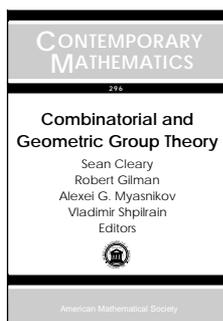


# New Publications Offered by the AMS

## Algebra and Algebraic Geometry



### Combinatorial and Geometric Group Theory

**Sean Cleary, Alexei G. Myasnikov and Vladimir Shpilrain, City College of New York, NY, and Robert Gilman, Stevens Institute of Technology, Hoboken, NJ, Editors**

This volume grew out of two AMS conferences held at Columbia University (New York, NY) and the Stevens Institute of Technology (Hoboken, NJ) and presents articles on a wide variety of topics in group theory.

Readers will find a variety of contributions, including a collection of over 170 open problems in combinatorial group theory, three excellent survey papers (on boundaries of hyperbolic groups, on fixed points of free group automorphisms, and on groups of automorphisms of compact Riemann surfaces), and several original research papers that represent the diversity of current trends in combinatorial and geometric group theory.

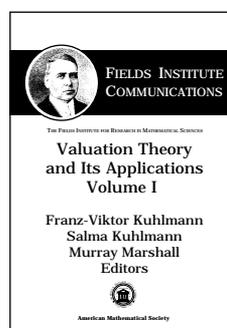
The book is an excellent reference source for graduate students and research mathematicians interested in various aspects of group theory.

**Contents:** **G. Baumslag, A. G. Myasnikov, and V. Shpilrain**, Open problems in combinatorial group theory. Second edition; **I. Kapovich and N. Benakli**, Boundaries of hyperbolic groups; **P. Dehornoy**, Thin groups of fractions; **A. M. Gaglione, D. Spellman, and B. Fine**, Every abelian group universally equivalent to a discriminating group is elementarily equivalent to a discriminating group; **S. V. Ivanov**, Weakly finitely presented infinite periodic groups; **B. Khan**, Positively generated subgroups of free groups and the Hanna Neumann conjecture; **A. R. Magid**, On the proalgebraic completion of a finitely generated group; **A. D. Myasnikov, A. G. Myasnikov, and V. Shpilrain**, On the Andrews-Curtis equivalence; **C. F. Rocca, Jr. and E. C. Turner**, Test ranks of finitely generated abelian groups; **G. Rosenberger and M. Scheer**, Classification of the finite generalized tetrahedron groups;

**E. Ventura**, Fixed subgroups in free groups: A survey; **A. Weaver**, Automorphisms of surfaces.

**Contemporary Mathematics**, Volume 296

July 2002, 275 pages, Softcover, ISBN 0-8218-2822-3, LC 2002066743, 2000 *Mathematics Subject Classification*: 20-XX, 57Mxx, 03Cxx, **Individual member \$41**, List \$69, Institutional member \$55, Order code CONM/296N



### Valuation Theory and Its Applications, Volume I

**Franz-Viktor Kuhlmann, Salma Kuhlmann, and Murray Marshall, University of Saskatchewan, Saskatoon, SK, Canada, Editors**

This book is the first of two proceedings volumes stemming from the

International Conference and Workshop on Valuation Theory held at the University of Saskatchewan (Saskatoon, SK, Canada).

Valuation theory arose in the early part of the twentieth century in connection with number theory and has many important applications to geometry and analysis: the classical application to the study of algebraic curves and to Dedekind and Prüfer domains; the close connection to the famous resolution of the singularities problem; the study of the absolute Galois group of a field; the connection between ordering, valuations, and quadratic forms over a formally real field; the application to real algebraic geometry; the study of noncommutative rings; etc. The special feature of this book is its focus on current applications of valuation theory to this broad range of topics. Also included is a paper on the history of valuation theory.

The book is suitable for graduate students and research mathematicians working in algebra, algebraic geometry, number theory, and mathematical logic.

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

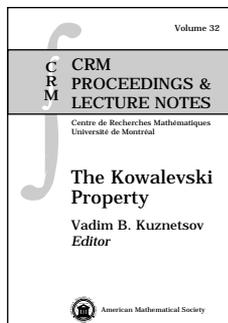
**Contents:** **S. S. Abhyankar**, Two step descent in modular Galois theory, theorems of Burnside and Cayley, and Hilbert's Thirteenth Problem; **M.-E. Alonso and H. Lombardi**, General-

ized Taylor formulae, computations in real closed valued fields and quantifier elimination; **S. A. Basarab**, The arithmetic-arboreal residue structure of a Prüfer domain, I; **H.-H. Brungs** and **G. Törner**, Left valuation rings, left cones, and a question of Frege's; **V. Cossart**, **O. Piltant**, and **A. J. Reguera-López**, Divisorial valuations dominating rational surface singularities; **T. C. Craven**, Valuations and Hermitian forms on skew fields; **S. D. Cutkosky**, Resolution of morphisms; **T. S. Gardener** and **H. Schoutens**, Rigid subanalytic sets; **J. Gräter**, Dubrovin valuation rings and orders in central simple algebras; **H. G. Grundman** and **T. L. Smith**,  $Q$ -adequate bicyclic bicubic fields; **D. Harbater**, **M. van der Put**, and **R. Guralnick**, Valued fields and covers in characteristic  $p$ , with an appendix by R. Guralnick; **U. T. Hartl**, Line bundles on rigid analytic spaces; **P. Hitzler** and **A. K. Seda**, The fixed-point theorems of Priess-Crampe and Ribenboim in logic programming; **S. K. Khanduja**, The minimum property of Krasner's constant; **H. Lombardi**, About Merckel's lemma; **A. Prestel**, Bounds for representations of polynomials positive on compact semi-algebraic sets; **A. Prestel** and **N. Schwartz**, Model theory of real closed rings; **P. Roquette**, History of valuation theory—Part I; **J. Schmid**, A density property for PpC-fields; **M. van der Put**, Valuation theory in rigid geometry and curves over valuation rings; **A. R. Wadsworth**, Valuation theory on finite dimensional division algebras.

**Fields Institute Communications**, Volume 32

July 2002, 449 pages, Hardcover, ISBN 0-8218-2813-4, LC 2002021581, 2000 *Mathematics Subject Classification*: 12-XX; 03-XX, 11-XX, 13-XX, 14-XX, 16-XX, 20-XX, **Individual member \$71**, List \$119, Institutional member \$95, Order code FIC/32N

## Analysis



### The Kowalevski Property

**Vadim B. Kuznetsov**,  
*University of Leeds, UK*, Editor

This book is a collection of survey articles on several topics related to the general notion of integrability. It stems from a workshop on "Mathematical Methods of Regular Dynamics" dedicated to Sophie Kowalevski. Leading experts introduce corre-

sponding areas in depth. The book provides a broad overview of research, from the pioneering work of the nineteenth century to the developments of the 1970s through the present.

The book begins with two historical papers by R. L. Cooke on Kowalevski's life and work. Following are 15 research surveys on integrability issues in differential and algebraic geometry, classical complex analysis, discrete mathematics, spinning tops, Painlevé equations, global analysis on manifolds, special functions, etc. It concludes with Kowalevski's famous paper published in *Acta Mathematica* in 1889, "Sur le problème de la rotation d'un corps solide autour d'un point fixe".

The book is suitable for graduate students in pure and applied mathematics, the general mathematical audience studying

integrability, and research mathematicians interested in differential and algebraic geometry, analysis, and special functions.

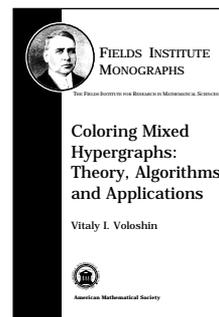
**Contents:** **R. L. Cooke**, The life of S. V. Kovalevskaya; **R. L. Cooke**, Kovalevskaya's mathematical work; **B. Enriquez**, The KZB connection: Parametrizations, flat sections and  $q$ -deformation; **L. Gavrilov**, Jacobians of singularized spectral curves and completely integrable systems; **L. Haine**, The  $q$ -hypergeometric equation, Askey-Wilson type solitons and rational curves with singularities; **K. Hikami**, Quantum discrete soliton equations; **E. I. Horozov**, Dual algebras of differential operators; **J.-S. Hu** and **M. Yan**, A link between two fundamental contributions of Kowalevski; **A. A. Kapaev**, Monodromy deformation approach to the scaling limit of the Painlevé first equation; **V. B. Kuznetsov**, Kowalevski top revisited; **D. Markushevich**, Some algebro-geometric integrable systems versus classical ones; **M. Mazzocco**, Painlevé sixth equation as isomonodromic deformations equation of an irregular system; **A. Nakayashiki** and **F. A. Smirnov**, Euler characteristics of theta divisors of Jacobians for spectral curves; **E. Previato**, Reduction theory, elliptic solitons and integrable systems; **T. Sasaki** and **M. Yoshida**, Schwarzian derivatives and uniformization; **A. O. Smirnov**, Elliptic solitons and Heun's equation; **V. V. Sokolov**, Generalized Kowalevski top: New integrable cases on  $e(3)$  and  $so(4)$ ; *Reprint of the Original Paper:* **S. Kowalevski**, Sur le problème de la rotation d'un corps solide autour d'un point fixe.

**CRM Proceedings & Lecture Notes**, Volume 32

July 2002, 372 pages, Softcover, ISBN 0-8218-2885-1, LC 2002066671, 2000 *Mathematics Subject Classification*: 14H70, 17B80, 37J35, 35Q58, 37K10, 70E40, 70H06, 81R12, 81U15, 37K15, **Individual member \$71**, List \$119, Institutional member \$95, Order code CRMP/32N

## Discrete Mathematics and Combinatorics

Supplementary Reading



### Coloring Mixed Hypergraphs: Theory, Algorithms and Applications

**Vitaly I. Voloshin**, *Moldovan Academy of Sciences, Kishinev, Republic of Moldova*

The theory of graph coloring has existed for more than 150 years.

Historically, graph coloring involved finding the minimum number of colors to be assigned to the vertices so that adjacent vertices would have different colors. From this modest beginning, the theory has become central in discrete mathematics with many contemporary generalizations and applications.

Generalization of graph coloring-type problems to mixed hypergraphs brings many new dimensions to the theory of colorings. A main feature of this book is that in the case of hypergraphs, there exist problems on both the minimum and the maximum number of colors. This feature pervades the theory, methods, algorithms, and applications of mixed hypergraph coloring.

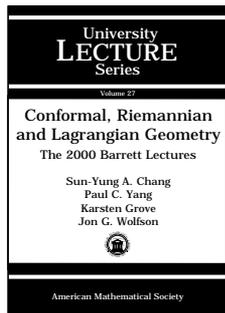
The book has broad appeal. It will be of interest to both pure and applied mathematicians, particularly those in the areas of discrete mathematics, combinatorial optimization, operations research, computer science, software engineering, molecular biology, and related businesses and industries. It also makes a nice supplementary text for courses in graph theory and discrete mathematics. This is especially useful for students in combinatorics and optimization. Since the area is new, students will have the chance at this stage to obtain results that may become classic in the future.

**Contents:** Introduction; The lower chromatic number of a hypergraph; Mixed hypergraphs and the upper chromatic number; Uncolorable mixed hypergraphs; Uniquely colorable mixed hypergraphs;  $C$ -perfect mixed hypergraphs; Gaps in the chromatic spectrum; Interval mixed hypergraphs; Pseudo-chordal mixed hypergraphs; Circular mixed hypergraphs; Planar mixed hypergraphs; Coloring block designs as mixed hypergraphs; Modelling with mixed hypergraphs; Bibliography; List of figures; Index.

**Fields Institute Monographs**, Volume 17

August 2002, 181 pages, Hardcover, ISBN 0-8218-2812-6, LC 2002066624, 2000 *Mathematics Subject Classification*: 05C15; 05C65, 05C90, 05C85, 68R05, **All AMS members \$39**, List \$49, Order code FIM/17N

## Geometry and Topology



### Conformal, Riemannian and Lagrangian Geometry The 2000 Barrett Lectures

**Sun-Yung A. Chang** and **Paul C. Yang**, *Princeton University, NJ*, **Karsten Grove**, *University of Maryland, College*

**Park**, **Jon G. Wolfson**, *Michigan State University, East Lansing*, and edited by **Alexandre Freire**, *University of Tennessee, Knoxville*

Recent developments in topology and analysis have led to the creation of new lines of investigation in differential geometry. The 2000 Barrett Lectures present the background, context, and main techniques of three such lines by means of surveys by leading researchers.

The first chapter (by Alice Chang and Paul Yang) introduces new classes of conformal geometric invariants and then applies powerful techniques in nonlinear differential equations to derive results on compactifications of manifolds and on Yamabe-type variational problems for these invariants. This is followed by Karsten Grove's lectures, which focus on the use of isometric group actions and metric geometry techniques to understand new examples and classification results in Riemannian geometry, especially in connection with positive curvature. The chapter written by Jon Wolfson introduces the emerging field of Lagrangian variational problems, which blends in novel ways the structures of symplectic geometry and the techniques of the modern calculus of variations.

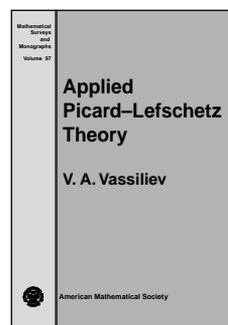
The lectures provide an up-to-date overview and an introduction to the research literature in each of their areas. This very readable introduction should prove useful to graduate students and researchers in differential geometry and geometric analysis.

**Contents:** S.-Y. A. Chang and P. C. Yang, Partial differential equations related to the Gauss-Bonnet-Chern integrand on 4-manifolds; K. Grove, Geometry of, and via, symmetries; J. G. Wolfson, Lagrangian cycles and volume.

**University Lecture Series**, Volume 27

August 2002, 86 pages, Softcover, ISBN 0-8218-3210-7, LC 2002071650, 2000 *Mathematics Subject Classification*: 53C20, 53C21, 53D12; 53C55, 57S15, 35B65, **All AMS members \$15**, List \$19, Order code ULECT/27N

**Independent Study**



### Applied Picard-Lefschetz Theory

**V. A. Vassiliev**, *Independent University of Moscow, Russia*, and *Steklov Mathematical Institute, Moscow, Russia*

Many important functions of mathematical physics are defined as

integrals depending on parameters. The Picard-Lefschetz theory studies how analytic and qualitative properties of such integrals (regularity, algebraicity, ramification, singular points, etc.) depend on the monodromy of corresponding integration cycles. In this book, V. A. Vassiliev presents several versions of the Picard-Lefschetz theory, including the classical local monodromy theory of singularities and complete intersections, Pham's generalized Picard-Lefschetz formulas, stratified Picard-Lefschetz theory, and also twisted versions of all these theories with applications to integrals of multivalued forms.

The author also shows how these versions of the Picard-Lefschetz theory are used in studying a variety of problems arising in many areas of mathematics and mathematical physics.

In particular, he discusses the following classes of functions:

- *volume functions* arising in the Archimedes-Newton problem of integrable bodies;
- *Newton-Coulomb potentials*;
- *fundamental solutions of hyperbolic partial differential equations*;
- *multidimensional hypergeometric functions* generalizing the classical Gauss hypergeometric integral.

The book is geared toward a broad audience of graduate students, research mathematicians and mathematical physicists interested in algebraic geometry, complex analysis, singularity theory, asymptotic methods, potential theory, and hyperbolic operators.

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

**Contents:** Introduction; Local monodromy theory of isolated singularities of functions and complete intersections; Stratified Picard-Lefschetz theory and monodromy of hyperplane sections; Newton's theorem on the non-integrability of ovals; Lacunas and local Petrovskii condition for hyperbolic differential operators with constant coefficients; Calculation of local

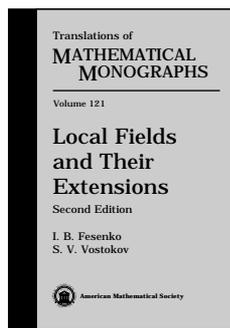
Petrovskii cycles and enumeration of local lacunas close to real singularities; Homology of local systems, twisted monodromy theory, and regularization of improper integration cycles; Analytic properties of surface potentials; Multidimensional hypergeometric functions, their ramification, singularities, and resonances; Bibliography; Index.

**Mathematical Surveys and Monographs, Volume 97**

September 2002, approximately 352 pages, Hardcover, ISBN 0-8218-2948-3, 2000 *Mathematics Subject Classification*: 14D05, 14B05, 31B10, 32S40, 35B60; 33C70, 35L67, **Individual member \$47**, List \$79, Institutional member \$63, Order code SURV/97N

## Number Theory

**Supplementary Reading**



### Local Fields and Their Extensions Second Edition

**I. B. Fesenko**, *University of Nottingham, England*, and  
**S. V. Vostokov**, *St. Petersburg University, Russia*

*Reviews of the Previous Edition:*

*It is remarkable to see just how far the subject has developed since 1968 ... contains an absolute wealth of material ... this approach is a real success ... results are obtained with a minimum of fuss, so that the story unfolds rather quickly and holds the reader's interest ... a copious supply of well-structured exercises ... most certainly a valuable addition to the literature ... carefully written and well-presented state of the art account of local fields, which contains much ... of interest to the expert and non-expert alike ... its appeal should go well beyond the usual public of number theorists.*

—*Bulletin of the London Mathematical Society*

*Well written ... A big amount of exercises contribute to the attraction of this highly original book.*

—*Zentralblatt MATH*

*Being self-contained, starting from scratch and including plenty of nice and quite feasible exercises, it is a very useful textbook. There are two interesting appendices, about absolute Galois groups and about multidimensional local fields, describing (without proofs) some recent results obtained by various authors.*

—*Monatshefte für Mathematik*

This book offers a modern exposition of the arithmetical properties of local fields using explicit and constructive tools and methods. It has been ten years since the publication of the first edition, and, according to *Mathematical Reviews*, 1,000 papers on local fields have been published during that period. This edition incorporates improvements to the first edition, with 60 additional pages reflecting several aspects of the developments in local number theory.

The volume consists of four parts: elementary properties of local fields, class field theory for various types of local fields and generalizations, explicit formulas for the Hilbert pairing, and Milnor  $K$ -groups of fields and of local fields. The first

three parts essentially simplify, revise, and update the first edition. The book includes the following recent topics: Fontaine-Wintenberger theory of arithmetically profinite extensions and fields of norms, explicit noncohomological approach to the reciprocity map with a review of all other approaches to local class field theory, Fesenko's  $p$ -class field theory for local fields with perfect residue field, simplified updated presentation of Vostokov's explicit formulas for the Hilbert norm residue symbol, and Milnor  $K$ -groups of local fields. Numerous exercises introduce the reader to other important recent results in local number theory, and an extensive bibliography provides a guide to related areas.

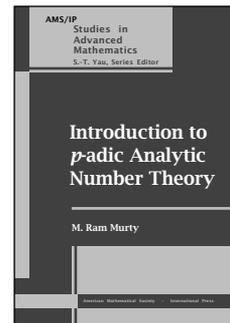
The book is geared toward graduate students and research mathematicians interested in local number theory and its applications in arithmetic algebraic geometry.

**Contents:** Complete discrete valuation fields; Extensions of discrete valuation fields; The norm map; Local class field theory I; Local class field theory II; The group of units of local number fields; Explicit formulas for the Hilbert symbol; Explicit formulas for the Hilbert pairing on formal groups; The Milnor  $K$ -groups of a local field; Bibliography; List of notations; Index.

**Translations of Mathematical Monographs, Volume 121**

August 2002, 345 pages, Hardcover, ISBN 0-8218-3259-X, LC 2002066561, 2000 *Mathematics Subject Classification*: 11Sxx, 11S15, 11S20, 11S31, 11S70, 11S85, 11S99, **All AMS members \$55**, List \$69, Order code MMONO/121.RN

**Independent Study**



### Introduction to $p$ -adic Analytic Number Theory

**M. Ram Murty**, *Queen's University, Kingston, ON, Canada*

This book is an elementary introduction to  $p$ -adic analysis from the number theory perspective. With over 100 exercises included, it will acquaint

the non-expert to the basic ideas of the theory and encourage the novice to enter this fertile field of research.

The main focus of the book is the study of  $p$ -adic  $L$ -functions and their analytic properties. It begins with a basic introduction to Bernoulli numbers and continues with establishing the Kummer congruences. These congruences are then used to construct the  $p$ -adic analog of the Riemann zeta function and  $p$ -adic analogs of Dirichlet's  $L$ -functions. Featured is a chapter on how to apply the theory of Newton polygons to determine Galois groups of polynomials over the rational number field. As motivation for further study, the final chapter introduces Iwasawa theory.

The book treats the subject informally, making the text accessible to non-experts. It would make a nice independent text for a course geared toward advanced undergraduates through beginning graduate students.

Titles in this series are copublished with International Press, Cambridge, MA.

**Contents:** Historical introduction; Bernoulli numbers;  $p$ -adic numbers; Hensel's lemma;  $p$ -adic interpolation;  $p$ -adic  $L$ -functions;  $p$ -adic integration; Leopoldt's formula for  $L_p(1, \chi)$ ;

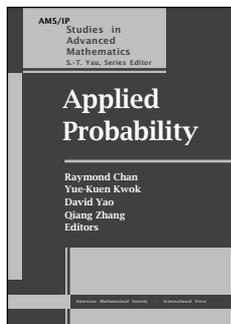
Newton polygons; An introduction to Iwasawa theory; Bibliography; Index.

AMS/IP Studies in Advanced Mathematics, Volume 27

August 2002, 149 pages, Hardcover, ISBN 0-8218-3262-X, LC 2002025584, 2000 *Mathematics Subject Classification*: 11-01, 11-02, 11E95, 11Sxx, All AMS members \$31, List \$39, Order code AMSIP/27N

## Probability

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### Applied Probability

**Raymond Chan**, *Chinese University of Hong Kong, Shatin*,  
**Yue-Kuen Kwok**, *Hong Kong University of Science and Technology, Clear Water Bay, China*, **David Yao**, *Columbia University, NY*, and **Qiang Zhang**, *State University of New York at Stony Brook, NY*, Editors

This book presents articles on original material from invited talks given at the “IMS Workshop on Applied Probability” organized by the Institute of Mathematical Sciences at the Chinese University of Hong Kong in May 1999. The goal of the workshop was to promote research in applied probability for local mathematicians and engineers and to foster exchange with experts from other parts of the world. The main themes were mathematical finance and stochastic networks.

The topics range from the theoretical study, e.g., ergodic theory and diffusion processes, to very practical problems, such as convertible bonds with market risk and insider trading.

The wide scope of coverage in the book make it a helpful reference for graduate students and researchers, and for practitioners working in mathematical finance.

Titles in this series are copublished with International Press, Cambridge, MA.

**Contents:** **R. H. Chan** and **W. K. Ching**, A direct method for stochastic automata networks; **D. Chen**, Estimating the speed of random walks; **M.-F. Chen**, A new story of ergodic theory; **S. Chen** and **J. Yong**, Solvability of a stochastic linear quadratic optimal control problem; **M. Davis** and **F. R. Lischka**, Convertible bonds with market risk and credit risk; **F. J. Hickernell** and **H. S. Hong**, Quasi-Monte Carlo methods and their randomizations; **H. Yu** and **Y.-K. Kwok**, Contingent claim approach for analyzing the credit risk of defaultable currency swaps; **S. Luo** and **Q. Zhang**, Dynamic insider trading; **S. Tang**, A new hedging model and a nonlinear generalization of Black-Scholes formula; **J.-a. Yan**, An overview on the Martingale approach to option pricing; **X. Zhang**, On comparison theorems for diffusion processes.

AMS/IP Studies in Advanced Mathematics, Volume 26

July 2002, 148 pages, Softcover, ISBN 0-8218-3191-7, LC 2002025578, 2000 *Mathematics Subject Classification*: 46N30, 47N30, 28Dxx, 93Exx, 91Bxx, All AMS members \$31, List \$39, Order code AMSIP/26N

NEW AMS PUBLICATIONS