

# Géométrie algébrique

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as well as survey papers which provide the reader with an overview of past and future developments in the field.

Jeffrey STOPPLE. — **A primer of analytic number theory: from Pythagoras to Riemann.** — Un vol. broché, 15 × 23, de XIII, 383 p. — ISBN 0-521-01253-8 (relié: 0-521-81309). — Prix: US\$35.00 (relié: US\$95.00). — Cambridge University Press, Cambridge, 2003.

This undergraduate introduction to analytic number theory develops analytic skills in the course of a study of ancient questions on polygonal numbers, perfect numbers, and amicable pairs. The question of how the primes are distributed among all integers is central in analytic number theory. This distribution is determined by the Riemann zeta function, and Riemann's work shows how it is connected to the zeros of his function and the significance of the Riemann hypothesis. Starting from a traditional calculus course and assuming no complex analysis, the author develops the basic ideas of elementary number theory. The text is supplemented by a series of exercises to further develop the concepts and includes brief sketches of more advanced ideas, to present contemporary research problems at a level suitable for undergraduates.

## *Corps et polynômes*

Leila SCHNEPS, (Editor). — **Galois groups and fundamental groups.** — Mathematical Sciences Research Institute publications, vol. 41. — Un vol. relié, 16,5 × 24, de XIV, 467 p. — ISBN 0-521-80831-6. — Prix: £50.00. — Cambridge University Press, Cambridge, 2003.

This book explores recent research underlining the remarkable connections between the algebraic and arithmetic world of Galois theory and the topological and geometric world of fundamental groups. B.H. Matzat and M. van der Put introduce differential Galois theory and solve the differential inverse Galois problem over global fields in positive characteristic; D. Harbater gives a comparative exposition of formal and rigid patching starting from the familiar complex case. S. Mochizuki discusses aspects of Grothendieck's famous anabelian geometry, while the articles by R. Guralnick, A. Tamagawa, and F. Pop and M. Saïdi investigate the structure of the fundamental groups of curves over different kinds of characteristic  $p$  fields. M. Imbert and L. Schneps study the structure of the Hurwitz spaces and moduli spaces of curves, which are of great importance to Galois theory because of the Galois action on their fundamental groups. The first interesting such group is  $SL_2(\mathbf{Z})$ , a family of special subgroups of which is studied by F. Bogomolov and Y. Tschinkel. Finally, R. Hain and M. Matsumoto present their result proving part of a conjecture by Deligne on the structure of the Lie algebra associated to the Galois action on the fundamental group of the thrice-punctured projective plane.

## *Géométrie algébrique*

Igor DOLGACHEV. — **Lectures on invariant theory.** — London Mathematical Society lecture note series, vol. 296 — Un vol. broché, 15 × 23, de XVI, 220 p. — ISBN 0-521-52548-5 — Prix: £29.95. — Cambridge University Press, Cambridge, 2003.

The primary goal of this book is to give a brief introduction to the main ideas of algebraic and geometric invariant theory. It assumes only a minimal background in algebraic geometry, algebra and representation theory. Topics covered include the symbolic method for computation of invariants on the space of homogeneous forms, the problem of finite generatedness of the algebra of invariants, the theory of covariants and constructions of categorical and geometric quotients.

Throughout, the emphasis is on concrete examples which originate in classical algebraic geometry. A novel feature of the book is a discussion of possible linearizations of actions and the variation of quotients under the change of linearization. Also included is the construction of toric varieties as torus quotients of affine spaces.

Shigeru MUKAI. — **An introduction to invariants and moduli.** — Cambridge studies in advanced mathematics, vol. 81. — Un vol. relié, 16×23,5, de XII, 505 p. — ISBN 0-521-80906-1. — Prix: £65.00. — Cambridge University Press, Cambridge, 2003.

Incorporated in this volume are the first two books in Mukai's series on moduli theory. The notion of a moduli space is central to geometry. However, its influence is not confined there: for example, the theory of moduli spaces is a crucial ingredient in the proof of Fermat's last theorem. Researchers and graduate students working in areas ranging from Donaldson or Seiberg-Witten invariants to more concrete problems such as vector bundles on curves will find this to be a valuable resource. Among other things, this volume includes an improved presentation of the classical foundations of invariant theory that, in addition to geometers, will be useful to those studying representation theory. This translation gives an accurate account of Mukai's influential Japanese texts.

Alexander POLISHCHUK. — **Abelian varieties, theta functions and the Fourier transform.** — Cambridge tracts in mathematics, vol. 153. — Un vol. relié, 16×23, de XVI, 292 p. — ISBN 0-521-80804-9. — Prix: £47.50. — Cambridge University Press, Cambridge, 2003.

This book is a modern introduction to the theory of Abelian varieties and theta functions. Here the Fourier transform techniques play a central role, appearing in several different contexts. In transcendental theory, the usual Fourier transform plays a major role in the representation theory of the Heisenberg group, the main building block for the theory of theta functions. Also, the Fourier transform appears in the discussion of mirror symmetry for complex and symplectic tori, which are used to compute cohomology of holomorphic line bundles on complex tori. When developing the algebraic theory (in arbitrary characteristic), emphasis is placed on the importance of the Fourier-Mukai transform for coherent sheaves on Abelian varieties. In particular, it is used in the computation of cohomology of line bundles, in classification of vector bundles on elliptic curves, and proofs of Riemann and Torelli theorems for Jacobians of algebraic curves. Another subject discussed in the book is the construction of equivalences between derived categories of coherent sheaves on Abelian varieties, which follows the same pattern as the construction of intertwining operators between different realizations of the unique irreducible representation of the Heisenberg group.

Claire VOISIN. — **Hodge theory and complex algebraic geometry II.** — Cambridge studies in advanced mathematics, vol. 77. — Un vol. relié, 16×23,5, de IX, 351 p. — ISBN 0-521-80283-0. — Prix: £60.00. — Cambridge University Press, Cambridge, 2003.

The second volume of this modern account of Kaehlerian geometry and Hodge theory starts with the topology of families of algebraic varieties. Proofs of the Lefschetz theorem on hyperplane sections, the Picard-Lefschetz study of Lefschetz pencils, and Deligne's theorems on the degeneration of the Leray spectral sequence and the global invariant cycles follow. The second part is devoted to the variations of Hodge structures, the study of Hodge loci, and the introduction of infinitesimal invariants. It is illustrated by Griffiths' description of the variation of Hodge structures of hypersurfaces. The main results of this part are the generalised Noether-Lefschetz theorems, the generic triviality of the Abel-Jacobi maps, and most importantly Nori's connectivity theorem which generalises the above. The last part of the book is devoted to the relationships between Hodge theory and algebraic cycles. The generalised Mumford theorem is

proved and the main conjectures on the subject are stated. The proof of Bloch's conjecture is given for certain types of surfaces. The book concludes with the example of cycles on Abelian varieties, where some results of Bloch and Beauville, for example, are expounded. The text is complemented by exercises which provide useful results in complex algebraic geometry.

## *Anneaux et algèbres*

TOMASZ BRZEZINSKI, Robert WISBAUER. — **Corings and comodules.** — London Mathematical Society lecture note series, vol. 309. — Un vol. broché, 15 × 23, de x, 476 p. — ISBN 0-521-53931-5. — Prix: £37.95. — Cambridge University Press, Cambridge, 2003.

This is the first extensive treatment of the theory of corings and their comodules. In the first part, the module-theoretic aspects of coalgebras over commutative rings are described. Corings are then defined as coalgebras for noncommutative rings. Topics covered include: module-theoretic aspects of corings, such as the relation of comodules to special subcategories of the category of modules (sigma-type categories); connections between corings and extensions of rings; properties of new examples of corings associated to entwining structures; generalisations of bialgebras such as bialgebroids and weak bialgebras; and the appearance of corings in noncommutative geometry.

Antonio GIAMBRUNO, Amitai REGEV, Mikhail ZAICEV, (Editors). — **Polynomial identities and combinatorial methods.** — Lecture notes in pure and applied mathematics, vol. 235. — Un vol. broché, 18 × 25, de ix, 421 p. — ISBN 0-8247-4051-3. — Prix: US\$175.00. — Marcel Dekker, New York, 2003.

Presenting a wide range of perspectives on topics ranging from ring theory and combinatorics to invariant theory and associative algebras, this reference covers current breakthroughs and strategies impacting research on polynomial identities – identifying new concepts in algebraic combinatorics, invariant and representation theory, and Lie algebras and superalgebras for novel studies in the field. It provides intensive discussions on various methods and techniques relating the theory of polynomial identities to other branches of algebraic study. The book examines Hopf algebras and quantum polynomials... free algebras and Scheier varieties... group-graded algebras... combinatorics of Young diagrams... Lie and Leibniz algebras... the theory of superalgebras... exponential functions and growth of varieties... group actions... and Poincaré series and Schur functions.

W. Keith NICHOLSON, Mohamed F. YOUSIF. — **Quasi-Frobenius rings.** — Cambridge tracts in mathematics, vol. 158. — Un vol. relié, 16 × 24, de xvii, 307 p. — ISBN 0-521-81593-2. — Prix: £55.00. — Cambridge University Press, Cambridge, 2003.

This book makes no attempt to be encyclopedic but provides an elementary account of the basic facts about these rings at a level allowing researchers and graduate students to gain entry to the field. Many earlier results about self-injective rings are extended to the much wider class of mininjective rings; the methods used unify and simplify what is known in the area and so bring the reader up to current research. Sufficient background knowledge can be found in standard texts on noncommutative rings. However, appendices on Morita equivalence; on perfect, semiperfect, and semiregular rings; and on the Camps-Dicks theorem are included to make the book self-contained. After the basic results are established, recent work is reviewed on three open problems in the field (the Faith conjecture, the FGF-conjecture, and the Faith-Menal conjecture). Some new results are provided, and new and old methods for attacking these problems are outlined in an easily accessible format.