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Complex Analysis

*Springer Undergraduate
Mathematics Series*

The present book is meant as a text for a course on complex analysis at the advanced undergraduate level, or first-year graduate level. Somewhat more material has been included than can be covered at leisure in one term, to give opportunities for the instructor to exercise his taste, and lead the

course in whatever direction strikes his fancy at the time. A large number of routine exercises are included for the more standard portions, and a few harder exercises of striking theoretical interest are also included, but may be omitted in courses addressed to less advanced students. In some sense, I think the classical German prewar texts were the best (Hurwitz-Courant, Knopp, Bieberbach, etc.) and I

would recommend to anyone to look through them. More recent texts have emphasized connections with real analysis, which is important, but at the cost of exhibiting succinctly and clearly what is peculiar about complex analysis: the power series expansion, the uniqueness of analytic continuation, and the calculus of residues. The systematic elementary development of formal and convergent power series was

standard fare in the German texts, but only Cartan, in the more recent books, includes this material, which I think is quite essential, e. g. , for differential equations. I have written a short text, exhibiting these features, making it applicable to a wide variety of tastes. The book essentially decomposes into two parts.

Elementary Differential Geometry presents the main results in the

differential geometry of curves and surfaces suitable for a first course on the subject. Prerequisites are kept to an absolute minimum – nothing beyond first courses in linear algebra and multivariable calculus – and the most direct and straightforward approach is used throughout. New features of this revised and expanded second edition include: a chapter on non-Euclidean geometry, a subject that is of great importance

in the history of mathematics and crucial in many modern developments. The main results can be reached easily and quickly by making use of the results and techniques developed earlier in the book. Coverage of topics such as: parallel transport and its applications; map colouring; holonomy and Gaussian curvature. Around 200 additional exercises, and a full solutions manual for instructors, available

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This book presents modern vector analysis and carefully describes the classical notation and understanding of the theory. It covers all of the classical vector analysis in Euclidean space, as well as on manifolds, and goes on to introduce de Rham Cohomology, Hodge theory, elementary differential geometry, and basic duality. The material is accessible to readers and students with only calculus and

linear algebra as prerequisites. A large number of illustrations, exercises, and tests with answers make this book an invaluable self-study source.

The authors' aim here is to present a precise and concise treatment of those parts of complex analysis that should be familiar to every research mathematician. They follow a path in the tradition of Ahlfors and Bers by dedicating the book to a very precise goal: the

statement and proof of the Fundamental Theorem for functions of one complex variable. They discuss the many equivalent ways of understanding the concept of analyticity, and offer a leisure exploration of interesting consequences and applications. Readers should have had undergraduate courses in advanced calculus, linear algebra, and some abstract algebra. No background in complex analysis is required.

Vector Calculus

Essential Real Analysis

Elementary Differential

Geometry

Groups, Rings and Fields

This is a basic introduction to modern algebra, providing a solid understanding of the axiomatic treatment of groups and then rings, aiming to promote a feeling for the evolutionary and historical development of the subject. It includes problems and fully worked solutions, enabling readers to master the subject rather than simply observing it.

The book contains 13 articles, some of which are survey articles and others research papers.

Written by eminent mathematicians,

these articles were presented at the International Workshop on Complex Analysis and Its Applications held at Walchand College of Engineering, Sangli. All the contributing authors are actively engaged in research fields related to the topic of the book. The workshop offered a comprehensive exposition of the recent developments in geometric functions theory, planar harmonic mappings, entire and meromorphic functions and their applications, both theoretical and computational. The recent developments in complex analysis and its applications play a crucial role in research in many disciplines. This textbook is intended for a one

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semester course in complex analysis for upper level undergraduates in mathematics. Applications, primary motivations for this text, are presented hand-in-hand with theory enabling this text to serve well in courses for students in engineering or applied sciences. The overall aim in designing this text is to accommodate students of different mathematical backgrounds and to achieve a balance between presentations of rigorous mathematical proofs and applications. The text is adapted to enable maximum flexibility to instructors and to students who may also choose to progress through the material outside of coursework. Detailed examples

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may be covered in one course, giving the instructor the option to choose those that are best suited for discussion. Examples showcase a variety of problems with completely worked out solutions, assisting students in working through the exercises. The numerous exercises vary in difficulty from simple applications of formulas to more advanced project-type problems. Detailed hints accompany the more challenging problems. Multi-part exercises may be assigned to individual students, to groups as projects, or serve as further illustrations for the instructor. Widely used graphics clarify both concrete and abstract concepts, helping students

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visualize the proofs of many results. Freely accessible solutions to every-other-odd exercise are posted to the book 's Springer website. Additional solutions for instructors ' use may be obtained by contacting the authors directly.

Basic Linear Algebra is a text for first year students leading from concrete examples to abstract theorems, via tutorial-type exercises. More exercises (of the kind a student may expect in examination papers) are grouped at the end of each section. The book covers the most important basics of any first course on linear algebra, explaining the algebra of matrices with applications to analytic geometry, systems of linear

equations, difference equations and complex numbers. Linear equations are treated via Hermite normal forms which provides a successful and concrete explanation of the notion of linear independence. Another important highlight is the connection between linear mappings and matrices leading to the change of basis theorem which opens the door to the notion of similarity. This new and revised edition features additional exercises and coverage of Cramer's rule (omitted from the first edition). However, it is the new, extra chapter on computer assistance that will be of particular interest to readers: this will take the form of a tutorial on the use of the

"LinearAlgebra" package in MAPLE 7 and will deal with all the aspects of linear algebra developed within the book.

Linear Functional Analysis

Current Topics in Pure and

Computational Complex Analysis

The Real and the Complex: A

History of Analysis in the 19th

Century

Introductory Mathematics: Algebra

and Analysis

Real Analysis is a

comprehensive introduction

to this core subject and is

ideal for self-study or as a

course textbook for first and

second-year

undergraduates. Combining

an informal style with precision mathematics, the book covers all the key topics with fully worked examples and exercises with solutions. All the concepts and techniques are deployed in examples in the final chapter to provide the student with a thorough understanding of this challenging subject. This book offers a fresh approach to a core subject and manages to provide a gentle and clear introduction without sacrificing rigour or accuracy.

This text provides an

accessible, self-contained and rigorous introduction to complex analysis and differential equations. Topics covered include holomorphic functions, Fourier series, ordinary and partial differential equations. The text is divided into two parts: part one focuses on complex analysis and part two on differential equations. Each part can be read independently, so in essence this text offers two books in one. In the second part of the book, some emphasis is given to the application of

complex analysis to differential equations. Half of the book consists of approximately 200 worked out problems, carefully prepared for each part of theory, plus 200 exercises of variable levels of difficulty. Tailored to any course giving the first introduction to complex analysis or differential equations, this text assumes only a basic knowledge of linear algebra and differential and integral calculus. Moreover, the large number of examples, worked out problems and exercises makes this the

ideal book for independent study.

This very well written and accessible book emphasizes the reasons for studying measure theory, which is the foundation of much of probability. By focusing on measure, many illustrative examples and applications, including a thorough discussion of standard probability distributions and densities, are opened. The book also includes many problems and their fully worked solutions.

The present volume contains all the exercises and their

Solutions for Lang's second edition of Undergraduate Analysis. The wide variety of exercises, which range from computational to more conceptual and which are of varying difficulty, cover the following subjects and more: real numbers, limits, continuous functions, differentiation and elementary integration, normed vector spaces, compactness, series, integration in one variable, improper integrals, convolutions, Fourier series and the Fourier integral, functions in n -space,

derivatives in vector spaces, the inverse and implicit mapping theorem, ordinary differential equations, multiple integrals, and differential forms. My objective is to offer those learning and teaching analysis at the undergraduate level a large number of completed exercises and I hope that this book, which contains over 600 exercises covering the topics mentioned above, will achieve my goal. The exercises are an integral part of Lang's book and I encourage the reader to

work through all of them. In some cases, the problems in the beginning chapters are used in later ones, for example, in Chapter IV when one constructs-bump functions, which are used to smooth out singularities, and prove that the space of functions is dense in the space of regulated maps. The numbering of the problems is as follows.

Exercise IX. 5. 7 indicates Exercise 7, §5, of Chapter IX. Acknowledgments I am grateful to Serge Lang for his help and enthusiasm in this project, as well as for

*teaching me mathematics
(and much more) with so
much generosity and
patience.*

*Problems and Solutions for
Undergraduate Analysis
Worlds Out of Nothing
From Real to Complex
Analysis*

*Twenty-One Lectures on
Complex Analysis*

*This book brings the most
important aspects of
modern topology within
reach of a second-year
undergraduate student. It
successfully unites the
most exciting aspects of
modern topology with those*

that are most useful for research, leaving readers prepared and motivated for further study. Written from a thoroughly modern perspective, every topic is introduced with an explanation of why it is being studied, and a huge number of examples provide further motivation. The book is ideal for self-study and assumes only a familiarity with the notion of continuity and basic algebra.

This radical approach to complex analysis replaces the standard calculational arguments with new

geometric ones. Using several hundred diagrams this is a new visual approach to the topic. Complex analysis is a classic and central area of mathematics, which is studied and exploited in a range of important fields, from number theory to engineering. Introduction to Complex Analysis was first published in 1985, and for this much awaited second edition the text has been considerably expanded, while retaining the style of the original. More detailed presentation is given of elementary

topics, to reflect the knowledge base of current students. Exercise sets have been substantially revised and enlarged, with carefully graded exercises at the end of each chapter. This is the latest addition to the growing list of Oxford undergraduate textbooks in mathematics, which includes: Biggs: *Discrete Mathematics 2nd Edition*, Cameron: *Introduction to Algebra*, Needham: *Visual Complex Analysis*, Kaye and Wilson: *Linear Algebra*, Acheson: *Elementary Fluid Dynamics*, Jordan and

Smith: Nonlinear Ordinary Differential Equations, Smith: Numerical Solution of Partial Differential Equations, Wilson: Graphs, Colourings and the Four-Colour Theorem, Bishop: Neural Networks for Pattern Recognition, Gelman and Nolan: Teaching Statistics.

The abstract concepts of metric spaces are often perceived as difficult. This book offers a unique approach to the subject which gives readers the advantage of a new perspective on ideas familiar from the analysis

of a real line. Rather than passing quickly from the definition of a metric to the more abstract concepts of convergence and continuity, the author takes the concrete notion of distance as far as possible, illustrating the text with examples and naturally arising questions. Attention to detail at this stage is designed to prepare the reader to understand the more abstract ideas with relative ease.

**Complex Analysis with
Applications**

A History of Differential

Equations to 1900

*An Introduction to Complex
Analysis*

*Complex Analysis and
Applications*

The purpose of this book is to provide an integrated course in real and complex analysis for those who have already taken a preliminary course in real analysis. It particularly emphasises the interplay between analysis and topology. Beginning with the theory of the Riemann integral (and its improper extension) on the real line, the fundamentals of metric spaces are then developed, with special attention being paid to connectedness, simple connectedness and various forms of homotopy. The final chapter develops the theory of complex analysis, in which emphasis is placed on the argument, the

winding number, and a general (homology) version of Cauchy's theorem which is proved using the approach due to Dixon. Special features are the inclusion of proofs of Montel's theorem, the Riemann mapping theorem and the Jordan curve theorem that arise naturally from the earlier development. Extensive exercises are included in each of the chapters, detailed solutions of the majority of which are given at the end. From Real to Complex Analysis is aimed at senior undergraduates and beginning graduate students in mathematics. It offers a sound grounding in analysis; in particular, it gives a solid base in complex analysis from which progress to more advanced topics may be made. This book contains a history of real and complex analysis in the nineteenth century, from the work of Lagrange

and Fourier to the origins of set theory and the modern foundations of analysis.

It studies the works of many contributors including Gauss, Cauchy, Riemann, and Weierstrass. This book is unique owing to the treatment of real and complex analysis as overlapping, inter-related subjects, in keeping with how they were seen at the time. It is suitable as a course in the history of mathematics for students who have studied an introductory course in analysis, and will enrich any course in undergraduate real or complex analysis. This book offers an essential textbook on complex analysis. After introducing the theory of complex analysis, it places special emphasis on the importance of Poincare theorem and Hartog's theorem in the function theory of several complex variables. Further, it lays the groundwork for future study in

analysis, linear algebra, numerical analysis, geometry, number theory, physics (including hydrodynamics and thermodynamics), and electrical engineering. To benefit most from the book, students should have some prior knowledge of complex numbers.

However, the essential prerequisites are quite minimal, and include basic calculus with some knowledge of partial derivatives, definite integrals, and topics in advanced calculus such as Leibniz's rule for differentiating under the integral sign and to some extent analysis of infinite series. The book offers a valuable asset for undergraduate and graduate students of mathematics and engineering, as well as students with no background in topological properties. This unusual and lively textbook offers a clear and intuitive approach to the classical and beautiful theory of

complex variables. With very little dependence on advanced concepts from several-variable calculus and topology, the text focuses on the authentic complex-variable ideas and techniques. Accessible to students at their early stages of mathematical study, this full first year course in complex analysis offers new and interesting motivations for classical results and introduces related topics stressing motivation and technique. Numerous illustrations, examples, and now 300 exercises, enrich the text. Students who master this textbook will emerge with an excellent grounding in complex analysis, and a solid understanding of its wide applicability.

Vector Analysis

Metric Spaces

Essential Topology

This textbook offers a comprehensive undergraduate course in real analysis in one variable. Taking the view that analysis can only be properly appreciated as a rigorous theory, the book recognises the difficulties that students experience when encountering this theory for the first time, carefully addressing them throughout.

Historically, it was the precise description of real numbers and the correct definition of limit that placed analysis on a solid foundation. The book therefore begins with these crucial ideas and the fundamental notion of sequence. Infinite series are then introduced, followed by the key concept of continuity. These lay the groundwork for differential and integral calculus, which are carefully

covered in the following chapters.

Pointers for further study are included throughout the book, and for the more adventurous there is a selection of "nuggets", exciting topics not commonly discussed at this level.

Examples of nuggets include Newton's method, the irrationality of π , Bernoulli numbers, and the Gamma function.

Based on decades of teaching experience, this book is written with the undergraduate student in mind. A large number of exercises, many with hints, provide the practice necessary for learning, while the included "nuggets" provide opportunities to deepen understanding and broaden horizons.

An introduction to complex analysis for students with some knowledge of

complex numbers from high school. It contains sixteen chapters, the first eleven of which are aimed at an upper division undergraduate audience. The remaining five chapters are designed to complete the coverage of all background necessary for passing PhD qualifying exams in complex analysis. Topics studied include Julia sets and the Mandelbrot set, Dirichlet series and the prime number theorem, and the uniformization theorem for Riemann surfaces, with emphasis placed on the three geometries: spherical, euclidean, and hyperbolic. Throughout, exercises range from the very simple to the challenging. The book is based on lectures given by the author at several universities, including UCLA, Brown University, La Plata, Buenos Aires, and

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the Universidad Autonomo de
Valencia, Spain.

Thoroughly updated, featuring new material on important topics such as hyperbolic geometry in higher dimensions and generalizations of hyperbolicity Includes full solutions for all exercises Successful first edition sold over 800 copies in North America Complex analysis can be a difficult subject and many introductory texts are just too ambitious for today's students. This book takes a lower starting point than is traditional and concentrates on explaining the key ideas through worked examples and informal explanations, rather than through "dry" theory.

Introduction to Complex Analysis
Complex Analysis and Differential

Equations

Hyperbolic Geometry

A First Course

The book describes the conceptual development of analysis from antiquity up to the end of the nineteenth century. Intra-theoretical processes are considered as well as the influence of applied problems and biographical and philosophical backgrounds. The book has thirteen chapters, each written by a leading specialist in the history of mathematics. The first

ten chapters tell the story in its temporal succession (narrative order) whereas the last three chapters give surveys on the history of differential equations, the calculus of variations, and functional analysis. Special features of the book are a separate chapter on the development of the theory of complex functions in the nineteenth century and two chapters on the influence of physics on analysis. One is about the

origins of analytical mechanics and one treats boundary value problems of mathematical physics (especially potential theory) in the nineteenth century. The authors present the history of analysis as near to the historical sources as is possible from the point of view of readability. The book includes comprehensive bibliographies, providing useful listings of the original literature. Mathematical examples are carefully chosen so

that readers with a very modest background in mathematics may follow them.

This elementary presentation exposes readers to both the process of rigor and the rewards inherent in taking an axiomatic approach to the study of functions of a real variable. The aim is to challenge and improve mathematical intuition rather than to verify it. The philosophy of this book is to focus attention on questions which give

***analysis its inherent
fascination. Each chapter
begins with the
discussion of some
motivating examples and
concludes with a series of
questions.***

***This text provides a lively
introduction to pure
mathematics. It begins
with sets, functions and
relations, proof by
induction and
contradiction, complex
numbers, vectors and
matrices, and provides a
brief introduction to
group theory. It moves
onto analysis, providing a***

***gentle introduction to
epsilon-delta technology
and finishes with
continuity and functions.
The book features
numerous exercises of
varying difficulty
throughout the text.
Vector calculus is the
fundamental language of
mathematical physics. It
provides a way to
describe physical
quantities in three-
dimensional space and
the way in which these
quantities vary. Many
topics in the physical
sciences can be analysed***

mathematically using the techniques of vector calculus. These topics include fluid dynamics, solid mechanics and electromagnetism, all of which involve a description of vector and scalar quantities in three dimensions. This book assumes no previous knowledge of vectors. However, it is assumed that the reader has a knowledge of basic calculus, including differentiation, integration and partial differentiation. Some

knowledge of linear algebra is also required, particularly the concepts of matrices and determinants. The book is designed to be self-contained, so that it is suitable for a programme of individual study. Each of the eight chapters introduces a new topic, and to facilitate understanding of the material, frequent reference is made to physical applications. The physical nature of the subject is clarified with over sixty diagrams,

which provide an important aid to the comprehension of the new concepts. Following the introduction of each new topic, worked examples are provided. It is essential that these are studied carefully, so that a full understanding is developed before moving ahead. Like much of mathematics, each section of the book is built on the foundations laid in the earlier sections and chapters.

**A History of Analysis
Real Analysis**

Complex Analysis Measure, Integral and Probability

Based on the latest historical research, *Worlds Out of Nothing* is the first book to provide a course on the history of geometry in the 19th century. Topics covered in the first part of the book are projective geometry, especially the concept of duality, and non-Euclidean geometry. The book then moves on to the study of the singular points of algebraic curves (Plücker's equations) and their role in resolving a paradox in the theory of duality; to Riemann's work on

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differential geometry; and to Beltrami's role in successfully establishing non-Euclidean geometry as a rigorous mathematical subject. The final part of the book considers how projective geometry rose to prominence, and looks at Poincaré's ideas about non-Euclidean geometry and their physical and philosophical significance. Three chapters are devoted to writing and assessing work in the history of mathematics, with examples of sample questions in the subject, advice on how to write essays, and comments on what instructors should be looking for. This book presents a history

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of differential equations, both ordinary and partial, as well as the calculus of variations, from the origins of the subjects to around 1900. Topics treated include the wave equation in the hands of d'Alembert and Euler; Fourier solutions to the heat equation and the contribution of Kovalevskaya; the work of Euler, Gauss, Kummer, Riemann, and Poincaré on the hypergeometric equation; Green's functions, the Dirichlet principle, and Schwarz's solution of the Dirichlet problem; minimal surfaces; the telegraphists' equation and Thomson's successful design of the

trans-Atlantic cable;
Riemann's paper on shock waves; the geometrical interpretation of mechanics; and aspects of the study of the calculus of variations from the problems of the catenary and the brachistochrone to attempts at a rigorous theory by Weierstrass, Kneser, and Hilbert. Three final chapters look at how the theory of partial differential equations stood around 1900, as they were treated by Picard and Hadamard. There are also extensive, new translations of original papers by Cauchy, Riemann, Schwarz, Darboux, and Picard. The

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first book to cover the history of differential equations and the calculus of variations in such breadth and detail, it will appeal to anyone with an interest in the field.

Beyond secondary school mathematics and physics, a course in mathematical analysis is the only prerequisite to fully appreciate its contents.

Based on a course for third-year university students, the book contains numerous historical and mathematical exercises, offers extensive advice to the student on how to write essays, and can easily be used in whole or in part as a course in the

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history of mathematics.

Several appendices help make the book self-contained and suitable for self-study.

All needed notions are developed within the book: with the exception of fundamentals which are presented in introductory lectures, no other knowledge is assumed Provides a more in-depth introduction to the subject than other existing books in this area Over 400 exercises including hints for solutions are included This textbook introduces the subject of complex analysis to advanced undergraduate and graduate students in a clear and concise manner. Key features of this

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textbook. effectively organizes the subject into easily manageable sections in the form of 50 class-tested lectures, uses detailed examples to drive the presentation, includes numerous exercise sets that encourage pursuing extensions of the material, each with an "Answers or Hints" section, covers an array of advanced topics which allow for flexibility in developing the subject beyond the basics, provides a concise history of complex numbers. An Introduction to Complex Analysis will be valuable to students in mathematics, engineering and other applied sciences.

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Prerequisites include a
course in calculus.

Change and Variations

A Complex Analysis Problem
Book

Visual Complex Analysis

A Course in the History of
Geometry in the 19th Century

This book discusses all the
major topics of complex
analysis, beginning with the
properties of complex
numbers and ending with the
proofs of the fundamental
principles of conformal
mappings. Topics covered in
the book include the study of
holomorphic and analytic
functions, classification of
singular points and the

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Laurent series expansion, theory of residues and their application to evaluation of integrals, systematic study of elementary functions, analysis of conformal mappings and their applications--making this book self-sufficient and the reader independent of any other texts on complex variables. The book is aimed at the advanced undergraduate students of mathematics and engineering, as well as those interested in studying complex analysis with a good working knowledge of advanced calculus. The mathematical

level of the exposition corresponds to advanced undergraduate courses of mathematical analysis and first graduate introduction to the discipline. The book contains a large number of problems and exercises, making it suitable for both classroom use and self-study. Many standard exercises are included in each section to develop basic skills and test the understanding of concepts. Other problems are more theoretically oriented and illustrate intricate points of the theory. Many additional problems are proposed as

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homework tasks whose level ranges from straightforward, but not overly simple, exercises to problems of considerable difficulty but of comparable interest.

Complex Analysis Springer

Science & Business Media

This unusually lively textbook introduces the theory of analytic functions, explores its diverse applications and shows the reader how to harness its powerful techniques. The book offers new and interesting motivations for classical results and introduces related topics that do not appear in

this form in other texts. For the second edition, the authors have revised some of the existing material and have provided new exercises and solutions.

This second edition presents a collection of exercises on the theory of analytic functions, including completed and detailed solutions. It introduces students to various applications and aspects of the theory of analytic functions not always touched on in a first course, while also addressing topics of interest to electrical engineering students (e.g., the realization

of rational functions and its connections to the theory of linear systems and state space representations of such systems). It provides examples of important Hilbert spaces of analytic functions (in particular the Hardy space and the Fock space), and also includes a section reviewing essential aspects of topology, functional analysis and Lebesgue integration. Benefits of the 2nd edition Rational functions are now covered in a separate chapter. Further, the section on conformal mappings has been expanded.

Understanding Analysis

Basic Linear Algebra

In the Spirit of Lipman Bers
Fundamental Mathematical
Analysis

This book provides an introduction to the ideas and methods of linear functional analysis at a level appropriate to the final year of an undergraduate course at a British university. The prerequisites for reading it are a standard undergraduate knowledge of linear algebra and real analysis (including the theory of metric spaces). Part of the development of functional analysis can be traced to attempts to find a suitable framework in which to discuss differential and integral equations. Often, the appropriate

setting turned out to be a vector space of real or complex-valued functions defined on some set. In general, such a vector space is infinite-dimensional. This leads to difficulties in that, although many of the elementary properties of finite-dimensional vector spaces hold in infinite dimensional vector spaces, many others do not. For example, in general infinite dimensional vector spaces there is no framework in which to make sense of analytic concepts such as convergence and continuity. Nevertheless, on the spaces of most interest to us there is often a norm (which extends the idea of the length of a vector to a somewhat more abstract setting).

Since a norm on a vector space gives rise to a metric on the space, it is now possible to do analysis in the space. As real or complex-valued functions are often called functionals, the term functional analysis came to be used for this topic. We now briefly outline the contents of the book.

This book provides a rigorous introduction to the techniques and results of real analysis, metric spaces and multivariate differentiation, suitable for undergraduate courses. Starting from the very foundations of analysis, it offers a complete first course in real analysis, including topics rarely found in such detail in an undergraduate textbook such as

the construction of non-analytic smooth functions, applications of the Euler-Maclaurin formula to estimates, and fractal geometry. Drawing on the author's extensive teaching and research experience, the exposition is guided by carefully chosen examples and counter-examples, with the emphasis placed on the key ideas underlying the theory. Much of the content is informed by its applicability: Fourier analysis is developed to the point where it can be rigorously applied to partial differential equations or computation, and the theory of metric spaces includes applications to ordinary differential equations and fractals. Essential Real Analysis

will appeal to students in pure and applied mathematics, as well as scientists looking to acquire a firm footing in mathematical analysis.

Numerous exercises of varying difficulty, including some suitable for group work or class discussion, make this book suitable for self-study as well as lecture courses.

At its core, this concise textbook presents standard material for a first course in complex analysis at the advanced undergraduate level. This distinctive text will prove most rewarding for students who have a genuine passion for mathematics as well as certain mathematical maturity. Primarily aimed at undergraduates with working

knowledge of real analysis and metric spaces, this book can also be used to instruct a graduate course.

The text uses a conversational style with topics purposefully apportioned into 21 lectures, providing a suitable format for either independent study or lecture-based teaching.

Instructors are invited to rearrange the order of topics according to their own vision. A clear and rigorous exposition is supported by engaging examples and exercises unique to each lecture; a large number of exercises contain useful calculation problems. Hints are given for a selection of the more difficult exercises. This text furnishes the reader with a means of learning

complex analysis as well as a subtle introduction to careful mathematical reasoning. To guarantee a student's progression, more advanced topics are spread out over several lectures. This text is based on a one-semester (12 week) undergraduate course in complex analysis that the author has taught at the Australian National University for over twenty years. Most of the principal facts are deduced from Cauchy's Independence of Homotopy Theorem allowing us to obtain a clean derivation of Cauchy's Integral Theorem and Cauchy's Integral Formula. Setting the tone for the entire book, the material begins with a proof of

the Fundamental Theorem of Algebra to demonstrate the power of complex numbers and concludes with a proof of another major milestone, the Riemann Mapping Theorem, which is rarely part of a one-semester undergraduate course.