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Elementary Functional Analysis

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Elementary Functional Analysis *OMB No. 6426877295081 edited by*

RAMOS LIZETH

ELEMENTARY

Functional Analysis

CRC Press
An advanced textbook for an introductory course in functional analysis. Includes revision of the work on metric and topological linear spaces and reflexivity and weak convergence. New material on the Wiener algebra of absolutely convergent Fourier series and on weak topologies has been added. A new final chapter includes elementary applications of functional analysis to differential and integral equations. Annotation copyrighted by Book News, Inc., Portland, OR
Functional Analysis
American Mathematical Society
This textbook provides an introduction to the methods and language of functional analysis, including Hilbert spaces, Fredholm theory for compact operators, and spectral theory of self-adjoint operators. It also presents the basic theorems and methods of abstract functional analysis and a few applications of these methods to Banach algebras and the theory of unbounded self-adjoint operators. The text corresponds to material for two semester courses (Part I and Part II, respectively) and is essentially self-contained. Prerequisites for the first part are minimal amounts of linear algebra and calculus. For the second part, some knowledge of topology and measure theory is recommended. Each of the 11 chapters is followed by numerous exercises, with solutions given at the end of the book. The amount of mathematics presented in the book can well be absorbed in a year's study and will provide a sound basis for future reading. It is suitable for graduate students and researchers interested in operator theory and functional analysis.
Functional Analysis SIAM
The goal of this work is to present the principles of functional analysis in a clear and concise way. The first three chapters of Functional Analysis: Fundamentals and Applications describe the general notions of distance, integral and norm, as well as their relations. The three chapters that follow deal with fundamental examples: Lebesgue spaces, dual spaces and Sobolev spaces. Two subsequent chapters develop applications to capacity theory and elliptic problems. In particular, the isoperimetric inequality and the Pólya-Szegő and Faber-Krahn inequalities are proved by purely functional methods. The epilogue contains a sketch of the history of functional analysis, in relation with integration and differentiation. Starting from elementary analysis and introducing relevant recent research, this work is an excellent resource for students in mathematics and applied mathematics.

A Functional Analysis of the Elementary School Principal

Walter de Gruyter GmbH & Co KG
While there is a plethora of excellent, but mostly "tell-it-all'' books on the subject, this one is intended to take a unique place in what today seems to be a still wide open niche for an introductory text on the basics of functional analysis to be taught within the existing constraints of the standard, for the United States, one-semester graduate curriculum (fifteen weeks with two seventy-five-minute lectures per week). The

book consists of seven chapters and an appendix taking the reader from the fundamentals of abstract spaces (metric, vector, normed vector, and inner product), through the basics of linear operators and functionals, the three fundamental principles (the Hahn-Banach Theorem, the Uniform Boundedness Principle, the Open Mapping Theorem and its equivalents: the Inverse Mapping and Closed Graph Theorems) with their numerous profound implications and certain interesting applications, to the elements of the duality and reflexivity theory. Chapter 1 outlines some necessary preliminaries, while the Appendix gives a concise discourse on the celebrated Axiom of Choice, its equivalents (the Hausdorff Maximal Principle, Zorn's Lemma, and Zermello's Well-Ordering Principle), and ordered sets. Being designed as a text to be used in a classroom, the book constantly calls for the student's actively mastering the knowledge of the subject matter. It contains 112 Problems, which are indispensable for understanding and moving forward. Many important statements are given as problems, a lot of these are frequently referred to and used in the main body. There are also 376 Exercises throughout the text, including Chapter 1 and the Appendix, which require of the student to prove or verify a statement or an example, fill in necessary details in a proof, or provide an intermediate step or a counterexample. They are also an inherent part of the material. More difficult problems are marked with an asterisk, many problem and exercises being supplied with "existential'' hints. The book is generous on Examples and contains numerous Remarks accompanying every definition and virtually each statement to discuss certain subtleties, raise questions on whether the converse assertions are true, whenever appropriate, or whether the conditions are essential. The prerequisites are set intentionally quite low, the students not being assumed to have taken graduate courses in real or complex analysis and general topology, to make the course accessible and attractive to a wider audience of STEM (science, technology, engineering, and mathematics) graduate students or advanced undergraduates with a solid background in calculus and linear algebra. With proper attention given to applications, plenty of examples, problems, and exercises, this well-designed text is ideal for a one-semester graduate course on the fundamentals of functional analysis for students in mathematics, physics, computer science, and engineering. ContentsPreliminariesMetric SpacesNormed Vector and Banach SpacesInner Product and Hilbert SpacesLinear Operators and FunctionalsThree Fundamental Principles of Linear Functional AnalysisDuality and ReflexivityThe Axiom of Choice and Equivalents

Lectures on Functional Analysis and the Lebesgue Integral John Wiley & Sons

Designed for undergraduate mathematics majors, this self-contained exposition of Gelfand's proof of Wiener's theorem explores set theoretic preliminaries, normed linear spaces and algebras, functions on Banach spaces, homomorphisms on

normed linear spaces, and more. 1966 edition.
Advanced Functional Analysis Elementary Functional Analysis
The book is based on courses taught by the author at Moscow State University. Compared to many other books on the subject, it is unique in that the exposition is based on extensive use of the language and elementary constructions of category theory. Among topics featured in the book are the theory of Banach and Hilbert tensor products, the theory of distributions and weak topologies, and Borel operator calculus. The book contains many examples illustrating the general theory presented, as well as multiple exercises that help the reader to learn the subject. It can be used as a textbook on selected topics of functional analysis and operator theory. Prerequisites include linear algebra, elements of real analysis, and elements of the theory of metric spaces.
Elementary Functional Analysis Springer Science & Business Media
Applied Functional Analysis, Third Edition provides a solid mathematical foundation for the subject. It motivates students to study functional analysis by providing many contemporary applications and examples drawn from mechanics and science. This well-received textbook starts with a thorough introduction to modern mathematics before continuing with detailed coverage of linear algebra, Lebesque measure and integration theory, plus topology with metric spaces. The final two chapters provides readers with an in-depth look at the theory of Banach and Hilbert spaces before concluding with a brief introduction to Spectral Theory. The Third Edition is more accessible and promotes interest and motivation among students to prepare them for studying the mathematical aspects of numerical analysis and the mathematical theory of finite elements.
Real and Functional Analysis John Wiley & Sons
This textbook presents the principles of functional analysis in a clear and concise way. The first three chapters describe the general notions of distance, integral, and norm, as well as their relations. Fundamental examples are provided in the three chapters that follow: Lebesgue spaces, dual spaces, and Sobolev spaces. Two subsequent chapters develop applications to capacity theory and elliptic problems. In particular, the isoperimetric inequality and the Pólya-Szegő and Faber-Krahn inequalities are proved by purely functional methods. The epilogue contains a sketch of the history of functional analysis in relation to integration and differentiation. Starting from elementary analysis and introducing relevant research, this work is an excellent resource for students in mathematics and applied mathematics. The second edition of Functional Analysis includes several improvements as well as the addition of supplementary material. Specifically, the coverage of advanced calculus and distribution theory has been completely rewritten and expanded. New proofs, theorems, and applications have been added as well for readers to explore.
Basic Methods of Linear Functional Analysis Springer Science & Business Media
The second part of an

elementary textbook which combines linear functional analysis, nonlinear functional analysis, and their substantial applications. The book addresses undergraduates and beginning graduates of mathematics, physics, and engineering who want to learn how functional analysis elegantly solves mathematical problems which relate to our real world and which play an important role in the history of mathematics. The books approach is to attempt to determine the most important applications. These concern integral equations, differential equations, bifurcation theory, the moment problem, Cebysev approximation, the optimal control of rockets, game theory, symmetries and conservation laws, the quark model, and gauge theory in elementary particle physics. The presentation is self-contained and requires only that readers be familiar with some basic facts of calculus.
Linear Functional Analysis
Springer Science & Business Media
This book is meant as a text for a first-year graduate course in analysis. In a sense, it covers the same topics as elementary calculus but treats them in a manner suitable for people who will be using it in further mathematical investigations. The organization avoids long chains of logical interdependence, so that chapters are mostly independent. This allows a course to omit material from some chapters without compromising the exposition of material from later chapters.

Analysis I

Courier Corporation
This concise text provides a gentle introduction to functional analysis. Chapters cover essential topics such as special spaces, normed spaces, linear functionals, and Hilbert spaces. Numerous examples and counterexamples aid in the understanding of key concepts, while exercises at the end of each chapter provide ample opportunities for practice with the material. Proofs of theorems such as the Uniform Boundedness Theorem, the Open Mapping Theorem, and the Closed Graph Theorem are worked through step-by-step, providing an accessible avenue to understanding these important results. The prerequisites for this book are linear algebra and elementary real analysis, with two introductory chapters providing an overview of material necessary for the subsequent text. Functional Analysis offers an elementary approach ideal for the upper-undergraduate or beginning graduate student. Primarily intended for a one-semester introductory course, this text is also a perfect resource for independent study or as the basis for a reading course.
Elementary Functional Analysis, Engl American Mathematical Soc.
This book provides an introduction to functional analysis for non-experts in mathematics. As such, it is distinct from most other books on the subject that are intended for mathematicians. Concepts are explained concisely with visual materials, making it accessible for those unfamiliar with graduate-level mathematics. Topics include topology, vector spaces, tensor spaces, Lebesgue integrals, and operators, to name a few. Two central issues—the theory of Hilbert space and the operator theory—and how they

relate to quantum physics are covered extensively. Each chapter explains, concisely, the purpose of the specific topic and the benefit of understanding it. Researchers and graduate students in physics, mechanical engineering, and information science will benefit from this view of functional analysis.

Essential Results of Functional Analysis

Springer Science & Business Media
It begins in Chapter 1 with an introduction to the necessary foundations, including the Arzelà–Ascoli theorem, elementary Hilbert space theory, and the Baire Category Theorem. Chapter 2 develops the three fundamental principles of functional analysis (uniform boundedness, open mapping theorem, Hahn–Banach theorem) and discusses reflexive spaces and the James space. Chapter 3 introduces the weak and weak topologies and includes the theorems of Banach–Alaoglu, Banach–Dieudonné, Eberlein–Šmulyan, Kre&ibreve;n–Milman, as well as an introduction to topological vector spaces and applications to ergodic theory. Chapter 4 is devoted to Fredholm theory. It includes an introduction to the dual operator and to compact operators, and it establishes the closed image theorem. Chapter 5 deals with the spectral theory of bounded linear operators. It introduces complex Banach and Hilbert spaces, the continuous functional calculus for self-adjoint and normal operators, the Gelfand spectrum, spectral measures, cyclic vectors, and the spectral theorem. Chapter 6 introduces unbounded operators and their duals. It establishes the closed image theorem in this setting and extends the functional calculus and spectral measure to unbounded self-adjoint operators on Hilbert spaces. Chapter 7 gives an introduction to strongly continuous semigroups and their infinitesimal generators. It includes foundational results about the dual semigroup and analytic semigroups, an exposition of measurable functions with values in a Banach space, and a discussion of solutions to the inhomogeneous equation and their regularity properties. The appendix establishes the equivalence of the Lemma of Zorn and the Axiom of Choice, and it contains a proof of Tychonoff's theorem. With 10 to 20 elaborate exercises at the end of each chapter, this book can be used as a text for a one-or-two-semester course on functional analysis for beginning graduate students. Prerequisites are first-year analysis and linear algebra, as well as some foundational material from the second-year courses on point set topology, complex analysis in one variable, and measure and integration.
Beginning Functional Analysis American Mathematical Soc.
Functions in R and C, including the theory of Fourier series, Fourier integrals and part of that of holomorphic functions, form the focal topic of these two volumes. Based on a course given by the author to large audiences at Paris VII University for many years, the exposition proceeds somewhat nonlinearly, blending rigorous mathematics skilfully with didactical and historical considerations. It sets out to illustrate the variety of possible approaches to the main results, in order

to initiate the reader to methods, the underlying reasoning, and fundamental ideas. It is suitable for both teaching and self-study. In his familiar, personal style, the author emphasizes ideas over calculations and, avoiding the condensed style frequently found in textbooks, explains these ideas without parsimony of words. The French edition in four volumes, published from 1998, has met with resounding success: the first two volumes are now available in English.

Elementary Functional Analysis Springer Science & Business Media

This text is an introduction to functional analysis which requires readers to have a minimal background in linear algebra and real analysis at the first-year graduate level. Prerequisite knowledge of general topology or Lebesgue integration is not required. The book explains the principles and applications of functional analysis and explores the development of the basic properties of normed linear, inner product spaces and continuous linear operators defined in these spaces. Though Lebesgue integral is not discussed, the book offers an in-depth knowledge on the numerous applications of the abstract results of functional analysis in differential and integral equations, Banach limits, harmonic analysis, summability and numerical integration. Also covered in the book are versions of the spectral theorem for compact, symmetric operators and continuous, self adjoint operators.

Functional Analysis Springer Nature

Functional analysis arose from traditional topics of calculus and integral and differential equations. This accessible text by an internationally renowned teacher and author starts with problems in numerical analysis and shows how they lead naturally to the concepts of functional analysis. Suitable for advanced undergraduates and graduate students, this book provides coherent explanations for complex concepts. Topics include Banach and Hilbert spaces, contraction mappings and other criteria for convergence, differentiation and integration in Banach spaces, the Kantorovich test for convergence of an iteration, and Rall's ideas of polynomial and quadratic operators. Numerous examples appear throughout the text.

Elementary Functional Analysis Springer

This textbook, based on three series of lectures held by the author at the University of Strasbourg, presents functional analysis in a non-traditional way by generalizing elementary theorems of plane geometry to spaces of arbitrary dimension. This approach leads naturally to the basic notions and theorems. Most results are illustrated by the small lp spaces. The Lebesgue integral, meanwhile, is treated via the direct approach of Frigyes Riesz, whose constructive definition of measurable functions leads to optimal, clear-cut versions of the classical theorems of Fubini-Tonelli and Radon-Nikodým. Lectures on Functional Analysis and the Lebesgue Integral presents the most important topics for students, with short, elegant proofs. The exposition style follows the Hungarian mathematical tradition of Paul Erdős and others. The order of the first two parts, functional analysis

and the Lebesgue integral, may be reversed. In the third and final part they are combined to study various spaces of continuous and integrable functions. Several beautiful, but almost forgotten, classical theorems are also included. Both undergraduate and graduate students in pure and applied mathematics, physics and engineering will find this textbook useful. Only basic topological notions and results are used and various simple but pertinent examples and exercises illustrate the usefulness and optimality of most theorems. Many of these examples are new or difficult to localize in the literature, and the original sources of most notions and results are indicated to help the reader understand the genesis and development of the field.
Applied Functional Analysis Academic Press
topics. However, only a modest preliminary knowledge is needed. In the first chapter, where we introduce an important topological concept, the so-called topological degree for continuous maps from subsets ofRn into Rn, you need not know anything about functional analysis. Starting with Chapter 2, where infinite dimensions first appear, one should be familiar with the essential step of consider ing a sequence or a function of some sort as a point in the corresponding vector space of all such sequences or functions, whenever this abstraction is worthwhile. One should also work out the things which are proved in § 7 and accept certain basic principles of linear functional analysis quoted there for easier references, until they are applied in later chapters. In other words, even the 'completely linear' sections which we have included for your convenience serve only as a vehicle for progress in nonlinearity. Another point that makes the text introductory is the use of an essentially uniform mathematical language and way of thinking, one which is no doubt familiar from elementary lectures in analysis that did not worry much about its connections with algebra and topology. Of course we shall use some elementary topological concepts, which may be new, but in fact only a few remarks here and there pertain to algebraic or differential topological concepts and methods.
Mathematical Analysis Courier Dover Publications
A guide to analytic methods in applied mathematics from the perspective of functional analysis, suitable for scientists, engineers and students.

Techniques of Functional Analysis for Differential and Integral Equations

Springer Science & Business Media
Functional analysis arose in the early twentieth century and gradually, conquering one stronghold after another, became a nearly universal mathematical doctrine, not merely a new area of mathematics, but a new mathematical world view. Its appearance was the inevitable consequence of the evolution of all of nineteenth-century mathematics, in particular classical analysis and mathematical physics. Its original basis was formed by Cantor’s theory of sets and linear algebra. Its existence answered the question of how to state general principles of a broadly interpreted analysis in a way suitable for the most diverse situations. A.M. Vershik

([45], p. 438). This text evolved from the content of a one semester introductory course in fu- tional analysis that I have taught a number of times since 1996 at the University of Virginia. My students have included ?rst and second year graduate students prep- ing for thesis work in analysis, algebra, or topology, graduate students in various departments in the School of Engineering and Applied Science, and several und- graduate mathematics or physics majors. After a ?rst draft of the manuscript was completed, it was also used for an independent reading course for several und- graduates preparing for graduate school.