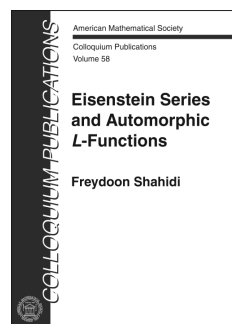


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Algebra and Algebraic Geometry



Eisenstein Series and Automorphic *L*-Functions

Freydoon Shahidi, *Purdue
University, West Lafayette, IN*

This book presents a treatment of the theory of *L*-functions developed by means of the theory of Eisenstein series and their Fourier coefficients, a theory which

is usually referred to as the Langlands–Shahidi method. The information gathered from this method, when combined with the converse theorems of Cogdell and Piatetski-Shapiro, has been quite sufficient in establishing a number of new cases of Langlands functoriality conjecture; at present, some of these cases cannot be obtained by any other method. These results have led to far-reaching new estimates for Hecke eigenvalues of Maass forms, as well as definitive solutions to certain problems in analytic and algebraic number theory.

This book gives a detailed treatment of important parts of this theory, including a rather complete proof of Casselman–Shalika’s formula for unramified Whittaker functions as well as a general treatment of the theory of intertwining operators. It also covers in some detail the global aspects of the method as well as some of its applications to group representations and harmonic analysis.

This book is addressed to graduate students and researchers who are interested in the Langlands program in automorphic forms and its connections with number theory.

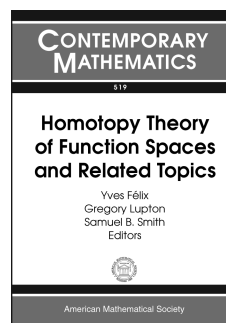
This item will also be of interest to those working in number theory.

Contents: Introduction; Reductive groups; Satake isomorphisms; Generic representations; Intertwining operators; Local coefficients; Eisenstein series; Fourier coefficients of Eisenstein series; Functional equations; Further properties of *L*-functions; Applications to functoriality; Appendices: Tables of Dynkin diagrams; Bibliography; Index.

Colloquium Publications, Volume 58

September 2010, approximately 207 pages, Hardcover, ISBN: 978-0-8218-4989-7, LC 2010010759, 2000 *Mathematics Subject Classification*: 11F70, 11R42; 22E50, 22E55, **AMS members US\$44**, List US\$55, Order code COLL/58

Analysis



Homotopy Theory of Function Spaces and Related Topics

Yves Félix, *Université Catholique
de Louvain, Louvain-la-Neuve,
Belgium*, **Gregory Lupton**,
Cleveland State University, OH,
and **Samuel B. Smith**, *St. Joseph’s
University, Philadelphia, PA*,
Editors

This volume contains the proceedings of the Workshop on Homotopy Theory of Function Spaces and Related Topics, which was held at the Mathematisches Forschungsinstitut Oberwolfach, in Germany, from April 5–11, 2009.

This volume contains fourteen original research articles covering a broad range of topics that include localization and rational homotopy theory, evaluation subgroups, free loop spaces, Whitehead products, spaces of algebraic maps, gauge groups, loop groups, operads, and string topology.

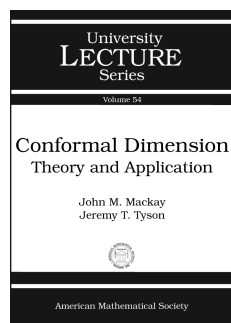
In addition to reporting on various topics in the area, this volume is supposed to facilitate the exchange of ideas within Homotopy Theory of Function Spaces and promote cross-fertilization between Homotopy Theory of Function Spaces and other areas. With these latter aims in mind, this volume includes a survey article which, with its extensive bibliography, should help bring researchers and graduate students up to speed on activity in this field as well as a problems list, which is an expanded and edited version of problems discussed in sessions held at the conference. The problems list is intended to suggest directions for future work.

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

Contents: *Survey article:* **S. B. Smith**, The homotopy theory of function spaces: A survey; *Contributed articles:* **U. Buijs**, Upper bounds for the Whitehead-length of mapping spaces; **D. Chataur**, String topology of classifying spaces and gravity algebras; **M. C. Crabb**, A fibrewise stable splitting and free loops on projective spaces; **Y. Félix** and **D. Tanré**, Rational homotopy of symmetric products and spaces of finite subsets; **J.-B. Gatsinzi**, Derivations, Hochschild cohomology and the Gottlieb group; **J.-B. Gatsinzi** and **R. Kwashira**, Rational homotopy groups of function spaces; **J. Giansiracusa** and **P. Salvatore**, Formality of the framed little 2-discs operad and semidirect products; **M. Golasinski**, **D. Gonçalves**, and **P. Wong**, James construction, Fox torus homotopy groups and Hopf invariants; **A. Kono** and **S. Tsukuda**, Notes on the triviality of adjoint bundles; **A. Kozłowski** and **K. Yamaguchi**, Spaces of algebraic maps from real projective spaces into complex projective spaces; **K. Kuribayashi**, On the rational cohomology of the total space of the universal fibration with an elliptic fibre; **J. Oprea** and **J. Strom**, On the realizability of Gottlieb groups; **C. L. Schochet** and **S. B. Smith**, Localization of grouplike function and section spaces with compact domain; **C. Wockel**, Non-integral central extensions of loop groups; *Problem list:* **Y. Félix**, Problems on mapping spaces and related subjects.

Contemporary Mathematics, Volume 519

August 2010, 230 pages, Softcover, ISBN: 978-0-8218-4929-3, LC 2010009614, 2000 *Mathematics Subject Classification*: 55P15, 55P35, 55P45, 55P48, 55P50, 55P60, 55P62, 55Q52, 55R35, 46M20, **AMS members US\$71.20**, List US\$89, Order code CONM/519



Conformal Dimension Theory and Application

John M. Mackay and Jeremy T. Tyson, *University of Illinois at Urbana-Champaign, IL*

Conformal dimension measures the extent to which the Hausdorff dimension of a metric space can be lowered by quasisymmetric deformations. Introduced

by Pansu in 1989, this concept has proved extremely fruitful in a diverse range of areas, including geometric function theory, conformal dynamics, and geometric group theory.

This survey leads the reader from the definitions and basic theory through to active research applications in geometric function theory, Gromov hyperbolic geometry, and the dynamics of rational maps, amongst other areas. It reviews the theory of dimension in metric spaces and of deformations of metric spaces. It summarizes the basic tools for estimating conformal dimension and illustrates their application to concrete problems of independent interest. Numerous examples and proofs are provided.

Working from basic definitions through to current research areas, this book can be used as a guide for graduate students interested in this field, or as a helpful survey for experts. Background needed for a potential reader of the book consists of a working knowledge of real and complex analysis on the level of first- and second-year graduate courses.

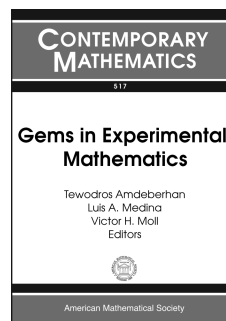
Contents: Background material; Conformal gauges and conformal dimension; Gromov hyperbolic groups and spaces and their boundaries; Lower bounds for conformal dimension; Sets and spaces of conformal dimension zero; Gromov-Hausdorff tangent

spaces and conformal dimension; Ahlfors regular conformal dimension; Global quasiconformal dimension.

University Lecture Series, Volume 54

July 2010, 143 pages, Softcover, ISBN: 978-0-8218-5229-3, LC 2010014667, 2000 *Mathematics Subject Classification*: 30L10, 28A78, **AMS members US\$32.80**, List US\$41, Order code ULECT/54

Applications



Gems in Experimental Mathematics

Tewodros Amdeberhan, *Tulane University, New Orleans, LA*, **Luis A. Medina**, *University of Puerto Rico, San Juan, PR*, and **Victor H. Moll**, *Tulane University, New Orleans, LA*, Editors

These proceedings reflect the special session on Experimental Mathematics held January 5, 2009, at the Joint Mathematics Meetings in Washington, DC as well as some papers specially solicited for this volume.

Experimental mathematics is a recently structured field of mathematics that uses the computer and advanced computing technology as a tool to perform experiments. These include the analysis of examples, testing of new ideas, and the search of patterns to suggest results and to complement existing analytical rigor.

The development of a broad spectrum of mathematical software products, such as *Mathematica*® and *Maple*™, has allowed mathematicians of diverse backgrounds and interests to use the computer as an essential tool as part of their daily work environment.

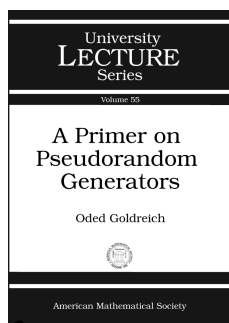
This volume reflects a wide range of topics related to the young field of Experimental Mathematics. The use of computation varies from aiming to exclude human input in the solution of a problem to traditional mathematical questions for which computation is a prominent tool.

Contents: **G. Almkvist**, The art of finding Calabi-Yau differential equations; **T. Amdeberhan**, A note on a question due to A. Garsia; **D. H. Bailey** and **J. M. Borwein**, Experimental computation with oscillatory integrals; **D. H. Bailey**, **J. M. Borwein**, **D. Broadhurst**, and **W. Zudilin**, Experimental mathematics and mathematical physics; **S. T. Boettner**, An extension of the parallel Risch algorithm; **R. P. Boyer** and **W. M. Y. Goh**, Appell polynomials and their zero attractors; **O.-Y. Chan** and **D. Manna**, Congruences for Stirling numbers of the second kind; **M. W. Coffey**, Expressions for harmonic number exponential generating functions; **R. E. Crandall**, Theory of log-rational integrals; **S. Garoufalidis** and **X. Sun**, A new algorithm for the recursion of hypergeometric multisums with improved universal denominator; **I. Gonzalez**, **V. H. Moll**, and **A. Straub**, The method of brackets. Part 2: Examples and applications; **J. G. Goyanesa**, History of the formulas and algorithms for π ; **J. Guillera**, A matrix form of Ramanujan-type series for $1/\pi$; **K. Kohl** and **F. Stan**, An algorithmic approach to the Mellin transform method; **C. Koutschan**, Eliminating human

insight: An algorithmic proof of Stembridge's TSPP theorem; **M. L. Lapidus** and **R. G. Niemeyer**, Towards the Koch snowflake fractal billiard: Computer experiments and mathematical conjectures; **L. A. Medina** and **D. Zeilberger**, An experimental mathematics perspective on the old, and still open, question of when to stop?; **M. J. Mossinghoff**, The distance to an irreducible polynomial; **S. Northshield**, Square roots of 2×2 matrices; **O. Oloa**, On a series of Ramanujan; **P. Raff** and **D. Zeilberger**, Finite analogs of Szemerédi's theorems; **A. V. Sills**, Towards an automation of the circle method; **J. H. Silverman**, The greatest common divisor of $a^n - 1$ and $b^n - 1$ and the Ailon-Rudnick conjecture; **J. Sondow** and **K. Schalm**, Which partial sums of the Taylor series for e are convergents to e ? (and a link to the primes 2, 5, 13, 37, 463). II; **C. Hillar**, **L. Garcia-Puente**, **A. M. Del Campo**, **J. Ruffo**, **Z. Teitler**, **S. L. Johnson**, and **F. Sottile**, Experimentation at the frontiers of reality in Schubert calculus; **Y. Yang** and **W. Zudilin**, On Sp_4 modularity of Picard-Fuchs differential equations for Calabi-Yau threefolds.

Contemporary Mathematics, Volume 517

July 2010, 413 pages, Softcover, ISBN: 978-0-8218-4869-2, LC 2010006127, 2000 *Mathematics Subject Classification*: 05A17, 11A05, 11A41, 11C08, 11F46, 11P55, 11Y60, 14J32, 14N15, 15A24, 37D40, 37D50, 65D18, 68R05, **AMS members US\$92**, List US\$115, Order code CONM/517



A Primer on Pseudorandom Generators

Oded Goldreich, *Weizmann Institute of Science, Rehovot, Israel*

A fresh look at the question of randomness was taken in the theory of computing: A distribution is pseudorandom if it

cannot be distinguished from the uniform distribution by any efficient procedure. This paradigm, originally associating efficient procedures with polynomial-time algorithms, has been applied with respect to a variety of natural classes of distinguishing procedures. The resulting theory of pseudorandomness is relevant to science at large and is closely related to central areas of computer science, such as algorithmic design, complexity theory, and cryptography.

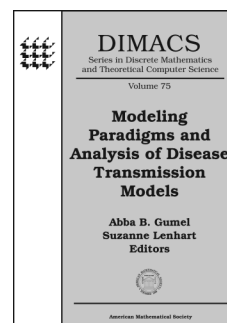
This primer surveys the theory of pseudorandomness, starting with the general paradigm, and discussing various incarnations while emphasizing the case of general-purpose pseudorandom generators (withstanding any polynomial-time distinguisher). Additional topics include the “derandomization” of arbitrary probabilistic polynomial-time algorithms, pseudorandom generators withstanding space-bounded distinguishers, and several natural notions of special-purpose pseudorandom generators.

The primer assumes basic familiarity with the notion of efficient algorithms and with elementary probability theory, but provides a basic introduction to all notions that are actually used. As a result, the primer is essentially self-contained, although the interested reader is at times referred to other sources for more detail.

Contents: Introduction; General-purpose pseudorandom generators; Derandomization of time-complexity classes; Space-bounded distinguishers; Special purpose generators; Concluding remarks; Appendices; Bibliography; Index.

University Lecture Series, Volume 55

September 2010, approximately 142 pages, Softcover, ISBN: 978-0-8218-5192-0, 2000 *Mathematics Subject Classification*: 68-01, 68-02, 68Q01, 68R01; 68Q15, 68Q17, 68W20, **AMS members US\$28.80**, List US\$36, Order code ULECT/55



Modeling Paradigms and Analysis of Disease Transmission Models

Abba B. Gumel, *University of Manitoba, Winnipeg, MB, Canada*, and **Suzanne Lenhart**, *University of Tennessee, Knoxville, TN*, Editors

This volume stems from two DIMACS activities, the U.S.-Africa Advanced Study Institute and the DIMACS Workshop, both on Mathematical Modeling of Infectious Diseases in Africa, held in South Africa in the summer of 2007. It contains both tutorial papers and research papers.

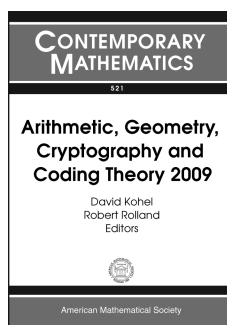
Students and researchers should find the papers on modeling and analyzing certain diseases currently affecting Africa very informative. In particular, they can learn basic principles of disease modeling and stability from the tutorial papers where continuous and discrete time models, optimal control, and stochastic features are introduced.

Co-published with the Center for Discrete Mathematics and Theoretical Computer Science beginning with Volume 8. Volumes 1–7 were co-published with the Association for Computer Machinery (ACM).

Contents: **S. Shrestha** and **J. O. Lloyd-Smith**, Introduction to mathematical modeling of infectious diseases; **E. M. Lungu**, **M. Kgosimore**, and **F. Nyabadza**, Tools for mathematical epidemiology; **R. M. Neilan** and **S. Lenhart**, An introduction to optimal control with an application in disease modeling; **A.-A. Yakubu**, Introduction to discrete-time epidemic models; **W. Ding** and **S. Lenhart**, Introduction to optimal control for discrete time models with an application to disease modeling; **J. Dushoff**, Incorporating stochasticity in simple models of disease spread; **M. S. Sánchez**, **J. O. Lloyd-Smith**, **B. G. Williams**, and **W. M. Getz**, Using mathematical models to monitor and evaluate the impact of public health interventions on epidemics: The case of the TB/HIV co-pandemic in Africa; **S. D. Hove-Musekwa**, **V. Runyowa**, and **Z. Mukandavire**, Modelling the epidemiological and economic impact of HIV/AIDS with particular reference to Zimbabwe; **O. Sharomi** and **A. B. Gumel**, Mathematical analysis of HIV treatment model with variable viral load and infection stages; **F. S. Roberts**, Greedy algorithms in economic epidemiology.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 75

September 2010, approximately 278 pages, Hardcover, ISBN: 978-0-8218-4384-0, LC 2010016461, 2000 *Mathematics Subject Classification*: 34D05, 34D20, 34D23, 92B05, 92-01, 92-02, 92-06, 92D25, 92D30, **AMS members US\$83.20**, List US\$104, Order code DIMACS/75



Arithmetic, Geometry, Cryptography and Coding Theory 2009

David Kohel and Robert Rolland,
Institut de Mathématiques de Luminy, Marseille, France, Editors

This volume contains the proceedings of the 12th conference on Arithmetic, Geometry, Cryptography and Coding

Theory, held in Marseille, France from March 30 to April 3, 2009, as well as the first Geocrypt conference, held in Point-à-Pitre, Guadeloupe from April 27 to May 1, 2009, and the European Science Foundation exploratory workshop on Curves, Coding Theory, and Cryptography, held in Marseille, France from March 25 to 29, 2009.

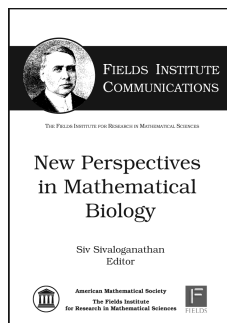
The articles contained in this volume come from three related symposia organized by the group Arithmétique et Théorie de l'Information in Marseille. The topics cover arithmetic properties of curves and higher dimensional varieties with applications to codes and cryptography.

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

Contents: Y. Aubry and F. Rodier, Differentially 4-uniform functions; J. Berthomieu, P. Hivert, and H. Mourtada, Computing Hironaka's invariants: Ridge and directrix; W. Castryck and J. Voight, Nongenerate curves of low genus over small finite fields; A. Venelli and F. Dassance, Faster side-channel resistant elliptic curve scalar multiplication; E. Férard and F. Rodier, Non linéarité des fonctions booléennes données par des polynômes de degré binaire 3 définies sur \mathbb{F}_{2^m} avec m pair; A. Garcia and H. Stichtenoth, A note on a maximal curve; D. Gruenewald, Computing Humbert surfaces and applications; E. Nart and C. Ritzenthaler, Genus 3 curves with many involutions and application to maximal curves in characteristic 2; A. Rigato, Uniqueness of low genus optimal curves over \mathbb{F}_2 ; A. Silverberg, Group order formulas for reductions of CM elliptic curves; B. Smith, Families of explicit isogenies of hyperelliptic Jacobians; X. Taixés i Ventosa and G. Wiese, Computing congruences of modular forms and Galois representations modulo prime powers.

Contemporary Mathematics, Volume 521

September 2010, 166 pages, Softcover, ISBN: 978-0-8218-4955-2, LC 2010010568, 2000 *Mathematics Subject Classification*: 11G10, 11G15, 11G20, 14G10, 14G15, 14G50, 14H05, 14H10, 14H45, 14Q05, AMS members US\$47.20, List US\$59, Order code CONM/521



New Perspectives in Mathematical Biology

Siv Sivaloganathan, *University of Waterloo, ON, Canada*, Editor

In the 21st century, the interdisciplinary field of mathematical biology and medicine has firmly taken center stage as one of the major themes of modern applied mathematics, with strong links to the empirical biomedical sciences. New

Perspectives in Mathematical Biology provides an overview of the distinct variety and diversity of current research in the field. In every chapter of this book, which covers themes ranging from

cancer modeling to infectious diseases to orthopaedics and musculoskeletal tissue mechanics, there is clear evidence of the strong connections and interactions of mathematics with the biological and biomedical sciences that have spawned new models and novel insights.

This book is loosely based on the plenary lectures delivered by some of the leading authorities on these subjects at the Society for Mathematical Biology (SMB) Conference that was held in Toronto in 2008 and will be of interest to graduate students, postdoctoral fellows, and researchers currently engaged in this field, bringing the reader to the forefront of current research.

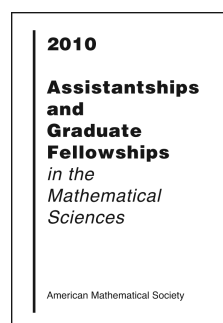
Titles in this series are co-published with the Fields Institute for Research in Mathematical Sciences (Toronto, Ontario, Canada).

Contents: H. Levine, W. F. Loomis, and W.-J. Rappel, Eukaryotic chemotaxis and its limitations due to stochastic sensing; T. W. Secomb, M. W. Dewhirst, and A. R. Pries, Growth and structural adaptation of blood vessels in normal and tumor tissues; N. L. Komarova, Modeling approaches to studying stem cells in cancer; M. A. Lewis, M. Krkosek, and M. Wonham, Dynamics of emerging wildlife disease; Y. Zhou and H. Cao, Discrete tuberculosis models and their application; M. L. Knothe Tate, T. Falls, S. Mishra, and R. Atit, Engineering an ecosystem: Taking cues from nature's paradigm to build tissue in the lab and the body.

Fields Institute Communications, Volume 57

September 2010, approximately 139 pages, Hardcover, ISBN: 978-0-8218-4845-6, LC 2010018723, 2000 *Mathematics Subject Classification*: 92-XX, AMS members US\$63.20, List US\$79, Order code FIC/57

General and Interdisciplinary



Assistantships and Graduate Fellowships in the Mathematical Sciences, 2010

From a review of a previous edition:

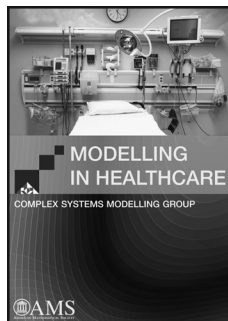
This directory is a tool for undergraduate mathematics majors seeking information about graduate programs in mathematics. Although most of the information can be

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

– *American Reference Books Annual*

This valuable reference source brings together a wealth of information about resources available for graduate study in mathematical sciences departments in the U.S. and Canada.

November 2010, approximately 94 pages, Softcover, ISBN: 978-0-8218-5236-1, **Individual member US\$18.40**, List US\$23, Order code ASST/2010



Modelling in Healthcare

The Complex Systems Modelling Group (CSMG), The IRMACS Center, Simon Fraser University, Burnaby, BC, Canada

How many patients will require admission to my hospital in two days? How widespread will influenza be in my community in two weeks? What will the

changing demographics of our community do to affect demand for medical services in our region in two years? These and similar questions are the province of Modelling in Healthcare. This new volume, presented by the Complex Systems Modelling Group at Simon Fraser University in Canada, uses plain language, sophisticated mathematics and vivid examples to guide and instruct. Sage advice on the benefits and limitations of the modeling process and model predictions is generously distributed so that the reader comes away with an understanding not only of the process but also on the practical uses (and misuses!) of models. Perhaps the most important aspect of this book is that the content and the logic are readily understandable by modelers, administrators and clinicians alike. This volume will surely serve as their common and thus preferred reference for modeling in healthcare for many years.

—**Timothy G. Buchman, Ph.D., M.D., FACS, FCCM**

Modelling in Healthcare adds much-needed breadth to the curriculum, giving readers the introduction to simulation methods, network analysis, game theory, and other essential modeling techniques that are rarely touched upon by traditional statistics texts.

—**Ben Klemens, Ph.D.**

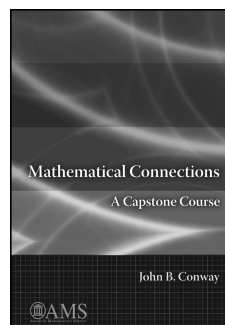
Mathematical and statistical modeling has tremendous potential for helping improve the quality and efficiency of health care delivery and as a tool for decision making by health care professionals. This book provides many relevant and successful applications of modeling in health care and can serve as an important resource and guide for those working in this exciting new field.

—**Reinhard Laubenbacher, Ph.D.**

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

Contents: *Modelling in healthcare:* The whys, whats, and whens of modelling in healthcare; How to use this book; The modelling process; *Data collection and statistical models:* Issues of data; The basics; Predictions and responses; Evaluating detrimental behaviour; Adjusting risky behaviour; *Model design and interpretation:* Issues in mathematical modelling; Explaining irrational behaviour; Modelling optimal behaviour; Modelling social interaction; The future starts now; Viewing the system as a whole; Dealing with lines and capacity; Finding the “best” intervention; Computer programming packages useful in modelling; Bibliography; Index.

August 2010, 218 pages, Hardcover, ISBN: 978-0-8218-4969-9, LC 2010009618, 2000 *Mathematics Subject Classification:* 00A06, 00A71, 97Mxx, **AMS members US\$55.20**, List US\$69, Order code MBK/74



Mathematical Connections

A Capstone Course

John B. Conway, George Washington University, DC

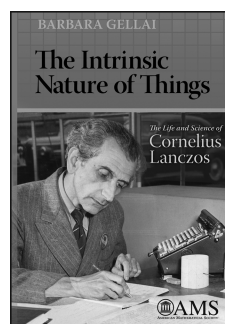
This book illustrates connections between various courses taken by undergraduate mathematics majors. As such it can be used as a text for a capstone course. The

chapters are essentially independent, and the instructor can choose the topics that will form the course and thus tailor the syllabus to suit the backgrounds and abilities of the students. At the end of such a course the graduating seniors should glimpse mathematics not as a series of independent courses but as something more like an integrated body of knowledge. The book has numerous exercises and examples so that the student has many opportunities to see the material illustrated and fleshed out.

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

Contents: Trisecting angles; Polyhedra; Hilbert spaces; The spectral theorem; Matrices and topology; Modules; Appendix; References; List of symbols; Subject index.

August 2010, 243 pages, Softcover, ISBN: 978-0-8218-4979-8, LC 2010012553, 2000 *Mathematics Subject Classification:* 15-01, 51-01, **AMS members US\$44**, List US\$55, Order code MBK/75



The Intrinsic Nature of Things

The Life and Science of Cornelius Lanczos

Barbara Gellai, Hungarian Academy of Sciences, Budapest, Hungary

This book recounts the extraordinary personal journey and scientific story of Hungarian-born mathematician and physicist Cornelius Lanczos. His life and his mathematical accomplishments are inextricably linked, reflecting the social upheavals and historical events that shaped his odyssey in 20th-century Hungary, Germany, the United States, and Ireland.

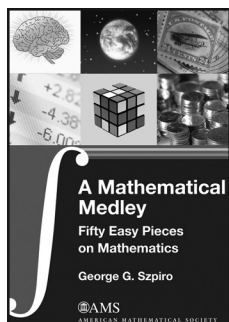
In his life Lanczos demonstrated a remarkable ability to be at the right place, or work with the right person, at the right time. At the start of his scientific career in Germany he worked as Einstein's assistant for one year and stayed in touch with him for years thereafter. Reacting to anti-Semitism in Germany in the 1930s, he moved to the United States, where he would work on some of the earliest digital computers at the National Bureau of Standards. After facing suspicion of Communist sympathies during the McCarthy era in the 1950s, Lanczos would relocate once again, joining Schrödinger at the Dublin Institute for Advanced Studies. Gellai's biography analyzes a rich life and a body of work that reaches across many scientific disciplines.

Lanczos made important contributions to several areas of mathematics and mathematical physics. His first major contribution was an exact solution of the Einstein field equations for gravity (in general relativity). He worked out the Fast Fourier

Transform, but since there were no machines on which to run it, this accomplishment would be forgotten for 25 years. Once he had access to computers, Lanczos independently rediscovered what is now known as the singular value decomposition, a fundamental tool in numerical methods. Other significant contributions included an important discovery about the Weyl tensor, which is now known as the Lanczos potential, and an important contribution on algorithms for finding eigenvalues of large matrices.

Contents: Background; Family and basic studies; A change in our world view: The theory of relativity; Higher studies; Lanczos's early research in the theory of relativity; Contribution to quantum mechanics; Purdue beginnings; The educator; "Why mathematics?"; Ripples on the old pond's surface; The Lanczos Method; Full-time research; Nature's Pythagorean theorem; Probing Riemannian space; Epilogue; A brief professional chronology of Cornelius Lanczos; Published papers and books of Cornelius Lanczos; Bibliography; Index.

October 2010, 218 pages, Softcover, ISBN: 978-0-8218-5166-1, LC 2010017680, 2000 *Mathematics Subject Classification*: 01A60, **AMS members US\$23.20**, List US\$29, Order code MBK/76



A Mathematical Medley

Fifty Easy Pieces on Mathematics

George G. Szpiro, *Neue Zürcher Zeitung, Zurich, Switzerland*

Szpiro's book provides a delightful, well-written, eclectic selection of mathematical tidbits that makes excellent

airplane reading for anyone with an interest in mathematics, regardless of their mathematical background. Excellent gift material.

—Keith Devlin, Stanford University, author of *The Unfinished Game* and *The Language of Mathematics*

It is great to have collected in one volume the many varied, insightful and often surprising mathematical stories that George Szpiro has written in his mathematical columns for the newspapers through the years.

—Marcus du Sautoy, Oxford University, author of *The Music of the Primes* and *Symmetry: A Journey into the Patterns of Nature*

Mathematics is thriving. Not only have long-standing problems, such as the Poincaré conjecture, been solved, but mathematics is an important element of many modern conveniences, such as cell phones, CDs, and secure transactions over the Internet. For good or for bad, it is also the engine that drives modern investment strategies. Fortunately for the general public, mathematics and its modern applications can be intelligible to the non-specialist, as George Szpiro shows in *A Mathematical Medley*.

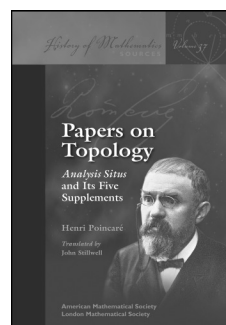
In stories of a few pages each, Szpiro describes in layman's terms mathematical problems that have recently been solved (or thought to have been solved), research that was published in scientific journals, and mathematical observations about contemporary life. Anecdotal stories about the lives of mathematicians and stories about famous old problems are interspersed among other vignettes.

Contents: A baker's dozen; Math for math's sake; Math applied to real life; Personalities; In the air; Training the brain; Games, gifts,

and other diversions; Choosing and dividing; Money, and making it; Interdisciplinary matters; References.

June 2010, 236 pages, Softcover, ISBN: 978-0-8218-4928-6, LC 2009053215, 2000 *Mathematics Subject Classification*: 00Axx, 01Axx, 97-XX, **AMS members US\$28**, List US\$35, Order code MBK/73

Geometry and Topology



Papers on Topology

Analysis Situs and Its Five Supplements

Henri Poincaré
Translated by John Stillwell

The papers in this book chronicle Henri Poincaré's journey in algebraic topology between 1892 and 1904, from his discovery of the fundamental group to

his formulation of the Poincaré conjecture. For the first time in English translation, one can follow every step (and occasional stumble) along the way, with the help of translator John Stillwell's introduction and editorial comments.

Now that the Poincaré conjecture has finally been proved, by Grigory Perelman, it seems timely to collect the papers that form the background to this famous conjecture. Poincaré's papers are in fact the first draft of algebraic topology, introducing its main subject matter (manifolds) and basic concepts (homotopy and homology). All mathematicians interested in topology and its history will enjoy this book.

This volume is one of an informal sequence of works within the History of Mathematics series. Volumes in this subset, "Sources", are classical mathematical works that served as cornerstones for modern mathematical thought.

These famous papers, with their characteristic mixture of deep insight and inevitable confusion, are here presented complete and in English for the first time, with a commentary by their translator, John Stillwell, that guides the reader into the heart of the subject. One of the finest works of one of the great mathematicians is now available anew for students and experts alike.

—Jeremy Gray

The AMS and John Stillwell have made an important contribution to the mathematics literature in this translation of Poincaré. For many of us, these great papers on the foundations of topology are given greater clarity in English. Moreover, reading Poincaré here illustrates the ultimate in research by successive approximations (akin to my own way of mathematical thinking).

—Stephen Smale

I am a proud owner of the original complete works in green leather in French bought for a princely sum in Paris around 1975. I have read in them extensively, and often during topology lectures I refer to parts of these works. I am happy that there is now the option for my students to read them in English.

—Dennis Sullivan

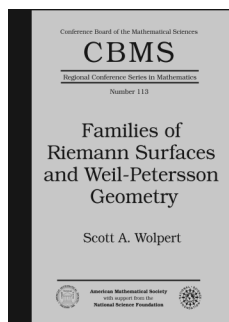
Co-published with the London Mathematical Society beginning with Volume 4. Members of the LMS may order directly from the AMS at

the AMS member price. The LMS is registered with the Charity Commissioners.

Contents: Translator's introduction; On *Analysis Situs*; *Analysis Situs*; Supplement to *Analysis Situs*; Second supplement to *Analysis Situs*; On certain algebraic surfaces: Third supplement to *Analysis Situs*; Cycles on algebraic surfaces: Fourth supplement to *Analysis Situs*; Fifth supplement to *Analysis Situs*; Index.

History of Mathematics, Volume 37

October 2010, approximately 241 pages, Softcover, ISBN: 978-0-8218-5234-7, LC 2010014958, 2000 *Mathematics Subject Classification*: 01-XX, 55-XX, 57-XX, **AMS members US\$47.20**, List US\$59, Order code HMATH/37



Families of Riemann Surfaces and Weil-Petersson Geometry

Scott A. Wolpert, *University of Maryland, College Park, MD*

This book is the companion to the CBMS lectures of Scott Wolpert at Central Connecticut State University. The lectures

span across areas of research progress on deformations of hyperbolic surfaces and the geometry of the Weil-Petersson metric. The book provides a generally self-contained course for graduate students and postgraduates. The exposition also offers an update for researchers; material not otherwise found in a single reference is included.

A unified approach is provided for an array of results. The exposition covers Wolpert's work on twists, geodesic-lengths and the Weil-Petersson symplectic structure; Wolpert's expansions for the metric, its Levi-Civita connection and Riemann tensor. The exposition also covers Brock's twisting limits, visual sphere result and pants graph quasi isometry, as well as the Brock-Masur-Minsky construction of ending laminations for Weil-Petersson geodesics. The rigidity results of Masur-Wolf and Daskalopoulos-Wentworth, following the approach of Yamada, are included. The book concludes with a generally self-contained treatment of the McShane-Mirzakhani length identity, Mirzakhani's volume recursion, approach to Witten-Kontsevich theory by hyperbolic geometry, and prime simple geodesic theorem.

Lectures begin with a summary of the geometry of hyperbolic surfaces and approaches to the deformation theory of hyperbolic surfaces. General expositions are included on the geometry and topology of the moduli space of Riemann surfaces, the $CAT(0)$ geometry of the augmented Teichmüller space, measured geodesic and ending laminations, the deformation theory of the prescribed curvature equation, and the Hermitian description of Riemann tensor. New material is included on estimating orbit sums as an approach for the potential theory of surfaces.

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

A co-publication of the AMS and CBMS.

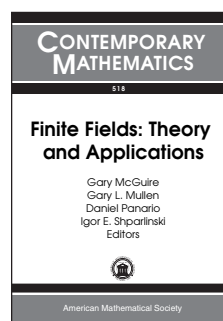
Contents: Preliminaries; Teichmüller space and horizontal strip deformations; Geodesic-lengths, twists and symplectic geometry; Geometry of the augmented Teichmüller space, part 1; Geometry of the augmented Teichmüller space, part 2; Geometry of the augmented Teichmüller space, part 3; Deformations of hyperbolic metrics and the curvature tensor; Collar expansions

and exponential-distance sums; Train tracks and the Mirzakhani volume recursion; Mirzakhani prime simple geodesic theorem; Bibliography; Index.

CBMS Regional Conference Series in Mathematics, Number 113

July 2010, 118 pages, Softcover, ISBN: 978-0-8218-4986-6, LC 2010011413, 2000 *Mathematics Subject Classification*: 20F67, 30F60, 32G15, 37F30; 11F41, 14H15, 32Q05, 32Q45, **AMS members US\$28.80**, **All Individuals US\$28.80**, List US\$36, Order code CBMS/113

Number Theory



Finite Fields: Theory and Applications

Gary McGuire, *University College Dublin, Ireland*, **Gary L. Mullen**, *Pennsylvania State University, University Park, PA*, **Daniel Panario**, *Carleton University, Ottawa, Ontario, Canada*, and **Igor E. Shparlinski**, *Macquarie University, North Ryde, NSW, Australia*, Editors

This volume contains the proceedings of the Ninth International Conference on Finite Fields and Applications, held in Ireland, July 13–17, 2009. It includes survey papers by all invited speakers as well as selected contributed papers.

Finite fields continue to grow in mathematical importance due to applications in many diverse areas. This volume contains a variety of results advancing the theory of finite fields and connections with, as well as impact on, various directions in number theory, algebra, and algebraic geometry. Areas of application include algebraic coding theory, cryptology, and combinatorial design theory.

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

Contents: C. D. Albuquerque, R. Palazzo, Jr., and E. B. Silva, Construction of new toric quantum codes; H. Aly, R. Marzouk, and W. Meidl, On the calculation of the linear complexity of periodic sequences; Y. Aubry, G. McGuire, and F. Rodier, A few more functions that are not APN infinitely often; K. A. Browning, J. F. Dillon, M. T. McQuistan, and A. J. Wolfe, An APN permutation in dimension six; L. Budaghyan and C. Carlet, CCZ-equivalence of single and multi output Boolean functions; A. Canteaut and M. Naya-Plasencia, Structural weaknesses of permutations with a low differential uniformity and generalized crooked functions; I. M. Rubio and F. N. Castro, Solvability of systems of polynomial equations with some prescribed monomials; M.-C. Chang, Character sums in finite fields; P. Charpin and G. M. Kyureghyan, Monomial functions with linear structure and permutation polynomials; S. D. Cohen, Primitive elements on lines in extensions of finite fields; R. S. Coulter and P. Kosick, Commutative semifields of order 243 and 3125; C. Dunand and R. Lercier, Normal elliptic bases and torus-based cryptography; L. H. Gallardo and O. Rahavandrany, Unitary superperfect binary polynomials; J. von zur Gathen, Shift-invariant polynomials and Ritt's second theorem; D. Gomez and A. Winterhof, Waring's problem in finite fields with Dickson polynomials; S. Gurak, Jacobi sums and

irreducible polynomials with prescribed trace and restricted norm; **J. J. He, D. Panario, and Q. Wang**, A family of binary sequences from interleaved construction and their cryptographic properties; **M. Homma and S. J. Kim**, Sziklai's conjecture on the number of points of a plane curve over a finite field II; **M.-D. Huang and A. K. Narayanan**, Folded algebraic-geometric codes from Galois extensions; **M.-D. Huang and W. Raskind**, A multilinear generalization of the Tate pairing; **J. Jedwab and K.-U. Schmidt**, The merit factor of binary sequence families constructed from m -sequences; **N. Koblitz and A. Menezes**, Intractable problems in cryptography; **W.-C. W. Li**, Modular curves and coding theory: A survey; **G. L. Matthews and J. D. Peachey**, Minimal generating sets of Weierstrass semigroups of certain m -tuples on the norm-trace function field; **G. McGuire and A. Zaytsev**, On the zeta functions of an optimal tower of function fields over \mathbb{F}_4 ; **H. Niederreiter**, The asymptotic theory of algebraic-geometry codes; **V. Pepe, C. Rösing, and L. Storme**, A spectrum result on maximal partial ovoids of the generalized quadrangle $\mathcal{Q}(4, q)$, q odd; **J. Wolfmann**, Cyclic codes aspects of bent functions.

Contemporary Mathematics, Volume 518

August 2010, 384 pages, Softcover, ISBN: 978-0-8218-4786-2, LC 2010008228, 2000 *Mathematics Subject Classification*: 11Gxx, 11Lxx, 11Txx, 14Gxx, 51Exx, 94Axx, 94Bxx, **AMS members US\$92**, List US\$115, Order code CONM/518

in computational aspects of probability, combinatorics and enumeration. Furthermore, the expository or partly expository papers included in this volume should serve as an entry point to this literature not only to experts in other areas but also to graduate students.

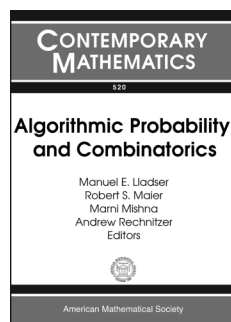
This item will also be of interest to those working in applications.

Contents: **M. Bousquet-Mélou and M. Mishna**, Walks with small steps in the quarter plane; **A. Bressler, T. Greenwood, R. Pemantle, and M. Petkovšek**, Quantum random walk on the integer lattice: Examples and phenomena; **T. DeVries**, A case study in bivariate singularity analysis; **P. Hitczenko and S. Janson**, Asymptotic normality of statistics on permutation tableaux; **A. E. Holroyd and J. Propp**, Rotor walks and Markov chains; **E. J. J. van Rensburg**, Approximate enumeration of self-avoiding walks; **I. Jensen**, Fuchsian differential equations from modular arithmetic; **N. Madras and H. Liu**, Random pattern-avoiding permutations; **R. Pemantle**, Analytic combinatorics in d variables: An overview; **R. Pemantle and M. C. Wilson**, Asymptotic expansions of oscillatory integrals with complex phase.

Contemporary Mathematics, Volume 520

August 2010, 240 pages, Softcover, ISBN: 978-0-8218-4783-1, LC 2010011434, 2000 *Mathematics Subject Classification*: 05-06, 60-06, 41-06, 82-06; 05A15, 05A16, 60C05, 41A60, **AMS members US\$63.20**, List US\$79, Order code CONM/520

Probability



Algorithmic Probability and Combinatorics

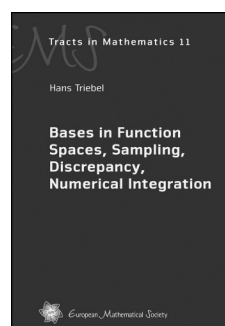
Manuel E. Lladser, *University of Colorado, Boulder, CO*, **Robert S. Maier**, *University of Arizona, Tucson, AZ*, **Marni Mishna**, *Simon Fraser University, Burnaby, BC, Canada*, and **Andrew Rechnitzer**, *University of British Columbia, Vancouver, BC, Canada*, Editors

This volume contains the proceedings of the AMS Special Sessions on Algorithmic Probability and Combinatorics held at DePaul University on October 5–6, 2007 and at the University of British Columbia on October 4–5, 2008.

This volume collects cutting-edge research and expository on algorithmic probability and combinatorics. It includes contributions by well-established experts and younger researchers who use generating functions, algebraic and probabilistic methods as well as asymptotic analysis on a daily basis. Walks in the quarter-plane and random walks (quantum, rotor and self-avoiding), permutation tableaux, and random permutations are considered. In addition, articles in the volume present a variety of saddle-point and geometric methods for the asymptotic analysis of the coefficients of single- and multi-variable generating functions associated with combinatorial objects and discrete random structures. The volume should appeal to pure and applied mathematicians, as well as mathematical physicists; in particular, anyone interested

New AMS-Distributed Publications

Analysis



Bases in Function Spaces, Sampling, Discrepancy, Numerical Integration

Hans Triebel, *University of Jena, Germany*

The first chapters of this book deal with Haar bases, Faber bases and some spline bases for function spaces in Euclidean n -space and n -cubes. These are used in the subsequent chapters to study sampling and numerical integration preferably in spaces with dominating mixed smoothness. The subject of the last chapter is the symbiotic relationship between numerical integration and discrepancy, measuring the deviation of sets of points from uniformity.

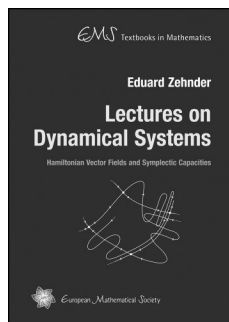
This book is addressed to graduate students and mathematicians who have a working knowledge of basic elements of function spaces and approximation theory and who are interested in the subtle interplay between function spaces, complexity theory and number theory (discrepancy).

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

Contents: Function spaces; Haar bases; Faber bases; Sampling; Numerical integration; Discrepancy; Bibliography; List of Figures; Symbols; Index.

EMS Tracts in Mathematics, Volume 11

May 2010, 305 pages, Hardcover, ISBN: 978-3-03719-085-2, 2000 *Mathematics Subject Classification:* 46-02, 46E35, 42C40, 42B35, 68Q17, 41A55, **AMS members US\$62.40**, List US\$78, Order code EMSTM/11



Lectures on Dynamical Systems

Hamiltonian Vector Fields
and Symplectic Capacities

**Eduard Zehnder, ETH Zurich,
Switzerland**

This book originated from an introductory lecture course on dynamical systems given by the author for advanced students in

mathematics and physics at ETH Zurich.

The first part centers around unstable and chaotic phenomena caused by the occurrence of homoclinic points. The existence of homoclinic points complicates the orbit structure considerably and gives rise to invariant hyperbolic sets nearby. The orbit structure in such sets is analyzed by means of the shadowing lemma, whose proof is based on the contraction principle. This lemma is also used to prove S. Smale's theorem about the embedding of Bernoulli systems near homoclinic orbits. The chaotic behavior is illustrated in the simple mechanical model of a periodically perturbed mathematical pendulum.

The second part of the book is devoted to Hamiltonian systems. The Hamiltonian formalism is developed in the elegant language of the exterior calculus. The theorem of V. Arnold and R. Jost shows that the solutions of Hamiltonian systems which possess sufficiently many integrals of motion can be written down explicitly and for all times. The existence proofs of global periodic orbits of Hamiltonian systems on symplectic manifolds are based on a variational principle for the old action functional of classical mechanics. The necessary tools from variational calculus are developed.

There is an intimate relation between the periodic orbits of Hamiltonian systems and a class of symplectic invariants called symplectic capacities. From these symplectic invariants one derives surprising symplectic rigidity phenomena. This allows a first glimpse of the fast developing new field of symplectic topology.

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

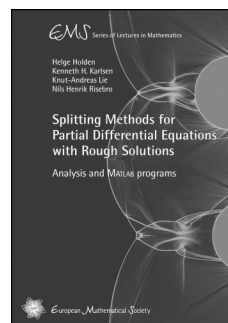
A publication of the European Mathematical Society (EMS).
Distributed within the Americas by the American Mathematical Society.

Contents: Introduction; Invariant manifolds of hyperbolic fixed points; Hyperbolic sets; Gradientlike flows; Hamiltonian vector fields and symplectic diffeomorphisms; Questions, phenomena, results; Symplectic invariants; Applications of the capacity c_0 in Hamiltonian systems; Bibliography; List of symbols; Index.

EMS Textbooks in Mathematics, Volume 11

May 2010, 363 pages, Hardcover, ISBN: 978-3-03719-081-4, 2000 *Mathematics Subject Classification:* 37-01, 34C25, 53D35, 70H15, **AMS members US\$51.20**, List US\$64, Order code EMSTEXT/11

Differential Equations



Splitting Methods for Partial Differential Equations with Rough Solutions

Analysis and MATLAB®
Programs

**Helge Holden, Norwegian
University of Science and
Technology, Trondheim, Norway,
and Kenneth H. Karlsen,
Knut-Andreas Lie, and Nils
Henrik Risebro, University of
Oslo, Norway**

Operator splitting (or the fractional steps method) is a very common tool to analyze nonlinear partial differential equations both numerically and analytically. By applying operator splitting to a complicated model one can often split it into simpler problems that can be analyzed separately. In this book one studies operator splitting for a family of nonlinear evolution equations, including hyperbolic conservation laws and degenerate convection-diffusion equations. Common for these equations is the prevalence of rough, or non-smooth, solutions, e.g., shocks.

Rigorous analysis is presented, showing that both semi-discrete and fully discrete splitting methods converge. For conservation laws, sharp error estimates are provided and for convection-diffusion equations one discusses a priori and a posteriori correction of entropy errors introduced by the splitting. Numerical methods include finite difference and finite volume methods as well as front tracking. The theory is illustrated by numerous examples. There is a dedicated Web page that provides MATLAB® codes for many of the examples.

The book is suitable for graduate students and researchers in pure and applied mathematics, physics, and engineering.

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

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

® MATLAB, The MathWorks, Inc., Natick, MA.

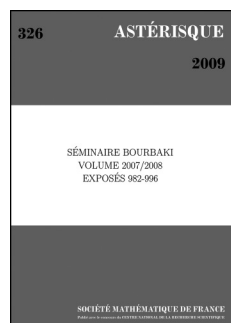
Contents: Introduction; Simple examples of semi-discrete operator splitting; General convergence theory; Convergence results for convection-diffusion problems; Error estimates for hyperbolic problems; Operator splitting for systems of equations; A. A crash course in numerical methods for conservation laws; References; Index.

EMS Series of Lectures in Mathematics, Volume 11

April 2010, 236 pages, Softcover, ISBN: 978-3-03719-078-4, 2000 *Mathematics Subject Classification:* 35L65, 35K65, 65M99, 65M15,

65M12, 35L67, 35D30, 47N40, 35A35, **AMS members US\$38.40**,
List US\$48, Order code EMSSERLEC/11

General and Interdisciplinary



Séminaire Bourbaki

Volume 2007/2008
Exposés 982-996

As in the preceding volumes of this seminar, one finds here fifteen survey lectures on topics of current interest: four lectures on algebraic geometry, one on number theory, one on probability theory, four on differential geometry, three about groups or Lie algebras, one concerning dynamical systems, and one about mathematical physics.

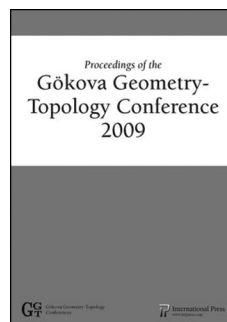
A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: *Novembre 2007:* **S. Druel**, Existence de modèles minimaux pour les variétés de type général; **P. Gille**, Le problème de Kneser-Tits; **B. Rémy**, Covolume des groupes S -arithmétiques et faux plans projectifs; **A. J. Wilkie**, o -minimal structures; **D. Zagier**, Ramanujan's mock theta functions and their applications; *Mars 2008:* **P. Cartier**, Groupoïdes de Lie et leurs algébroïdes; **L. H. Eliasson**, Résultats non-perturbatifs pour l'équation de Schrödinger et d'autres cocycles quasi-périodiques; **C. Gasbarri**, The strong abc conjecture over function fields; **M. Ledoux**, Géométrie des espaces métriques mesurés: les travaux de Lott, Villani, Sturm; **M. Păun**, Courants d'Ahlfors et localisation des courbes entières; *Juin 2008:* **V. Beffara**, Grands graphes planaires aléatoires et carte brownienne; **P. Haïssinsky**, Géométrie quasiconforme, analyse au bord des espaces métriques hyperboliques et rigidités; **C. Pauly**, La dualité étrange; **B. Poizat**, Amalgames de Hrushovski; **J.-C. Yoccoz**, Échanges d'intervalles et surfaces de translation.

Astérisque, Number 326

April 2010, 409 pages, Softcover, ISBN: 978-2-85629-269-3, 2000 *Mathematics Subject Classification:* 03C64, 03Cxx, 05C15, 05C05, 05C12, 05C80, 11F06, 11F11, 11F37, 11G30, 11G50, 12H20, 14E30, 14G05, 14G25, 14H60, 14H81, 14J29, 14N35, 20F65, 20F67, 20F69, 20G15, 20G25, 20G30, 20Gxx, 22A22, 22E40, 28A33, 30C65, 30D35, 30D45, 30F10, 30F60, 31C15, 31C20, 32G15, 32M15, 32Q30, 32U40, 33D15, 34C27, 35K05, 37A20, 37C15, 37C55, 37E05, 46E35, 49Q20, 51E24, 53C21, 53C23, 53C24, 53C35, 53D17, 57M07, 58C40, 60B05, 58H05, 58Jxx, 60F17, 60J60, 60J65, **Individual member US\$108**, List US\$120, Order code AST/326

Geometry and Topology



Proceedings of the Gökova Geometry-Topology Conference 2009

Selman Akbulut, *Michigan State University, East Lansing, Denis Auroux*, *Massachusetts Institute of Technology, Cambridge*, and **Turgut Önder**, *Middle East Technical University, Ankara*, Turkey, Editors

The Gökova Geometry-Topology Conferences were inaugurated in 1992 with the support of TUBITAK (The Scientific and Technological Research Council of Turkey) and are held annually on the shores of the scenic Gökova Bay on the southwestern coast of Turkey.

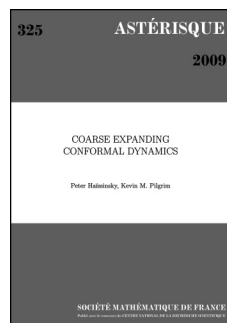
These conferences have been supported by TUBITAK since their inception and since 2005 they have received partial funding from NSF. Over the years the topics of these conferences were chosen from the exciting subjects of geometry and topology, usually with the most recent developments taking the front stage.

A publication of International Press. Distributed worldwide by the American Mathematical Society.

Contents: **W. Chen**, Group actions on 4-manifolds: Some recent results and open questions; **M. Shapiro**, Introduction to integrable systems: Open Toda lattice, KP-, and KdV-hierarchies; **P. Rossi**, Integrable systems and holomorphic curves; **F. Catanese**, **M. Lönne**, and **B. Wajnryb**, Moduli spaces of surfaces and monodromy invariants; **S. Salur** and **A. J. Todd**, Deformations of asymptotically cylindrical special Lagrangian submanifolds; **J. Fine** and **D. Panov**, Building symplectic manifolds using hyperbolic geometry; **S. Akbulut**, Twisting 4-manifolds along RP^2 .

International Press

April 2010, 154 pages, Softcover, ISBN: 978-1-57146-199-5, 2000 *Mathematics Subject Classification:* 00Bxx, 51-XX, 54-XX, **AMS members US\$36**, List US\$45, Order code INPR/90



Coarse Expanding Conformal Dynamics

Peter Haïssinsky, *Université de Provence, Marseille, France*, and **Kevin M. Pilgrim**, *Indiana University, Bloomington, IN*

Motivated by the dynamics of rational maps, the authors introduce a class of topological dynamical systems satisfying certain topological regularity, expansion, irreducibility, and finiteness conditions. The authors call such maps "topologically coarse expanding conformal" (top. CXC) dynamical systems. Given such a system $f : X \rightarrow X$ and a finite cover of X by connected open

sets, the authors construct a negatively curved infinite graph on which f acts naturally by local isometries.

The induced topological dynamical system on the boundary at infinity is naturally conjugate to the dynamics of f . This implies that X inherits metrics in which the dynamics of f satisfies the Principle of the Conformal Elevator: arbitrarily small balls may be blown up with bounded distortion to nearly round sets of definite size. This property is preserved under conjugation by a quasimetric map, and (top. CXC) dynamical systems on a metric space satisfying this property the authors call "metrically CXC". The ensuing results deepen the analogy between rational maps and Kleinian groups by extending it to analogies between metric CXC systems and hyperbolic groups.

The authors give many examples and several applications. In particular, they provide a new interpretation of the characterization of rational functions among topological maps and of generalized Lattès examples among uniformly quasiregular maps. *Via* techniques in the spirit of those used to construct quasiconformal measures for hyperbolic groups, the authors also establish existence, uniqueness, naturality, and metric regularity properties for the measure of maximal entropy of such systems.

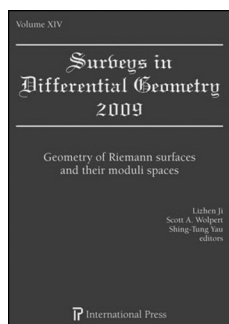
This item will also be of interest to those working in analysis.

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: Introduction; Coarse expanding conformal dynamics; Geometrization; Expanding non-invertible dynamics; A. Quasiconformal analysis; B. Hyperbolic groups in a nutshell; Bibliography; Index; Table of symbols.

Astérisque, Number 325

April 2010, 139 pages, Softcover, ISBN: 978-2-85629-266-2, 2000 *Mathematics Subject Classification*: 53C23, 30C65, 37B99, 37D20, 37F15, 37F20, 37F30, 54E40, **Individual member US\$51.30**, List US\$57, Order code AST/325



Surveys in Differential Geometry, Volume XIV

Geometry of Riemann Surfaces and Their Moduli Spaces

Lizhen Ji, *University of Michigan, Ann Arbor*, **Scott A. Wolpert**, *University of Maryland, College Park, MD*, and **Shing-Tung Yau**, *Harvard University, Cambridge, MA*, Editors

The editors of the highly esteemed *Journal of Differential Geometry* (published by International Press) each year present a new volume of Surveys in Differential Geometry, a collection of original contributions upon a specially chosen topic pertaining to differential geometry and related topics. The series presents an overview of recent trends, while making predictions and suggestions for future research.

Each invited contributor is a prominent specialist in the field of algebraic geometry, mathematical physics, or related areas. Contributors to Surveys tend to transcend classical frameworks within their field.

Once every three years, Lehigh University and Harvard University, in conjunction with the editors of the JDG, sponsor a conference whose purpose is to survey the general field of differential geometry and related subjects. Speakers at the conference are likewise selected for their prominence in a given field and for their innovative contributions to it. Hence every third volume of Surveys is a publication of those presented talks.

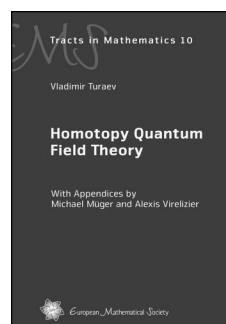
The Surveys in Differential Geometry series is a beneficial collection for experts and non-experts alike, and in particular, for those independent of the mainstream of activity in the field of geometry.

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

A publication of International Press. Distributed worldwide by the American Mathematical Society.

Contents: **E. Arbarello** and **M. Cornalba**, Divisors in the moduli spaces of curves; **R. L. Cohen**, Stability phenomena in the topology of moduli spaces; **G. Farkas**, Birational aspects of the geometry of M_g ; **S. Grushevsky** and **I. Krichever**, The universal Whitham hierarchy and the geometry of the moduli space of pointed Riemann surfaces; **J. Harris**, Brill-Noether theory; **P. Hubert**, **E. Lanneau**, and **M. Möller**, $GL^+_2(\mathbb{R})$ -orbit closures via topological splittings; **J. Jost** and **S. T. Yau**, Harmonic mappings and moduli spaces of Riemann surfaces; **Y.-P. Lee** and **R. Vakil**, Algebraic structures on the topology of moduli spaces of curves and maps; **K. Liu**, **X. Sun**, and **S.-T. Yau**, Recent development on the geometry of the Teichmüller and moduli spaces of Riemann surfaces; **V. Marković** and **D. Šarić**, The universal properties of Teichmüller spaces; **H. Masur**, Geometry of Teichmüller space with the Teichmüller metric; **I. Morrison**, GIT constructions of moduli spaces of stable curves and maps; **Y. Ruan**, Riemann surfaces, integrable hierarchies, and singularity theory. **International Press**

April 2010, 407 pages, Hardcover, ISBN: 978-1-57146-140-7, 2000 *Mathematics Subject Classification*: 53-XX, 14H10, 14H15, 14H45, 32G15, 53C43, 53C56, 58D27, **AMS members US\$68**, List US\$85, Order code INPR/89



Homotopy Quantum Field Theory

Vladimir Turaev, *Indiana University, Bloomington* with Appendices by **Michael Müger** and **Alexis Virelizier**

Homotopy Quantum Field Theory (HQFT) is a branch of Topological Quantum Field Theory founded by E. Witten and M. Atiyah.

It applies ideas from theoretical physics to study principal bundles over manifolds and, more generally, homotopy classes of maps from manifolds to a fixed target space.

This book is the first systematic exposition of Homotopy Quantum Field Theory. It starts with a formal definition of an HQFT and provides examples of HQFTs in all dimensions. The main body of the text is focused on 2-dimensional and 3-dimensional HQFTs. A study of these HQFTs leads to new algebraic objects: crossed Frobenius group-algebras, crossed ribbon group-categories, and Hopf group-coalgebras. These notions and their connections with HQFTs are discussed in detail.

The text ends with several appendices including an outline of recent developments and a list of open problems. Three appendices by M. Mürger and A. Virelizier summarize their work in this area.

The book is addressed to mathematicians, theoretical physicists, and graduate students interested in topological aspects of quantum field theory. The exposition is self-contained and well suited for a one-semester graduate course. Prerequisites include only basics of algebra and topology.

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

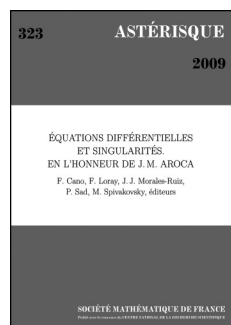
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: Generalities on HQFTs; Group-algebras; Two-dimensional HQFTs; Biangular algebras and lattice HQFTs; Enumeration problems in dimension two; Crossed G -categories and invariants of links; Modular G -categories and HQFTs; Miscellaneous algebra; Appendix 1. Relative HQFTs; Appendix 2. State sum invariants of 3-dimensional G -manifolds; Appendix 3. Recent work on HQFTs; Appendix 4. Open problems; Appendix 5. On the structure of braided crossed G -categories; Appendix 6. Algebraic properties of Hopf G -coalgebras; Appendix 7. Invariants of 3-dimensional G -manifolds from Hopf coalgebras; Bibliography; Index.

EMS Tracts in Mathematics, Volume 10

May 2010, 290 pages, Hardcover, ISBN: 978-3-03719-086-9, 2000 *Mathematics Subject Classification*: 57-02, 81-02, 16-02, 18-02, 57M27, **AMS members US\$62.40**, List US\$78, Order code EMSTM/10

Logic and Foundations



Équations Différentielles et Singularités

En l'honneur de J. M. Aroca

Felipe Cano, *Universidad de Valladolid, Spain*, **Frank Loray**, *Université de Rennes, France*, **Juan José Morales-Ruiz**, *University of Catalunya, Barcelona, Spain*, **Paulo Sad**, *Institute for Pure and Applied Mathematics, Rio de Janeiro, Brazil*, and **Mark Spivakovsky**, *Université de Toulouse, France*, Editors

This volume contains 23 papers about "Differential Equations and Singularities" written on the occasion of the congress in honour of J.M. Aroca, which took place at the University of Valladolid on September 4–8, 2006.

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

A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico.

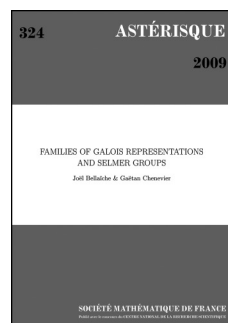
Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: F. A. Cuesta, A. L. Rojo, and M. M. Stadler, Dynamique transverse de la lamination de Ghys-Kenyon; C. Beddani, Comparaison des valuations divisorielles; F. E. Brochero Martínez and L. López-Hernanz, Gevrey class of the infinitesimal generator of a diffeomorphism; C. Camacho and L. H. de Figueiredo, On the limit of families of algebraic subvarieties with unbounded volume; J. Cano and P. F. Ayuso, The space of generalized formal power series solution of an ordinary differential equation; G. Casale, Une preuve galoisienne de l'irréductibilité au sens de Nishioka-Umemura de la première équation de Painlevé; D. Cerveau, Feuilletages en droites, équations des eikonales et autres équations différentielles; M. Chaperon and S. L. de Medrano, Some regularities and singularities appearing in the study of polynomials and operators; N. Corral, Polar pencil of curves and foliations; A. L. Neto, Homogeneous commuting vector fields on \mathbb{C}^2 ; J.-M. Lion and P. Speissegger, Un théorème de type Haefliger définissable; F. Loray and D. M. Pérez, Projective structures and projective bundles over compact Riemann surfaces; R. Moussu and J.-P. Rolin, Une preuve combinatoire du théorème de Frobenius; P. Fernández-Sánchez and J. Mozo-Fernández, On generalized surfaces in $(\mathbb{C}^3, 0)$; E. Paul, The Galoisian envelope of a germ of foliation: the quasi-homogeneous case; J. V. Pereira and P. Sad, Rigidity of fibrations; J.-P. Ramis and J. Sauloy, The q -analogue of the wild fundamental group (II); J. Ribón, Unfoldings of tangent to the identity diffeomorphisms; G. Rond, Séries de Poincaré motiviques d'un germe d'hypersurface irréductible quasi-ordinaire; J. Sauloy, Équations aux q -différences et fibrés vectoriels holomorphes sur la courbe elliptique $\mathbb{C}^*/q^{\mathbb{Z}}$; M. G. Soares, Singularities of logarithmic foliations and connectedness of the union of logarithmic components; H. Umemura, On the definition of the Galois groupoid; J. van der Hoeven, Transserial Hardy fields.

Astérisque, Number 323

April 2010, 487 pages, Softcover, ISBN: 978-2-85629-263-1, 2000 *Mathematics Subject Classification*: 03C99, 11S40, 12-XX, 12H05, 13F30, 13G05, 14B05, 14E05, 14J17, 14P10, 14P15, 15A18, 32A05, 32G34, 32H02, 32H50, 32S05, 32S25, 32S65, 34M35, 34M40, 34M55, 34Mxx, 37A20, 37C10, 37C85, 37F75, 37F99, 39A13, 46Bxx, 47-XX, 53C10, 58A10, 58A17, 58A30, 58H05, 58K05, 58K20, 58K50, **Individual member US\$121.50**, List US\$135, Order code AST/323

Number Theory



Families of Galois Representations and Selmer Groups

Joël Bellaïche, *Columbia University, New York, NY*, and **Gaëtan Chenevier**, *Université Paris 13, Villetaneuse, France*

This book presents an in-depth study of the families of Galois representations carried by the p -adic eigenvarieties attached to unitary groups. The study encompasses some general algebraic aspects (properties of the space of representations of a group in the neighborhood of a

point, reducibility loci, pseudocharacters), and other aspects more specific to Galois groups of local or number fields. In particular, the authors define and study certain deformation functors of crystalline representations of the absolute Galois group of \mathbb{Q}_p , namely *trianguline deformations*, which are naturally associated to the families above.

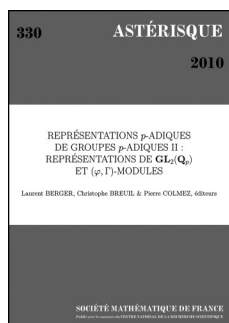
As an application, the authors show how the geometry of these eigenvarieties at “classical” points is related to the dimension of certain Selmer groups. This, combined with conjectures of Langlands and Arthur on the discrete automorphic spectrum of unitary groups, allows the authors to prove, among other things, new cases of the Bloch–Kato conjectures (in any dimension).

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; Pseudocharacters, representations and extensions; Trianguline deformations of refined crystalline representations; Generalization of a result of Kisin on crystalline periods; Rigid analytic families of refined p -adic representations; Selmer groups and a conjecture of Bloch–Kato; Automorphic forms on definite unitary groups: results and conjectures; Eigenvarieties of definite unitary groups; The sign conjecture; The geometry of the eigenvariety at some Arthur points and higher rank Selmer groups; Appendix: Arthur’s conjectures; Bibliography; Index of notations.

Astérisque, Number 324

April 2010, 314 pages, Softcover, ISBN: 978-2-85629-264-8, 2000 *Mathematics Subject Classification*: 11F80, 14D15, 11G40, 20G05; 14G22, 11S25, 11F70, 11R39, 11F55, 20C15, 15A24, 11F33, 11F85, 14F30, 14B12, **Individual member US\$94.50**, List US\$105, Order code AST/324



Représentations p -adiques de Groupes p -adiques II

Représentations de $GL_2(\mathbb{Q}_p)$ et (φ, Γ) -Modules

Laurent Berger, *Université de Lyon, France*, **Christophe Breuil**, *CNRS & IHES, Bures-sur-Yvette, France*, and **Pierre Colmez**, *CNRS, Paris, France*, Editors

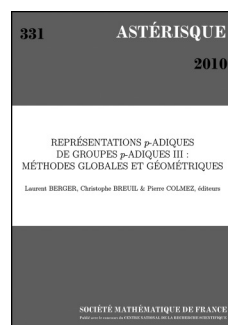
This second volume is devoted to applications of Fontaine’s theory of (φ, Γ) -modules to that of p -adic unitary representations of $GL_2(\mathbb{Q}_p)$, whose aim is to construct a $(p$ -adic local Langlands) correspondence between these representations and 2-dimensional p -adic representations of the absolute Galois group of \mathbb{Q}_p . In this volume the reader will find an overview of classical p -adic functional analysis, diverse features of the unitary principal series of $GL_2(\mathbb{Q}_p)$, and the construction of functors building bridges between the world of Galois representations and that of representations of $GL_2(\mathbb{Q}_p)$ and its mirabolic subgroup.

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.-F. Vigneras**, Banach ℓ -adic representations of p -adic groups; **P. Colmez**, Fonctions d’une variable p -adique; **P. Colmez**, (φ, Γ) -modules et représentations du mirabolique de $GL_2(\mathbb{Q}_p)$; **L. Berger** and **C. Breuil**, Sur quelques représentations potentiellement cristallines de $GL_2(\mathbb{Q}_p)$; **P. Colmez**, La série principale unitaire de $GL_2(\mathbb{Q}_p)$; **L. Berger**, Représentations modulaires de $GL_2(\mathbb{Q}_p)$ et représentations galoisiennes de dimension 2; **P. Colmez**, Représentations de $GL_2(\mathbb{Q}_p)$ et (φ, Γ) -modules; **M. Kisin**, Deformations of $G_{\mathbb{Q}_p}$ and $GL_2(\mathbb{Q}_p)$ representations; **G. Böckle**, Deformation rings for some mod 3 Galois representations of the absolute Galois group of \mathbb{Q}_3 ; **F. Andreatta** and **A. Iovita**, Erratum to the article: Global applications to relative (φ, Γ) -modules, I.

Astérisque, Number 330

May 2010, 554 pages, Softcover, ISBN: 978-2-85629-281-5, 2000 *Mathematics Subject Classification*: 11Fxx, 11Sxx, **Individual member US\$94.50**, List US\$105, Order code AST/330



Représentations p -adiques de Groupes p -adiques III

Méthodes Globales et Géométriques

Laurent Berger, *Université de Lyon, France*, **Christophe Breuil**, *CNRS & IHES, Bures-sur-Yvette, France*, and **Pierre Colmez**, *CNRS, Paris, France*, Editors

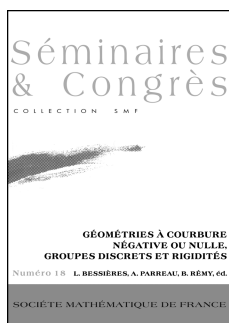
In this last volume on the local p -adic correspondence for $GL_2(\mathbb{Q}_p)$, the editors have gathered papers which, mostly, do not use directly the (φ, Γ) -module theory. The methods and results are often geometric (p -adic comparison theorems, de Rham cohomology of the Drinfeld half-plane), or global (local-global compatibility with étale completed cohomology). There are also papers on p -adic Hodge theory and the \mathcal{L} -invariant and important local results on extensions between certain representations of $GL_2(\mathbb{Q}_p)$.

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: **G. Stevens**, Goleman’s \mathcal{L} -invariant and families of modular forms; **P. Colmez**, Invariants \mathcal{L} et dérivées de valeurs propres de Frobenius; **M. Bertolini**, **H. Darmon**, and **A. Iovita**, Families of automorphic forms on definite quaternion algebras and Teitelbaum’s conjecture; **C. Breuil**, Série spéciale p -adique et cohomologie étale complétée; **C. Breuil** and **A. Mézard**, Représentations semi-stables de $GL_2(\mathbb{Q}_p)$, demi-plan p -adique et réduction modulo p ; **R. Coleman** and **A. Iovita**, Hidden structures on semistable curves; **C. Breuil** and **M. Emerton**, Représentations p -adiques ordinaires de $GL_2(\mathbb{Q}_p)$ et compatibilité local-global; **V. Paškūnas**, Extensions for supersingular representations of $GL_2(\mathbb{Q}_p)$; **M. Emerton**, Ordinary parts of admissible representations of p -adic reductive groups I. Definition and first properties; **M. Emerton**, Ordinary parts of admissible representations of p -adic reductive groups II. Derived functors; **M. Emerton** and **V. Paškūnas**, On the effaceability of certain δ -functors.

Astérisque, Number 331

May 2010, 469 pages, Softcover, ISBN: 978-2-85629-282-2, 2000 *Mathematics Subject Classification*: 11Fxx, 11Sxx, **Individual member US\$81**, List US\$90, Order code AST/331



Géométries à Courbure Négative ou Nulle, Groupes Discrets et Rigidités

Laurent Bessières and **Anne Parreau**, *Université de Grenoble I, St. Martin d'Heres, France*, and **Bertrand Rémy**, *Université Claude Bernard Lyon 1, Villeurbanne, France*, Editors

This volume gathers lecture notes taken at the 2004 Summer School, which was held at the Institut Fourier (Grenoble). The title of the Summer School ("Negative or zero-curvature geometries, discrete groups and rigidities") has been used for the present volume. In many cases the lecture notes have been rewritten and enhanced.

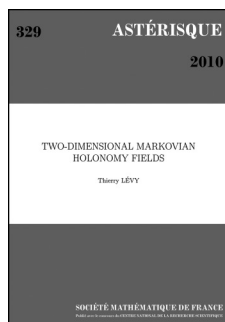
A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: 1. *Quelques groupes et géométries:* **J. Maubon**, Symmetric spaces of the non-compact type: Differential geometry; **P.-É. Paradan**, Symmetric spaces of the non-compact type: Lie groups; **G. Rousseau**, Euclidean buildings; **Y. Benoist**, Five lectures on lattices in semisimple Lie groups; 2. *Quelques rigidités en géométrie différentielle:* **G. Besson**, Calabi-Weil infinitesimal rigidity; **M. Bourdon**, Quasi-conformal geometry and Mostow rigidity; **L. Bessières**, Minimal volume; **M. Burger** and **A. Iozzi**, A useful formula from bounded cohomology; 3. *Espaces métriques singuliers:* **G. Courtois**, Critical exponents and rigidity in negative curvature; **C. Druţu**, Quasi-isometry rigidity of groups; **P. Pansu**, Superrigidity géométrique et applications harmoniques; 4. *Déformations, espaces de modules et compactifications:* **F. Paulin**, Sur la compactification de Thurston de l'espace de Teichmüller; **A. Beauville**, Moduli of cubic surfaces and Hodge theory.

Séminaires et Congrès, Number 18

April 2010, 466 pages, Softcover, ISBN: 978-2-85629-240-2, 2000 *Mathematics Subject Classification*: 11F06, 11F75, 14J10, 20E42, 20F55, 20F65, 20F67, 20F69, 20H10, 22E15, 22E40, 22E46, 22Exx, 22-XX, 30C65, 30F60, 32G20, 43A85, 51E24, 53C20, 53C21, 53C23, 53C24, 53C35, 53C43, 57M50, 57R55, 57S20, 57S25, 57S30, 57Txx, 58E20, 58E40, **Individual member US\$118.80**, List US\$132, Order code SECO/18

Probability



Two-Dimensional Markovian Holonomy Fields

Thierry Lévy, *CNRS, École Normale Supérieure, Paris, France*

This text defines and studies a class of stochastic processes indexed by curves drawn on a compact surface and taking

their values in a compact Lie group. The author calls these processes two-dimensional Markovian holonomy fields. The prototype of these processes, and the only one to have been constructed before the present work, is the canonical process under the Yang-Mills measure, first defined by Ambar Sengupta and later by the author. The Yang-Mills measure sits in the class of Markovian holonomy fields very much like the Brownian motion in the class of Lévy processes.

The author proves that every regular Markovian holonomy field determines a Lévy process of a certain class on the Lie group in which it takes its values, and he constructs, for each Lévy process in this class, a Markovian holonomy field to which it is associated. When the Lie group is in fact a finite group, the author gives an alternative construction of this Markovian holonomy field as the monodromy of a random ramified principal bundle. Heuristically, this agrees with the physical origin of the Yang-Mills measure as the holonomy of a random connection on a principal bundle.

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; Surfaces and graphs; Multiplicative processes indexed by paths; Markovian holonomy fields; Lévy processes and Markovian holonomy fields; Random ramified coverings; Index; Bibliography.

Astérisque, Number 329

May 2010, 172 pages, Softcover, ISBN: 978-2-85629-283-9, 2000 *Mathematics Subject Classification*: 60G60, 60J99, 60G51, 60B15, 57M20, 57M12, 81T13, 81T27, **Individual member US\$46.80**, List US\$52, Order code AST/329