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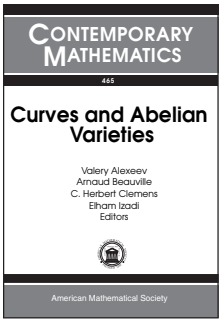
Algebra and Algebraic Geometry



Curves and Abelian Varieties

Valery Alexeev, *University of Georgia, Athens, GA*, **Arnaud Beauville**, *Université de Nice, France*, **C. Herbert Clemens**, *Ohio State University, Columbus, OH*, and **Elham Izadi**, *University of Georgia, Athens, GA*, Editors

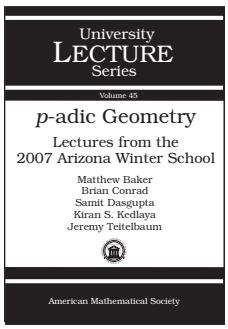
This book is devoted to recent progress in the study of curves and abelian varieties. It discusses both classical aspects of this deep and beautiful subject as well as two important new developments, tropical geometry and the theory of log schemes.

In addition to original research articles, this book contains three surveys devoted to singularities of theta divisors, of compactified Jacobians of singular curves, and of "strange duality" among moduli spaces of vector bundles on algebraic varieties.

Contents: L. Caporaso, Compactified Jacobians, Abel maps and theta divisors; **S. Casalaina-Martin**, Singularities of theta divisors in algebraic geometry; **O. Debarre**, The diagonal property for abelian varieties; **I. Dolgachev** and **D. Lehavi**, On isogenous principally polarized abelian surfaces; **M. Green**, **P. Griffiths**, and **M. Kerr**, Néron models and boundary components for degenerations of Hodge structure of mirror quintic type; **V. Kanev** and **H. Lange**, Polarization type of isogenous Prym-Tyurin varieties; **A. Marian** and **D. Oprea**, A tour of theta dualities on moduli spaces of sheaves; **G. Mikhalkin** and **I. Zharkov**, Tropical curves, their Jacobians and theta functions; **M. Olsson**, Logarithmic interpretation of the main component in toric Hilbert schemes; **A. Verra**, On the universal principally polarized abelian variety of dimension 4.

Contemporary Mathematics, Volume 465

August 2008, 274 pages, Softcover, ISBN: 978-0-8218-4334-5, LC 2008014250, 2000 *Mathematics Subject Classification:* 14H10, 14H40, 14K10, 14K30, **AMS members US$63**, List US$79, Order code CONM/465



p-adic Geometry

Lectures from the 2007 Arizona Winter School

Matthew Baker, *Georgia Institute of Technology, Atlanta, GA*, **Brian Conrad**, *University of Michigan, Ann Arbor, MI*, **Samit Dasgupta**, *Harvard University, Cambridge, MA*, **Kiran S. Kedlaya**, *Massachusetts Institute of Technology, Cambridge, MA*, **Jeremy Teitelbaum**, *University of Illinois at Chicago, IL*, and **edited by David Savitt** and **Dinesh S. Thakur**, *University of Arizona, Tucson, AZ*

In recent decades, *p*-adic geometry and *p*-adic cohomology theories have become indispensable tools in number theory, algebraic geometry, and the theory of automorphic representations. The Arizona Winter School 2007, on which the current book is based, was a unique opportunity to introduce graduate students to this subject.

Following invaluable introductions by John Tate and Vladimir Berkovich, two pioneers of non-archimedean geometry, Brian Conrad's chapter introduces the general theory of Tate's rigid analytic spaces, Raynaud's view of them as the generic fibers of formal schemes, and Berkovich spaces. Samit Dasgupta and Jeremy Teitelbaum discuss the *p*-adic upper half plane as an example of a rigid analytic space, and give applications to number theory (modular forms and the *p*-adic Langlands program). Matthew Baker offers a detailed discussion of the Berkovich projective line and *p*-adic potential theory on that and more general Berkovich curves. Finally, Kiran Kedlaya discusses theoretical and computational aspects of *p*-adic cohomology and the zeta functions of varieties. This book will be a welcome addition to the library of any graduate student and researcher who is interested in learning about the techniques of *p*-adic geometry.

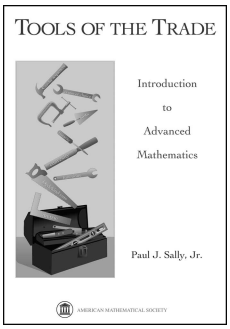
Contents: V. Berkovich, Non-archimedean analytic geometry: first steps; **B. Conrad**, Several approaches to non-archimedean geometry; **S. Dasgupta** and **J. Teitelbaum**, The *p*-adic upper half plane; **M. Baker**, An introduction to Berkovich analytic spaces and non-archimedean potential theory on curves; **K. S. Kedlaya**, *p*-adic cohomology: from theory to practice.

University Lecture Series, Volume 45

September 2008, 203 pages, Softcover, ISBN: 978-0-8218-4468-7, LC 2008023597, 2000 *Mathematics Subject Classification:* 14G22; 11F85, 14F30, **AMS members US$36**, List US$45, Order code ULECT/45

Analysis

COURSE ADOPTION



Tools of the Trade

Introduction to Advanced Mathematics

Paul J. Sally, Jr., *University of Chicago, IL*

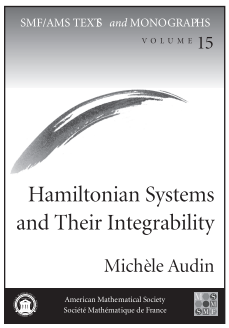
This book provides a transition from the formula-full aspects of the beginning study of college level mathematics to the rich and creative world of more advanced topics. It is designed to assist the student in mastering the techniques of analysis and proof that are required to do mathematics.

Along with the standard material such as linear algebra, construction of the real numbers via Cauchy sequences, metric spaces and complete metric spaces, there are three projects at the end of each chapter that form an integral part of the text. These projects include a detailed discussion of topics such as group theory, convergence of infinite series, decimal expansions of real numbers, point set topology and topological groups. They are carefully designed to guide the student through the subject matter. Together with numerous exercises included in the book, these projects may be used as part of the regular classroom presentation, as self-study projects for students, or for Inquiry Based Learning activities presented by the students.

Contents: Sets, functions, and other basic ideas; Linear algebra; The construction of the real and complex numbers; Metric and Euclidean spaces; Complete metric spaces and the p-adic completion of $\mathbb{Q}$; Index.

September 2008, approximately 199 pages, Hardcover, ISBN: 978-0-8218-4634-6, LC 2008024594, 2000 *Mathematics Subject Classification:* 26-01; 26A03, 26A06, 12J25, **AMS members US$39**, List US$49, Order code MBK/55

Differential Equations



Hamiltonian Systems and Their Integrability

Michèle Audin, *Institut de Recherche Mathématique Avancée, Université Louis Pasteur*

From a review of the French edition:

The book is addressed to graduate students without previous exposure to these topics … this is a refreshing attempt at giving a bird's eye view of disparate techniques that enter the geometric/differential nature of integrability of certain Hamiltonian systems. … The book is intended to be readable by a non-expert; … Several examples conclude each chapter, a good feature as they are workable and instructive …

– Mathematical Reviews

Hamiltonian systems began as a mathematical approach to the study of mechanical systems. As the theory developed, it became clear that the systems that had a sufficient number of conserved quantities enjoyed certain remarkable properties. These are the completely integrable systems. In time, a rich interplay arose between integrable systems and other areas of mathematics, particularly topology, geometry, and group theory.

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.

Audin has included many examples and exercises. Most of the exercises build on the material in the text. None of the important proofs have been relegated to the exercises. Many of the examples are classical, rather than abstract.

This book would be suitable for a graduate course in Hamiltonian systems.

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

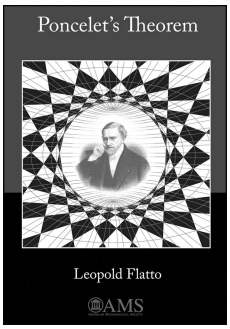
Titles in this series are co-published with Société Mathématique de France. SMF members are entitled to AMS member discounts.

Contents: Introduction to integrable systems; Action-angle variables; Integrability and Galois groups; An introduction to Lax equations; Appendix A: What one needs to know about differential Galois theory; Appendix B: What one needs to know about algebraic curves; Bibliography; Index.

SMF/AMS Texts and Monographs, Volume 15

October 2008, 149 pages, Softcover, ISBN: 978-0-8218-4413-7, LC 2008023869, 2000 *Mathematics Subject Classification:* 70H05, 53C15, 12Hxx, 34A30, 14H10, 14Pxx, **AMS members US$44**, List US$55, Order code SMFAMS/15

Geometry and Topology



Poncelet's Theorem

Leopold Flatto

Poncelet's theorem is a famous result in algebraic geometry, dating to the early part of the nineteenth century. It concerns closed polygons inscribed in one conic and circumscribed about another. The theorem is of great depth in that it relates to a large and diverse body of mathematics. There are several proofs of the theorem, none of which is elementary. A particularly attractive feature of the theorem, which is easily understood but difficult to prove, is that it serves as a prism through which one can learn and appreciate a lot of beautiful mathematics.

This book stresses the modern approach to the subject and contains much material not previously available in book form. It also discusses the relation between Poncelet's theorem and some aspects of queueing theory and mathematical billiards.

The proof of Poncelet's theorem presented in this book relates it to the theory of elliptic curves and exploits the fact that such curves are endowed with a group structure. The book also treats the real and degenerate cases of Poncelet's theorem. These cases are interesting in themselves, and their proofs require some other considerations. The real case is handled by employing notions from dynamical systems.

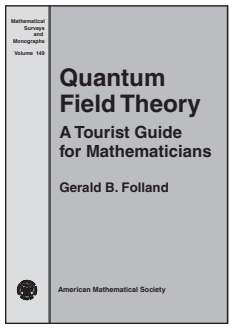
The material in this book should be understandable to anyone who has taken the standard courses in undergraduate mathematics. To achieve this, the author has included in the book preliminary chapters dealing with projective geometry, Riemann surfaces, elliptic functions, and elliptic curves. The book also contains numerous figures illustrating various geometric concepts.

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

Contents: Introduction; *Projective geometry:* Basic notions of projective geometry; Conics; Intersection of two conics; *Complex analysis:* Riemann surfaces; Elliptic functions; The modular function; Elliptic curves; *Poncelet and Cayley theorems:* Poncelet's theorem; Cayley's theorem; Non-generic cases; The real case of Poncelet's theorem; *Related topics:* Billiards in an ellipse; Double queues; *Supplement:* Billiards and the Poncelet theorem; *Appendices:* Factorization of homogeneous polynomials; Degenerate conics of a conic pencil. Proof of Theorem 4.9; Lifting theorems; Proof of Theorem 11.5; Billiards in an ellipse. Proof of Theorem 13.1; References.

November 2008, approximately 235 pages, Softcover, ISBN: 978-0-8218-4375-8, LC 2008025623, 2000 *Mathematics Subject Classification:* 51-01, 51M04, 51N15, **AMS members US$39**, List US$49, Order code MBK/56

Mathematical Physics



Quantum Field Theory

A Tourist Guide for Mathematicians

Gerald B. Folland, *University of Washington, Seattle, WA*

Quantum field theory has been a great success for physics, but it is difficult for mathematicians to learn because it is mathematically incomplete. Folland, who is a mathematician, has spent considerable time digesting the physical theory and sorting out the mathematical issues in it. Fortunately for mathematicians, Folland is a gifted expositor.

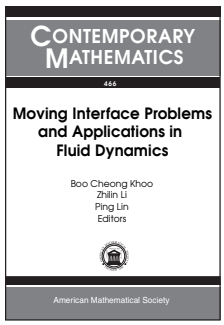
The purpose of this book is to present the elements of quantum field theory, with the goal of understanding the behavior of elementary particles rather than building formal mathematical structures, in a form that will be comprehensible to mathematicians. Rigorous definitions and arguments are presented as far as they are available, but the text proceeds on a more informal level when necessary, with due care in identifying the difficulties.

The book begins with a review of classical physics and quantum mechanics, then proceeds through the construction of free quantum fields to the perturbation-theoretic development of interacting field theory and renormalization theory, with emphasis on quantum electrodynamics. The final two chapters present the functional integral approach and the elements of gauge field theory, including the Salam–Weinberg model of electromagnetic and weak interactions.

Contents: Prologue; Review of pre-quantum physics; Basic quantum mechanics; Relativistic quantum mechanics; Free quantum fields; Quantum fields with interactions; Renormalization; Functional integrals; Gauge field theories; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 149

September 2008, 325 pages, Hardcover, ISBN: 978-0-8218-4705-3, LC 2008021019, 2000 *Mathematics Subject Classification:* 81-01; 81T13, 81T15, 81U20, 81V10, **AMS members US$71**, List US$89, Order code SURV/149



Moving Interface Problems and Applications in Fluid Dynamics

Boo Cheong Khoo, *National University of Singapore, Singapore*, **Zhilin Li**, *North Carolina State University, Raleigh, NC*, and **Ping Lin**, *University of Dundee, United Kingdom*, Editors

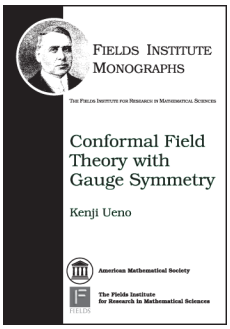
This volume is a collection of research papers presented at the program on Moving Interface Problems and Applications in Fluid Dynamics, which was held between January 8 and March 31, 2007 at the Institute for Mathematical Sciences (IMS)

of the National University of Singapore. The topics discussed include modeling and simulations of biological flow coupled to deformable tissue/elastic structure, shock wave and bubble dynamics and various applications including biological treatments with experimental verification, multi-medium flow or multi-phase flow and various applications including cavitation/supercavitation, detonation problems, Newtonian and non-Newtonian fluid, and many other areas. Readers can benefit from some recent research results in these areas.

Contents: R. Dillon, **M. Owen**, and **K. Painter**, A single-cell-based model of multicellular growth using the immersed boundary method; **J. Hua**, **P. Lin**, and **J. F. Stene**, Numerical simulation of gas bubbles rising in viscous liquids at high Reynolds number; **K. Ito** and **Z. Qiao**, A high order finite difference scheme for the Stokes equations; **S. Jiang** and **G. Ni**, An efficient γ-model BGK scheme for multicomponent flows on unstructured meshes; **D. V. Le**, **B. C. Khoo**, and **Z. Li**, An implicit-forcing immersed interface method for the incompressible Navier-Stokes equations; **A. Naber**, **C. Liu**, and **J. J. Feng**, The nucleation and growth of gas bubbles in a Newtonian fluid: An energetic variational phase field approach; **X. Pan**, Critical fields of liquid crystals; **J. Palacios** and **G. Tryggvason**, The transient motion of buoyant bubbles in a vertical Couette flow; **X. S. Wang**, Issues of immersed boundary/continuum methods; **H. Xie**, **K. Ito**, **Z. Li**, and **J. Toivanen**, A finite element method for interface problems with locally modified triangulations.

Contemporary Mathematics, Volume 466

September 2008, approximately 190 pages, Softcover, ISBN: 978-0-8218-4267-6, LC 2008015355, 2000 *Mathematics Subject Classification:* 34-XX, 35-XX, 49-XX, 65-XX, 74-XX, 76-XX, 92-XX, **AMS members US$47**, List US$59, Order code CONM/466



Conformal Field Theory with Gauge Symmetry

Kenji Ueno, *Kyoto University, Japan*

This book presents a systematic approach to conformal field theory with gauge symmetry from the point of view of complex algebraic geometry. After presenting the basic facts of the theory of compact Riemann surfaces and the representation theory of affine Lie algebras in Chapters 1 and 2, conformal blocks for pointed Riemann surfaces with coordinates are constructed in Chapter 3. In Chapter 4 the sheaf of conformal blocks associated to a family of pointed Riemann surfaces with coordinates is constructed, and in Chapter 5 it is shown that this sheaf supports a projective flat connection—one of the most important facts of conformal field theory. Chapter 6 is devoted to the study of the detailed structure of the conformal field theory over $\mathbb{P}^1$.

Recently it was shown that modular functors can be constructed from conformal field theory, giving an interesting relationship between algebraic geometry and topological quantum field theory. This book provides a timely introduction to an intensively studied topic of conformal field theory with gauge symmetry by a leading algebraic geometer, and includes all the necessary techniques and results that are used to construct the modular functor.

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

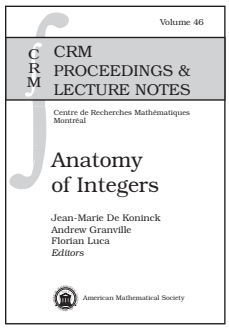
Titles in this series are co-published with The Fields Institute for Research in Mathematical Sciences (Toronto, Ontario, Canada).

Contents: Riemann surfaces and stable curves; Affine Lie algebras and integrable highest weight representations; Conformal blocks and correlation functions; Sheaf of conformal blocks; Projectively flat connections; Vertex operators and KZ equations; Appendix; Bibliography; Index.

Fields Institute Monographs, Volume 24

September 2008, 168 pages, Hardcover, ISBN: 978-0-8218-4088-7, LC 2008022192, 2000 *Mathematics Subject Classification:* 81T40, 81R10, 14D21, 17B81, **AMS members US$47**, List US$59, Order code FIM/24

Number Theory



Anatomy of Integers

Jean-Marie De Koninck, *Université Laval, Québec, QC, Canada*, **Andrew Granville**, *Université de Montréal, QC, Canada*, and **Florian Luca**, *Universidad Nacional Autonoma de México, Morelia, México*, Editors

The book is mostly devoted to the study of the prime factors of integers, their size and their quantity, to good bounds on the number of integers with different properties (for example, those with only large prime factors) and to the distribution of divisors of integers in a given interval. In particular, various estimates concerning smooth numbers are developed. A large emphasis is put on the study of additive and multiplicative functions as well as various arithmetic functions such as the partition function. More specific topics include the Erdős–Kac Theorem, cyclotomic polynomials, combinatorial methods, quadratic forms, zeta functions, Dirichlet series and L-functions. All these create an intimate understanding of the properties of integers and lead to fascinating and unexpected consequences. The volume includes contributions from leading participants in this active area of research, such as Kevin Ford, Carl Pomerance, Kannan Soundararajan and Gérald Tenenbaum.

Titles in this series are co-published with the Centre de Recherches Mathématiques.

Contents: V. Blomer, Ternary quadratic forms, and sums of three squares with restricted variables; **R. de la Bretèche**, Entiers ayant exactement r diviseurs dans un intervalle donné; **P. Erdős**, **F. Luca**, and **C. Pomerance**, On the proportion of numbers coprime to a given integer; **K. Ford**, Integers with a divisor in $(y, 2y]$; **H. A. Helfgott**, Power-free values, repulsion between points, differing beliefs and the existence of error; **H. Maier**, Anatomy of integers and cyclotomic polynomials; **J.-L. Nicolas**, Parité des valeurs de la fonction de partition $p(n)$ et anatomie des entiers; **K. Soundararajan**, The distribution of smooth numbers in arithmetic progressions; **G. Tenenbaum** and **J. Wu**, Moyennes de certaines fonctions multiplicatives sur les entiers friables, 4; **A. Akbary** and **M. R. Murty**, Uniform distribution of zeros of Dirichlet series; **S. Baier** and **L. Zhao**, On primes represented by quadratic polynomials; **W. D. Banks**, **A. M. Güloğlu**,

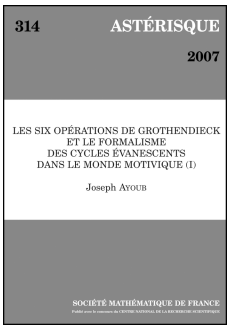
C. W. Nevans, and **F. Saidak**, Descartes numbers; **E. Croot**, A combinatorial method for developing Lucas sequence identities; **J.-M. De Koninck** and **F. Luca**, On the difference of arithmetic functions at consecutive arguments; **A. Granville** and **K. Soundararajan**, Pretentious multiplicative functions and an inequality for the zeta-function; **R. Khan**, On the distribution of $\omega(n)$; **W. Kuo** and **Y.-R. Liu**, The Erdős–Kac theorem and its generalizations; **J. Liu**, **E. Royer**, and **J. Wu**, On a conjecture of Montgomery-Vaughan on extreme values of automorphic L-functions at 1; **N. Ng**, The Möbius function in short intervals; **P. Pollack**, An explicit approach to hypothesis H for polynomials over a finite field; **C. L. Stewart**, On prime factors of integers which are sums or shifted products; **E. B. Wong**, Simultaneous approximation of reals by values of arithmetic functions.

CRM Proceedings & Lecture Notes, Volume 46

August 2008, 297 pages, Softcover, ISBN: 978-0-8218-4406-9, LC 2008020012, 2000 *Mathematics Subject Classification:* 11-06, 11N25, 11N36, 11N60; 11L07, 11L20, 11L40, 11N37, 11N56, 11P83, **AMS members US$79**, List US$99, Order code CRMP/46

New AMS-Distributed Publications

Algebra and Algebraic Geometry



Les Six Opérations de Grothendieck et le Formalisme des Cycles Évanescents dans le Monde Motivique (I)

Joseph Ayoub, *Université Paris 13, France*

By the work of Morel, Voevodsky, and other mathematicians, one has the notion of the *stable motivic homotopy type* of a smooth S-scheme. This object lives in the *stable homotopy category* of S-schemes $\mathbf{SH}(S)$.

This work consists of two volumes and each of them is divided into two chapters. In the first chapter, the author shows that from the viewpoint of functoriality, the categories $\mathbf{SH}(S)$ behave like the derived categories of l-adic sheaves. Indeed, the formalism of Grothendieck operations f^*, f_*, $f_!$ and $f^!$ extends to the motivic world. In the second chapter, the author studies the constructibility of motives and develops Verdier duality. The third chapter deals with the theory of nearby motives and vanishing motives. The last chapter provides a self-contained treatment of the construction of the categories $\mathbf{SH}(S)$.

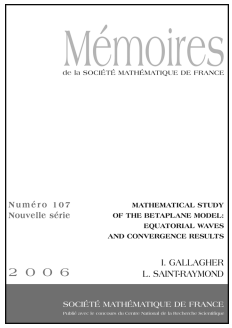
A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: Les quatre opérations de Grothendieck dans un cadre motivique; Compléments sur les 2-foncteurs homotopiques stables et les quatre opérations; Bibliographie.

Astérisque, Number 314

September 2007, 464 pages, Softcover, ISBN: 978-2-85629-244-0, 2000 *Mathematics Subject Classification:* 14-02, 14C25, 14F20, 14F35, 14F42, 18A40, 18F10, 18F20, 18F25, 18G55, 19E15, **Individual member US$119**, List US$132, Order code AST/314

Differential Equations



Mathematical Study of the Betaplane Model: Equatorial Waves and Convergence Results

Isabelle Gallagher, *Université Paris VII, France*, and **Laure Saint-Raymond**, *Université Paris VI, France*

The authors are interested in a model of rotating fluids, describing the motion of the ocean in the equatorial zone. This model is known as the Saint-Venant, or shallow-water type system, to which a rotation term is added whose amplitude is linear with respect to the latitude; in particular it vanishes at the equator. After a physical introduction to the model, the authors describe the various waves involved and study in detail the resonances associated to those waves. They then exhibit the formal limit system (as the rotation becomes large), obtained as usual by filtering out the waves, and prove its wellposedness. Finally they prove three types of convergence results: a weak convergence result towards a linear, geostrophic equation, a strong convergence result of the filtered solutions towards the unique strong solution to the limit system, and a "hybrid" strong convergence result of the filtered solutions towards a weak solution to the limit system. In particular the authors obtain that there are no confined equatorial waves in the mean motion as the rotation becomes large.

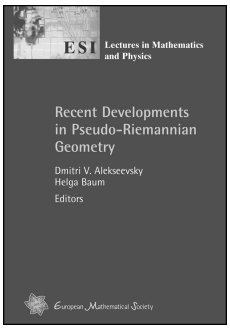
A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Equatorial waves; The envelope equations; Convergence results; Bibliography; Notation index.

Mémoires de la Société Mathématique de France, Number 107

December 2006, 116 pages, Softcover, ISBN: 978-2-85629-228-0, 2000 *Mathematics Subject Classification:* 35Q30, 35P99, 76U05, 86A10, **Individual member US$35**, List US$39, Order code SMFMEM/107

Geometry and Topology



Recent Developments in Pseudo-Riemannian Geometry

Dmitri V. Alekseevsky, *Edinburgh University, Scotland*, and **Helga Baum**, *Humboldt-Universität, Berlin, Germany*, Editors

This book provides an introduction to and survey of recent developments in pseudo-Riemannian geometry, including applications in mathematical physics, by leading experts in the field. Topics covered are:

- Classification of pseudo-Riemannian symmetric spaces
- Holonomy groups of Lorentzian and pseudo-Riemannian manifolds
- Hypersymplectic manifolds
- Anti-self-dual conformal structures in neutral signature and integrable systems
- Neutral Kähler surfaces and geometric optics
- Geometry and dynamics of the Einstein universe
- Essential conformal structures and conformal transformations in pseudo-Riemannian geometry
- The causal hierarchy of spacetimes
- Geodesics in pseudo-Riemannian manifolds
- Lorentzian symmetric spaces in supergravity
- Generalized geometries in supergravity
- Einstein metrics with Killing leaves

The book is addressed to advanced students as well as to researchers in differential geometry, global analysis, general relativity and string theory. It shows essential differences between the geometry on manifolds with positive definite metrics and on those with indefinite metrics, and highlights the interesting new geometric phenomena, which naturally arise in the indefinite metric case. The reader finds a description of the present state of the art in the field as well as open problems, which can stimulate further research.

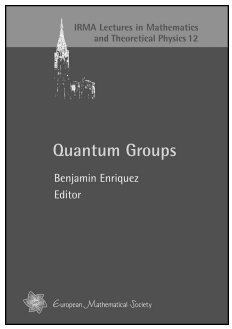
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: I. Kath and **M. Olbrich**, The classification problem for pseudo-Riemannian symmetric spaces; **A. Galaev** and **T. Leistner**, Holonomy groups of Lorentzian manifolds: classification, examples, and applications; **A. Dancer** and **A. Swann**, Hypersymplectic manifolds; **M. Dunajski** and **S. West**, Anti-self-dual conformal structures in neutral signature; **B. Guilfoyle** and **W. Klingenberg**, A neutral Kähler surface with applications in geometric optics; **T. Barbot**, **V. Charette**, **T. Drumm**, **W. M. Goldman**, and **K. Melnick**, A primer on the $(2+1)$ Einstein universe; **C. Frances**, Essential conformal structures in Riemannian and Lorentzian geometry; **W. Kühnel** and **H.-B. Rademacher**, Conformal transformations of pseudo-Riemannian manifolds; **E. Minguzzi** and **M. Sánchez**, The causal hierarchy of spacetimes; **A. M. Candela** and **M. Sánchez**, Geodesics in semi-Riemannian manifolds: geometric properties and variational tools; **J. Figueroa-O'Farrill**, Lorentzian symmetric spaces in supergravity; **F. Witt**, Metric bundles of split signature and type II supergravity; **G. Vilasi**, Einstein metrics with 2-dimensional Killing leaves and their physical interpretation; List of contributors; Index.

ESI Lectures in Mathematics and Physics, Volume 4

June 2007, 549 pages, Softcover, ISBN: 978-3-03719-051-7, 2000 *Mathematics Subject Classification:* 53-00, 53C50, **AMS members US$62**, List US$78, Order code EMSESILEC/4

Mathematical Physics



Quantum Groups

Benjamin Enriquez, *IRMA (CNRS), Strasbourg, France*, Editor

The volume starts with a lecture course by P. Etingof on tensor categories (notes by D. Calaque). This course is an introduction to tensor categories, leading to topics of recent research such as realizability of fusion rings, Ocneanu rigidity, module categories, weak Hopf algebras, Morita theory for tensor categories, lifting theory, categorical dimensions, Frobenius–Perron dimensions, and the classification of tensor categories.

The remainder of the book consists of three detailed expositions on associators and the Vassiliev invariants of knots, classical and quantum integrable systems and elliptic algebras, and the groups of algebra automorphisms of quantum groups. The preface puts the results presented in perspective.

Directed at research mathematicians and theoretical physicists as well as graduate students, the volume gives an overview of the ongoing research in the domain of quantum groups, an important subject of current mathematical physics.

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

Contents: D. Calaque and **P. Etingof**, Lectures on tensor categories; **J. Lieberum**, The Drinfeld associator of gl(1|1); **A. Odesskii** and **V. Rubtsov**, Integrable systems associated with elliptic algebras; **N. Andruskiewitsch** and **F. Dumas**, On the automorphisms of $U_q^+(\mathfrak{g})$.

IRMA Lectures in Mathematics and Theoretical Physics, Volume 12

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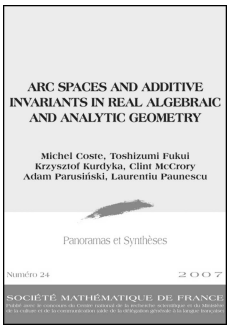
Number Theory



Arc Spaces and Additive Invariants in Real Algebraic and Analytic Geometry

Michel Coste, *Université de Rennes 1, France*, **Toshizumi Fukui**, *Saitama University, Urawa, Japan*, **Krzysztof Kurdyka**, *Université de Savoie, Le Bourget-du-Lac, France*, **Clint McCrory**, *University of Georgia, Athens, GA*, **Adam Parusiński**, *Université d'Angers, France*, and **Laurentiu Paunescu**, *University of Sydney, Australia*

In this volume the authors present some new trends in real algebraic geometry based on the study of arc spaces and additive invariants of real algebraic sets. Generally, real algebraic geometry uses methods of its own that usually differ sharply from the more widely known methods of complex algebraic geometry. This feature is particularly apparent when studying the basic topological and geometric properties of real algebraic sets; the rich algebraic structures are usually hidden and cannot be recovered from the topology. The use of arc spaces and additive invariants partially obviates this disadvantage. Moreover, these methods are often parallel to the basic approaches of complex algebraic geometry.

The authors' presentation contains the construction of local topological invariants of real algebraic sets by means of algebraically constructible functions. This technique is extended to the wider family of arc-symmetric semialgebraic sets. Moreover, the latter family defines a natural topology that fills a gap between the Zariski topology and the euclidean topology.

In real equisingularity theory, Kuo's blow-analytic equivalence of real analytic function germs provides an equivalence relation that corresponds to topological equivalence in the complex analytic set-up. Among other applications, arc-symmetric geometry, via the motivic integration approach, gives new invariants of this equivalence, allowing some initial classification results.

The volume contains two courses and two survey articles that are designed for a wide audience, in particular students and young researchers.

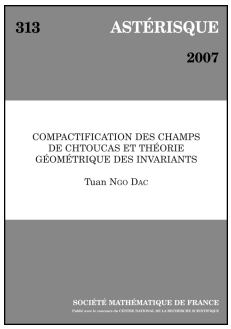
This item will also be of interest to those working in analysis.

A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: **M. Coste**, Real algebraic sets; **K. Kurdyka** and **A. Parusiński**, Arc-symmetric sets and arc-analytic mappings; **C. McCrory** and **A. Parusiński**, Algebraically constructible functions: real algebra and topology; **T. Fukui** and **L. Paunescu**, On blow-analytic equivalence; References.

Panoramas et Synthèses, Number 24

November 2007, 126 pages, Softcover, ISBN: 978-2-85629-236-5, 2000 *Mathematics Subject Classification:* 14Pxx, 14P05, 14P10, 14P25, 32B20, 32C05, 58A07, **Individual member US$48**, List US$53, Order code PASY/24



Compactification des Champs de Chtoucas et Théorie Géométrique des Invariants

Tuan Ngo Dac, *CNRS-Université de Paris Nord, Villetaneuse, France*

In the proof of Drinfeld and Lafforgue of the Langlands correspondence for GL_r over function fields, the most difficult part is to construct compactifications of moduli spaces (or stacks) classifying Drinfeld's shtukas. If one hopes to prove the Langlands correspondence over function fields for other reductive groups G, it is natural to generalize the above constructions for the stacks of G-shtukas. However, the approach of Lafforgue, based on the semistable reduction due to Langton, seems difficult to carry out.

In this article, the author uses the geometric invariant theory to give a new method to construct compactifications of moduli spaces of Drinfeld's shtukas. This not only rediscovers the compactications constructed by Drinfeld and Lafforgue but also gives rise to new families of compactications.

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Contents: Introduction; Chtoucas de Drinfeld : rappels; Variation des quotients; Semistabilité; Compactification des champs de chtoucas de Drinfeld; Propreté; Nouvelles compactifications des champs de chtoucas de Drinfeld; Compactifications des champs de chtoucas à modifications multiples; Bibliographie.

Astérisque, Number 313

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