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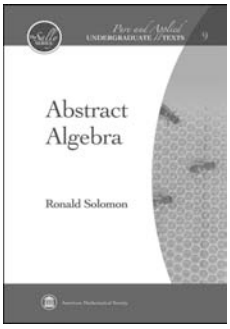
Algebra and Algebraic Geometry

COURSE ADOPTION



Abstract Algebra

Ronald Solomon, *Ohio State University, Columbus, OH*

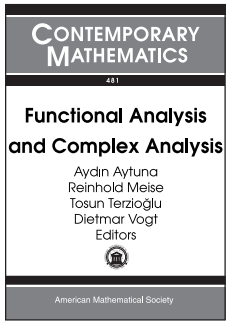
This undergraduate text takes a novel approach to the standard introductory material on groups, rings, and fields. At the heart of the text is a semi-historical journey through the early decades of the subject as it emerged in the revolutionary work of Euler, Lagrange, Gauss, and Galois. Avoiding excessive abstraction whenever possible, the text focuses on the central problem of studying the solutions of polynomial equations. Highlights include a proof of the Fundamental Theorem of Algebra, essentially due to Euler, and a proof of the constructability of the regular 17-gon, in the manner of Gauss. Another novel feature is the introduction of groups through a meditation on the meaning of congruence in the work of Euclid. Everywhere in the text, the goal is to make clear the links connecting abstract algebra to Euclidean geometry, high school algebra, and trigonometry, in the hope that students pursuing a career as secondary mathematics educators will carry away a deeper and richer understanding of the high school mathematics curriculum. Another goal is to encourage students, insofar as possible in a textbook format, to build the course for themselves, with exercises integrally embedded in the text of each chapter.

Contents: Background; Geometry; Polynomials; Numbers; The grand synthesis; Index.

Pure and Applied Undergraduate Texts, Volume 9

February 2009, 227 pages, Hardcover, ISBN: 978-0-8218-4795-4, LC 2008047399, 2000 *Mathematics Subject Classification:* 12-01, **AMS members US$50**, List US$62, Order code AMSTEXT/9

Analysis



Functional Analysis and Complex Analysis

Aydın Aytuna, *Sabancı University, İstanbul, Turkey*, **Reinhold Meise**, *University of Dusseldorf, Dusseldorf, Germany*, **Tosun Terzioğlu**, *Sabancı University, İstanbul, Turkey*, and **Dietmar Vogt**, *University of Wuppertal, Germany*, Editors

In recent years, the interplay between the methods of functional analysis and complex analysis has led to some remarkable results in a wide variety of topics. It turned out that the structure of spaces of holomorphic functions is fundamentally linked to certain invariants initially defined on abstract Fréchet spaces as well as to the developments in pluripotential theory.

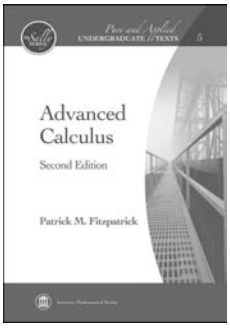
The aim of this volume is to document some of the original contributions to this topic presented at a conference held at Sabancı University in İstanbul, in September 2007. This volume also contains some surveys that give an overview of the state of the art and initiate further research in the interplay between functional and complex analysis.

Contents: C. O. Kiselman, Vyacheslav Zakharyuta's complex analysis; **Z. Błocki**, Remark on the definition of the complex Monge-Ampère operator; **J. Bonet** and **R. Meise**, Convolution operators on quasianalytic classes of Roumieu type; **J. S. Brauchart**, **D. P. Hardin**, and **E. B. Saff**, Riesz energy and sets of revolution in $\mathbb{R}_3$; **P. Djakov** and **B. Mityagin**, Bari-Markus property for Riesz projections of Hill operators with singular potentials; **M. Langenbruch**, Right inverses for differential operators on Fourier ultra-hyperfunctions and the property (DN); **S. E. Marzguioui** and **J. Wiegerinck**, Connectedness in the pluri-fine topology; **V. P. Palamodov**, Quantum shape of compact domains in phase plane; **A. Rashkovskii**, Analyticity and propagation of plurisubharmonic singularities; **D. Vogt**, Linear topological properties of spaces $\mathcal{H}^\omega$ and of spaces of ultradifferentiable functions; **J. Wengenroth**, Invertibility for Fréchet valued real analytic functions; **V. Zakharyuta**, Kolmogorov problem on widths asymptotics and pluripotential theory.

Contemporary Mathematics, Volume 481

April 2009, 196 pages, Softcover, ISBN: 978-0-8218-4460-1, LC 2008040610, 2000 *Mathematics Subject Classification:* 46E10, 46A04, 46F05, 32U15, 35E20, 32E30, 28A78, 46A63, 47B06, 32W20, **AMS members US$55**, List US$69, Order code CONM/481

COURSE ADOPTION



Advanced Calculus

Second Edition

Patrick M. Fitzpatrick, *University of Maryland, College Park, MD*

Advanced Calculus is intended as a text for courses that furnish the backbone of the student's undergraduate education in mathematical analysis. The goal is to rigorously present the fundamental concepts within the context of illuminating examples and stimulating exercises. This book is self-contained and starts with the creation of basic tools using the completeness axiom. The continuity, differentiability, integrability, and power series representation properties of functions of a single variable are established. The next few chapters describe the topological and metric properties of Euclidean space. These are the basis of a rigorous treatment of differential calculus (including the Implicit Function Theorem and Lagrange Multipliers) for mappings between Euclidean spaces and integration for functions of several real variables.

Special attention has been paid to the motivation for proofs. Selected topics, such as the Picard Existence Theorem for differential equations, have been included in such a way that selections may be made while preserving a fluid presentation of the essential material.

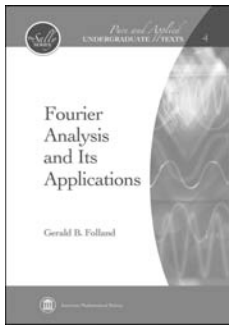
Supplemented with numerous exercises, *Advanced Calculus* is a perfect book for undergraduate students of analysis.

Contents: Preliminaries; Tools for analysis; Convergent sequences; Continuous functions; Differentiation; Elementary functions as solutions of differential equations; Integration: Two fundamental theorems; Integration: Further topics; Approximation by Taylor polynomials; Sequences and series of functions; The Euclidean space $\mathbb{R}^n$; Continuity, compactness, and connectedness; Metric spaces; Differentiating functions of several variables; Local approximation of real-valued functions; Approximating nonlinear mappings by linear mappings; Images and inverses: The inverse function theorem; The implicit function theorem and its applications; Integrating functions of several variables; Iterated integration and changes of variables; Line and surface integrals; Consequences of the field and positivity axioms; Linear algebra; Index.

Pure and Applied Undergraduate Texts, Volume 5

March 2009, 590 pages, Hardcover, ISBN: 978-0-8218-4791-6, LC 2008047395, 2000 *Mathematics Subject Classification:* 26-01, 26A06, **AMS members US$66**, List US$82, Order code AMSTEXT/5

COURSE ADOPTION



Fourier Analysis and Its Applications

Gerald B. Folland, *University of Washington, Seattle, WA*

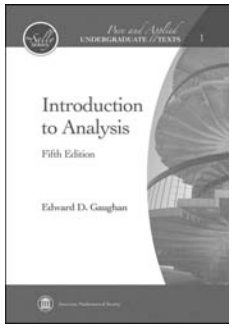
This book presents the theory and applications of Fourier series and integrals, eigenfunction expansions, and related topics, on a level suitable for advanced undergraduates. It includes material on Bessel functions, orthogonal polynomials, and Laplace transforms, and it concludes with chapters on generalized functions and Green's functions for ordinary and partial differential equations. The book deals almost exclusively with aspects of these subjects that are useful in physics and engineering, and includes a wide variety of applications. On the theoretical side, it uses ideas from modern analysis to develop the concepts and reasoning behind the techniques without getting bogged down in the technicalities of rigorous proofs.

Contents: Overture; Fourier series; Orthogonal sets of functions; Some boundary value problems; Bessel functions; Orthogonal polynomials; The Fourier transform; The Laplace transform; Generalized functions; Green's functions; Appendices; Answers to the exercises; References; Index of symbols; Index.

Pure and Applied Undergraduate Texts, Volume 4

March 2009, 433 pages, Hardcover, ISBN: 978-0-8218-4790-9, LC 2008047394, 2000 *Mathematics Subject Classification:* 42-01; 00A05, 33-01, 34B05, 34L10, 44A10, 46-01, **AMS members US$58**, List US$72, Order code AMSTEXT/4

COURSE ADOPTION



Introduction to Analysis

Fifth Edition

Edward D. Gaughan, *New Mexico State University, Las Cruces, NM*

Introduction to Analysis is designed to bridge the gap between the intuitive calculus usually offered at the undergraduate level and the sophisticated analysis courses the student encounters at the graduate level. In this book the student is given the vocabulary and facts necessary for further study in analysis. The course for which it is designed is usually offered at the junior level, and it is assumed that the student has little or no previous experience with proofs in analysis. A considerable amount of time is spent motivating the theorems and proofs and developing the reader's intuition. Of course, that intuition must be tempered with the realization that rigorous proofs are required for theorems. The topics are quite standard: convergence of sequences, limits of functions, continuity, differentiation, the Riemann integral, infinite series, power series, and convergence of sequences of functions. Many examples are given to illustrate the theory, and exercises at the end of each chapter are keyed to each section. Also, at the end of each section, one finds several Projects. The purpose of a Project is to give the reader a substantial mathematical problem and the necessary guidance to solve that problem. A Project is distinguished from an

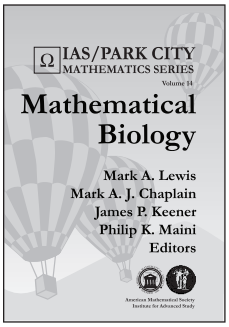
exercise in that the solution of a Project is a multi-step process requiring assistance for the beginner student.

Contents: Preliminaries; Sequences; Limits of functions; Continuity; Differentiation; The Riemann integral; Infinite series; Sequences and series of functions; Index.

Pure and Applied Undergraduate Texts, Volume 1

March 2009, 240 pages, Hardcover, ISBN: 978-0-8218-4787-9, LC 2008047387, 2000 *Mathematics Subject Classification:* 26-01, **AMS members US$50**, List US$62, Order code AMSTEXT/1

Applications



Mathematical Biology

Mark A. Lewis, *University of Alberta, Edmonton, AB, Canada*, **Mark A. J. Chaplain**, *University of Dundee, Scotland*, **James P. Keener**, *University of Utah, Salt Lake City, UT*, and **Philip K. Maini**, *University of Oxford, England*, Editors

Each summer the IAS/Park City Mathematics Institute Graduate Summer School gathers some of the best researchers and educators in a particular field to present lectures on a major area of mathematics. A unifying theme of the mathematical biology courses presented here is that the study of biology involves dynamical systems. Introductory chapters by Jim Keener and Mark Lewis describe the biological dynamics of reactions and of spatial processes.

Each remaining chapter stands alone, as a snapshot of in-depth research within a sub-area of mathematical biology. Jim Cushing writes about the role of nonlinear dynamical systems in understanding complex dynamics of insect populations. Epidemiology, and the interplay of data and differential equations, is the subject of David Earn's chapter on dynamic diseases. Topological methods for understanding dynamical systems are the focus of the chapter by Leon Glass on perturbed biological oscillators. Helen Byrne introduces the reader to cancer modeling and shows how mathematics can describe and predict complex movement patterns of tumors and cells. In the final chapter, Paul Bressloff couples nonlinear dynamics to nonlocal oscillations, to provide insight to the form and function of the brain.

The book provides a state-of-the-art picture of some current research in mathematical biology. Our hope is that the excitement and richness of the topics covered here will encourage readers to explore further in mathematical biology, pursuing these topics and others on their own.

The level is appropriate for graduate students and research scientists. Each chapter is based on a series of lectures given by a leading researcher and develops methods and theory of mathematical biology from first principles. Exercises are included for those who wish to delve further into the material.

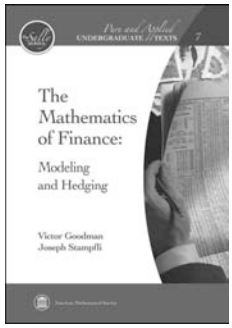
Titles in this series are co-published with the Institute for Advanced Study/Park City Mathematics Institute. Members of the Mathematical Association of America (MAA) and the National Council of Teachers of Mathematics (NCTM) receive a 20% discount from list price.

Contents: M. A. Lewis and **J. Keener**, Introduction; **J. P. Keener**, Introduction to dynamics of biological systems; **M. A. Lewis**, **T. Hillen**, and **F. Lutscher**, Spatial dynamics in ecology; **J. M. Cushing**, Matrix models and population dynamics; **D. J. D. Earn**, Mathematical epidemiology of infectious diseases; **L. Glass**, Topological approaches to biological dynamics; **H. Byrne**, Mathematical modelling of solid tumour growth: from avascular to vascular, via angiogenesis; **P. C. Bressloff**, Lectures in mathematical neuroscience.

IAS/Park City Mathematics Series, Volume 14

April 2009, approximately 408 pages, Hardcover, ISBN: 978-0-8218-4765-7, LC 2008047401, 2000 *Mathematics Subject Classification:* 34-02, 35-02, 37-02, 92-02, **AMS members US$63**, List US$79, Order code PCMS/14

COURSE ADOPTION



The Mathematics of Finance

Modeling and Hedging

Victor Goodman and **Joseph Stampfli**, *Indiana University, Bloomington, IN*

This book is ideally suited for an introductory undergraduate course on financial engineering. It explains the basic concepts of financial derivatives, including put and call options, as well as more complex derivatives such as barrier options and options on futures contracts. Both discrete and continuous models of market behavior are developed in this book. In particular, the analysis of option prices developed by Black and Scholes is explained in a self-contained way, using both the probabilistic Brownian Motion method and the analytical differential equations method.

The book begins with binomial stock price models, moves on to multistage models, then to the Cox–Ross–Rubinstein option pricing process, and then to the Black–Scholes formula. Other topics presented include Zero Coupon Bonds, forward rates, the yield curve, and several bond price models. The book continues with foreign exchange models and the Keynes Interest Rate Parity Formula, and concludes with the study of country risk, a topic not inappropriate for the times.

In addition to theoretical results, numerical models are presented in much detail. Each of the eleven chapters includes a variety of exercises.

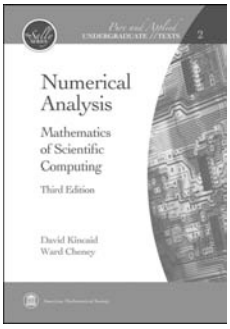
Contents: Financial markets; Binomial trees, replicating portfolios, and arbitrage; Tree models for stocks and options; Using spreadsheets to compute stock and option trees; Continuous models and the Black-Scholes formula; The analytic approach to Black-Scholes; Hedging; Bond models and interest rate options; Computational methods for bonds; Currency markets and foreign exchange risks; International political risk analysis; Answers to selected exercises; Index.

Pure and Applied Undergraduate Texts, Volume 7

April 2009, 250 pages, Hardcover, ISBN: 978-0-8218-4793-0, LC 2008047397, 2000 *Mathematics Subject Classification:* 91-01;

60H10, 60H30, 91B28, **AMS members US$50**, List US$62, Order code AMSTEXT/7

COURSE ADOPTION



Numerical Analysis

Mathematics of Scientific Computing, Third Edition

David Kincaid and **Ward Cheney**, *University of Texas at Austin, TX*

This book introduces students with diverse backgrounds to various types of mathematical analysis that are commonly needed in scientific computing. The subject of numerical analysis is treated from a mathematical point of view, offering a complete analysis of methods for scientific computing with appropriate motivations and careful proofs.

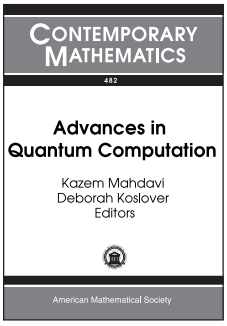
In an engaging and informal style, the authors demonstrate that many computational procedures and intriguing questions of computer science arise from theorems and proofs. Algorithms are presented in pseudocode, so that students can immediately write computer programs in standard languages or use interactive mathematical software packages.

This book occasionally touches upon more advanced topics that are not usually contained in standard textbooks at this level.

Contents: Numerical analysis: What is it?; Mathematical preliminaries; Computer arithmetic; Solution of nonlinear equations; Solving systems of linear equations; Selected topics in numerical linear algebra; Approximating functions; Numerical differentiation and integration; Numerical solution of ordinary differential equations; Numerical solution of partial differential equations; Linear programming and related topics; Optimization; Appendix A. An overview of mathematical software; Bibliography; Index.

Pure and Applied Undergraduate Texts, Volume 2

January 2009, 788 pages, Hardcover, ISBN: 978-0-8218-4788-6, LC 2008047389, 2000 *Mathematics Subject Classification:* 65-01, **AMS members US$71**, List US$89, Order code AMSTEXT/2



Advances in Quantum Computation

Kazem Mahdavi and **Deborah Koslover**, *University of Texas at Tyler, TX*, Editors

This volume represents the talks given at the Conference on Interactions between Representation Theory, Quantum Field Theory, Category Theory, Mathematical Physics, and Quantum Information Theory, held in September 2007 at the University of Texas at Tyler.

The papers in this volume, written by top experts in the field, address physical aspects, mathematical aspects, and foundational issues of quantum computation.

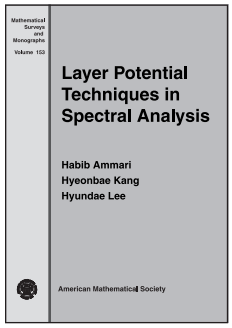
This volume will benefit researchers interested in advances in quantum computation and communication, as well as graduate students who wish to enter the field of quantum computation.

Contents: Z. Zhang and **G. Chen**, Mathematical formulations of atom trap quantum gates; **H. E. Brandt**, Charge renormalization, Apréry's number, and the trefoil knot; **Y. Zhang**, Braid group, Temperley-Lieb algebra, and quantum information and computation; **T. Schedler**, Poisson algebras and Yang-Baxter equations; **J. M. Myers** and **F. H. Madjid**, Ambiguity in quantum-theoretical descriptions of experiments; **P. Benioff**, Reference frame fields based on quantum theory representations of real and complex numbers; **E. C. Rowell**, Two paradigms for topological quantum computation; **S. Bravyi**, Contraction of matchgate tensor networks on non-planar graphs; **M. Haque**, Probing topological order in quantum Hall states using entanglement calculations; **A. Hamma**, Topological order and entanglement; **V. E. Korepin** and **Y. Xu**, Hierarchical quantum search.

Contemporary Mathematics, Volume 482

April 2009, 240 pages, Softcover, ISBN: 978-0-8218-4627-8, LC 2008042590, 2000 *Mathematics Subject Classification:* 81P68, 81T18, 81V10, 68M07, 37F25, 20F36, 57M25, 57M27, 47N55, **AMS members US$63**, List US$79, Order code CONM/482

Differential Equations



Layer Potential Techniques in Spectral Analysis

Habib Ammari, *Ecole Polytechnique, Palaiseau, France*, and **Hyeonbae Kang** and **Hyundae Lee**, *Inha University, Incheon, South Korea*

Since the early part of the twentieth century, the use of integral equations has developed into a range of tools for the study of partial differential equations. This includes the use of single- and double-layer potentials to treat classical boundary value problems.

The aim of this book is to give a self-contained presentation of an asymptotic theory for eigenvalue problems using layer potential techniques with applications in the fields of inverse problems, band gap structures, and optimal design, in particular the optimal design of photonic and phononic crystals. Throughout this book, it is shown how powerful the layer potentials techniques are for solving not only boundary value problems but also eigenvalue problems if they are combined with the elegant theory of Gohberg and Sigal on meromorphic operator-valued functions. The general approach in this book is developed in detail for eigenvalue problems for the Laplacian and the Lamé system in the following two situations: one under variation of domains or boundary conditions and the other due to the presence of inclusions.

The book will be of interest to researchers and graduate students working in the fields of partial differential equations, integral equations, and inverse problems. Researchers in engineering and physics may also find this book helpful.

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

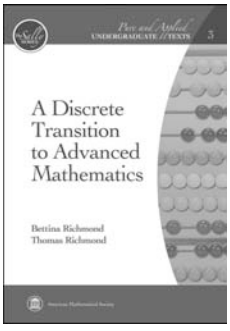
Contents: Introduction; *Gohberg-Sigal theory:* Generalized argument principle and Rouché's theorem; *Eigenvalue perturbation problems and applications:* Layer potentials; Eigenvalue perturbations of the Laplacian; Vibration testing for detecting internal corrosion; Perturbations of scattering frequencies of resonators with narrow slits and slots; Eigenvalue perturbations of the Lamé system; *Photonic and phononic band gaps and optimal design:* Floquet transform, spectra of periodic elliptic operators, and quasi-periodic layer potentials; Photonic band gaps; Phononic band gaps; Optimal design problems; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 153

March 2009, 202 pages, Hardcover, ISBN: 978-0-8218-4784-8, LC 2008048317, 2000 *Mathematics Subject Classification:* 47A55, 47A75, 31A10, 34A55, 35R30, 35B34, 45Q05, 30E25, **AMS members US$55**, List US$69, Order code SURV/153

Discrete Mathematics and Combinatorics

COURSE ADOPTION



A Discrete Transition to Advanced Mathematics

Bettina Richmond and **Thomas Richmond**, *Western Kentucky University, Bowling Green, KY*

As the title indicates, this book is intended for courses aimed at bridging the gap between lower-level mathematics and advanced mathematics. The text provides a careful introduction to techniques for writing proofs and a logical development of topics based on intuitive understanding of concepts. The authors utilize a clear writing style and a wealth of examples to develop an understanding of discrete mathematics and critical thinking skills. While including many traditional topics, the text offers innovative material throughout. Surprising results are used to motivate the reader. The last three chapters address topics such as continued fractions, infinite arithmetic, and the interplay among Fibonacci numbers, Pascal's triangle, and the golden ratio, and may be used for independent reading assignments. The treatment of sequences may be used to introduce epsilon-delta proofs. The selection of topics provides flexibility for the instructor in a course designed to spark the interest of students through exciting material while preparing them for subsequent proof-based courses.

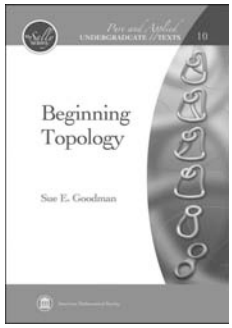
Contents: Sets and logic; Proofs; Number theory; Combinatorics; Relations; Functions and cardinality; Graph theory; Sequences; Fibonacci numbers and Pascal's triangle; Continued fractions; Answers or hints for selected exercises; Bibliography; Index.

Pure and Applied Undergraduate Texts, Volume 3

February 2009, 424 pages, Hardcover, ISBN: 978-0-8218-4789-3, LC 2008047393, 2000 *Mathematics Subject Classification:* 00-01, **AMS members US$58**, List US$72, Order code AMSTEXT/3

Geometry and Topology

COURSE ADOPTION



Beginning Topology

Sue E. Goodman, *University of North Carolina, Chapel Hill, NC*

Beginning Topology is designed to give undergraduate students a broad notion of the scope of topology in areas of point-set, geometric, combinatorial, differential, and algebraic topology, including an introduction to knot theory. A primary goal is to expose students to some recent research and to get them actively involved in learning. Exercises and open-ended projects are placed throughout the text, making it adaptable to seminar-style classes.

The book starts with a chapter introducing the basic concepts of point-set topology, with examples chosen to captivate students' imaginations while illustrating the need for rigor. Most of the material in this and the next two chapters is essential for the remainder of the book. One can then choose from chapters on map coloring, vector fields on surfaces, the fundamental group, and knot theory.

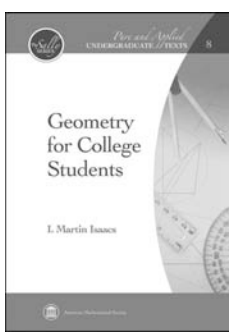
A solid foundation in calculus is necessary, with some differential equations and basic group theory helpful in a couple of chapters. Topics are chosen to appeal to a wide variety of students: primarily upper-level math majors, but also a few freshmen and sophomores as well as graduate students from physics, economics, and computer science. All students will benefit from seeing the interaction of topology with other fields of mathematics and science; some will be motivated to continue with a more in-depth, rigorous study of topology.

Contents: Introduction to point set topology; Surfaces; The Euler characteristic; Maps and graphs; Vector fields on surfaces; The fundamental group; Introduction to knots; Bibliography and reading list; Index.

Pure and Applied Undergraduate Texts, Volume 10

February 2009, 236 pages, Hardcover, ISBN: 978-0-8218-4796-1, LC 2008047400, 2000 *Mathematics Subject Classification:* 55-01, 57-01, **AMS members US$50**, List US$62, Order code AMSTEXT/10

COURSE ADOPTION



Geometry for College Students

I. Martin Isaacs, *University of Wisconsin, Madison, WI*

One of the challenges many mathematics students face occurs after they complete their study of basic calculus and linear algebra, and they start taking courses where they are expected to write proofs. Historically, students have been learning to think mathematically and to write proofs by studying Euclidean geometry. In the author's opinion, geometry is still the best way to make the transition from elementary to advanced mathematics.

The book begins with a thorough review of high school geometry, then goes on to discuss special points associated with triangles, circles and certain associated lines, Ceva's theorem, vector techniques of proof, and compass-and-straightedge constructions. There is also some emphasis on proving numerical formulas like the laws of sines, cosines, and tangents, Stewart's theorem, Ptolemy's theorem, and the area formula of Heron.

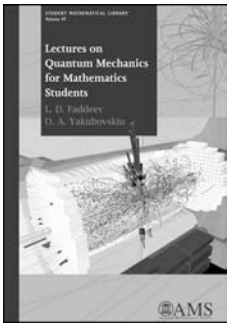
An important difference of this book from the majority of modern college geometry texts is that it avoids axiomatics. The students using this book have had very little experience with formal mathematics. Instead, the focus of the course and the book is on interesting theorems and on the techniques that can be used to prove them. This makes the book suitable to second- or third-year mathematics majors and also to secondary mathematics education majors, allowing the students to learn how to write proofs of mathematical results and, at the end, showing them what mathematics is really all about.

Contents: The basics; Triangles; Circles and lines; Ceva's theorem and its relatives; Vector methods of proof; Geometric constructions; Some further reading; Index.

Pure and Applied Undergraduate Texts, Volume 8

April 2009, 222 pages, Hardcover, ISBN: 978-0-8218-4794-7, LC 2008047398, 2000 *Mathematics Subject Classification:* 51-01, **AMS members US$50**, List US$62, Order code AMSTEXT/8

Mathematical Physics



Lectures on Quantum Mechanics for Mathematics Students

L. D. Faddeev, *Steklov Mathematical Institute, St. Petersburg, Russia*, and **O. A. Yakubovskiĭ**, *St. Petersburg University, Russia*
with an appendix by Leon Takhtajan

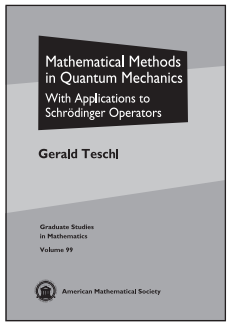
This book is based on notes from the course developed and taught for more than 30 years at the Department of Mathematics of Leningrad University. The goal of the course was to present the basics of quantum mechanics and its mathematical content to students in mathematics. This book differs from the majority of other textbooks on the subject in that much more attention is paid to general principles of quantum mechanics. In particular, the authors describe in detail the relation between classical and quantum mechanics. When selecting particular topics, the authors emphasize those that are related to interesting mathematical theories. In particular, the book contains a discussion of problems related to group representation theory and to scattering theory.

This book is rather elementary and concise, and it does not require prerequisites beyond the standard undergraduate mathematical curriculum. It is aimed at giving a mathematically oriented student the opportunity to grasp the main points of quantum theory in a mathematical framework.

Contents: The algebra of observables in classical mechanics; States; Liouville's theorem, and two pictures of motion in classical mechanics; Physical bases of quantum mechanics; A finite-dimensional model of quantum mechanics; States in quantum mechanics; Heisenberg uncertainty relations; Physical meaning of the eigenvalues and eigenvectors of observables; Two pictures of motion in quantum mechanics. The Schrödinger equation. Stationary states; Quantum mechanics of real systems. The Heisenberg commutation relations; Coordinate and momentum representations; "Eigenfunctions" of the operators Q and P; The energy, the angular momentum, and other examples of observables; The interconnection between quantum and classical mechanics. Passage to the limit from quantum mechanics to classical mechanics; One-dimensional problems of quantum mechanics. A free one-dimensional particle; The harmonic oscillator; The problem of the oscillator in the coordinate representation; Representation of the states of a one-dimensional particle in the sequence space l_2; Representation of the states for a one-dimensional particle in the space $\mathcal{D}$ of entire analytic functions; The general case of one-dimensional motion; Three-dimensional problems in quantum mechanics. A three-dimensional free particle; A three-dimensional particle in a potential field; Angular momentum; The rotation group; Representations of the rotation group; Spherically symmetric operators; Representation of rotations by 2×2 unitary matrices; Representation of the rotation group on a space of entire analytic functions of two complex variables; Uniqueness of the representations D_j; Representations of the rotation group on the space $L^2(S^2)$. Spherical functions; The radial Schrödinger equation; The hydrogen atom. The alkali metal atoms; Perturbation theory; The variational principle; Scattering theory. Physical formulation of the problem; Scattering of a one-dimensional particle by a potential barrier; Physical meaning of the solutions ψ_1 and ψ_2; Scattering by a rectangular barrier; Scattering by a potential center; Motion of wave packets in a central force field; The integral equation of scattering theory; Derivation of a formula for the cross-section; Abstract scattering theory; Properties of commuting operators; Representation of the state space with respect to a complete set of observables; Spin; Spin of a system of two electrons; Systems of many particles. The identity principle; Symmetry of the coordinate wave functions of a system of two electrons. The helium atom; Multi-electron atoms. One-electron approximation; The self-consistent field equations; Mendeleev's periodic system of the elements; Lagrangian formulation of classical mechanics.

Student Mathematical Library, Volume 47

April 2009, approximately 242 pages, Softcover, ISBN: 978-0-8218-4699-5, 2000 *Mathematics Subject Classification:* 81-01, 81Qxx, **AMS members US$31**, List US$39, Order code STML/47



Mathematical Methods in Quantum Mechanics

With Applications to Schrödinger Operators

Gerald Teschl, *University of Vienna, Austria*

Quantum mechanics and the theory of operators on Hilbert space have been deeply linked since their beginnings in the early twentieth century. States of a quantum

system correspond to certain elements of the configuration space and observables correspond to certain operators on the space. This book is a brief, but self-contained, introduction to the mathematical methods of quantum mechanics, with a view towards applications to Schrödinger operators.

Part 1 of the book is a concise introduction to the spectral theory of unbounded operators. Only those topics that will be needed for later applications are covered. The spectral theorem is a central topic in this approach and is introduced at an early stage. Part 2 starts with the free Schrödinger equation and computes the free resolvent and time evolution. Position, momentum, and angular momentum are discussed via algebraic methods. Various mathematical methods are developed, which are then used to compute the spectrum of the hydrogen atom. Further topics include the nondegeneracy of the ground state, spectra of atoms, and scattering theory.

This book serves as a self-contained introduction to spectral theory of unbounded operators in Hilbert space with full proofs and minimal prerequisites: Only a solid knowledge of advanced calculus and a one-semester introduction to complex analysis are required. In particular, no functional analysis and no Lebesgue integration theory are assumed. It develops the mathematical tools necessary to prove some key results in nonrelativistic quantum mechanics.

Mathematical Methods in Quantum Mechanics is intended for beginning graduate students in both mathematics and physics and provides a solid foundation for reading more advanced books and current research literature. It is well suited for self-study and includes numerous exercises (many with hints).

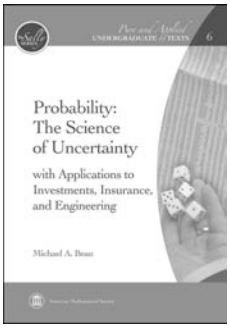
Contents: *Preliminaries:* A first look at Banach and Hilbert spaces; *Mathematical foundations of quantum mechanics:* Hilbert spaces; Self-adjointness and spectrum; The spectral theorem; Applications of the spectral theorem; Quantum dynamics; Perturbation theory for self-adjoint operators; *Schrödinger operators:* The free Schrödinger operator; Algebraic methods; One dimensional Schrödinger operators; One-particle Schrödinger operators; Atomic Schrödinger operators; Scattering theory; *Appendix:* Almost everything about Lebesgue integration; Bibliographical notes; Bibliography; Glossary of notation; Index.

Graduate Studies in Mathematics, Volume 99

April 2009, approximately 302 pages, Hardcover, ISBN: 978-0-8218-4660-5, LC 2008045437, 2000 *Mathematics Subject Classification:* 81-01, 81Qxx, 46-01, 34Bxx, 47B25, **AMS members US$47**, List US$59, Order code GSM/99

Probability

COURSE ADOPTION



Probability: The Science of Uncertainty

with Applications to Investments, Insurance, and Engineering

Michael A. Bean

This book covers the basic probability of distributions with an emphasis on applications from the areas of investments, insurance, and engineering. Written by a Fellow of the Casualty Actuarial Society and the Society of Actuaries with many years of experience as a university professor and industry practitioner, the book is suitable as a text for senior undergraduate and beginning graduate students in mathematics, statistics, actuarial science, finance, or engineering as well as a reference for practitioners in these fields. The book is particularly well suited for students preparing for professional exams, and for several years it has been recommended as a textbook on the syllabus of examinations for the Casualty Actuarial Society and the Society of Actuaries.

In addition to covering the standard topics and probability distributions, this book includes separate sections on more specialized topics such as mixtures and compound distributions, distributions of transformations, and the application of specialized distributions such as the Pareto, beta, and Weibull. The book also has a number of unique features such as a detailed description of the celebrated Markowitz investment portfolio selection model. A separate section contains information on how graphs of the specific distributions studied in the book can be created using Mathematica™.

The book includes a large number of problems of varying difficulty. A student manual with solutions to selected problems are available. For more information regarding the student manual, please contact AMS Member and Customer Services at cust-serv@ams.org.

An instructor's manual with complete solutions to all the problems as well as supplementary material is available to teachers using the book as the text for the class. To receive it, send e-mail to textbooks@ams.org.

Contents: Introduction; A survey of some basic concepts through examples; Classical probability; Random variables and probability distributions; Special discrete distributions; Special continuous distributions; Transformations of random variables; Sums and products of random variables; Mixtures and compound distributions; The Markowitz investment portfolio selection model; Appendixes; Answers to selected exercises; Index.

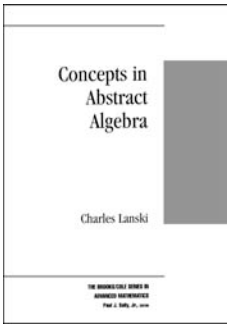
Pure and Applied Undergraduate Texts, Volume 6

February 2009, 448 pages, Hardcover, ISBN: 978-0-8218-4792-3, LC 2008047396, 2000 *Mathematics Subject Classification:* 60-01, **AMS members US$58**, List US$72, Order code AMSTEXT/6

New AMS-Distributed Publications

Algebra and Algebraic Geometry

COURSE ADOPTION



Concepts in Abstract Algebra

Charles Lanski, *University of Southern California, Los Angeles, CA*

The style and structure of *Concepts in Abstract Algebra* are designed to help students learn the core concepts and associated techniques in algebra deeply and well. Providing a fuller and richer account of material than time allows in a lecture, this text presents interesting examples of sufficient complexity so that students can see the concepts and results used in a nontrivial setting. Charles Lanski gives students the opportunity to practice by offering many exercises that require the use and synthesis of the techniques and results. Both readable and mathematically interesting, the text also helps students learn the art of constructing mathematical arguments. Overall, students discover how mathematics proceeds and how to use techniques that mathematicians actually employ.

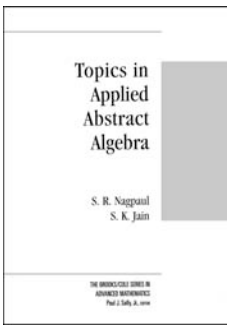
Available exclusively from the AMS.

A publication of Brooks/Cole: Cengage Learning.

Brooks/Cole: Cengage Learning, Volume 14

September 2004, 550 pages, Hardcover, ISBN: 978-0-534-42323-0, **AMS members US$71**, List US$89, Order code CENGAGE/14

COURSE ADOPTION



Topics in Applied Abstract Algebra

S. R. Nagpaul and **S. K. Jain**, *Ohio University, Athens, OH*

This book presents interesting applications of abstract algebra to practical real-world problems. Especially for those whose interest in algebra is not confined to abstract theory, the text makes the study of abstract algebra more exciting and meaningful. The book is appropriate as either a text for an applied abstract algebra course or as a supplemental text for a standard course in abstract algebra. While fully developed, the algebraic theory presented is just what is required for the applications discussed in the book.

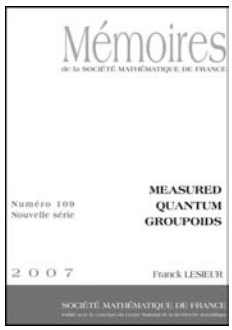
Available exclusively from the AMS.

A publication of Brooks/Cole: Cengage Learning.

Brooks/Cole: Cengage Learning, Volume 15

October 2004, 336 pages, Hardcover, ISBN: 978-0-534-41911-0, **AMS members US$55**, List US$69, Order code CENGAGE/15

Analysis



Measured Quantum Groupoids

Franck Lesieur, *Université de Caen, France*

In this volume, the author gives a definition for measured quantum groupoids. He aims to construct objects with duality including both quantum groups and groupoids. J. Kustermans and S. Vaes' works about locally compact quantum groups the author generalizes thanks to formalism introduced by M. Enock and J. M. Vallin in the case of inclusion of von Neumann algebras. From a structure of Hopf-bimodule with left and right invariant operator-valued weights, the author defines a fundamental pseudo-multiplicative unitary. To get a satisfying duality in the general case, he assumes the existence of an antipode given by its polar decomposition. This theory is illustrated with many examples, among them the inclusion of von Neumann algebras (M. Enock) and a sub family of measured quantum groupoids with easier axiomatic.

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

Contents: Introduction; Recalls; Fundamental pseudo-multiplicative unitary; *Part I. Measured quantum groupoids:* Definition; Uniqueness, modulus and scaling operator; A density theorem; Manageability of the fundamental unitary; Duality; *Part II. Examples:* Adapted measured quantum groupoids; Groupoids; Finite quantum groupoids; Quantum groups; Compact case; Quantum space quantum groupoid; Pairs quantum groupoid; Inclusions of von Neumann algebras; Operations on adapted measured quantum groupoids; Bibliography.

Mémoires de la Société Mathématique de France, Number 109

November 2008, 122 pages, Softcover, ISBN: 978-2-85629-233-4, 2000 *Mathematics Subject Classification:* 46Lxx, **Individual member US$36**, List US$40, Order code SMFMEM/109

General and Interdisciplinary

Séminaire Bourbaki

Volume 2006/2007
Exposés 967–981

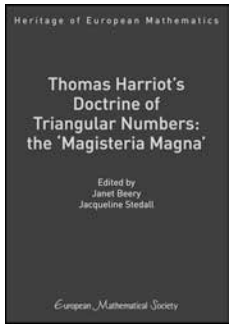
As in the preceding volumes of this seminar, one finds here fifteen survey lectures on topics of current interest: three lectures on algebraic geometry, two on arithmetic geometry, one about Diophantine approximation, two on number theory, three on differential geometry, two about groups or Lie algebras, and two about mathematical physics.

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

Contents: *Novembre 2006:* **Y. F. Bilu**, The many faces of the subspace theorem; **A. Chambert-Loir**, Compter (rapidement) le nombre de solutions d'équations dans les corps finis; **V. Colin**, Livres ouverts en géométrie de contact; **O. Debarre**, Systèmes pluricanoniques sur les variétés de type général; **A. Zuk**, Groupes engendrés pour les automates; *Mars 2007:* **C. De Lellis**, Ordinary differential equations with rough coefficients and the renormalization theorem of Ambrosio; **F. Pellarin**, Aspects de l'indépendance algébrique en caractéristique non nulle; **J. V. Pereira**, Algebraization of codimension one Webs; **J.-M. Roquejoffre**, Propriétés qualitatives des solutions des équations de Hamilton–Jacobi; **O. Schiffmann**, Variétés carquois de Nakajima; *Juin 2007:* **H. Carayol**, La conjecture de Sato–Tate; **Y. C. de Verdière**, Semi-classical measures and entropy; **D. Harari**, Points rationnels sur les sous-variétés des variétés abéliennes au-dessus d'un corps de fonctions; **C. Torossian**, La conjecture de Kashiwara–Vergne; **C. Voisin**, Géométrie des esapces de modules de courbes et de surfaces K3.

Astérisque, Number 317

November 2008, 535 pages, Softcover, ISBN: 978-2-85629-230-3, 2000 *Mathematics Subject Classification:* 11J68, 11D61, 11G30, 11G35, 11J81, 57R17, 53D35, 14J40, 14F17, 14E25, 14E30, 20F69, 37C10, 35Q35, 35B65, 35L65, 49N60, 11J93, 11G09, 12H10, 14L17, 11G05, 11G20, 11G25, 11Y16, 14G15, 14G40, 14Q05, 35A05, 35C15, 35D10, 37J50, 70H20, 14J10, 17B65, 11F80, 37D20, 37D40, 58J40, 58J50, 14G05, 17Bxx, 17B25, 22Exx, 53C35, 53D55, 14H10, 14J15, 14J28, **Individual member US$81**, List US$90, Order code AST/317



Thomas Harriot's Doctrine of Triangular Numbers: the 'Magisteria Magna'

Janet Beery, *University of Redlands, CA*, and **Jacqueline Stedall**, *The Queens College, Oxford, England*, Editors

Thomas Harriot (1560–1621) was a mathematician and astronomer who founded the English school of algebra. He is known not only for his work in algebra and geometry but also as a prolific writer with wide-ranging interests in ballistics, navigation, and optics. (He discovered the sine law of refraction now known as Snell's law.)

By about 1614, Harriot had developed finite difference interpolation methods for navigational tables. In 1618 (or slightly later) he composed a treatise entitled 'De numeris triangularibus et inde de progressionibus arithmeticis, Magisteria magna', in which he derived symbolic interpolation formulae and showed how to use them. This treatise was never published and is here reproduced for the first time. Commentary has been added to help the reader follow Harriot's beautiful but almost completely nonverbal presentation.

The introductory essay preceding the treatise gives an overview of the contents of the 'Magisteria' and describes its influence on Harriot's contemporaries and successors over the next sixty years. Harriot's method was not superseded until Newton, apparently independently, made a similar discovery in the 1660s. The ideas in the 'Magisteria' were spread primarily through personal communication and unpublished manuscripts, and so, quite apart from their intrinsic mathematical interest, their survival in England during the seventeenth century provides an important case study in the dissemination of mathematics through informal networks of friends and acquaintances.

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

Contents: Thomas Harriot and the 'Magisteria magna': A short chronology; Thomas Harriot's 'Magisteria magna' and constant difference interpolation in the seventeenth century; Bibliography; De numeris triangularibus et inde de progressionibus arithmeticis: Magisteria magna; Acknowledgements.

Heritage of European Mathematics, Volume 2

November 2008, 144 pages, Hardcover, ISBN: 978-3-03719-059-3, 2000 *Mathematics Subject Classification:* 01-02, **AMS members US$67**, List US$84, Order code EMSHEM/2

Geometry and Topology

Groups of Diffeomorphisms

In Honor of Shigeyuki Morita on the Occasion of His 60th Birthday

Robert Penner, *University of Southern California, Los Angeles, CA*, **Dieter Kotschick**, *Ludwig-Maximilians Universität, München, Munich, Germany*, **Takashi Tsuboi** and **Nariya Kawazumi**, *University of Tokyo, Japan*, **Teruaki Kitano**, *Soka University, Tokyo, Japan*, and **Yoshihiko Mitsumatsu**, *Chuo University, Tokyo, Japan*, Editors

This volume is dedicated to Shigeyuki Morita on the occasion of his 60th birthday. It consists of selected papers on recent trends and results in the study of various groups of diffeomorphisms, including mapping class groups, from the point of view of algebraic and differential topology, as well as dynamical ones involving foliations and symplectic or contact diffeomorphisms.

Most of the authors were invited speakers or participants of the *International Symposium on Groups of Diffeomorphisms 2006*, which was held at the University of Tokyo (Komaba) in September 2006. The editors believe that the scope of this volume well reflects Morita's mathematical interests and hope this book inspires not only the specialists in these fields but also a wider audience of mathematicians.

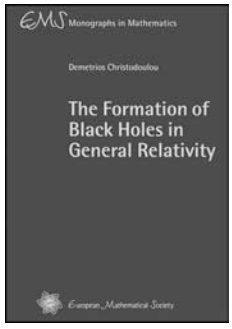
Published for the Mathematical Society of Japan by Kinokuniya, Tokyo, and distributed worldwide, except in Japan, by the AMS.

Contents: S. R. Fenley, Asymptotic geometry of foliations and pseudo-Anosov flows—a survey; **K. Igusa**, Pontrjagin classes and higher torsion of sphere bundles; **T. Kitano** and **T. Morifuji**, L^2-torsion invariants and the Magnus representation of the mapping class group; **H.-V. Lê** and **K. Ono**, Parameterized Gromov–Witten invariants and topology of symplectomorphism groups; **R. C. Penner**, Mapping class actions on surface group completions; **T. Sakasai**, Johnson's homomorphisms and the rational cohomology of subgroups of the mapping class group; **T. Akita**, On mod p Riemann-Roch formulae for mapping class groups; **J. S. Birman**, **T. E. Brendle**, and **N. Broaddus**, Calculating the image of the second Johnson-Morita representation; **J. S. Birman**, **D. Johnson**, and **A. Putman**, Symplectic Heegaard splittings and linked abelian groups; **D. Burago**, **S. Ivanov**, and **L. Polterovich**, Conjugation-invariant norms on groups of geometric origin; **H. Endo**, A generalization of Chakiris' fibrations; **K. Fujiwara**, Subgroups generated by two pseudo-Anosov elements in a mapping class group. I. Uniform exponential growth; **K. Gomi**, Differential characters and the Steenrod squares; **R. Hain**, Relative weight filtrations on completions of mapping class groups; **Y. Kasahara**, Remarks on the faithfulness of the Jones representations; **N. Kawazumi**, On the stable cohomology algebra of extended mapping class groups for surfaces; **D. Kotschick**, Stable length in stable groups; **Y. Mitsumatsu** and **E. Vogt**, Foliations and compact leaves on 4-manifolds I. Realization and self-intersection of compact leaves; **S. Morita**, Symplectic automorphism groups of nilpotent quotients of fundamental groups of surfaces; **G. Segal** and **U. Tillmann**, Mapping configuration spaces to moduli spaces; **M. Suzuki**, New examples of elements in the kernel of the Magnus representation of the Torelli group; **T. Tsuboi**, On the simplicity of the group of contactomorphisms; **T. Tsuboi**, On the uniform perfectness of diffeomorphism groups.

Advanced Studies in Pure Mathematics, Volume 52

November 2008, 524 pages, Hardcover, ISBN: 978-4-931469-48-8, 2000 *Mathematics Subject Classification:* 57-06; 19D06, 19D10, 37C85, 37D40, 37E10, 37E25, 37E30, 53D05, 53D10, 53D12, 53D35, 53D40, 53D45, 55P35, 55P47, 55P62, 55R35, 55R40, 57R17, 57R19, 57R20, 57R30, 57R32, 57R50, 57S05, 57S25, 57S30, 58H10, **AMS members US$69**, List US$86, Order code ASPM/52

Mathematical Physics



The Formation of Black Holes in General Relativity

Demetrios Christodoulou, *Eidgen Technische Hochschule, Zürich, Switzerland*

In 1965 Penrose introduced the fundamental concept of a trapped surface, on the basis of which he proved a theorem which asserts that a spacetime containing such a surface must come to an end. The presence of a trapped surface implies, moreover, that there is a region of spacetime, the black hole, which is inaccessible to observation from infinity.

Since that time a major challenge has been to find out how trapped surfaces actually form, by analyzing the dynamics of gravitational collapse. The present monograph achieves this aim by establishing the formation of trapped surfaces in pure general relativity through the focusing of gravitational waves.

The theorems proved in this monograph constitute the first foray into the long-time dynamics of general relativity in the large, that is, when the initial data are no longer confined to a suitable neighborhood of trivial data. The main new method, the short pulse method, applies to general systems of Euler–Lagrange equations of hyperbolic type and provides the means to tackle problems which have hitherto seemed unapproachable.

This monograph will be of interest to people working in general relativity, geometric analysis, and partial differential equations.

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

Contents: The optical structure equations; The characteristic initial data; L^∞ estimates for the connection coefficients; $L^4(S)$estimates for the 1st derivatives of the connection coefficients; The uniformization theorem; $L^4(S)$ estimates for the 2nd derivatives of the connection coefficients; L^2 estimates for the 3rd derivatives of the connection coefficients; The multiplier fields and the commutation fields; Estimates for the derivatives of the deformation tensors of the commutation fields; The Sobolev inequalities on the C_u and the $\underline{C}_{\underline{u}}$; The S-tangential derivatives and the rotational Lie derivatives; Weyl fields and currents. The existence theorem; The multiplier error estimates; The 1st-order Weyl current error estimates; The 2nd-order Weyl current error

estimates; The energy-flux estimates. Completion of the continuity argument; Trapped surface formation; Bibliography; Index.

EMS Monographs in Mathematics, Volume 4

January 2009, 600 pages, Hardcover, ISBN: 978-3-03719-068-5, 2000 *Mathematics Subject Classification:* 83C57, 35L70, 35Q75, 58J45, 83C75, **AMS members US$102**, List US$128, Order code EMSMONO/4

Surveys on Geometry and Integrable Systems

Martin Guest, *Tokyo Metropolitan University, Japan*, **Reiko Miyaoka**, *Tohoku University, Japan*, and **Yoshihiro Ohnita**, *Osaka City University, Japan*

The articles in this volume provide a panoramic view of the role of geometry in integrable systems, firmly rooted in surface theory but currently branching out in all directions. The longer articles by Bobenko (the Bonnet problem), Dorfmeister (the generalized Weierstrass representation), Joyce (special Lagrangian 3-folds) and Terng (geometry of soliton equations) are substantial surveys of several aspects of the subject. The shorter ones indicate more briefly how the classical ideas have spread throughout differential geometry, symplectic geometry, algebraic geometry, and theoretical physics.

Published for the Mathematical Society of Japan by Kinokuniya, Tokyo, and distributed worldwide, except in Japan, by the AMS.

Contents: A. I. Bobenko, Exploring surfaces through methods from the theory of integrable systems: The Bonnet problem; **J. Dorfmeister**, Generalized Weierstraß representations of surfaces; **A. Fujioka** and **J. Inoguchi**, Timelike surfaces with harmonic inverse mean curvature; **C. Gu**, Darboux transformations and generalized self-dual Yang–Mills flows; **F. Hélein** and **P. Romon**, From CMC surfaces to Hamiltonian stationary Lagrangian surfaces; **D. Joyce**, Special Lagrangian 3-folds and integrable systems; **X. Liu**, Quantum product, topological recursion relations, and the Virasoro conjecture; **S. Matsutani**, A generalized Weierstrass representation for a submanifold S in $\mathbb{E}^n$ arising from the submanifold Dirac operator; **I. McIntosh**, Harmonic tori and their spectral data; **R. Miyaoka**, Isoparametric geometry and related fields; **H. Pedersen**, Kähler Ricci solitons; **W. Rossman**, **M. Umehara**, and **K. Yamada**, Period problems for mean curvature one surfaces in H^3 (with applications to surfaces of low total curvature); **C.-L. Terng**, Geometries and symmetries of soliton equations and integrable elliptic equations; **P. Topalov**, A-integrability of geodesic flows and geodesic equivalence.

Advanced Studies in Pure Mathematics, Volume 51

November 2008, 510 pages, Hardcover, ISBN: 978-4-931469-46-4, 2000 *Mathematics Subject Classification:* 70H06; 35Q53, 37K05, 37K10, 53A05, 53A07, 53A10, 58D25, 58D27, 58E20, **AMS members US$61**, List US$76, Order code ASPM/51