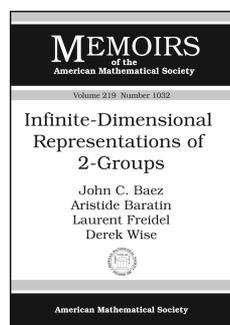


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Algebra and Algebraic Geometry



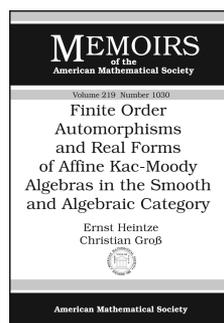
Infinite-Dimensional Representations of 2-Groups

John C. Baez, *University of California, Riverside, CA*, **Aristide Baratin**, *Max Planck Institute for Gravitational Physics, Golm, Germany*, **Laurent Freidel**, *Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada*, and **Derek Wise**, *University of Erlangen-Nurnberg, Erlagen, Germany*

Contents: Introduction; Representations of 2-groups; Measurable categories; Representations on measurable categories; Conclusion; Appendix A. Tools from measure theory; Bibliography.

Memoirs of the American Mathematical Society, Volume 219, Number 1032

August 2012, 120 pages, Softcover, ISBN: 978-0-8218-7284-0, 2010 *Mathematics Subject Classification*: 20C35; 18D05, 22A22, **Individual member US\$42.60**, List US\$71, Institutional member US\$56.80, Order code MEMO/219/1032



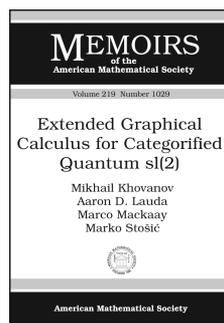
Finite Order Automorphisms and Real Forms of Affine Kac-Moody Algebras in the Smooth and Algebraic Category

Ernst Heintze and **Christian Groß**, *Universität Augsburg, Germany*

Contents: Introduction; Isomorphisms between smooth loop algebras; Isomorphisms of smooth affine Kac-Moody algebras; Automorphisms of the *first* kind of finite order; Automorphisms of the *second* kind of finite order; Involutions; Real forms; The algebraic case; Appendix A. $\pi_0((\text{Aut } \mathfrak{g})^\ell)$ and representatives of its conjugacy classes; Appendix B. Conjugate linear automorphisms of \mathfrak{g} ; Appendix C. Curves of automorphisms of finite order; Bibliography.

Memoirs of the American Mathematical Society, Volume 219, Number 1030

August 2012, 66 pages, Softcover, ISBN: 978-0-8218-6918-5, LC 2012015560, 2010 *Mathematics Subject Classification*: 17B67, 17B40, 53C35, **Individual member US\$34.80**, List US\$58, Institutional member US\$46.40, Order code MEMO/219/1030



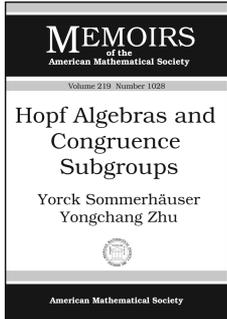
Extended Graphical Calculus for Categorified Quantum $\mathfrak{sl}(2)$

Mikhail Khovanov, *Columbia University, New York, NY*, **Aaron D. Lauda**, *University of Southern California, Los Angeles, CA*, **Marco Mackaay**, *Universidade do Algarve, Faro, Portugal*, and **Marko Stošić**, *Instituto Superior Tecnico, Lisboa, Portugal*

Contents: Introduction; Thick calculus for the nilHecke ring; Brief review of calculus for categorified $\mathfrak{sl}(2)$; Thick calculus and \mathcal{U} ; Decompositions of functors and other applications; Bibliography.

Memoirs of the American Mathematical Society, Volume 219, Number 1029

August 2012, 87 pages, Softcover, ISBN: 978-0-8218-8977-0, LC 2012015558, 2010 *Mathematics Subject Classification*: 81R50; 18D05, 05E05, **Individual member US\$40.20**, List US\$67, Institutional member US\$53.60, Order code MEMO/219/1029



Hopf Algebras and Congruence Subgroups

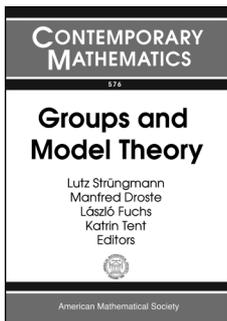
Yorck Sommerhäuser, *University of South Alabama, Mobile, AL*, and **Yongchang Zhu**, *Hong Kong University of Science & Technology, Kowloon, Hong Kong*

Contents: Introduction; The modular group; Quasitriangular Hopf algebras;

Factorizable Hopf algebras; The action of the modular group; The semisimple case; The case of the Drinfel'd double; Induced modules; Equivariant Frobenius-Schur indicators; Two congruence subgroup theorems; The action of the Galois group; Galois groups and indicators; Galois groups and congruence subgroups; Notes; Bibliography; Subject index; Symbol index.

Memoirs of the American Mathematical Society, Volume 219, Number 1028

August 2012, 134 pages, Softcover, ISBN: 978-0-8218-6913-0, LC 2012015550, 2010 *Mathematics Subject Classification*: 16T05; 17B37, **Individual member US\$43.20**, List US\$72, Institutional member US\$57.60, Order code MEMO/219/1028



Groups and Model Theory

Lutz Strüingmann, *University of Duisburg-Essen, Germany*, **Manfred Droste**, *University of Leipzig, Germany*, **László Fuchs**, *Tulane University, New Orleans, LA*, and **Katrin Tent**, *University of Münster, Germany*, Editors

This book contains the proceedings of the conference "Groups and Model Theory", held May 30–June 3, 2011, in Ruhr, Germany, in honor of Rüdiger Göbel's 70th birthday.

In the last thirty years, group theory has received new input through the application of methods from logic to problems in algebra. In particular, model theory has strongly influenced both commutative and non-commutative group theory. This led to striking new developments in group theory and has had an interesting impact back on model theory. This interplay has been revisited by algebraists and model theorists and is showing strong and promising roads for future research.

This book presents important current research at the border of model theory and group theory by renowned researchers. Articles in this volume cover abelian groups, modules over commutative rings, permutation groups, automorphism groups of homogeneous structures such as graphs, relational structures, geometries,

topological spaces or groups, consequences of model theoretic properties like stability or categoricity, subgroups of small index, the automorphism tower problem, as well as random constructions.

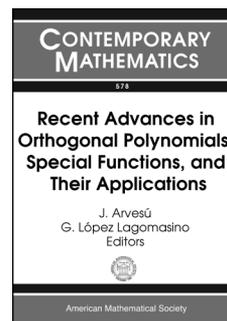
This item will also be of interest to those working in logic and foundations.

Contents: U. Albrecht, S. Breaz, and P. Schultz, Functorial properties of Hom and Ext; G. Braun and S. Pokutta, Rigid abelian groups and the probabilistic method; P. Danchev and B. Goldsmith, On projection-invariant subgroups of abelian p -groups; G. D'Este, Looking for indecomposable right bounded complexes; C. De Vivo and C. Metelli, Butler's theorem revisited; M. Flagg, The role of the Jacobson radical in isomorphism theorems; A. Fornasiero and I. Halupczok, Dimension in topological structures: Topological closure and local property; L. Fuchs, On kernel modules of cotorsion pairs; R. Göbel and S. Pokutta, Absolutely rigid fields and Shelah's absolutely rigid trees; B. Goldsmith and K. Gong, A note on Hopfian and co-Hopfian abelian groups; D. Herden, Upper cardinal bounds for absolute structures; C. Jacoby, Undefinability of local Warfield groups in $L_{\infty\omega}$; C. Jacoby, K. Leistner, P. Loth, and L. Strüingmann, Abelian groups with partial decomposition bases in $L_{\infty\omega}^{\delta}$, Part I; C. Jacoby and P. Loth, Abelian groups with partial decomposition bases in $L_{\infty\omega}^{\delta}$, Part II; I. Kaplan and S. Shelah, Automorphism towers and automorphism groups of fields without choice; P. W. Keef, On subgroups of totally projective primary abelian groups and direct sums of cyclic groups; D. C. Lockett and J. K. Truss, Generic endomorphisms of homogeneous structures; P. Lücke, Special pairs and automorphisms of centreless groups; D. Macpherson and K. Tent, Pseudofinite groups with NIP theory and definability in finite simple groups; O. Mutzbauer and E. Solak, (1,2)-groups for a regulator quotient of exponent p^4 ; J. D. Reid, On the macro structure of torsion free groups; L. Salce, Some results on the algebraic entropy; S. Shelah, Modules and infinitary logics.

Contemporary Mathematics, Volume 576

September 2012, 314 pages, Softcover, ISBN: 978-0-8218-6923-9, LC 2012012699, 2010 *Mathematics Subject Classification*: 20A15, 20F50, 20F10, 20F28, 20P05, 20K10, 20K20, 03C64, 03C98, 16D10, **AMS members US\$86.40**, List US\$108, Order code CONM/576

Analysis



Recent Advances in Orthogonal Polynomials, Special Functions, and Their Applications

J. Arvesú and **G. López Lagomasino**, *Universidad Carlos III de Madrid, Leganés, Spain*, Editors

This volume contains the proceedings of the 11th International Symposium on Orthogonal Polynomials, Special Functions, and Their Applications, held August 29–September 2, 2011, at the Universidad Carlos III de Madrid in Leganés, Spain.

The papers cover asymptotic properties of polynomials on curves of the complex plane, universality behavior of sequences of orthogonal polynomials for large classes of measures and its application in random matrix theory, the Riemann–Hilbert approach in the study of

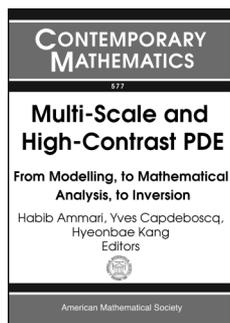
Padé approximation and asymptotics of orthogonal polynomials, quantum walks and CMV matrices, spectral modifications of linear functionals and their effect on the associated orthogonal polynomials, bivariate orthogonal polynomials, and optimal Riesz and logarithmic energy distribution of points. The methods used include potential theory, boundary values of analytic functions, Riemann–Hilbert analysis, and the steepest descent method.

Contents: M. Alfaro and W. Van Assche, Life and work (so far) of Paco Marcellán; A. I. Aptekarev, J. S. Dehesa, P. Sánchez-Moreno, and D. N. Tulyakov, Asymptotics of L_p -norms of Hermite polynomials and Rényi entropy of Rydberg oscillator states; J. S. Brauchart, D. P. Hardin, and E. B. Saff, The next-order term for optimal Riesz and logarithmic energy asymptotics on the sphere; M. J. Cantero, L. Moral, and L. Velázquez, Spectral transformations of hermitian linear functionals; T. Claeys and S. Olver, Numerical study of higher order analogues of the Tracy–Widom distribution; A. Eremenko and P. Yuditskii, Comb functions; J. S. Geronimo, P. Iliev, and G. Knese, Orthogonality relations for bivariate Bernstein-Szegő measures; F. A. Grünbaum, Quantum walks and CMV matrices; D. S. Lubinsky, Discrete beta ensembles based on Gauss type quadratures; A. Martínez-Finkelshtein, E. A. Rakhmanov, and S. P. Suetin, Heine, Hilbert, Padé, Riemann, and Stieltjes: John Nuttall’s work 25 years later; E. A. Rakhmanov, Orthogonal polynomials and S -curves; V. Totik, Fast decreasing and orthogonal polynomials.

Contemporary Mathematics, Volume 578

October 2012, approximately 254 pages, Softcover, ISBN: 978-0-8218-6896-6, 2010 *Mathematics Subject Classification*: 30E05, 30E10, 30E15, 33-XX, 42C05, 42C10, 41A20, 41A21, 41A25, 41A30, **AMS members US\$68.80**, List US\$86, Order code CONM/578

Applications



Multi-Scale and High-Contrast PDE

From Modelling, to Mathematical Analysis, to Inversion

Habib Ammari, *Ecole Normale Supérieure, Paris, France*, Yves Capdeboscq, *Mathematical Institute, Oxford, United Kingdom*, and Hyeonbae Kang, *Inha University, Incheon, Korea*, Editors

This volume contains the proceedings of the conference “Multi-Scale and High-Contrast PDE: From Modelling, to Mathematical Analysis, to Inversion”, held June 28–July 1, 2011, at the University of Oxford.

The mathematical analysis of PDE modelling materials, or tissues, presenting multiple scales has been an active area of research for more than 40 years. The study of the corresponding imaging, or reconstruction, problem is a more recent one. If the material parameters of the PDE present high contrast ratio, then the solution to the PDE becomes particularly challenging to analyze, or compute. Similar difficulties occur in time dependent equations in high frequency regimes. Over the last decade the analysis of the inversion problem at moderate frequencies, the rigorous derivation of

asymptotics at high frequencies, and the regularity properties of solutions of elliptic PDE in highly heterogeneous media have received a lot of attention.

The focus of this volume is on recent progress towards a complete understanding of the direct problem with high contrast or high frequencies, and unified approaches to the inverse and imaging problems for both small and large contrast or frequencies. The volume also includes contributions on the inverse problem, both on its analysis and on numerical reconstructions. It offers the reader a good overview of current research and direction for further pursuit on multiscale problems, both in PDE and in signal processing, and in the analysis of the equations or the computation of their solutions. Special attention is devoted to new models and problems coming from physics leading to innovative imaging methods.

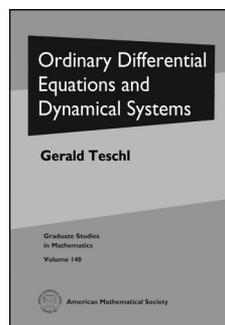
This item will also be of interest to those working in differential equations.

Contents: H. Ammari, J. Garnier, V. Jugnon, H. Kang, H. Lee, and M. Lim, Enhancement of near-cloaking. Part III: Numerical simulations, statistical stability, and related questions; O. D. Lavrentovich, Looking at the world through liquid crystal glasses; E. Zuazua, A remark on the observability of conservative linear systems; Y. Capdeboscq, G. Leadbetter, and A. Parker, On the scattered field generated by a ball inhomogeneity of constant index in dimension three; E. Bonnetier and F. Triki, Pointwise bounds on the gradient and the spectrum of the Neumann-Poincaré operator: The case of 2 discs; B. Düring and C.-B. Schönlieb, A high-contrast fourth-order PDE from imaging: numerical solution by ADI splitting; M. de Hoop, E. Fedrizzi, J. Garnier, and K. Sølna, Imaging with noise blending; G. Bal and O. Pinaud, Correlations of heterogeneous wave fields propagating in homogeneous media.

Contemporary Mathematics, Volume 577

October 2012, 144 pages, Softcover, ISBN: 978-0-8218-6929-1, LC 2012013127, 2010 *Mathematics Subject Classification*: 35B30, 35J05, 35J25, 35K35, 35R30, 65M06, 76A15, 35L05, 93B05, **AMS members US\$49.60**, List US\$62, Order code CONM/577

Differential Equations



Ordinary Differential Equations and Dynamical Systems

Gerald Teschl, *University of Vienna, Austria*

This book provides a self-contained introduction to ordinary differential equations and dynamical systems suitable for beginning graduate students.

The first part begins with some simple examples of explicitly solvable equations and a first glance at qualitative methods. Then the fundamental results concerning the initial value problem are proved: existence, uniqueness, extensibility, dependence on initial conditions. Furthermore, linear equations are considered, including the Floquet theorem, and some perturbation results. As somewhat independent topics, the Frobenius method for linear equations in the complex domain is established and Sturm–Liouville boundary value problems, including oscillation theory, are investigated.

The second part introduces the concept of a dynamical system. The Poincaré–Bendixson theorem is proved, and several examples of planar systems from classical mechanics, ecology, and electrical engineering are investigated. Moreover, attractors, Hamiltonian systems, the KAM theorem, and periodic solutions are discussed. Finally, stability is studied, including the stable manifold and the Hartman–Grobman theorem for both continuous and discrete systems.

The third part introduces chaos, beginning with the basics for iterated interval maps and ending with the Smale–Birkhoff theorem and the Melnikov method for homoclinic orbits.

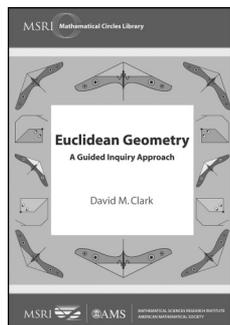
The text contains almost three hundred exercises. Additionally, the use of mathematical software systems is incorporated throughout, showing how they can help in the study of differential equations.

Contents: *Part 1. Classical theory:* Introduction; Initial value problems; Linear equations; Differential equations in the complex domain; Boundary value problems; *Part 2. Dynamical systems:* Dynamical systems; Planar dynamical systems; Higher dimensional dynamical systems; Local behavior near fixed points; *Part 3. Chaos:* Discrete dynamical systems; Discrete dynamical systems in one dimension; Periodic solutions; Chaos in higher dimensional systems; Bibliographical notes; Bibliography; Glossary of notation; Index.

Graduate Studies in Mathematics, Volume 140

September 2012, approximately 356 pages, Hardcover, ISBN: 978-0-8218-8328-0, 2010 *Mathematics Subject Classification:* 34-01, 37-01, **AMS members US\$51.20**, List US\$64, Order code GSM/140

Geometry and Topology



Euclidean Geometry A Guided Inquiry Approach

David M. Clark, *State University of New York, New Paltz, NY*

Geometry has been an essential element in the study of mathematics since antiquity. Traditionally, we have also learned formal reasoning by studying Euclidean geometry. In this book, David Clark develops a modern axiomatic approach to this ancient subject,

both in content and presentation.

Mathematically, Clark has chosen a new set of axioms that draw on a modern understanding of set theory and logic, the real number continuum and measure theory, none of which were available in Euclid's time. The result is a development of the standard content of Euclidean geometry with the mathematical precision of Hilbert's foundations of geometry. In particular, the book covers all the topics listed in the Common Core State Standards for high school synthetic geometry.

The presentation uses a guided inquiry, active learning pedagogy. Students benefit from the axiomatic development because they themselves solve the problems and prove the theorems with the instructor serving as a guide and mentor. Students are thereby empowered with the knowledge that they can solve problems on their own without reference to authority.

This book, written for an undergraduate axiomatic geometry course, is particularly well suited for future secondary school teachers.

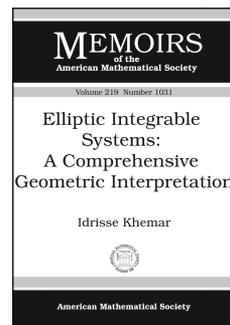
In the interest of fostering a greater awareness and appreciation of mathematics and its connections to other disciplines and everyday life, MSRI and the AMS are publishing books in the Mathematical Circles Library series as a service to young people, their parents and teachers, and the mathematics profession.

Titles in this series are co-published with the Mathematical Sciences Research Institute (MSRI).

Contents: Congruent figures; Axioms, theorems and proofs; Area measure; Angle measure; Similar figures; Trigonometric ratios; Circle measure; Perspective geometry; The axioms; Guidelines for the instructor; Hilbert's axioms; Bibliography; Index.

MSRI Mathematical Circles Library, Volume 9

August 2012, approximately 145 pages, Softcover, ISBN: 978-0-8218-8985-5, 2010 *Mathematics Subject Classification:* 97G40; 97A30, 97D40, 97G30, 97G50, **AMS members US\$31.20**, List US\$39, Order code MCL/9



Elliptic Integrable Systems: A Comprehensive Geometric Interpretation

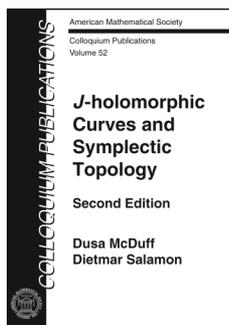
Idriss Khemar, *Université Henri Poincaré, Vandoeuvre-lès-Nancy, France*

Contents: Introduction; Notation, conventions and general definitions;

Invariant connections on reductive homogeneous spaces; m -th elliptic integrable system associated to a k' -symmetric space; Finite order isometries and twistor spaces; Vertically harmonic maps and harmonic sections of submersions; Generalized harmonic maps; Generalized harmonic maps into f -manifolds; Generalized harmonic maps into reductive homogeneous spaces; Appendix; Bibliography; Index; List of symbols.

Memoirs of the American Mathematical Society, Volume 219, Number 1031

August 2012, 215 pages, Softcover, ISBN: 978-0-8218-6925-3, 2010 *Mathematics Subject Classification:* 53B20, 53B35; 53B50, **Individual member US\$52.80**, List US\$88, Institutional member US\$70.40, Order code MEMO/219/1031



J-holomorphic Curves and Symplectic Topology

Second Edition

Dusa McDuff, *Barnard College, Columbia University, New York, NY*, and **Dietmar Salamon**, *ETH, Zurich, Switzerland*

The theory of J -holomorphic curves has been of great importance since its introduction by Gromov in 1985. In mathematics, its applications include many key results in symplectic topology. It was also one of the main inspirations for the creation of Floer homology. In mathematical physics, it provides a natural context in which to define Gromov–Witten invariants and quantum cohomology, two important ingredients of the mirror symmetry conjecture.

The main goal of this book is to establish the fundamental theorems of the subject in full and rigorous detail. In particular, the book contains complete proofs of Gromov’s compactness theorem for spheres, of the gluing theorem for spheres, and of the associativity of quantum multiplication in the semipositive case. The book can also serve as an introduction to current work in symplectic topology: there are two long chapters on applications, one concentrating on classical results in symplectic topology and the other concerned with quantum cohomology. The last chapter sketches some recent developments in Floer theory. The five appendices of the book provide necessary background related to the classical theory of linear elliptic operators, Fredholm theory, Sobolev spaces, as well as a discussion of the moduli space of genus zero stable curves and a proof of the positivity of intersections of J -holomorphic curves in four-dimensional manifolds. The second edition clarifies various arguments, corrects several mistakes in the first edition, includes some additional results in Chapter 10 and Appendices C and D, and updates the references to recent developments.

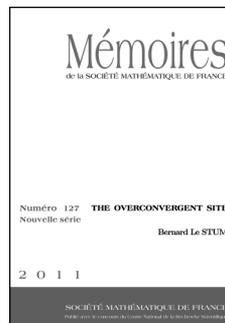
Contents: Introduction; J -holomorphic curves; Moduli spaces and transversality; Compactness; Stable maps; Moduli spaces of stable maps; Gromov–Witten invariants; Hamiltonian perturbations; Applications in symplectic topology; Gluing; Quantum cohomology; Floer homology; Fredholm theory; Elliptic regularity; The Riemann–Roch theorem; Stable curves of genus zero; Singularities and intersections; Bibliography; List of symbols; Index.

Colloquium Publications, Volume 52

August 2012, approximately 730 pages, Hardcover, ISBN: 978-0-8218-8746-2, LC 2012016161, 2010 *Mathematics Subject Classification*: 53D05, 53D45, 53D35, 57R17, 37J05, 32Q65; 53D12, 53D40, 58J05, 14N35, **AMS members US\$87.20**, List US\$109, Order code COLL/52.R

New AMS-Distributed Publications

Algebra and Algebraic Geometry



The Overconvergent Site

Bernard Le Stum, *Université de Rennes 1, France*

The author proves that rigid cohomology can be computed as the cohomology of a site analogous to the crystalline site. Berthelot designed rigid cohomology as a common generalization of crystalline and Monsky–Washnitzer cohomology.

Unfortunately, unlike the former, the functoriality of the theory is not built in. The author defines the “overconvergent site” which is functorially attached to an algebraic variety.

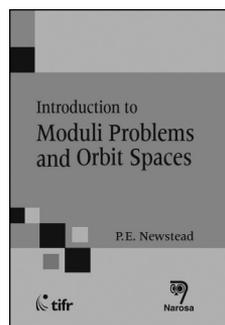
The author proves that the category of modules of finite presentation on this ringed site is equivalent to the category of overconvergent isocrystals on the variety. He also proves that their cohomology coincides.

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; Geometry; Coefficients; Cohomology; Appendix; Bibliography; Index.

Mémoires de la Société Mathématique de France, Number 127

April 2012, 108 pages, Softcover, ISBN: 978-2-85629-341-6, 2010 *Mathematics Subject Classification*: 14F30, **Individual member US\$33.30**, List US\$37, Order code SMFMEM/127



Introduction to Moduli Problems and Orbit Spaces

P. E. Newstead, *University of Liverpool, England*

Geometric Invariant Theory (GIT), developed in the 1960s by David Mumford, is the theory of quotients by group actions in algebraic geometry. The theory’s principal application is to the construction of various moduli spaces.

Newstead gave a series of lectures in 1975 at the Tata Institute of Fundamental Research, Mumbai, on GIT and its application to the moduli of vector bundles on curves. It was a masterful and understandable exposition of important material, with clear proofs and many examples. The notes, published as a volume in the TIFR lecture notes series, became a classic, and generations of algebraic geometers working in these subjects got their basic introduction

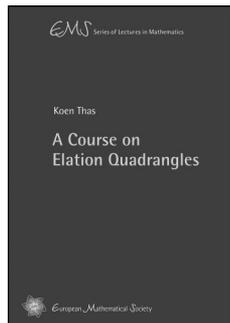
to this area through these lecture notes. Though continuously in demand, these lecture notes have been out of print for many years. The Tata Institute is happy to reissue these notes in this volume.

A publication of the Tata Institute of Fundamental Research. Distributed worldwide except in India, Bangladesh, Bhutan, Maldives, Nepal, Pakistan, and Sri Lanka.

Contents: Preliminaries; The concept of moduli; Endomorphisms of vector spaces; Quotients; Examples; Vector bundles over a curve; Bibliography; List of symbols; Index.

Tata Institute of Fundamental Research

March 2011, 152 pages, Softcover, ISBN: 978-81-8487-162-3, 2010 *Mathematics Subject Classification:* 14L24, 14D20, 14H60, **AMS members US\$32**, List US\$40, Order code TIFR/17



A Course on Elation Quadrangles

Koen Thas, Ghent University, Belgium

The notion of elation generalized quadrangle is a natural generalization to the theory of generalized quadrangles of the important notion of translation planes in the theory of projective planes. Almost any known class of finite generalized

quadrangles can be constructed from a suitable class of elation quadrangles.

In this book the author considers several aspects of the theory of elation generalized quadrangles. Special attention is given to local Moufang conditions on the foundational level, exploring, for instance, Knarr's question from the 1990s concerning the very notion of elation quadrangles. All the known results on Kantor's prime power conjecture for finite elation quadrangles are gathered, some of them published here for the first time. The structural theory of elation quadrangles and their groups is heavily emphasized. Other related topics, such as p -modular cohomology, Heisenberg groups, and existence problems for certain translation nets, are briefly touched.

This book starts from scratch and is essentially self-contained. Many alternative proofs are given for known theorems. This course contains dozens of exercises at various levels, from very easy to rather difficult, and will stimulate undergraduate and graduate students to enter the fascinating and rich world of elation quadrangles. More accomplished mathematicians will find the final chapters especially challenging.

This item will also be of interest to those working in discrete mathematics and combinatorics.

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

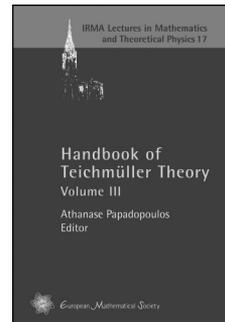
Contents: Generalized quadrangles; The Moufang condition; Elation quadrangles; Some features of special p -groups; Parameters of elation quadrangles and structure of elation groups; Standard elations and flock quadrangles; Foundations of EGQs; Elation quadrangles with nonisomorphic elation groups; Application: Existence of translation nets; Elations of dual translation quadrangles; Local Moufang conditions; Bibliography; Symbols; Index.

EMS Series of Lectures in Mathematics, Volume 17

June 2012, 129 pages, Softcover, ISBN: 978-3-03719-110-1, 2010 *Mathematics Subject Classification:* 05-02, 20-02, 51-02, 05B25, 05E18,

20B25, 20D15, 20D20, 51B25, 51E12, **AMS members US\$28.80**, List US\$36, Order code EMSSERLEC/17

Analysis



Handbook of Teichmüller Theory

Volume III

Athanase Papadopoulos, Université de Strasbourg, France, Editor

The subject of this handbook is Teichmüller theory in a wide sense, namely the theory of geometric structures on surfaces and

their moduli spaces. This includes the study of vector bundles on these moduli spaces, the study of mapping class groups, the relation with 3-manifolds, the relation with symmetric spaces and arithmetic groups, the representation theory of fundamental groups, and applications to physics. Thus the handbook is a place where several fields of mathematics interact: Riemann surfaces, hyperbolic geometry, partial differential equations, several complex variables, algebraic geometry, algebraic topology, combinatorial topology, low-dimensional topology, theoretical physics, and others. This confluence of ideas toward a unique subject is a manifestation of the unity and harmony of mathematics.

This volume contains surveys on the fundamental theory as well as surveys on applications to and relations with the fields mentioned above. It is written by leading experts in these fields. Some of the surveys contain classical material, while others present the latest developments of the theory as well as open problems.

This volume is divided into the following four sections:

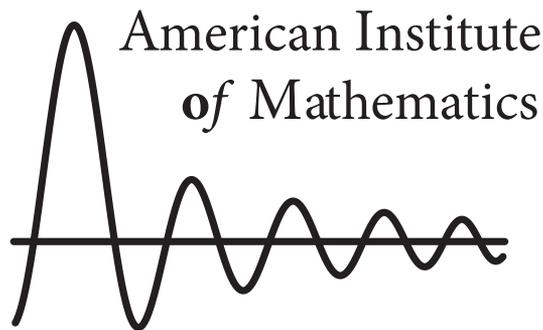
- The metric and the analytic theory
- The group theory
- The algebraic topology of mapping class groups and moduli spaces
- Teichmüller theory and mathematical physics

This handbook is addressed to graduate students and researchers in all the fields mentioned.

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

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

Contents: **A. Papadopoulos**, Introduction to Teichmüller theory, old and new, III; **Part A. The metric and the analytic theory, 3:** **J.-P. Otal**, Quasiconformal and BMO-quasiconformal homeomorphisms; **J. Hu**, Earthquakes on the hyperbolic plane; **C. Series**, Kerckhoff's lines of minima in Teichmüller space; **Part B. The group theory, 3:** **L. Ji**, A tale of two groups: arithmetic groups and mapping class groups; **J. D. McCarthy** and **A. Papadopoulos**, Simplicial actions of mapping class groups; **V. Disarlo**, On the coarse geometry of the complex of domains; **M. Korkmaz**, Minimal generating sets for the mapping class group of a surface; **K. Habiro** and **G. Massuyeau**, From mapping class groups to monoids of homology cobordisms: A survey; **T. Sakasai**, A survey of Magnus representations for mapping class groups and



American Institute of Mathematics

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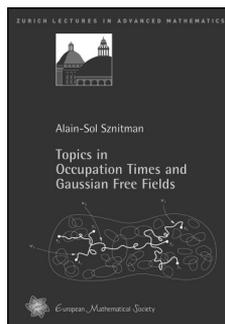
New AMS-Distributed Publications

homology cobordisms of surfaces; **L. Funar**, **C. Kapoudjian**, and **V. Sergiescu**, Asymptotically rigid mapping class groups and Thompson's groups; *Part C. The algebraic topology of mapping class groups and their intersection theory*: **D. Zvonkine**, An introduction to moduli spaces of curves and their intersection theory; **I. Madsen**, Homology of the open moduli space of curves; **L. Ji** and **S. Zucker**, On the L^p -cohomology and the geometry of metrics on moduli spaces of curves; *Part D. Teichmüller theory and mathematical physics*: **K. Krasnov** and **J.-M. Schlenker**, The Weil-Petersson metric and the renormalized volume of hyperbolic 3-manifolds; **R. M. Kashaev**, Discrete Liouville equation and Teichmüller theory; Corrigenda; List of contributors; Index.

IRMA Lectures in Mathematics and Theoretical Physics, Volume 17

June 2012, 874 pages, Hardcover, ISBN: 978-3-03719-103-3, 2010 *Mathematics Subject Classification*: 30-00, 32-00, 57-00, 11F06, 11F75, 14D20, 14H15, 14J60, 14H55, 20F14, 20F28, 20F38, 20F65, 20F67, 20H10, 53A35, 53B35, 53C35, 53C50, 53C80, 53C55, 53D55, 53Z05, **AMS members US\$102.40**, List US\$128, Order code EMSILMTP/17

Probability and Statistics



Topics in Occupation Times and Gaussian Free Fields

Alain-Sol Sznitman, *ETH, Zürich, Switzerland*

This book grew out of a graduate course at ETH Zürich during the spring 2011 term. It explores various links between such notions as occupation times of Markov chains, Gaussian free fields, Poisson point processes of Markovian loops, and random interacements, which have been the object of intensive research over the last few years. These notions are developed in the convenient setup of finite weighted graphs endowed with killing measures.

This book first discusses elements of continuous-time Markov chains, Dirichlet forms, potential theory, together with some consequences for Gaussian free fields. Next, isomorphism theorems and generalized Ray-Knight theorems, which relate occupation times of Markov chains to Gaussian free fields, are presented. Markovian loops are constructed and some of their key properties derived. The field of occupation times of Poisson point processes of Markovian loops is investigated. Of special interest are its connection to the Gaussian free field, and a formula of Symanzik. Finally, links between random interacements and Markovian loops are discussed, and some further connections with Gaussian free fields are mentioned.

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Contents: Introduction; Generalities; Isomorphism theorems; The Markovian loop; Poisson gas of Markovian loops; References; Index.

Zurich Lectures in Advanced Mathematics, Volume 16

May 2012, 122 pages, Softcover, ISBN: 978-3-03719-109-5, 2010 *Mathematics Subject Classification*: 60K35, 60J27, 60G15, 82B41, **AMS members US\$28.80**, List US\$36, Order code EMSZLEC/16