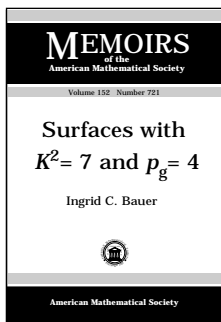


New Publications Offered by the AMS

Algebra and Algebraic Geometry



Surfaces with $K^2 = 7$ and $p_g = 4$

Ingrid C. Bauer, *University of Gottingen, Germany*

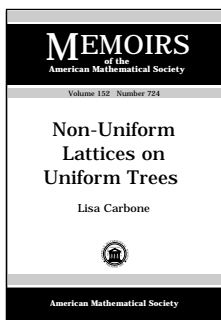
This item will also be of interest to those working in geometry and topology.

Contents: Introduction; The canonical system; Some known results; Surfaces with $K^2 = 7, p_g = 4$, such that the canonical system doesn't have a fixed

part; $|K|$ has a (non trivial) fixed part; The moduli space; Bibliography.

Memoirs of the American Mathematical Society, Volume 152, Number 721

July 2001, 79 pages, Softcover, ISBN 0-8218-2689-1, LC 2001022723, 2000 *Mathematics Subject Classification*: 14J10, 14J25, 32J15, **Individual member \$26**, List \$43, Institutional member \$34, Order code MEMO/152/721N



Non-Uniform Lattices on Uniform Trees

Lisa Carbone, *Columbia University, New York, NY*

Contents: Introduction; Graphs of groups, tree actions and edge-indexed graphs; $\text{Aut}(X)$ and its discrete subgroups; Existence of tree lattices; Non-uniform coverings of indexed graphs with an arithmetic bridge; Non-uniform coverings of indexed graphs

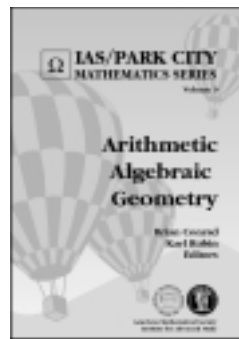
with a separating edge; Non-uniform coverings of indexed graphs with a ramified loop; Eliminating multiple edges; Existence of arithmetic bridges; Bibliography.

Memoirs of the American Mathematical Society, Volume 152, Number 724

July 2001, 127 pages, Softcover, ISBN 0-8218-2721-9, LC 2001023977, 2000 *Mathematics Subject Classification*: 20-02; 22-02, **Individual member \$28**, List \$47, Institutional member \$38, Order code MEMO/152/724N

Supplementary Reading

Recommended Text



Arithmetic Algebraic Geometry

Brian Conrad, *University of Michigan, Ann Arbor*, and Karl Rubin, *Stanford University, CA*, Editors

The articles in this volume are expanded versions of lectures delivered at the Graduate Summer School and at the Mentoring Program for

Women in Mathematics held at the Institute for Advanced Study/Park City Mathematics Institute. The theme of the program was arithmetic algebraic geometry. The choice of lecture topics was heavily influenced by the recent spectacular work of Wiles on modular elliptic curves and Fermat's Last Theorem. The main emphasis of the articles in the volume is on elliptic curves, Galois representations, and modular forms. One lecture series offers an introduction to these objects. The others discuss selected recent results, current research, and open problems and conjectures. The book would be a suitable text for an advanced graduate topics course in arithmetic algebraic geometry.

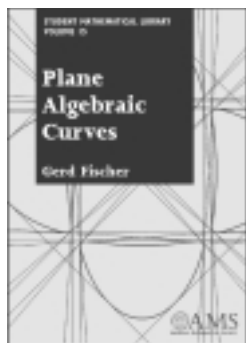
Contents: Introduction; Joe P. Buhler, *Elliptic curves, modular forms, and applications*; Preface; Elliptic curves; Points on elliptic curves; Elliptic curves over \mathbf{C} ; Modular forms of level 1; L-series; Modular forms of higher level; l -adic representations; The rank of elliptic curves over \mathbf{Q} ; Applications of elliptic curves; Bibliography; Alice Silverberg, *Open questions in arithmetic algebraic geometry*; Overview; Torsion subgroups; Ranks; Conjectures of Birch and Swinnerton-Dyer; ABC and related conjectures; Some other conjectures; Bibliography; Kenneth A. Ribet and William A. Stein, *Lectures on Serre's conjectures*; Preface; Introduction to Serre's conjecture; Optimizing the weight; Optimizing the level; Exercises; Appendix by Brian Conrad: The Shimura construction in weight 2; Appendix by Kevin Buzzard: A mod l multiplicity one result; Bibliography; Fernando Q. Gouvêa, *Deformations of Galois representations*; Introduction; Galois groups and their representations; Deformations of representations; The universal deformation;

existence; The universal deformation: properties; Explicit deformations; Deformations with prescribed properties; Modular deformations; p -adic families and infinite ferns; A criterion for existence of a universal deformation ring; An overview of a theorem of Flach; An introduction to the p -adic geometry of modular curves; Bibliography; *Ralph Greenberg, Introduction to Iwasawa theory for elliptic curves*: Preface; Mordell-Weil groups; Selmer groups; Λ -modules; Mazur's control theorem; Bibliography; *John Tate, Galois cohomology*: Galois cohomology; Bibliography; *Wen-Ching Winnie Li, The arithmetic of modular forms*: Introduction; Introduction to elliptic curves, modular forms, and Calabi-Yau varieties; The arithmetic of modular forms; Connections among modular forms, elliptic curves, and representations of Galois groups; Bibliography; *Noriko Yui, Arithmetic of certain Calabi-Yau varieties and mirror symmetry*: Introduction; The modularity conjecture for rigid Calabi-Yau threefolds over the field of rational numbers; Arithmetic of orbifold Calabi-Yau varieties over number fields; $K3$ surfaces, mirror moonshine phenomenon; Bibliography.

IAS/Park City Mathematics Series, Volume 9

August 2001, 569 pages, Hardcover, ISBN 0-8218-2173-3, LC 2001035291, 2000 *Mathematics Subject Classification*: 11F11, 11F33, 11F70, 11F80, 11G07, 11G18, 11R23, 11S25, 11G05, **All AMS members \$60**, List \$75, Order code PCMS/9N

Recommended Text



Plane Algebraic Curves

Gerd Fischer, *Heinrich-Heine-Universität, Düsseldorf, Germany*

From a review for the German Edition:

The present book provides a completely self-contained introduction to complex plane curves from the

traditional algebraic-analytic viewpoint. The arrangement of the material is of outstanding instructional skill, and the text is written in a very lucid, detailed and enlightening style ...

Compared to the many other textbooks on (plane) algebraic curves, the present new one comes closest in spirit and content, to the work of E. Brieskorn and H. Knoerr ... One could say that the book under review is a beautiful, creative and justifiable abridged version of this work, which also stresses the analytic-topological point of view ... the present book is a beautiful invitation to algebraic geometry, encouraging for beginners, and a welcome source for teachers of algebraic geometry, especially for those who want to give an introduction to the subject on the undergraduate-graduate level, to cover some not too difficult topics in substantial depth, but to do so in the shortest possible time.

—*Zentralblatt für Mathematik*

The study of the zeroes of polynomials, which for one variable is essentially algebraic, becomes a geometric theory for several variables. In this book, Fischer looks at the classic entry point to the subject: plane algebraic curves. Here one quickly sees the mix of algebra and geometry, as well as analysis and topology, that is typical of complex algebraic geometry, but without the need for advanced techniques from commutative algebra or the abstract machinery of sheaves and schemes.

In the first half of this book, Fischer introduces some elementary geometrical aspects, such as tangents, singularities, inflection points, and so on. The main technical tool is the concept of intersection multiplicity and Bézout's theorem. This part culminates in the beautiful Plücker formulas, which relate the various invariants introduced earlier.

The second part of the book is essentially a detailed outline of modern methods of local analytic geometry in the context of complex curves. This provides the stronger tools needed for a good understanding of duality and an efficient means of computing intersection multiplicities introduced earlier. Thus, we meet rings of power series, germs of curves, and formal parametrizations. Finally, through the patching of the local information, a Riemann surface is associated to an algebraic curve, thus linking the algebra and the analysis.

Concrete examples and figures are given throughout the text, and when possible, procedures are given for computing by using polynomials and power series. Several appendices gather supporting material from algebra and topology and expand on interesting geometric topics.

This is an excellent introduction to algebraic geometry, which assumes only standard undergraduate mathematical topics: complex analysis, rings and fields, and topology. Reading this book will help the student establish the appropriate geometric intuition that lies behind the more advanced ideas and techniques used in the study of higher dimensional varieties.

This is the English translation of a German work originally published by Vieweg Verlag (Wiesbaden, Germany).

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

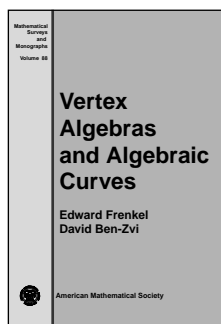
Contents: Introduction; Affine algebraic curves and their equations; The projective closure; Tangents and singularities; Polars and Hessian curves; The dual curve and the Plücker formulas; The ring of convergent power series; Parametrizing the branches of a curve by Puiseux series; Tangents and intersection multiplicities of germs of curves; The Riemann surface of an algebraic curve; The resultant; Covering maps; The implicit function theorem; The Newton polygon; A numerical invariant of singularities of curves; Harnack's inequality; Bibliography; Subject index; List of symbols.

Student Mathematical Library, Volume 15

August 2001, approximately 206 pages, Softcover, ISBN 0-8218-2122-9, 2000 *Mathematics Subject Classification*: 14H50, 14Hxx, 14-01, **All AMS members \$28**, List \$35, Order code STML/15N

Independent Study

Recommended Text



Vertex Algebras and Algebraic Curves

Edward Frenkel, *University of California, Berkeley*, and **David Ben-Zvi**, *University of Chicago, IL*

Vertex algebras were first introduced about 15 years ago as a tool used in the description of the algebraic structure of certain quantum field theories.

In recent years it became increasingly important that vertex algebras are useful not only in the representation theory of

infinite-dimensional Lie algebras, where they are by now ubiquitous, but also in other fields, such as algebraic geometry, theory of finite groups, modular functions, topology, etc. This book is an introduction to the theory of vertex algebras with a particular emphasis on the relationship between vertex algebras and the geometry of moduli spaces of algebraic curves. The authors make the first steps toward reformulating the theory of vertex algebras in a way that is suitable for algebraic-geometric applications.

The notion of a vertex algebra is introduced in the book in a coordinate independent way, allowing the authors to give global geometric meaning to vertex operators on arbitrary smooth algebraic curves, possibly equipped with some additional data. To each vertex algebra and a smooth curve, they attach an invariant called the space of conformal blocks. When the complex structure of the curve and other geometric data are varied, these spaces combine into a sheaf on the relevant moduli space. From this perspective, vertex algebras appear as the algebraic objects that encode the geometric structure of various moduli spaces associated with algebraic curves.

Numerous examples and applications of vertex algebras are included, such as the Wakimoto realization of affine Kac-Moody algebras, integral solutions of the Knizhnik-Zamolodchikov equations, classical and quantum Drinfeld-Sokolov reductions, and the W -algebras.

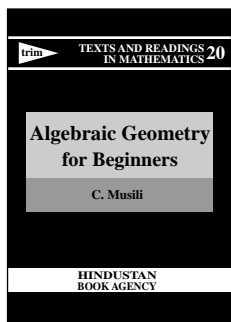
The authors also establish a connection between vertex algebras and chiral algebras, recently introduced by A. Beilinson and V. Drinfeld.

Contents: Definition of vertex algebras; Vertex algebras associated to Lie algebras; Associativity and operator product expansion; Rational vertex algebras; Vertex algebra bundles; Action of internal symmetries; Vertex algebra bundles: Examples; Conformal blocks I; Conformal blocks II; Free field realization I; Free field realization II; The Knizhnik-Zamolodchikov equations; Solving the KZ equations; Quantum Drinfeld-Sokolov reduction and W ; Vertex Lie algebras and classical limits; Vertex algebras and moduli spaces I; Vertex algebras and moduli spaces II; Chiral algebras; Appendix A; List of frequently used notation; Index; Bibliography.

Mathematical Surveys and Monographs, Volume 88

August 2001, approximately 376 pages, Hardcover, ISBN 0-8218-2894-0, 2000 *Mathematics Subject Classification*: 17B69; 81R10, 81T40, 17B65, 17B67, 17B68, 14D20, 14D21, 14H10, 14H60, 14H81, **Individual member \$33**, List \$55, Institutional member \$44, Order code SURV/88N

Recommended Text



Algebraic Geometry for Beginners

C. Musili, *University of Hyderabad, India*

A publication of the Hindustan Book Agency.

This volume offers a nearly self-contained introduction to some of the basic concepts of algebraic geometry. Prerequisites have been kept to a minimum in order to examine the

following areas and some of their standard applications: Bézout's Theorem, the Fundamental Theorem of Projective Geometry, and Zariski's Main Theorem. The exposition is

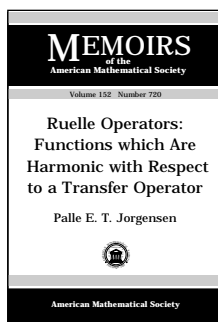
modern, but in the language of "varieties", rather than that of "schemes", making it more accessible to the non-expert. There is extensive coverage of plane curves, including elliptic curves and complex tori, moduli questions, and applications to cryptography.

Distributed worldwide except in India by the American Mathematical Society.

Contents: Commutative algebra; Affine varieties; Projective varieties; Non-singular varieties; Plane curves; Zariski's main theorem; Bibliography; Index; Glossary.

Number 7

March 2001, 335 pages, Hardcover, ISBN 81-85931-27-5, 2000 *Mathematics Subject Classification*: 13-XX, 14-XX, **All AMS members \$30**, List \$38, Order code HIN/7N



Ruelle Operators: Functions which Are Harmonic with Respect to a Transfer Operator

Palle E. T. Jorgensen, *University of Iowa, Iowa City*

Contents: Introduction; A discrete $ax + b$ group; Proof of Theorem 2.4; Wavelet filters; Cocycle equivalence of filter functions; The transfer operator of Keane; A representation theorem for R-harmonic functions; Signed solutions to $R(f) = f$; Bibliography.

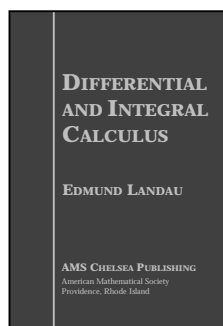
Memoirs of the American Mathematical Society, Volume 152, Number 720

July 2001, 60 pages, Softcover, ISBN 0-8218-2688-3, LC 2001022581, 2000 *Mathematics Subject Classification*: 46L60, 42A16, 43A65; 46L45, 42A65, 41A15, **Individual member \$24**, List \$40, Institutional member \$32, Order code MEMO/152/720N

Classic

Recommended Text

Back in Print from the AMS



Differential and Integral Calculus

Third Edition

Edmund Landau

And what a book it is! The marks of Landau's thoroughness and elegance, and of his undoubted authority, impress themselves on the reader at every turn, from the opening of the preface ... to the closing of the final chapter. It is a book that all analysts ...

should possess ... to see how a master of his craft like Landau presented the calculus when he was at the height of his power and reputation.

—*Mathematical Gazette*

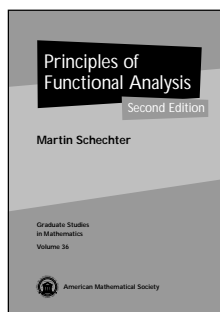
After completing his famous *Foundations of Analysis* (See AMS Chelsea Publishing, Volume 79.H for the English Edition and AMS Chelsea Publishing, Volume 141 for the German Edition, *Grundlagen der Analysis*), Landau turned his attention to this book on calculus. The approach is that of an unrepentant analyst, with an emphasis on functions rather than on geometric or physical applications. The book is another example of Landau's formidable skill as an expositor. It is a masterpiece of rigor and clarity.

Contents: *Part One. Differential Calculus:* Limits as $n = \infty$; Logarithms, powers, and roots; Functions and continuity; Limits as $x = \xi$; Definition of the derivative; General theorems on the formation of the derivative; Increase, decrease, maximum, minimum; General properties of continuous functions on closed intervals; Rolle's theorem and the theorem of the mean; Derivatives of higher order; Taylor's theorem; "0/0" and similar matters; Infinite series; Uniform convergence; Power series; Exponential series and binomial series; The trigonometric functions; Functions of two variables and partial derivatives; Inverse functions and implicit functions; The inverse trigonometric functions; Some necessary algebraic theorems; *Part Two. Integral Calculus:* Definition of the integral; Basic formulas of the integral calculus; The integration of rational functions; The integration of certain non-rational functions; Concept of the definite integral; Theorems on the definite integral; The integration of infinite series; The improper integral; The integral with infinite limits; The gamma function; Fourier series; Index of definitions; Subject index.

AMS Chelsea Publishing

January 1965, 372 pages, Hardcover, ISBN 0-8218-2830-4, LC 60-8966, 2000 *Mathematics Subject Classification:* 26-01, 01A75, All AMS members \$32, List \$35, Order code CHEL/78.HN

Recommended Text



Principles of Functional Analysis Second Edition

Martin Schechter, *University of California, Irvine*

From a review for the First Edition:

"Charming" is a word that seldom comes to the mind of a science reviewer, but if he is charmed by a

treatise, why not say so? I am charmed by this book.

Professor Schechter has written an elegant introduction to functional analysis including related parts of the theory of integral equations. It is easy to read and is full of important applications. He presupposes very little background beyond advanced calculus; in particular, the treatment is not burdened by topological "refinements" which nowadays have a tendency of dominating the picture.

The book can be warmly recommended to any reader who wants to learn about this subject without being deterred by less relevant introductory matter or scared away by heavy prerequisites.

—Einar Hille in *The American Scientist*

Functional analysis plays a crucial role in the applied sciences as well as in mathematics. It is a beautiful subject that can be motivated and studied for its own sake. In keeping with this

basic philosophy, the author has made this introductory text accessible to a wide spectrum of students, including beginning-level graduates and advanced undergraduates.

The exposition is inviting, following threads of ideas, describing each as fully as possible, before moving on to a new topic. Supporting material is introduced as appropriate, and only to the degree needed. Some topics are treated more than once, according to the different contexts in which they arise.

The prerequisites are minimal, requiring little more than advanced calculus and no measure theory. The text focuses on normed vector spaces and their important examples, Banach spaces and Hilbert spaces. The author also includes topics not usually found in texts on the subject.

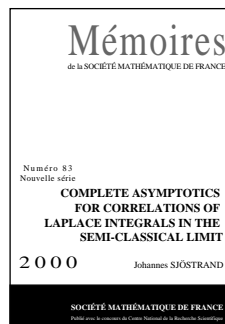
This Second Edition incorporates many new developments while not overshadowing the book's original flavor. Areas in the book that demonstrate its unique character have been strengthened. In particular, new material concerning Fredholm and semi-Fredholm operators is introduced, requiring minimal effort as the necessary machinery was already in place. Several new topics are presented, but relate to only those concepts and methods emanating from other parts of the book. These topics include perturbation classes, measures of noncompactness, strictly singular operators, and operator constants.

Overall, the presentation has been refined, clarified, and simplified, and many new problems have been added.

Contents: Basic notions; Duality; Linear operators; The Riesz theory for compact operators; Fredholm operators; Spectral theory; Unbounded operators; Reflexive Banach spaces; Banach algebras; Semigroups; Hilbert space; Bilinear forms; Selfadjoint operators; Measures of operators; Examples and applications; Bibliography; Index.

Graduate Studies in Mathematics, Volume 36

September 2001, 393 pages, Hardcover, ISBN 0-8218-2895-9, LC 2001031601, 2000 *Mathematics Subject Classification:* 46-01, 47-01, 46B20, 46B25, 46C05, 47A05, 47A07, 47A12, 47A53, 47A55, All AMS members \$47, List \$59, Order code GSM/36N



Complete Asymptotics for Correlations of Laplace Integrals in the Semi-Classical Limit

Johannes Sjöstrand, *Centre Mathématiques, Palaiseau, France*

A publication of the Société Mathématique de France.

The author studies the exponential decay asymptotics of correlations at large distance, associated to a measure of Laplace type, in the semi-classical limit. The new feature, compared to earlier works by V. Bach, T. Jecko, and the author, is that full asymptotics of the decay rate and the prefactor are given, instead of just the leading terms. He also treats the thermodynamical limit. As before, the Witten-Laplacian via a Grushin (Feshbach) problem is studied, but now higher order problems are used involving multiparticle states.

New Publications Offered by the AMS

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Slight generalization of the main result; Assumptions on ϕ ; The spaces $\mathcal{H}_{\pm 1}$; Reshuffling of Z and Z^* ; Study of $((1/\alpha!)(Z^*)^\alpha(e^{-\phi/h})|(1/\beta!)(Z^*)^\beta(e^{-\phi/h}))$; Higher order Grushin problems; Asymptotics of the solutions of the Grushin problems; Exponential weights; Parameter dependent exponents; Asymptotics of the correlations; Extraction of a main result; Non-commutative Taylor expansions; Hilbert-Schmidt property of tensors; Bibliography.

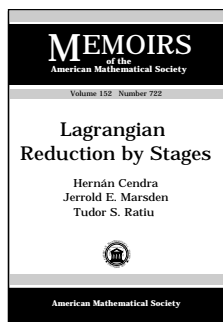
Mémoires de la Société Mathématique de France, Number 83

December 2000, 104 pages, Softcover, ISBN 2-85629-097-3,

2000 *Mathematics Subject Classification*: 82B20, 81Q20,

Individual member \$30, List \$33, Order code SMFMEM/83N

Differential Equations



Lagrangian Reduction by Stages

Hernán Cendra, *Universidad Nacional del Sur, Bahía Blanca, Argentina*, **Jerrold E. Marsden**, *California Institute of Technology, Pasadena*, and **Tudor S. Ratiu**, *École Polytechnique Fédérale de Lausanne, Switzerland*

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

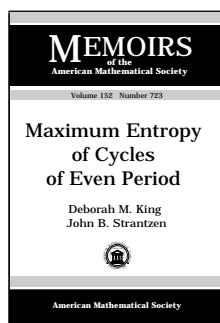
Contents: Introduction; Preliminary constructions; The Lagrange-Poincaré equations; Wong's equations and coordinate formulas; The Lie algebra structure on sections of the reduced bundle; Reduced tangent bundles; Further examples; The category $\mathcal{L}\mathfrak{P}^*$ and Poisson geometry; Bibliography.

Memoirs of the American Mathematical Society, Volume 152, Number 722

July 2001, 108 pages, Softcover, ISBN 0-8218-2715-4, LC

2001023978, 2000 *Mathematics Subject Classification*: 37J15;

70H33, 53D20, **Individual member \$28**, List \$47, Institutional member \$38, Order code MEMO/152/722N



Maximum Entropy of Cycles of Even Period

Deborah M. King, *University of New South Wales, Sydney, NSW, Australia*, and **John B. Strantzen**, *La Trobe University, Bundoora, Victoria, Australia*

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

Contents: Introduction; Preliminaries; Some useful properties of the induced matrix of a maximodal permutation; The family of orbit types; Some easy lemmas; Two inductive lemmas; The remaining case; References.

Memoirs of the American Mathematical Society, Volume 152, Number 723

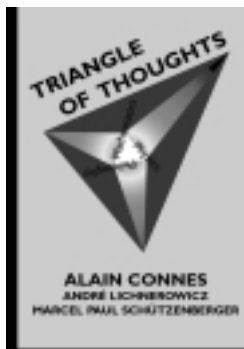
July 2001, 59 pages, Softcover, ISBN 0-8218-2707-3, LC

2001023976, 2000 *Mathematics Subject Classification*: 37B40,

37E15, **Individual member \$24**, List \$40, Institutional member \$32, Order code MEMO/152/723N

General and Interdisciplinary

Recommended Text



Triangle of Thoughts

Alain Connes, **André Lichnerowicz**, and **Marcel Paul Schützenberger**

Our view of the world today is fundamentally influenced by twentieth century results in physics and mathematics. Here, three members of the French Academy of Sciences: Alain Connes, André Lichnerowicz, and Marcel Paul Schützenberger, discuss

the relations among mathematics, physics, and philosophy, and other sciences. Written in the form of conversations among three brilliant scientists and deep thinkers, the book touches on, among others, the following questions:

- Is there a "primordial truth" that exists beyond the realm of what is provable? More generally, is there a distinction between what is true in mathematics and what is provable?
- How is mathematics different from other sciences? How is it the same? Does mathematics have an "object" or an "object of study", the way physics, chemistry and biology do?
- Mathematics is a lens, through which we view the world. Connes, Lichnerowicz, and Schützenberger examine that lens, to understand how it affects what we do see, but also to understand how it limits what we can see.
- How does a well-informed mathematician view fundamental topics of physics, such as: quantum mechanics, general relativity, quantum gravity, grand unification, and string theory?
- What are the relations between computational complexity and the laws of physics?

- Can pure thought alone lead physicists to the right theories, or must experimental data be the driving force? How should we compare Heisenberg's arrival at matrix mechanics from spectral data to Einstein's arrival at general relativity through his thought experiments?

The conversations are sprinkled with stories and quotes from outstanding scientists, which enliven the discourse. The book will make you think again about things that you once thought were quite familiar.

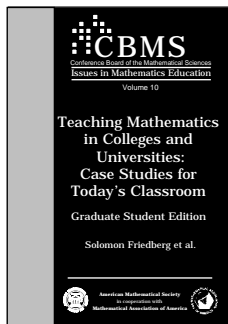
Alain Connes is one of the founders of non-commutative geometry. He holds the Chair of Analysis and Geometry at the Collège de France. He was awarded the Fields Medal in 1982.

André Lichnerowicz, mathematician, noted geometer, theoretical physicist, and specialist in general relativity, was a professor at the Collège de France.

Marcel Paul Schützenberger made brilliant contributions to combinatorics and graph theory. He was simultaneously a medical doctor, a biologist, a psychiatrist, a linguist, and an algebraist.

Contents: Logic and reality; The nature of mathematical objects; Physics and mathematics: The double-edged sword; Fundamental theory and real calculation; Mathematics and the description of the world; Cosmology and grand unification; Interpreting quantum mechanics; Reflections on time; Biographical Note: André Lichnerowicz; Biographical Note: Marcel Paul Schützenberger.

July 2001, 181 pages, Hardcover, ISBN 0-8218-2614-X, LC 00-065064, 2000 *Mathematics Subject Classification*: 00A30, All AMS members \$24, List \$30, Order code TOTN



Teaching Mathematics in Colleges and Universities: Case Studies for Today's Classroom

Graduate Student Edition

Solomon Friedberg, *Boston*

College, Chestnut Hill, MA, Avner Ash, Elizabeth Brown, Deborah Hughes Hallett, Reva Kasman, Margaret Kenney, Lisa A. Mantini, William McCallum, Jeremy Teitelbaum, and Lee Zia

Progress in mathematics frequently occurs first by studying particular examples and then by generalizing the patterns that have been observed into far-reaching theorems. Similarly, in teaching mathematics one often employs examples to motivate a general principle or to illustrate its use. This volume uses the same idea in the context of learning *how* to teach: By analyzing particular teaching situations, one can develop broadly applicable teaching skills useful for the professional mathematician. These teaching situations are the Case Studies of the title.

Just as a good mathematician seeks both to understand the details of a particular problem and to put it in a broader context, the examples presented here are chosen to offer a serious set of detailed teaching issues and to afford analysis from a broad perspective.

Each case raises a variety of pedagogical and communication issues that may be explored either individually or in a group facilitated by a faculty member. Teaching notes for such a facilitator are included for each Case in the Faculty Edition.

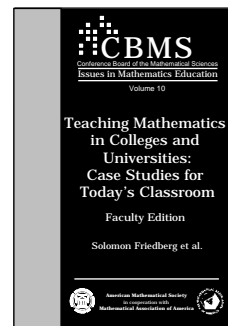
The methodology of Case Studies is widely used in areas such as business and law. The consideration of the mathematics cases presented here will help readers to develop teaching skills for their own classrooms.

This series is published in cooperation with the Mathematical Association of America.

Contents: Introduction; *Fourteen case studies:* Changing sections; Emily's test; Fundamental problems; Making the grade (College algebra version/Calculus I version/Multivariable calculus version); Making waves; Order out of chaos; Pairing up; The quicksand of problem four; Salad days; Seeking points; Study habits; Studying the exam (College algebra questions/Calculus II questions/Multivariable calculus questions); There's something about Ted; What were they thinking?.

CBMS Issues in Mathematics Education, Volume 10

June 2001, 67 pages, Softcover, ISBN 0-8218-2823-1, LC 2001022683, 2000 *Mathematics Subject Classification*: 00A35, 97D40; 00A05, 97C70, 97D30, 97D50, 97D60, 97D70, 97U70, All AMS members \$13, List \$16, Order code CBMATH/10N



Teaching Mathematics in Colleges and Universities: Case Studies for Today's Classroom

Faculty Edition

Solomon Friedberg, *Boston*

College, Chestnut Hill, MA and members of the Boston College Mathematics Case Studies Project Development Team

Contents: Introduction; *Fourteen case studies:* Changing sections; Emily's test; Fundamental problems part I; Making the Grade (College algebra version/Calculus I version/Multivariable calculus version); Making waves; Order out of chaos; Pairing up; The quicksand of problem four; Salad days; Seeking points; Study habits; Studying the exam (College algebra questions/Calculus II questions/Multivariable calculus questions); There's something about Ted part I; What were they thinking?; *Supporting materials for faculty:* Developing effective mathematics teaching assistants using case studies: An introduction for faculty; Using case studies in a TA-development program; Types of cases; Summaries of cases; How these cases were created; Changing sections, teaching guide; Emily's test, teaching guide; Fundamental problems part II (Fundamental problems, teaching guide); Making the grade, teaching guide; Making waves part II (Making waves, teaching guide); Order out of chaos, teaching guide; Pairing up, teaching guide; The quicksand of problem four, teaching guide; Salad days, teaching guide; Seeking points, teaching guide; Study habits, teaching guide; Studying the exam, teaching guide (College algebra version/Calculus II version/Multivariable calculus version); There's something about Ted Part II/There's some-

thing about Ted, teaching guide; What were they thinking?, teaching guide.

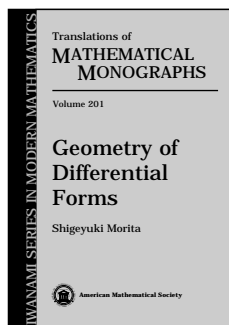
CBMS Issues in Mathematics Education, Volume 10.F

June 2001, 158 pages, Softcover, ISBN 0-8218-2875-4, 2000 *Mathematics Subject Classification*: 00A35, 97D40; 00A05, 97C70, 97D30, 97D50, 97D60, 97D70, 97U70, All AMS members \$23, List \$29, Order code CBMATH/10.FN

Geometry and Topology

Recommended Text

Geometry of Differential Forms



Shigeyuki Morita, University of Tokyo, Japan

Since the times of Gauss, Riemann, and Poincaré, one of the principal goals of the study of manifolds has been to relate local analytic properties of a manifold with its global topological properties. Among the high points on this route are the Gauss-Bonnet formula, the de Rham complex, and the Hodge theorem; these results show, in particular, that the central

tool in reaching the main goal of global analysis is the theory of differential forms.

The book by Morita is a comprehensive introduction to differential forms. It begins with a quick introduction to the notion of differentiable manifolds and then develops basic properties of differential forms as well as fundamental results concerning them, such as the de Rham and Frobenius theorems. The second half of the book is devoted to more advanced material, including Laplacians and harmonic forms on manifolds, the concepts of vector bundles and fiber bundles, and the theory of characteristic classes. Among the less traditional topics treated is a detailed description of the Chern-Weil theory.

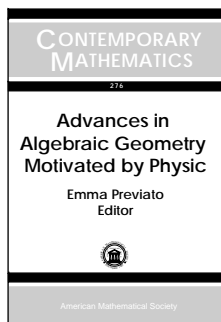
The book can serve as a textbook for undergraduate students and for graduate students in geometry.

Contents: Manifolds; Differential forms; de Rham theorem; Laplacian and harmonic forms; Vector bundles and characteristic classes; Fiber bundles and characteristic classes; Perspectives; References; Solutions; Index.

Translations of Mathematical Monographs (Iwanami Series in Modern Mathematics), Volume 201

July 2001, approximately 352 pages, Softcover, ISBN 0-8218-1045-6, LC 2001022608, 2000 *Mathematics Subject Classification*: 57Rxx, 58Axx, All AMS members \$42, List \$53, Order code MMONO/201N

Mathematical Physics



Advances in Algebraic Geometry Motivated by Physics

Emma Previato, Boston University, MA, Editor

Our knowledge of objects of algebraic geometry such as moduli of curves, (real) Schubert classes, fundamental groups of complements of hyperplane arrangements, toric varieties, and variation of Hodge structures, has been

enhanced recently by ideas and constructions of quantum field theory, such as mirror symmetry, Gromov-Witten invariants, quantum cohomology, and gravitational descendants.

These are some of the themes of this refereed collection of papers, which grew out of the special session, "Enumerative Geometry in Physics," held at the AMS meeting in Lowell, MA, April 2000. This session brought together mathematicians and physicists who reported on the latest results and open questions; all the abstracts are included as an Appendix, and also included are papers by some who could not attend.

The collection provides an overview of state-of-the-art tools, links that connect classical and modern problems, and the latest knowledge available.

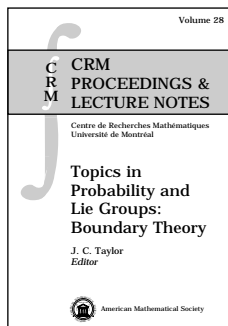
This item will also be of interest to those working in algebra and algebraic geometry.

Contents: Enumerative or reality problems: S. J. Kovács, Number of automorphisms of principally polarized abelian varieties; F. Sottile, Rational curves on Grassmannians: Systems theory, reality, and transversality; A. I. Suciu, Fundamental groups of line arrangements: Enumerative aspects; *Variational and moduli problems:* D. Abramovich and A. Bertram, The formula $12 = 10 + 2 \times 1$ and its generalizations: Counting rational curves on F_2 ; D. Abramovich and F. Oort, Stable maps and Hurwitz schemes in mixed characteristics; L. Caporaso, On modular properties of odd theta-characteristics; E. Cattani and J. Fernandez, Asymptotic Hodge theory and quantum products; H. Clemens, On rational curves in n -space with given normal bundle; R. Vakil, A tool for stable reduction of curves on surfaces; *Mirror symmetry and Gromov-Witten invariants:* D. A. Cox, S. Katz, and Y.-P. Lee, Virtual fundamental classes of zero loci; T. J. Jarvis, T. Kimura, and A. Vaintrob, Gravitational descendants and the moduli space of higher spin curves; B. Kreuzler, Homological mirror symmetry in dimension one; A. R. Mavlyutov, The Hodge structure of semiample hypersurfaces and a generalization of the monomial-divisor mirror map; A. Polishchuk and A. Vaintrob, Algebraic construction of Witten's top Chern class; A. Postnikov, Symmetries of Gromov-Witten invariants; S. Rosenberg and M. Vajiac, Gauge theory techniques in quantum cohomology; C. Woodward, Gromov-Witten invariants of flag manifolds and products of conjugacy classes; *Appendix:* E. Previato, The Lowell meeting.

Contemporary Mathematics, Volume 276

July 2001, 294 pages, Softcover, ISBN 0-8218-2810-X, LC 2001022549, 2000 *Mathematics Subject Classification*: 13P10, 14-XX, 32G20, 32S22, 53Cxx, 53D45; 20Fxx, 57M05, 65H20, 93B55, Individual member \$45, List \$75, Institutional member \$60, Order code CONM/276N

Probability



Topics in Probability and Lie Groups: Boundary Theory

J. C. Taylor, *McGill University, Montreal, PQ, Canada*, Editor

This volume is comprised of two parts: the first contains articles by S. N. Evans, F. Ledrappier, and Figà-Talamanca. These articles arose from a Centre de Recherches de Mathéma-

tiques (CRM) seminar entitled, "Topics in Probability on Lie Groups: Boundary Theory".

Evans gives a synthesis of his pre-1992 work on Gaussian measures on vector spaces over a local field. Ledrappier uses the freegroup on d generators as a paradigm for results on the asymptotic properties of random walks and harmonic measures on the Martin boundary. These articles are followed by a case study by Figà-Talamanca using Gelfand pairs to study a diffusion on a compact ultrametric space.

The second part of the book is an appendix to the book *Compactifications of Symmetric Spaces* (Birkhauser) by Y. Guivarc'h and J. C. Taylor. This appendix consists of an article by each author and presents the contents of this book in a more algebraic way. L. Ji and J.-P. Anker simplifies some of their results on the asymptotics of the Green function that were used to compute Martin boundaries. And Taylor gives a self-contained account of Martin boundary theory for manifolds using the theory of second order strictly elliptic partial differential operators.

Contents: J.-P. Anker and L. Ji, Heat kernel and Green function estimates on noncompact symmetric spaces. II; S. N. Evans, Local fields, Gaussian measures, and Brownian motions; A. Figà-Talamanca, An application of Gelfand pairs to a problem of diffusion in compact ultrametric spaces; Y. Guivarc'h, J. C. Taylor, and L. Ji, Compactifications of symmetric spaces and positive eigenfunctions of the Laplacian; F. Ledrappier, Some asymptotic properties of random walks on free groups; J. C. Taylor, The Martin compactification associated with a second order strictly elliptic partial differential operator on a manifold M .

CRM Proceedings & Lecture Notes, Volume 28

July 2001, 202 pages, Softcover, ISBN 0-8218-0275-5, LC 2001032073, 2000 *Mathematics Subject Classification*: 60B99; 31C35, 22E30, 22E46, 60J50, **Individual member \$35**, List \$59, Institutional member \$47, Order code CRMP/28N

Previously Announced Publications

A Classic

Supplementary Reading

Plateau's Problem

An Invitation to Varifold Geometry

Frederick J. Almgren, Jr.

There have been many wonderful developments in the theory of minimal surfaces and geometric measure theory in the past 25 to 30 years. Many of the researchers who have produced these excellent results were inspired by this little book—or by Fred Almgren himself.

The book is indeed a delightful invitation to the world of variational geometry. A central topic is Plateau's Problem, which is concerned with surfaces that model the behavior of soap films. When trying to resolve the problem, however, one soon finds that smooth surfaces are insufficient: Varifolds are needed. With varifolds, one can obtain geometrically meaningful solutions without having to know in advance all their possible singularities. This new tool makes possible much exciting new analysis and many new results.

Plateau's problem and varifolds live in the world of geometric measure theory, where differential geometry and measure theory combine to solve problems which have variational aspects. The author's hope in writing this book was to encourage young mathematicians to study this fascinating subject further. Judging from the success of his students, it achieves this exceedingly well.

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

Student Mathematical Library, Volume 13

July 2001, approximately 88 pages, Softcover, ISBN 0-8218-2747-2, LC 2001022082, 2000 *Mathematics Subject Classification*: 49-01, 26-01, 28-01, 28A75, 49Q15, 49Q20, 58E12, **All AMS members \$15**, List \$19, Order code STL/13RT167

Supplementary Reading

Essays in the History of Lie Groups and Algebraic Groups

Armand Borel, *Institute for Advanced Study, Princeton, NJ*

Lie groups and algebraic groups are important in many major areas of mathematics and mathematical physics. We find them in diverse roles, notably as groups of automorphisms of geometric structures, as symmetries of differential systems, or as basic tools in the theory of automorphic forms. The author looks at their development, highlighting the evolution from the almost purely local theory at the start to the global theory that we know today. Starting from Lie's theory of local analytic transformation groups and early work on Lie algebras, he follows the process of globalization in its two main frameworks: differential geometry and topology on one hand, algebraic geometry on the other. Chapters II to IV are devoted to the former, Chapters V to VIII, to the latter.

The essays in the first part of the book survey various proofs of the full reducibility of linear representations of $SL_2(\mathbb{C})$, the

contributions of H. Weyl to representations and invariant theory for semisimple Lie groups, and conclude with a chapter on E. Cartan's theory of symmetric spaces and Lie groups in the large.

The second part of the book first outlines various contributions to linear algebraic groups in the 19th century, due mainly to E. Study, E. Picard, and above all, L. Maurer. After being abandoned for nearly fifty years, the theory was revived by C. Chevalley and E. Kolchin, and then further developed by many others. This is the focus of Chapter VI. The book concludes with two chapters on the work of Chevalley on Lie groups and Lie algebras and of Kolchin on algebraic groups and the Galois theory of differential fields, which put their contributions to algebraic groups in a broader context.

Professor Borel brings a unique perspective to this study. As an important developer of some of the modern elements of both the differential geometric and the algebraic geometric sides of the theory, he has a particularly deep understanding of the underlying mathematics. His lifelong involvement and his historical research in the subject area give him a special appreciation of the story of its development.

Copublished with the London Mathematical Society. Members of the LMS may order directly from the AMS at the AMS member price. The LMS is registered with the Charity Commissioners.

History of Mathematics, Volume 21

July 2001, approximately 184 pages, Hardcover, ISBN 0-8218-0288-7, LC 2001018175, 2000 *Mathematics Subject Classification*: 01A55, 01A60, 20-03, 20G15, 20G20, 22-03, 22E10, 22E46, 32M05, 32M15, 32-03, 53C35, 57T15, **All AMS members \$31**, List \$39, Order code HMATH/21RT167

Problèmes de Petits Diviseurs dans les Équations aux Dérivées Partielles

Walter Craig, *McMaster University, Hamilton, ON, Canada*

A publication of the Société Mathématique de France.

Many problems in nonlinear PDE which are of physical significance can be posed as Hamiltonian systems: Some principal examples include the nonlinear wave equations, the nonlinear Schrödinger equation, the KdV equation and the Euler equations of fluid mechanics. Complementing the theory of the initial value problem, it is natural to pose the question of stability of solutions for all times, and to describe the principal structures of phase space which are invariant under the flow. The subject of this volume is the development of extensions of KAM theory of invariant tori for PDE, for which the phase space is naturally infinite dimensional. The book starts with the definition of a Hamiltonian system in infinite dimensions. It reviews the classical theory of periodic solutions for finite dimensional dynamical systems, commenting on the role played by resonances. It then develops a direct approach to KAM theory in infinite dimensional settings, applying it to several of the PDE of interest. The volume includes a description of the methods of Fröhlich and Spencer for resolvent expansions of linear operators, as it is a basic technique used in this approach to KAM theory. The final chapter gives a presentation of the more recent developments of the subject. Text is in French.

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Panoramas et Synthèses, Number 9

December 2000, 120 pages, Softcover, ISBN 2-85629-095-7, 2000 *Mathematics Subject Classification*: 35-XX, 37-XX, **Individual member \$30**, List \$33, Order code PASY/9RT167

Recommended Text

Problems in Mathematical Analysis II Continuity and Differentiation

W. J. Kaczor and M. T. Nowak, *Maria Curie-Skłodowska University, Lublin, Poland*

We learn by doing. We learn mathematics by doing problems. And we learn more mathematics by doing more problems. This is the sequel to *Problems in Mathematical Analysis I* (Volume 4 in the Student Mathematical Library series). If you want to hone your understanding of continuous and differentiable functions, this book contains hundreds of problems to help you do so. The emphasis here is on real functions of a single variable. Topics include: continuous functions, the intermediate value property, uniform continuity, mean value theorems, Taylor's formula, convex functions, sequences and series of functions.

The book is mainly geared toward students studying the basic principles of analysis. However, given its selection of problems, organization, and level, it would be an ideal choice for tutorial or problem-solving seminars, particularly those geared toward the Putnam exam. It is also suitable for self-study. The presentation of the material is designed to help student comprehension, to encourage them to ask their own questions, and to start research. The collection of problems will also help teachers who wish to incorporate problems into their lectures. The problems are grouped into sections according to the methods of solution. Solutions for the problems are provided.

Student Mathematical Library, Volume 12

June 2001, 398 pages, Softcover, ISBN 0-8218-2051-6, LC 99-087039, 2000 *Mathematics Subject Classification*: 00A07; 26A06, 26A15, 26A24, **All AMS members \$39**, List \$49, Order code STML/12RT167

Also available ...

Problems in Mathematical Analysis I

W. J. Kaczor and M. T. Nowak, *Maria Curie-Skłodowska University, Lublin, Poland*

Student Mathematical Library

Volume 4: June 2001, 380 pages, Softcover, ISBN 0-8218-2050-8, LC 99-087039, 2000 *Mathematics Subject Classification*: 00A07, 40-01; 26A06, 26A15, 26A24, **All AMS members \$31**, List \$39, Order code STML/4RT167

Set: June 2001, 796 pages, Softcover, ISBN 0-8218-2849-5, LC 99-087039, 2000 *Mathematics Subject Classification*: 00A07, 40-01; 26A06, 26A15, 26A24, **All AMS members \$62**, List \$78, Order code STMLSETRT167

Ensembles Quasi-Minimaux avec Contrainte de Volume et Rectifiabilité Uniforme

Séverine Rigot, *Université de Paris-Sud, Orsay, France*

A publication of the Société Mathématique de France.

In this memoir, the author studies the regularity of quasi-minimal sets for the perimeter with a volume constraint, i.e., measurable subsets G of \mathbb{R}^n which satisfy the following quasi-minimality condition: $\int_{\mathbb{R}^n} |\nabla \chi_G| \leq \int_{\mathbb{R}^n} |\nabla \chi_{G'}| + g(|G \Delta G'|)$, for every $G' \subset \mathbb{R}^n$ such that $G \Delta G' \in \mathbb{R}^n$ and $|G'| = |G|$. Here $\int_{\mathbb{R}^n} |\nabla \chi_G|$ denotes the perimeter of G and $g: [0, +\infty[\rightarrow [0, +\infty[$ is fixed such that $g(x) = o(x^{(n-1)/n})$.

The main result of this memoir is the uniform rectifiability of their boundary with universal parameters. This result is then applied to the study of minimizers with prescribed Lebesgue measure of a functional E defined by

$$E(G) = H^{n-1}(\partial G) + \iint_{G \times G} K(x - y) dx dy, \text{ where } G \subset \mathbb{R}^n,$$

$H^{n-1}(\partial G)$ denotes the $(n-1)$ -Hausdorff measure of the boundary of G and $K \in L^1(\mathbb{R}^n)$ with compact support. Using the fact that the parameters in the regularity properties of quasi-minimizers with a volume constraint are universal, the author obtains the existence of optimal sets together with a description of these minimizers (regularity of their boundary, size and number of their connected components). Text is in French.

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Mémoires de la Société Mathématique de France, Number 82

December 2000, 104 pages, Softcover, ISBN 2-85629-093-0, 2000 *Mathematics Subject Classification*: 49Q20, **Individual member \$30**, List \$33, Order code SMFMEM/82RT167

Topology, Ergodic Theory, Real Algebraic Geometry

Rokhlin's Memorial

V. Turaev, *Université Louis Pasteur—CNRS, Strasbourg, France*, and **A. Vershik**, *Steklov Mathematical Institute, St. Petersburg, Russia*, Editors

This book is dedicated to the memory of the outstanding Russian mathematician, V. A. Rokhlin (1919–1984). It is a collection of research papers written by his former students and followers, who are now experts in their fields. The topics in this volume include topology (the Morse-Novikov theory, spin bordisms in dimension 6, and skein modules of links), real algebraic geometry (real algebraic curves, plane algebraic surfaces, algebraic links, and complex orientations), dynamics (ergodicity, amenability, and random bundle transformations), geometry of Riemannian manifolds, theory of Teichmüller spaces, measure theory, etc. The book also includes a biography of Rokhlin by Vershik and two articles of historical interest.

Contributors include: A. M. Vershik, J. E. Andersen, V. Turaev, F. Bihan, A. Bufetov, Z. Coelho, W. Parry, A. Degtyarev, M. Farber, S. Finashin, I. Itenberg, N. V. Ivanov, V. A. Kaimanovich, V. Kharlamov, J.-J. Risler, E. Shustin, Y. Kifer, S. Yu. Orevkov, M. Pollicott, R. Sharp, O. Viro, B. Weiss, and A. V. Zhubr.

American Mathematical Society Translations—Series 2 (*Advances in the Mathematical Sciences*), Volume 202

March 2001, 286 pages, Hardcover, ISBN 0-8218-2740-5, LC 91-640741, 2000 *Mathematics Subject Classification*: 14P25, 37Axx; 28Axx, 28Dxx, 57Q25, **Individual member \$71**, List \$119, Institutional member \$95, Order code TRANS2/202RT167

Introduction to Topology

V. A. Vassiliev, *Independent University of Moscow, Russia*

From a review for the Russian edition ...

The book is based on a course given by the author in 1996 to first and second year students at Independent Moscow University ... the emphasis is on illustrating what is happening in topology, and the proofs (or their ideas) covered are those which either have important generalizations or are useful in explaining important concepts ... This is an excellent book and one can gain a great deal by reading it. The material, normally requiring several volumes, is covered in 123 pages, allowing the reader to appreciate the interaction between basic concepts of algebraic and differential topology without being buried in minutiae.

—*Mathematical Reviews*

This English translation of a Russian book presents the basic notions of differential and algebraic topology, which are indispensable for specialists and useful for research mathematicians and theoretical physicists. In particular, ideas and results are introduced related to manifolds, cell spaces, coverings and fibrations, homotopy groups, homology and cohomology, intersection index, etc. The author notes, "The lecture note origins of the book left a significant imprint on its style. It contains very few detailed proofs: I tried to give as many illustrations as possible and to show what really occurs in topology, not always explaining why it occurs." He concludes, "As a rule, only those proofs (or sketches of proofs) that are interesting *per se* and have important generalizations are presented."

Student Mathematical Library, Volume 14

March 2001, 149 pages, Softcover, ISBN 0-8218-2162-8, LC 2001018842, 2000 *Mathematics Subject Classification*: 55-01, **All AMS members \$20**, List \$25, Order code STML/14RT167