Advanced Complex Analysis Harvard Mathematics Department

The three volumes of this series of books, of which this is the second, put forward the mathematical elements that make up the foundations of a number of contemporary scientific methods: modern theory on systems, physics and engineering. Whereas the first volume focused on the formal conditions for systems of linear equations (in particular of linear differential equations) to have solutions, this book presents the approaches to finding solutions to polynomial equations and to systems of linear differential equations with varying coefficients. Fundamentals of Advanced Mathematics, Volume 2: Field Extensions, Topology and Topological Vector Spaces, Functional Spaces, and Sheaves begins with the classical Galois theory and the theory of transcendental field extensions. Next, the differential side of these theories is treated, including the differential Galois theory (Picard-Vessiot theory of systems of linear differential equations with time-varying coefficients) and differentially transcendental field extensions. The treatment of analysis includes topology (using both filters and nets), topological vector spaces (using the notion of disked space, which simplifies the theory of duality), and the radon measure (assuming that the usual theory of measure and integration is known). In addition, the theory of sheaves is developed with application to the theory of distributions and the theory of hyperfunctions (assuming that the usual theory of functions of the complex variable is known). This volume is the prerequisite to the study of linear systems with time-varying coefficients from the point-of-view of algebraic analysis and the algebraic theory of nonlinear systems. Present Galois Theory, transcendental field extensions, and Picard Includes sections on Vessiot theory, differentially transcendental field extensions, topology, topological vector spaces, Radon measure, differential calculus in Banach spaces, sheaves, distributions, hyperfunctions, algebraic analysis, and local analysis of systems of linear differential equations

Calculus and linear algebra are two dominant themes in contemporary mathematics and its applications. The aim of this book is to introduce linear algebra in an intuitive geometric setting as the study of linear maps and to use these simpler linear functions to study more complicated nonlinear functions. In this way, many of the ideas, techniques, and formulas in the calculus of several variables are clarified and understood in a more conceptual way.

After using this text a student should be well prepared for subsequent advanced courses in both algebra and linear differential equations as well as the many applications where linearity and its interplay with nonlinearity are significant. This second edition has been revised to clarify the concepts. Many exercises and illustrations have been included to make the text more usable for students.

In the twentieth century, American mathematicians began to make critical advances in a field previously dominated by Europeans. Harvard's mathematics department was at the center of these developments. A History in Sum is an inviting account of the pioneers who trailblazed a distinctly American tradition of mathematics--in algebraic geometry, complex analysis, and other esoteric subdisciplines that are rarely written about outside of journal articles or advanced textbooks. The heady mathematical concepts that emerged, and the men and women who shaped them, are described here in lively, accessible prose. The story begins in 1825, when a precocious sixteen-year-old freshman, Benjamin Peirce, arrived at the College. He would become the first American to produce original mathematics--an ambition frowned upon in an era when professors largely limited themselves to teaching. Peirce's successors transformed the math department into a world-class research center, attracting to the faculty such luminaries as George David Birkhoff. Influential figures soon flocked to Harvard, some overcoming great challenges to pursue their elected calling. A History in Sum elucidates the contributions of these extraordinary minds and makes clear why the history of the Harvard mathematics department is an essential part of the history of mathematics in America and beyond.

Expository articles on Several Complex Variables and its interactions with PDEs, algebraic geometry, number theory, and differential geometry, first published in 2000.

A Functional Analytic Approach

Higher Topos Theory (AM-170)

Calculus Two

AFOSR Research: the Current Research Program, and a Summary of Research Accomplishments

Higher category theory is generally regarded as technical and forbidding, but part of it is considerably more tractable: the theory of infinity-categories, higher categories in which all higher morphisms are assumed to be invertible. In Higher Topos Theory, Jacob Lurie presents the foundations of this theory, using the language of weak Kan complexes introduced by Boardman and Vogt, and shows how existing theorems in algebraic topology can be reformulated and generalized in the theory's new language. The result is a powerful theory with applications in many areas of mathematics. The book's first five chapters give an exposition of the theory of infinity-categories that emphasizes their role as a generalization of ordinary categories. Many of the fundamental ideas from classical category theory are generalized to the infinity-categorical setting, such as limits and colimits, adjoint functors, ind-objects and pro-objects, locally accessible and presentable categories, Grothendieck fibrations, presheaves, and Yoneda's lemma. A sixth chapter presents an infinity-categorical version of the theory of Grothendieck topoi, introducing the notion of an infinity-topos, an infinity-category that resembles the infinity-category of topological spaces in the sense that it satisfies certain axioms that codify some of the basic principles of algebraic topology. A seventh and final chapter presents applications that illustrate connections between the theory of higher topoi and ideas from classical topology.

A comprehensive graduate-level textbook that takes a fresh approach to complex analysis A Course in Complex Analysis explores a central branch of mathematical analysis, with broad applications in mathematics and other fields such as physics and engineering. Ideally designed for a year-long graduate course on complex analysis and based on nearly twenty years of classroom lectures, this modern and comprehensive textbook is equally suited for independent study or as a reference for more experienced scholars. Saeed Zakeri guides the reader through a journey that highlights the topological and geometric themes of complex analysis and provides a solid foundation for more advanced studies, particularly in Riemann surfaces, conformal geometry, and dynamics. He presents all the main topics of classical theory in great depth and blends them seamlessly with many elegant developments that are not commonly found in textbooks at this level. They include the dynamics of Möbius transformations, Schlicht functions and distortion theorems, boundary behavior of conformal and harmonic maps, analytic arcs and the general reflection principle, Hausdorff dimension and holomorphic removability, a multifaceted approach to the theorems of Picard and Montel, Zalcman's rescaling theorem, conformal metrics and Ahlfors's generalization of the Schwarz lemma, holomorphic branched coverings, geometry of the modular group, and the uniformization theorem for spherical domains. Written with exceptional clarity and insightful style, A Course in Complex Analysis is accessible to beginning graduate students and advanced undergraduates with some background knowledge of analysis and topology. Zakeri includes more than 350 problems, with problem sets at the end of each chapter, along with numerous carefully selected examples. This well-organized and richly illustrated book is peppered throughout with marginal notes of historical and expository value. Presenting a wealth of material in a single volume, A Course in Complex Analysis will be a valuable resource for students and working mathematicians.

Basic treatment includes existence theorem for solutions of differential systems where data is analytic, holomorphic functions, Cauchy's integral, Taylor and Laurent expansions, more. Exercises. 1973 edition.

These counterexamples deal mostly with the part of analysis known as "real variables." Covers the real number system, functions and limits, differentiation, Riemann integration, sequences, infinite series, functions of 2 variables, plane sets, more. 1962 edition.

Math Goes to the Movies

Mathematics for Physicists

Percolation

Volume 5

Schaum's Outline of Complex Variables, 2ed

An integrated package of powerful probabilistic tools and key applications in modern mathematical data science.

A Comprehensive Course in Analysis by Poincaré Prize winner Barry Simon is a five-volume set that can serve as a graduate-level analysis textbook with a lot of additional bonus information, including hundreds of problems and numerous notes that extend the text and provide important historical background. Depth and breadth of exposition make this set a valuable reference source for almost all areas of classical analysis. Part 2B provides a comprehensive look at a number of subjects of complex analysis not included in Part 2A. Presented in this volume are the theory of conformal metrics (including the Poincaré metric, the Ahlfors-Robinson proof of Picard's theorem, and Bell's proof of the Painlevé smoothness theorem), topics in analytic number theory (including Jacobi's two- and four-square theorems, the Dirichlet prime progression theorem, the prime number theorem, and the Hardy-Littlewood asymptotics for the number of partitions), the theory of Fuschian differential equations, asymptotic methods (including Euler's method, stationary phase, the saddle-point method, and the WKB method), univalent functions (including an introduction to SLE), and Nevanlinna theory. The chapters on Fuschian differential equations and on asymptotic methods can be viewed as a minicourse on the theory of special functions.

"This textbook is intended for a year-long graduate course on complex analysis, a branch of mathematical analysis that has broad applications, particularly in physics, engineering, and applied mathematics. Based on nearly twenty years of classroom lectures, the book is accessible enough for independent study, while the rigorous approach will appeal to more experienced readers and scholars, propelling further research in this field. While other graduate-level complex analysis textbooks do exist, Zakeri takes a distinctive approach by highlighting the geometric properties and topological underpinnings of this area. Zakeri includes more than three hundred and fifty problems, with problem sets at the end of each chapter, along with additional solved examples. Background knowledge of undergraduate analysis and topology is needed, but the thoughtful examples are accessible to beginning graduate students and advanced undergraduates. At the same time, the book has sufficient depth for advanced readers to enhance their own research. The textbook is well-written, clearly illustrated, and peppered with historical information, making it approachable without sacrificing rigor. It is poised to be a valuable textbook for graduate students, filling a needed gap by ways of its level and unique approach"--

Advanced Calculus of Several Variables provides a conceptual treatment of multivariable calculus. This book emphasizes the interplay of geometry, analysis through linear algebra, and approximation of nonlinear mappings by linear ones. The classical applications and computational methods that are responsible for much of the interest and importance of calculus are also considered. This text is organized into six chapters. Chapter I deals with linear algebra and geometry of Euclidean n-space Rn. The multivariable differential calculus is treated in Chapters II and III, while multivariable integral calculus is covered in Chapters IV and V. The last chapter is devoted to venerable problems of the calculus of variations. This publication is intended for students who have completed a standard introductory calculus sequence.

Lars Ahlfors -- At the Summit of Mathematics

A Course in Complex Analysis

Periodic Functions and Distributions, Complex Analysis, Laplace Transform and Applications

Conformally Invariant Processes in the Plane

Advanced Calculus of Several Variables

Theoretical physicists have predicted that the scaling limits of many two-dimensional lattice models in statistical physics are in some sense conformally invariant. This belief has allowed physicists to predict many quantities for these critical systems. The nature of these scaling limits has recently been described precisely by using one well-known tool, Brownian motion, and a new construction, the Schramm-Loewner evolution (SLE). This book is an introduction to the conformally invariant processes that appear as scaling limits. The following topics are covered: stochastic integration; complex Brownian motion and measures derived from Brownian motion; conformal mappings and univalent functions; the Loewner differential equation and Loewner chains; the Schramm-Loewner evolution (SLE), which is a Loewner chain with a Brownian motion input; and applications to intersection exponents for Brownian motion. The prerequisites are first-year graduate courses in real analysis, complex analysis, and probability. The book is suitable for graduate students and research mathematicians interested in random processes and their applications in theoretical physics.

This text covers many principal topics in the theory of functions of a complex variable. These include, in real analysis, set algebra, measure and topology, real- and complex-valued functions, and topological vector spaces. In complex analysis, they include polynomials and power series, functions holomorphic in a region, entire functions, analytic continuation, singularities, harmonic functions, families of functions, and convexity theorems.

"This accessible approach to set theory for upper-level undergraduates poses rigorous but simple arguments. Each definition is accompanied by commentary that motivates and explains new concepts. A historical introduction is followed by discussions of classes and sets, functions, natural and cardinal numbers, the arithmetic of ordinal numbers, and related topics. 1971 edition with new material by the author"--

Tough Test Questions? Missed Lectures? Not Enough Time? Fortunately for you, there's Schaum's. More than 40 million students have trusted Schaum's Outlines to help them succeed in the classroom and on exams. Schaum's is the key to faster learning and higher grades in every subject. Each Outline presents all the essential course information in an easy-to-follow, topic-by-topic format. You also get hundreds of examples, solved problems, and practice exercises to test your skills. This Schaum's Outline gives you: Practice problems with full explanations that reinforce knowledge Coverage of the most up-to-date developments in your course field In-depth review of practices and applications Fully compatible with your classroom text, Schaum's highlights all the important facts you need to know. Use Schaum's to shorten your study time-and get your best test scores! Schaum's Outlines-Problem Solved.

Fundamentals of Advanced Mathematics 2

Mathematical Methods for Engineers and Scientists 1

The Mathematical Theory of Communication

Complex Analysis, Determinants and Matrices

The Geometry of Schemes

Grothendieck's beautiful theory of schemes permeates modern algebraic geometry and underlies its applications to number theory, physics, and applied mathematics. This simple account of that theory emphasizes and explains the universal geometric concepts behind the definitions. In the book, concepts are illustrated with fundamental examples, and explicit calculations show how the constructions of scheme theory are carried out in practice.

The first section of the book deals with some of the influential mathematics departments in the United States. Functioning as centers of research and training, these departments played a major role in shaping the mathematical life in this country. The second section deals with an extraordinary conference held at Princeton in 1946 to commemorate the university's bicentennial. The influence of women in American mathematics, the burgeoning of differential geometry in the last 50 years, and discussions of the work of von Karman and Weiner are among other topics covered.

A History in SumHarvard University Press

The guide that helps students study faster, learn better, and get top grades More than 40 million students have trusted Schaum's to help them study faster, learn better, and get top grades. Now Schaum's is better than ever-with a new look, a new format with hundreds of practice problems, and completely updated information to conform to the latest developments in every field of study. Fully compatible with your classroom text, Schaum's highlights all the important facts you need to know. Use Schaum's to shorten your study time-and get your best test scores! Schaum's Outlines-Problem Solved.

Problems in Real and Complex Analysis

Vector Analysis, Ordinary Differential Equations and Laplace Transforms

A Book of Set Theory

Revised

Mathematical Methods for Engineers and Scientists 2

Scientific knowledge grows at a phenomenal pace--but few books have had as lasting an impact or played as important a role in our modern world as The Mathematical Theory of Communication, published originally as a paper on communication theory more than fifty years ago. Republished in book form shortly thereafter, it has since gone through four hardcover and sixteen paperback printings. It is a revolutionary work, astounding in its foresight and contemporaneity. The University of Illinois Press is pleased and honored to issue this commemorative reprinting of a classic.

This book uses elementary versions of modern methods found in sophisticated mathematics to discuss portions of "advanced calculus" in which the subtlety of the concepts and methods makes rigor difficult to attain at an elementary level.

The topics of this set of student-oriented books are presented in a discursive style that is readable and easy to follow. Numerous clearly stated, completely worked out examples together with carefully selected problem sets with answers are used to enhance students' understanding and manipulative skill. The goal is to help students feel comfortable and confident in using advanced mathematical tools in junior, senior, and beginning graduate courses.

Mathematics for Physicists is a relatively short volume covering all the essential mathematics needed for a typical first degree in physics, from a starting point that is compatible with modern school mathematics syllabuses. Early chapters deliberately overlap with senior school mathematics, to a degree that will depend on the background of the individual reader, who may quickly skip over those topics with which he or she is already familiar. The rest of the book covers the mathematics that is usually compulsory for all students in their first two years of a typical university physics degree, plus a little more. There are worked examples throughout the text, and chapter-end problem sets. Mathematics for Physicists features: Interfaces with modern school mathematics syllabuses All topics usually taught in the first two years of a physics degree Worked examples throughout Problems in every chapter, with answers to selected questions at the end of the book and full solutions on a website This text will be an excellent resource for undergraduate students in physics and a quick reference guide for more advanced students, as well as being appropriate for students in other physical sciences, such as astronomy, chemistry and earth sciences.

Schaum's Outline of Advanced Mathematics for Engineers and Scientists

A Century of Mathematics in America

Advanced Calculus

Advanced Complex Analysis: A Comprehensive Course in Analysis, Part 2B

Calculus on Manifolds

This textbook is an introduction to the classical theory of functions of a complex variable. The author's aim is to explain the basic theory in an easy to understand and careful way. He emphasizes geometrical considerations, and, to avoid topological difficulties associated with complex analysis, begins by deriving Cauchy's integral formula in a topologically simple case and then deduces the basic properties of continuous and differentiable functions. The remainder of the book deals with conformal mappings, analytic continuation, Riemann's mapping theorem, Riemann surfaces and analytic functions on a Riemann surface. The book is profusely illustrated and includes many examples. Problems are collected together at the end of the book. It should be an ideal text for either a first course in complex analysis or more advanced study.

This book tells the story of the Finnish-American mathematician Lars Ahlfors (1907-1996). He was educated at the University of Helsinki as a student of Ernst Lindelöf and Rolf Nevanlinna and later became a professor there. He left Finland permanently in 1944 and was professor and emeritus at Harvard University for more than fifty years. Already at the age of twenty-one Ahlfors became a well-known mathematician having solved Denjoy's conjecture, and in 1936 he established his world renown when he was awarded the Fields Medal, the "Nobel Prize in mathematics". In this book the description of his mathematics avoids technical details and concentrates on his contributions to the general development of complex analysis. Besides mathematics there is also a lot to tell about Ahlfors. World War II marked his life, and he was a colorful personality, with many interesting stories about him. Olli Lehto, the author of the book, first met Lars Ahlfors and his family as a young doctor at Harvard in 1950. Numerous meetings after that in various parts of the world led to a close friendship between them.

This report is designed to present the research programs of the Air Force Office of Scientific Research for the information of users of Air Force research, for scientific investigators working in the same or in allied fields, and for the military, scientific and academic, and Government communities at large.

This book is intended for someone learning functions of a complex variable and who enjoys using MATLAB. It will enhance the exprience of learning complex variable theory and will strengthen the knowledge of someone already trained in ths branch of advanced calculus. ABET, the accrediting board for engineering programs, makes it clear that engineering graduates must be skilled in the art of programming in a language such as MATLAB®. Supplying students with a bridge between the functions of complex variable theory and MATLAB, this supplemental text enables instructors to easily add a MATLAB component to their complex variables courses. A MATLAB® Companion to Complex Variables provides readers with a clear understanding of the utility of MATLAB in complex variable calculus. An ideal adjunct to standard texts on the functions of complex variables, the book allows professors to quickly find and assign MATLAB programming problems that will strengthen students' knowledge of the language and concepts of complex variable theory. The book shows students how MATLAB can be a powerful learning aid in such staples of complex variable theory as conformal mapping, infinite series, contour integration, and Laplace and Fourier transforms. In addition to MATLAB programming problems, the text includes many examples in each chapter along with MATLAB code. Fractals, the most recent interesting topic involving complex variables, demands to be treated with a language such as MATLAB. This book concludes with a Coda, which is devoted entirely to this visually intriguing subject. MATLAB is not without constraints, limitations, irritations, and quirks, and there are subtleties involved in performing the calculus of complex variable theory with this language. Without knowledge of these subtleties, engineers or scientists attempting to use MATLAB for solutions of practical problems in complex variable theory suffer the risk of making major mistakes. This book serves as an early warning system about these pitfalls.

Counterexamples in Analysis

A MatLab® Companion to Complex Variables

A Modern Approach to Classical Theorems of Advanced Calculus

An Introduction with Applications in Data Science

A History in Sum

In this textbook, a concise approach to complex analysis of one and several variables is presented. After an introduction of Cauchy's integral theorem general versions of Runge's approximation theorem and Mittag-Leffler's theorem are discussed. The fi rst part ends with an analytic characterization of simply connected domains. The second part is concerned with functional analytic methods: Fréchet and Hilbert spaces of holomorphic functions, the Bergman kernel, and unbounded operators on Hilbert spaces to tackle the theory of several variables, in particular the inhomogeneous Cauchy–Riemann equations and the d-bar Neumann operator. Contents Complex numbers and functions Cauchy's Theorem and Cauchy's formula Analytic continuation Construction and approximation of holomorphic functions Harmonic functions Several complex variables Bergman spaces The canonical solution operator to Nuclear Fréchet spaces of holomorphic functions The -complex The twisted -complex and Schrödinger operators

This fascinating behind-the-scenes look at movie math shows how fun and illuminating equations can be.

This second edition has a unique approach that provides a broad and wide introduction into the fascinating area of probability theory. It starts on a fast track with the treatment of probability theory and stochastic processes by providing short proofs. The last chapter is unique as it features a wide range of applications in other fields like Vlasov dynamics of fluids, statistics of circular data, singular continuous random variables, Diophantine equations, percolation theory, random Schrödinger operators, spectral graph theory, integral geometry, computer vision, and processes with high risk.Many of these areas are under active investigation and this volume is highly suited for ambitious undergraduate students, graduate students and researchers.

This book, first published in 2006, is an account of percolation theory and its ramifications.

Field Extensions, Topology and Topological Vector Spaces, Functional Spaces, and Sheaves

Complex Analysis

High-Dimensional Probability

Probability Theory and Stochastic Processes with Applications (Second Edition)

Complex Variables and Applications

This book is the fifth and final volume of Raoul Bott's Collected Papers. It collects all of Bott's published articles since 1991 as well as some articles published earlier but missing in the earlier volumes. The volume also contains interviews with Raoul Bott, several of his previously unpublished speeches, commentaries by his collaborators such as Alberto Cattaneo and Jonathan Weitsman on their joint articles with Bott, Michael Atiyah's obituary of Raoul Bott, Loring Tu's authorized biography of Raoul Bott, and reminiscences of Raoul Bott by his friends, students, colleagues, and collaborators, among them Stephen Smale, David Mumford, Arthur Jaffe, Shing-Tung Yau, and Loring Tu. The mathematical articles, many inspired by physics, encompass stable vector bundles, knot and manifold invariants, equivariant cohomology, and loop spaces. The nonmathematical contributions give a sense of Bott's approach to mathematics, style, personality, zest for life, and humanity. In one of the articles, from the vantage point of his later years, Raoul Bott gives a tour-de-force historical account of one of his greatest achievements, the Bott periodicity theorem. A large number of the articles originally appeared in hard-to-find conference proceedings or journals. This volume makes them all easily accessible. It also features a collection of photographs giving a panoramic view of Raoul Bott's life and his interaction with other mathematicians.

A comprehensive introduction to quasiconformal surgery in holomorphic dynamics. Contains a wide variety of applications and illustrations.

With this second volume, we enter the intriguing world of complex analysis. From the first theorems on, the elegance and sweep of the results is evident. The starting point is the simple idea of extending a function initially given for real values of the argument to one that is defined when the argument is complex. From there, one proceeds to the main properties of holomorphic functions, whose proofs are generally short and quite illuminating: the Cauchy theorems, residues, analytic continuation, the argument principle. With this background, the reader is ready to learn a wealth of additional material connecting the subject with other areas of mathematics: the Fourier transform treated by contour integration, the zeta function and the prime number theorem, and an introduction to elliptic functions culminating in their application to combinatorics and number theory. Thoroughly developing a subject with many ramifications, while striking a careful balance between conceptual insights and the technical underpinnings of rigorous analysis, Complex Analysis will be welcomed by students of mathematics, physics, engineering and other sciences. The Princeton Lectures in Analysis represents a sustained effort to introduce the core areas of mathematical analysis while also illustrating the organic unity between them. Numerous examples and applications throughout its four planned volumes, of which Complex Analysis is the second, highlight the far-reaching consequences of certain ideas in analysis to other fields of mathematics and a variety of sciences. Stein and Shakarchi move from an introduction addressing Fourier series and integrals to in-depth considerations of complex analysis; measure and integration theory, and Hilbert spaces; and, finally, further topics such as functional analysis, distributions and elements of probability theory.

Pedagogical insights gained through 30 years of teaching applied mathematics led the author to write this set of student-oriented books. Topics such as complex analysis, matrix theory, vector and tensor analysis, Fourier analysis, integral transforms, ordinary and partial differential equations are presented in a discursive style that is readable and easy to follow. Numerous clearly stated, completely worked out examples together with carefully selected problem sets with answers are used to enhance students' understanding and manipulative skill. The goal is to help students feel comfortable and confident in using advanced mathematical tools in junior, senior, and beginning graduate courses.

Topics in Complex Analysis

Quasiconformal Surgery in Holomorphic Dynamics

Linear and Nonlinear Functions

Elementary Theory of Analytic Functions of One or Several Complex Variables

Raoul Bott: Collected Papers

Once upon a time students of mathematics and students of science or engineering took the same courses in mathematical analysis beyond calculus. Now it is common to separate" advanced mathematics for science and engi neering" from what might be called "advanced mathematical analysis for mathematicians." It seems to me both useful and timely to attempt a reconciliation. The separation between kinds of courses has unhealthy effects. Mathe matics students reverse the historical development of analysis, learning the unifying abstractions first and the examples later (if ever). Science students learn the examples as taught generations ago, missing modern insights. A choice between encountering Fourier series as a minor instance of the repre sentation theory of Banach algebras, and encountering Fourier series in isolation and developed in an ad hoc manner, is no choice at all. It is easy to recognize these problems, but less easy to counter the legiti mate pressures which have led to a separation. Modern mathematics has broadened our perspectives by abstraction and bold generalization, while developing techniques which can treat classical theories in a definitive way. On the other hand, the applier of mathematics has continued to need a variety of definite tools and has not had the time to acquire the broadest and most definitive grasp-to learn necessary and sufficient conditions when simple sufficient conditions will serve, or to learn the general framework encompass ing different examples.

An authorised reissue of the long out of print classic textbook, Advanced Calculus by the late Dr Lynn Loomis and Dr Shlomo Sternberg both of Harvard University has been a revered but hard to find textbook for the advanced calculus course for decades. This book is based on an honors course in advanced calculus that the authors gave in the 1960's. The foundational material, presented in the unstarred sections of Chapters 1 through 11, was normally covered, but different applications of this basic material were stressed from year to year, and the book therefore contains more material than was covered in any one year. It can accordingly be used (with omissions) as a text for a year's course in advanced calculus, or as a text for a three-semester introduction to analysis. The prerequisites are a good grounding in the calculus of one variable from a mathematically rigorous point of view, together with some acquaintance with linear algebra. The reader should be familiar with limit and continuity type arguments and have a certain amount of mathematical sophistication. As possible introductory texts, we mention Differential and Integral Calculus by R Courant, Calculus by T Apostol, Calculus by M Spivak, and Pure Mathematics by G Hardy. The reader should also have some experience with partial derivatives. In overall plan the book divides roughly into a first half which develops the calculus (principally the differential calculus) in the setting of normed vector spaces, and a second half which deals with the calculus of differentiable manifolds.

Most of the mathematical ideas presented in this volume are based on papers given at an AMS meeting held at Fairfield University in October 1983. The unifying theme of the talks was Geometric Function Theory. Papers in this volume generally represent extended versions of the talks presented by the authors. In addition, the proceedings contain several papers that could not be given in person. A few of the papers have been expanded to include further research results obtained in the time between the conference and submission of manuscripts. In most cases, an expository section or history of recent research has been added. The authors' new research results are incorporated into this more general framework. The collection represents a survey of research carried out in recent years in a variety of topics. The paper by Y. J. Leung deals with the Loewner equation, classical results on coefficient bodies and modern optimal control theory.Glenn Schober writes about the class Σ, its support points and extremal configurations. Peter Duren deals with support points for the class S, Loewner chains and the process of truncation. A very complete survey about the role of polynomials and their limits in class S is contributed by T. J. Suffridge. A generalization of the univalence criterion due to Nehari and its relation to the hyperbolic metric is contained in the paper by David Minda. The omitted area problem for functions in class S is solved in the paper by Roger Barnard. New results on angular derivatives and domains are represented in the paper by Burton Rodin and Stefan E. Warschawski, while estimates on the radial growth of the derivative of univalent functions are given by Thom MacGregor. In the paper by B. Bshouty and W. Hengartner a conjecture of Bombieri is proved for some cases.Other interesting problems for special subclasses are solved by B. A. Case and J. R. Quine; M. O. Reade, H. Silverman and P. G. Todorov; and, H. Silverman and E. M. Silvia. New univalence criteria for integral transforms are given by Edward Merkes. Potential theoretic results are represented in the paper by Jack Quine with new results on the Star Function and by David Tepper with free boundary problems in the flow around an obstacle. Approximation by functions which are the solutions of more general elliptic equations are treated by A. Dufresnoy, P. M. Gauthier and W. H. Ow. At the time of preparation of these manuscripts, nothing was known about the proof of the Bieberbach conjecture. Many of the authors of this volume and other experts in the field were recently interviewed by the editor regarding the effect of the proof of the conjecture. Their ideas regarding future trends in research in complex analysis are presented in the epilogue by Dorothy Shaffer.A graduate level course in complex analysis provides adequate background for the enjoyment of this book.

Several Complex Variables

Advanced Mathematical Analysis