Fluids and singular integrals; C. Kenig, The well-posedness of non-linear dispersive equations: Some recent developments; C. Sadosky, The BMO extended family in product spaces; B. Muckenhoupt, Mean convergence of Cesàro means of Laguerre expansions; R. L. Jones, Variation inequalities for singular integrals and related operators; S. Wainger, A maximal function on the

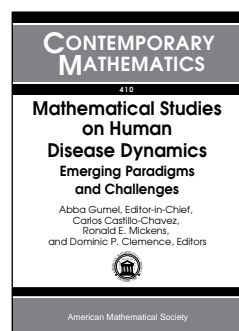
discrete Heisenberg group with applications to ergodic theory; **B. Muckenhoupt, R. L. Jones, P. Janakiraman, D. Ryabogin, and J. Xiao**, Problems.

Contemporary Mathematics, Volume 411

October 2006, 147 pages, Softcover, ISBN-10: 0-8218-3920-9, ISBN-13: 978-0-8218-3920-1, LC 2006042842, 2000

Mathematics Subject Classification: 26A33, 32M15, 35Q53, 35Q55, 42B20, 42B25, 42B30, 42B35, 42C10, 76B03, **All AMS members US\$39**, List US\$49, Order code CONM/411

Applications



Mathematical Studies on Human Disease Dynamics

Emerging Paradigms and Challenges

Abba Gumel, Editor-in-Chief, University of Manitoba, Winnipeg, MB, Canada, Carlos Castillo-Chavez, Arizona State University, Tempe, AZ, Ronald

E. Mickens, Clark Atlanta University, GA, and Dominic P. Clemence, North Carolina A&T State University, Greensboro, NC, Editors

This volume contains the proceedings of the AMS-SIAM-IMS Joint Summer Research Conference on Modeling the Dynamics of Human Diseases: Emerging Paradigms and Challenges, held in Snowbird, Utah, July 17–21, 2005.

The goal of the conference was to bring together leading and upcoming researchers to discuss the latest advances and challenges associated with the modeling of the dynamics of emerging and re-emerging diseases, and to explore various control strategies. The articles included in this book are devoted to some of the significant recent advances, trends, and challenges associated with the mathematical modeling and analysis of the dynamics and control of some diseases of public health importance. In addition to illustrating many of the diverse prevailing epidemiological challenges, together with the diversity of mathematical approaches needed to address them, this book provides insights on a number of topical modeling issues such as the modeling and control of mosquito-borne diseases, respiratory diseases, animal diseases (such as foot-and-mouth disease), cancer and tumor growth modeling, influenza, HIV, HPV, rotavirus, etc. This book also touches upon other important topics such as the use of modeling in homeland security and some review and new results on various modeling paradigms including network, stochastic and deterministic formulations together with the

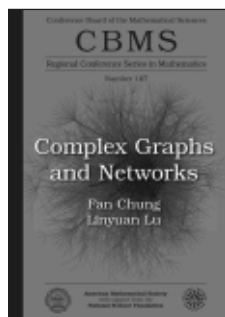
use of optimal control and related methods for evaluating control strategies.

Contents: **L. J. S. Allen, E. J. Allen, and C. B. Jonsson**, The impact of environmental variation on hantavirus infection in rodents; **J. P. Aparicio and J. C. Hernández**, Preventive treatment of tuberculosis through contact tracing; **C. Bowman and A. Gumel**, Optimal vaccination strategies for an influenza-like illness in a heterogeneous population; **G. Chowell, A. Cintrón-Arias, S. Del Valle, F. Sánchez, B. Song, J. M. Hyman, H. W. Hethcote, and C. Castillo-Chavez**, Mathematical applications associated with the deliberate release of infectious agents; **G. Chowell, A. L. Rivas, N. W. Hengartner, J. M. Hyman, and C. Castillo-Chavez**, Critical response to post-outbreak vaccination against foot-and-mouth disease; **L. G. de Pillis and A. E. Radunskaya**, Some promising approaches to tumor-immune modeling; **E. H. Elbasha**, Impact of prophylactic vaccination against human papillomavirus infection; **T. J. Emerson**, Population dynamics of developmental deficits due to an environmental neurotoxicant; **W. Gu and H. Moore**, Optimal therapy regimens for treatment-resistant mutations of HIV; **T. L. Jackson, R. Ashkenazi, S. Heusel, and H. V. Jain**, Cancer modeling: A perspective on what's new and what's next; **Y. Jiang**, Understanding a killer: A predictive model for tumor development; **H. R. Joshi, S. Lenhart, M. Y. Li, and L. Wang**, Optimal control methods applied to disease models; **A. L. Lloyd, S. Valeika, and A. Cintrón-Arias**, Infection dynamics on small-world networks; **J. O. Lloyd-Smith, S. J. Schreiber, and W. M. Getz**, Moving beyond averages: Individual-level variation in disease transmission; **E. M. Lungu, M. Kgosimore, and F. Nyabadza**, Models for the spread of HIV/AIDS: Trends in Southern Africa; **R. E. Mickens**, Application of NSFD methods to the numerical integration of bio-sciences differential equation models; **K. R. Ríos-Soto, C. Castillo-Chavez, M. G. Neubert, E. S. Titi, and A. A. Yakubu**, Epidemic spread in populations at demographic equilibrium; **F. Sánchez, M. Engman, L. Harrington, and C. Castillo-Chavez**, Models for Dengue transmission and control; **E. Shim, H. T. Banks, and C. Castillo-Chavez**, Seasonality of rotavirus infection with its vaccination; **C. J. Struchiner, P. M. Luz, C. T. Codeço, F. C. Coelho, and E. Massad**, Current research issues in mosquito-borne diseases modeling; **S. Tennenbaum, T. G. Kassem, S. Roudenko, and C. Castillo-Chavez**, The role of transactional sex in spreading HIV in Nigeria.

Contemporary Mathematics, Volume 410

October 2006, approximately 386 pages, Softcover, ISBN-10: 0-8218-3775-3, ISBN-13: 978-0-8218-3775-7, 2000 *Mathematics Subject Classification*: 92-01, 92B05, 92D25, 92D40, 93A30, 92D30, **All AMS members US\$79**, List US\$99, Order code CONM/410

Discrete Mathematics and Combinatorics



Complex Graphs and Networks

Fan Chung, *University of California at San Diego, La Jolla, CA*, and Linyuan Lu, *University of South Carolina, Columbia, SC*

Through examples of large complex graphs in realistic networks, research in graph theory has been forging

ahead into exciting new directions. Graph theory has emerged as a primary tool for detecting numerous hidden structures in various information networks, including Internet graphs, social networks, biological networks, or, more generally, any graph representing relations in massive data sets.

How will we explain from first principles the universal and ubiquitous coherence in the structure of these realistic but complex networks? In order to analyze these large sparse graphs, we use combinatorial, probabilistic, and spectral methods, as well as new and improved tools to analyze these networks. The examples of these networks have led us to focus on new, general, and powerful ways to look at graph theory. The book, based on lectures given at the CBMS Workshop on the Combinatorics of Large Sparse Graphs, presents new perspectives in graph theory and helps to contribute to a sound scientific foundation for our understanding of discrete networks that permeate this information age.

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

Contents: Graph theory in the information age; Old and new concentration inequalities; A generative model—the preferential attachment scheme; Duplication models for biological networks; Random graphs with given expected degrees; The rise of the giant component; Average distance and the diameter; Eigenvalues of the adjacency matrix of $G(\mathbf{w})$; The semi-circle law for $G(\mathbf{w})$; Coupling on-line and off-line analyses of random graphs; The configuration model for power law graphs; The small world phenomenon in hybrid graphs; Bibliography; Index.

CBMS Regional Conference Series in Mathematics, Number 107

October 2006, 264 pages, Softcover, ISBN-10: 0-8218-3657-9, ISBN-13: 978-0-8218-3657-6, LC 2006042898, 2000 *Mathematics Subject Classification*: 05Cxx, 68R10, 68W20, 90B10, 90C06, 90C35, 94C15, **All AMS members US\$44**, List US\$55, Order code CBMS/107

Geometry and Topology



Isometric Embedding of Riemannian Manifolds in Euclidean Spaces

Qing Han, *University of Notre Dame, IN*, and Jia-Xing Hong, *Fudan University, Shanghai, China*

The question of the existence of isometric embeddings of Riemannian manifolds in Euclidean space is already more than a century old. This book presents, in a systematic way, results both local and global and in arbitrary dimension but with a focus on the isometric embedding of surfaces in \mathbb{R}^3 . The emphasis is on those PDE techniques which are essential to the most important results of the last century. The classic results in this book include the Janet-Cartan Theorem, Nirenberg's solution of the Weyl problem, and Nash's Embedding Theorem, with a simplified proof by Günther. The book also includes the main results from the past twenty years, both local and global, on the isometric embedding of surfaces in Euclidean 3-space.

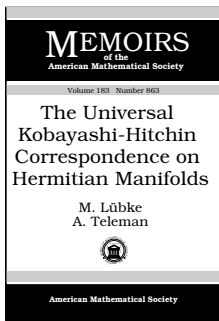
The work will be indispensable to researchers in the area. Moreover, the authors integrate the results and techniques into a unified whole, providing a good entry point into the area for advanced graduate students or anyone interested in this subject. The authors avoid what is technically complicated. Background knowledge is kept to an essential minimum: a one-semester course in differential geometry and a one-year course in partial differential equations.

Contents: *Isometric embedding of Riemannian manifolds:* Fundamental theorems; Surfaces in low dimensional Euclidean spaces; *Local isometric embedding of surfaces in \mathbb{R}^3 :* Basic equations; Nonzero Gauss curvature; Gauss curvature changing sign cleanly; Nonnegative Gauss curvature; Nonpositive Gauss curvature; *Global isometric embedding of surfaces in \mathbb{R}^3 :* Deformation of surfaces; The Weyl problem; Complete negatively curved surfaces; Boundary value problems; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 130

October 2006, 260 pages, Hardcover, ISBN-10: 0-8218-4071-1, ISBN-13: 978-0-8218-4071-9, LC 2006045898, 2000

Mathematics Subject Classification: 35J60, 53C21, 53C45, 58J05; 35J70, 35L45, 35L80, 35M10, 53C24, **All AMS members US\$60**, List US\$75, Order code SURV/130



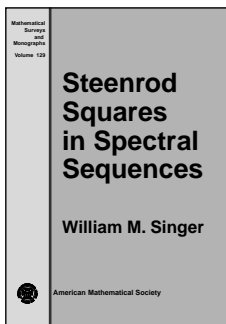
The Universal Kobayashi-Hitchin Correspondence on Hermitian Manifolds

M. Lübke, *Leiden University, The Netherlands*, and A. Teleman, *CMI, Marseille, France*

Contents: Introduction; The finite dimensional Kobayashi-Hitchin correspondence; A “universal” complex geometric classification problem; Hermitian-Einstein pairs; Polystable pairs allow Hermitian-Einstein reductions; Examples and applications; Appendix; Bibliography.

Memoirs of the American Mathematical Society, Volume 183, Number 863

July 2006, 97 pages, Softcover, ISBN-10: 0-8218-3913-6, ISBN-13: 978-0-8218-3913-3, LC 2006045238, 2000 *Mathematics Subject Classification*: 53C07, 32G13, 58D27, 53C55, 53D20, 32L05, 32M05, **Individual member US\$35**, List US\$58, Institutional member US\$46, Order code MEMO/183/863



Steenrod Squares in Spectral Sequences

William M. Singer, *Fordham University, Bronx, NY*

This book develops a general theory of Steenrod operations in spectral sequences. It gives special attention to the change-of-rings spectral sequence for the cohomology of an extension of Hopf algebras and to the

Eilenberg-Moore spectral sequence for

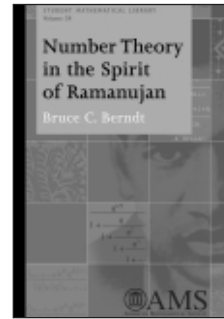
the cohomology of classifying spaces and homotopy orbit spaces. In treating the change-of-rings spectral sequence, the book develops from scratch the necessary properties of extensions of Hopf algebras and constructs the spectral sequence in a form particularly suited to the introduction of Steenrod squares. The resulting theory can be used effectively for the computation of the cohomology rings of groups and Hopf algebras, and of the Steenrod algebra in particular, and so should play a useful role in stable homotopy theory. Similarly the book offers a self-contained construction of the Eilenberg-Moore spectral sequence, in a form suitable for the introduction of Steenrod operations. The corresponding theory is an effective tool for the computation of the cohomology rings of the classifying spaces of the exceptional Lie groups, and it promises to be equally useful for the computation of the cohomology rings of homotopy orbit spaces and of the classifying spaces of loop groups.

Contents: Conventions; The spectral sequence of a bisimplicial coalgebra; Bialgebra actions on the cohomology of algebras; Extensions of Hopf algebras; Steenrod operations in the change-of-rings spectral sequence; The Eilenberg-Moore spectral sequence; Steenrod operations in the Eilenberg-Moore spectral sequence; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 129

September 2006, 155 pages, Hardcover, ISBN-10: 0-8218-4141-6, ISBN-13: 978-0-8218-4141-9, LC 2006045953, 2000 *Mathematics Subject Classification*: 16E40, 18G25, 18G30, 18G40, 55R20, 55R40, 55S10, 55T05, 55T15, 55T20, **All AMS members US\$44**, List US\$55, Order code SURV/129

Number Theory



Number Theory in the Spirit of Ramanujan

Bruce C. Berndt, *University of Illinois, Urbana-Champaign, IL*

Ramanujan is recognized as one of the great number theorists of the twentieth century. Here now is the first book to provide an introduction to his work in number theory. Most of Ramanujan's work in number theory

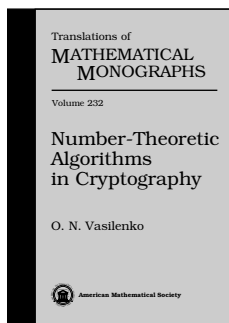
arose out of q -series and theta functions. This book provides an introduction to these two important subjects and to some of the topics in number theory that are inextricably intertwined with them, including the theory of partitions, sums of squares and triangular numbers, and the Ramanujan tau function. The majority of the results discussed here are originally due to Ramanujan or were rediscovered by him. Ramanujan did not leave us proofs of the thousands of theorems he recorded in his notebooks, and so it cannot be claimed that many of the proofs given in this book are those found by Ramanujan. However, they are all in the spirit of his mathematics.

The subjects examined in this book have a rich history dating back to Euler and Jacobi, and they continue to be focal points of contemporary mathematical research. Therefore, at the end of each of the seven chapters, Berndt discusses the results established in the chapter and places them in both historical and contemporary contexts. The book is suitable for advanced undergraduates and beginning graduate students interested in number theory.

Contents: Introduction; Congruences for $p(n)$ and $\tau(n)$; Sums of squares and sums of triangular numbers; Eisenstein series; The connection between hypergeometric functions and theta functions; Applications of the primary theorem of Chapter 5; The Rogers-Ramanujan continued fraction; Bibliography; Index.

Student Mathematical Library, Volume 34

September 2006, 187 pages, Softcover, ISBN-10: 0-8218-4178-5, ISBN-13: 978-0-8218-4178-5, LC 2006045959, 2000 *Mathematics Subject Classification*: 11Pxx; 11P81, 11P83, 11F20, 11F27, 11A55, 33C75, 33E05, **All AMS members US\$28**, List US\$35, Order code STML/34



Number-Theoretic Algorithms in Cryptography

O. N. Vasilenko, *Moscow State University, Russia*

Algorithmic number theory is a rapidly developing branch of number theory, which, in addition to its mathematical importance, has substantial applications in computer

science and cryptography. Among the algorithms used in cryptography, the following are especially important:

- algorithms for primality testing;
- factorization algorithms for integers and for polynomials in one variable;
- applications of the theory of elliptic curves;
- algorithms for computation of discrete logarithms;
- algorithms for solving linear equations over finite fields;
- algorithms for performing arithmetic operations on large integers.

The book describes the current state of these and some other algorithms. It also contains extensive bibliography. For this English translation, additional references were prepared and commented on by the author.

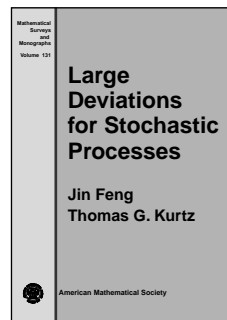
This item will also be of interest to those working in applications.

Contents: Primality testing and construction of large primes; Factorization of integers with exponential complexity; Factorization of integers with subexponential complexity; Application of elliptic curves to primality testing and factorization of integers; Algorithms for computing discrete logarithm; Factorization of polynomials over finite fields; Reduced lattice bases and their applications; Factorization of polynomials over the field of rational numbers with polynomial complexity; Discrete Fourier transform and its applications; High-precision integer arithmetic; Solving systems of linear equations over finite fields; Facts from number theory; Bibliography; Index.

Translations of Mathematical Monographs, Volume 232

August 2006, approximately 248 pages, Hardcover, ISBN-10: 0-8218-4090-8, ISBN-13: 978-0-8218-4090-0, 2000 *Mathematics Subject Classification*: 11T71; 94A60, **All AMS members US\$71**, List US\$89, Order code MMONO/232

Probability



Large Deviations for Stochastic Processes

Jin Feng, *University of Kansas, Lawrence, KS*, and Thomas G. Kurtz, *University of Wisconsin at Madison, WI*

The book is devoted to the results on large deviations for a class of stochastic processes. Following an introduction and overview, the material is presented in three parts.

Part 1 gives necessary and sufficient conditions for exponential tightness that are analogous to conditions for tightness in the theory of weak convergence. Part 2 focuses on Markov processes in metric spaces. For a sequence of such processes, convergence of Fleming's logarithmically transformed nonlinear semigroups is shown to imply the large deviation principle in a manner analogous to the use of convergence of linear semigroups in weak convergence. Viscosity solution methods provide applicable conditions for the necessary convergence. Part 3 discusses methods for verifying the comparison principle for viscosity solutions and applies the general theory to obtain a variety of new and known results on large deviations for Markov processes. In examples concerning infinite dimensional state spaces, new comparison principles are derived for a class of Hamilton-Jacobi equations in Hilbert spaces and in spaces of probability measures.

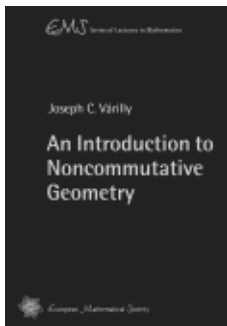
Contents: *Introduction:* Introduction; An overview; *The general theory of large deviations:* Large deviations and exponential tightness; Large deviations for stochastic processes; *Large deviations for Markov processes and semigroup convergence:* Large deviations for Markov processes and nonlinear semigroup convergence; Large deviations and nonlinear semigroup convergence using viscosity solutions; Extensions of viscosity solution methods; The Nisio semigroup and a control representation of the rate function; *Examples of large deviations and the comparison principle:* The comparison principle; Nearly deterministic processes in R^d ; Random evolutions; Occupation measures; Stochastic equations in infinite dimensions; *Appendix:* Operators and convergence in function spaces; Variational constants, rate of growth and spectral theory for the semigroup of positive linear operators; Spectral properties for discrete and continuous Laplacians; Results from mass transport theory; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 131

October 2006, approximately 404 pages, Hardcover, ISBN-10: 0-8218-4145-9, ISBN-13: 978-0-8218-4145-7, LC 2006045899, 2000 *Mathematics Subject Classification*: 60F10, 47H20; 60J05, 60J25, 60J35, 49L25, **All AMS members US\$79**, List US\$99, Order code SURV/131

New AMS-Distributed Publications

Analysis



An Introduction to Noncommutative Geometry

Joseph C. Várilly, *University of Costa Rica, San Jose, Costa Rica*

Noncommutative geometry, inspired by quantum physics, describes singular spaces by their noncommutative coordinate algebras

and metric structures by Dirac-like operators. Such metric geometries are described mathematically by Connes' theory of spectral triples. These lectures, delivered at an EMS Summer School on noncommutative geometry and its applications, provide an overview of spectral triples based on examples.

This introduction is aimed at graduate students of both mathematics and theoretical physics. It deals with Dirac operators on spin manifolds, noncommutative tori, Moyal quantization and tangent groupoids, action functionals, and isospectral deformations. The structural framework is the concept of a noncommutative spin geometry; the conditions on spectral triples which determine this concept are developed in detail. The emphasis throughout is on gaining understanding by computing the details of specific examples.

The book provides a middle ground between a comprehensive text and a narrowly focused research monograph. It is intended for self-study, enabling the reader to gain access to the essentials of noncommutative geometry. New features since the original course are an expanded bibliography and a survey of more recent examples and applications of spectral triples.

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

A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: Commutative geometry from the noncommutative point of view; Spectral triples on the Riemann sphere; Real spectral triples: the axiomatic foundation; Geometries on the noncommutative torus; The noncommutative integral; Quantization and the tangent groupoid; Equivalence of geometries; Action functionals; Epilogue: new directions; Bibliography; Index.

EMS Series of Lectures in Mathematics

June 2006, 121 pages, Softcover, ISBN-10: 3-03719-024-8, ISBN-13: 978-3-03719-024-1, 2000 *Mathematics Subject Classification*: 58B34, 46L87, 81T75, **All AMS members US\$27**, List US\$34, Order code EMSSERLEC/4

NEW AMS
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