

An Introduction To Banach Space Theory 1st Edition

This volume presents answers to some natural questions of a general analytic character that arise in the theory of Banach spaces. I believe that altogether too many of the results presented herein are unknown to the active abstract analysts, and this is not as it should be. Banach space theory has much to offer the practitioners of analysis; unfortunately, some of the general principles that motivate the theory and make accessible many of its stunning achievements are couched in the technical jargon of the area, thereby making it unapproachable to one unwilling to spend considerable time and effort in deciphering the jargon. With this in mind, I have concentrated on presenting what I believe are basic phenomena in Banach spaces that any analyst can appreciate, enjoy, and perhaps even use. The topics covered have at least one serious omission: the beautiful and powerful theory of type and cotype. To be quite frank, I could not say what I wanted to say about this subject without increasing the length of the text by at least 75 percent. Even then, the words would not have done as much good as the advice to seek out the rich Seminaire Maurey-Schwartz lecture notes, wherein the theory's development can be traced from its conception. Again, the treasured volumes of Lindenstrauss and Tzafriri also present much of the theory of type and cotype and are must reading for those really interested in Banach space theory.

Written by a distinguished specialist in functional analysis, this book presents a comprehensive treatment of the history of Banach spaces and (abstract bounded) linear operators. Banach space theory is presented as a part of a broad mathematics context, using tools from such areas as set theory, topology, algebra, combinatorics, probability theory, logic, etc. Equal emphasis is given to both spaces and operators. The book may serve as a reference for researchers and as an introduction for graduate students who want to learn Banach space theory with some historical flavor.

This book on Banach space theory focuses on what have been called three-space problems. It contains a fairly complete description of ideas, methods, results and counterexamples. It can be considered self-contained, beyond a course in functional analysis and some familiarity with modern Banach space methods. It will be of interest to researchers for its methods and open problems, and to students for the exposition of techniques and examples.

This book is intended to be used with graduate courses in Banach space theory.

Introduction to Tensor Products of Banach Spaces

Introduction to Functional Analysis with Applications

Banach Spaces for Analysts

The Basis for Linear and Nonlinear Analysis

"This book covers such topics as L_p spaces, distributions, Baire category, probability theory and Brownian motion, several complex variables and oscillatory integrals in Fourier analysis. The authors focus on key results in each area, highlighting their importance and the organic unity of the subject"--Provided by publisher.

The Handbook presents an overview of most aspects of modern Banach space theory and its applications. The up-to-date surveys, authored by leading research workers in the area, are written to be accessible to a wide audience. In addition to presenting the state of the art of Banach space theory, the surveys discuss the relation of the subject with such areas as harmonic analysis, complex analysis, classical convexity, probability theory, operator theory, combinatorics, logic, geometric measure theory, and partial differential equations. The Handbook begins with a chapter on basic concepts in Banach space theory which contains all the background needed for reading any other chapter in the Handbook. Each of the twenty one articles in this volume after the basic concepts chapter is devoted to one specific direction of Banach space theory or its applications. Each article contains a motivated introduction as well as an exposition of the main results, methods, and open problems in its specific direction. Most have an extensive bibliography. Many articles contain new proofs of known results as well as expositions of proofs which are hard to locate in the literature or are only outlined in the original research papers. As well as being valuable to experienced researchers in Banach space theory, the Handbook should be an outstanding source for inspiration and information to graduate students and beginning researchers. The Handbook will be useful for mathematicians who want to get an idea of the various developments in Banach space theory.

Preparing students for further study of both the classical works and current research, this is an accessible text for students who have had a course in real and complex analysis and understand the basic properties of L_p spaces. It is sprinkled liberally with examples, historical notes, citations, and original sources, and over 450 exercises provide practice in the use of the results developed in the text through supplementary examples and counterexamples.

This two-volume text provides a complete overview of the theory of Banach spaces, emphasising its interplay with classical and harmonic analysis (particularly Sidon sets) and probability. The authors give a full exposition of all results, as well as numerous exercises and comments to complement the text and aid graduate students in functional analysis. The book will also be an invaluable reference volume for researchers in analysis. Volume 1 covers the basics of Banach space theory, operator theory in Banach spaces, harmonic analysis and probability. The authors also provide an annex devoted to compact Abelian groups. Volume 2 focuses on applications of the tools presented in the first volume, including Dvoretzky's theorem, spaces without the approximation property, Gaussian processes, and more. In volume 2, four leading experts also provide surveys outlining major developments in the field since the publication of the original French edition.

An Introduction to Metric Spaces and Fixed Point Theory

Introduction to Banach Spaces: Analysis and Probability:

Banach Hilbert Spaces, Vector Measures and Group Representations

Topics in Banach Space Theory

Sequences and Series in Banach Spaces

This is the first ever truly introductory text to the theory of tensor products of Banach spaces. Coverage includes a full treatment of the Grothendieck theory of tensor norms, approximation property and the Radon-Nikodym Property, Bochner and Pettis integrals. Each chapter contains worked examples and a set of exercises, and two appendices offer material on summability in Banach spaces and properties of spaces of measures.

The purpose of this book is to present the main structure theorems in the isometric theory of classical Banach spaces. Elements of general topology, measure theory, and Banach spaces are assumed to be familiar to the reader. A classical Banach space is a Banach space X whose dual space is linearly isometric to $L_p(j_1, \mathbb{R})$ (or $L_p(j_1, \mathbb{C})$ in the complex case) for some measure j_1 and some $1 \leq p < \infty$. If 1

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This textbook is an introduction to the theory of Hilbert space and its applications. The notion of Hilbert space is central in functional analysis and is used in numerous branches of pure and applied mathematics. Dr Young has stressed applications of the theory, particularly to the solution of partial differential equations in mathematical physics and to the approximation of functions in complex analysis. Some basic familiarity with real analysis, linear algebra and metric spaces is assumed, but otherwise the book is self-contained. It is based on courses given at the University of Glasgow and contains numerous examples and exercises (many with solutions). Thus it will make an excellent first course in Hilbert space theory at either undergraduate or graduate level and will also be of interest to electrical engineers and physicists, particularly those involved in control theory and filter design.

From Vector Spaces to Function Spaces

A Course on Topological Vector Spaces

Isoperimetry and Processes

An Introduction to Banach Space Theory

Introduction to Banach spaces and their geometry

This book provides an introduction to the theory of topological vector spaces, with a focus on locally convex spaces. It discusses topologies in dual pairs, culminating in the Mackey-Arens theorem, and also examines the properties of the weak topology on Banach spaces, for instance Banach's theorem on weak*-closed subspaces on the dual of a Banach space (alias the Krein-Smulian theorem), the Eberlein-Smulian theorem, Krein's theorem on the closed convex hull of weakly compact sets in a Banach space, and the Dunford-Pettis theorem characterising weak compactness in L^1 -spaces. Lastly, it addresses topics such as the locally convex final topology, with the application to test functions $D(\)$ and the space of distributions, and the Krein-Milman theorem. The book adopts an "economic" approach to interesting topics, and avoids exploring all the arising side topics. Written in a concise mathematical style, it is intended primarily for advanced graduate students with a background in elementary functional analysis, but is also useful as a reference text for established mathematicians.

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Accessible text covering core functional analysis topics in Hilbert and Banach spaces, with detailed proofs and 200 fully-worked exercises.

Fundamental to the study of any mathematical structure is an understanding of its symmetries. In the class of Banach spaces, this leads naturally to a study of isometries—the linear transformations that preserve distances. In his foundational treatise, Banach showed that every linear isometry on the space of continuous functions on a compact metric space must transform a continuous function x into a continuous function y satisfying $y(t) = h(t)x(p(t))$, where p is a homeomorphism and $|h|$ is identically one. *Isometries on Banach Spaces: Function Spaces* is the first of two planned volumes that survey investigations of Banach-space isometries. This volume emphasizes the characterization of isometries and focuses on establishing the type of explicit, canonical form given above in a variety of settings. After an introductory discussion of isometries in general, four chapters are devoted to describing the isometries on classical function spaces. The final chapter explores isometries on Banach algebras. This treatment provides a clear account of historically important results, exposes the principal methods of attack, and includes some results that are more recent and some that are lesser known. Unique in its focus, this book will prove useful for experts as well as beginners in the field and for those who simply want to acquaint themselves with this area of Banach space theory.

Theory of Linear Operations

Introduction to Banach Spaces and Algebras

Three-space Problems in Banach Space Theory

An Introduction to Hilbert Space

function spaces

This classic work by the late Stefan Banach has been translated into English so as to reach a yet wider audience. It contains the basics of the algebra of operators, concentrating on the study of linear operators, which corresponds to that of the linear forms $a_1x_1 + a_2x_2 + \dots + a_nx_n$ of algebra. The book gathers results concerning linear operators defined in general spaces of a certain kind, principally in Banach spaces, examples of which are: the space of continuous functions, that of the p th-power-summable functions, Hilbert space, etc. The general theorems are interpreted in various mathematical areas, such as group theory, differential equations, integral equations, equations with infinitely many unknowns, functions of a real variable, summation methods and orthogonal series. A new fifty-page section ("Some Aspects of the Present Theory of Banach Spaces") complements this important monograph.

*An updated and revised edition of the 1986 title *Convexity and Optimization in Banach Spaces*, this book provides a self-contained presentation of basic results of the theory of*

convex sets and functions in infinite-dimensional spaces. The main emphasis is on applications to convex optimization and convex optimal control problems in Banach spaces. A distinctive feature is a strong emphasis on the connection between theory and application. This edition has been updated to include new results pertaining to advanced concepts of subdifferential for convex functions and new duality results in convex programming. The last chapter, concerned with convex control problems, has been rewritten and completed with new research concerning boundary control systems, the dynamic programming equations in optimal control theory and periodic optimal control problems. Finally, the structure of the book has been modified to highlight the most recent progression in the field including fundamental results on the theory of infinite-dimensional convex analysis and includes helpful bibliographical notes at the end of each chapter.

*A powerful introduction to one of the most active areas of theoretical and applied mathematics This distinctive introduction to one of the most far-reaching and beautiful areas of mathematics focuses on Banach spaces as the milieu in which most of the fundamental concepts are presented. While occasionally using the more general topological vector space and locally convex space setting, it emphasizes the development of the reader's mathematical maturity and the ability to both understand and "do" mathematics. In so doing, Functional Analysis provides a strong springboard for further exploration on the wider range of topics the book presents, including: * Weak topologies and applications * Operators on Banach spaces * Bases in Banach spaces * Sequences, series, and geometry in Banach spaces Stressing the general techniques underlying the proofs, Functional Analysis also features many exercises for immediate clarification of points under discussion. This thoughtful, well-organized synthesis of the work of those mathematicians who created the discipline of functional analysis as we know it today also provides a rich source of research topics and reference material.*

A guide to analytic methods in applied mathematics from the perspective of functional analysis, suitable for scientists, engineers and students.

Introduction to Banach Spaces: Analysis and Probability

Martingales in Banach Spaces

A Short Course on Banach Space Theory

Volume II: Probabilistic Methods and Operator Theory

Introduction to Banach Algebras, Operators, and Harmonic Analysis

Banach spaces provide a framework for linear and nonlinear functional analysis, operator theory, abstract analysis, probability, optimization and other branches of mathematics. This book introduces the reader to linear functional analysis and to related parts of infinite-dimensional Banach space theory. Key Features: - Develops classical theory, including weak topologies, locally convex space, Schauder bases and compact operator theory - Covers Radon-Nikodým property, finite-dimensional spaces and local theory on tensor products - Contains sections on uniform homeomorphisms and non-linear theory, Rosenthal's L1 theorem, fixed points, and more - Includes information about further topics and directions of research and some open problems at the end of each chapter - Provides numerous exercises for practice The text is suitable for graduate courses or for independent study. Prerequisites include basic courses in calculus and linear. Researchers in functional analysis will also benefit for this book as it can serve as a reference book.

Publisher Description

Presents up-to-date Banach space results. * Features an extensive bibliography for outside reading. * Provides detailed exercises that elucidate more introductory material.

This textbook is an introduction to functional analysis suited to final year undergraduates or beginning graduates. Its various applications of Hilbert spaces, including least squares approximation, inverse problems, and Tikhonov regularization, should appeal not only to mathematicians interested in applications, but also to researchers in related fields. Functional Analysis adopts a self-contained approach to Banach spaces and operator theory that covers the main topics, based upon the classical sequence and function spaces and their operators. It assumes only a minimum of knowledge in elementary linear algebra and real analysis; the latter is redone in the light of metric spaces. It contains more than a thousand worked examples and exercises, which make up the main body of the book.

Introduction to Further Topics in Analysis

Probability in Banach Spaces

Introduction to Banach Spaces and their Geometry

Functional Analysis

An Introduction to Functional Analysis

The theory of operator spaces is very recent and can be described as a non-commutative Banach space theory. An 'operator space' is simply a Banach space with an embedding into the space $B(H)$ of all bounded operators on a Hilbert space H . The first part of this book is an introduction with emphasis on examples that illustrate various aspects of the theory. The second part is devoted to applications to C^* -algebras, with a systematic exposition of tensor products of C^* -algebras. The third (and shorter) part of the book describes applications to non self-adjoint operator algebras, and similarity problems. In particular the author's counterexample to the 'Halmos problem' is presented, as well as work on the new concept of 'length' of an operator algebra. Graduate students and professional mathematicians interested in functional analysis, operator algebras and theoretical physics will find that this book has much to offer.

An Introduction to Banach Space Theory Springer Science & Business Media

This second volume of Analysis in Banach Spaces, Probabilistic Methods and Operator Theory, is the successor to Volume I, Martingales and Littlewood-Paley Theory. It presents a thorough study

of the fundamental randomisation techniques and the operator-theoretic aspects of the theory. The first two chapters address the relevant classical background from the theory of Banach spaces, including notions like type, cotype, K-convexity and contraction principles. In turn, the next two chapters provide a detailed treatment of the theory of R-boundedness and Banach space valued square functions developed over the last 20 years. In the last chapter, this content is applied to develop the holomorphic functional calculus of sectorial and bi-sectorial operators in Banach spaces. Given its breadth of coverage, this book will be an invaluable reference to graduate students and researchers interested in functional analysis, harmonic analysis, spectral theory, stochastic analysis, and the operator-theoretic approach to deterministic and stochastic evolution equations.

Introduction to Banach Spaces and their Geometry

History of Banach Spaces and Linear Operators

Banach Space Theory

An Introduction to Metric Spaces, Hilbert Spaces, and Banach Algebras

Convexity and Optimization in Banach Spaces

The Isometric Theory of Classical Banach Spaces

This textbook is an introduction to the techniques of summing and nuclear norms. The author's aim is to present a clear and simple account of these ideas and to demonstrate the power of their application to a variety of Banach space questions. The style is expository and the only prerequisite is a beginner's course on Normed linear spaces and a minimal knowledge of functional analysis. Thus, Dr Jameson is able to concentrate on important, central results and gives concrete and largely non-technical proofs, often supplying alternative proofs which both contribute something to the understanding. Final-year undergraduates and postgraduates in functional analysis will enjoy this introduction to the subject, and there are many examples and exercises throughout the text to help the reader and to demonstrate the range of application these techniques find. A list of references indicates the way for further reading.

This text provides the reader with the necessary technical tools and background to reach the frontiers of research without the introduction of too many extraneous concepts. Detailed and accessible proofs are included, as are a variety of exercises and problems. The two new chapters in this second edition are devoted to two topics of much current interest amongst functional analysts: Greedy approximation with respect to bases in Banach spaces and nonlinear geometry of Banach spaces. This new material is intended to present these two directions of research for their intrinsic importance within Banach space theory, and to motivate graduate students interested in learning more about them. This textbook assumes only a basic knowledge of functional analysis, giving the reader a self-contained overview of the ideas and techniques in the development of modern Banach space theory. Special emphasis is placed on the study of the classical Lebesgue spaces L_p (and their sequence space analogues) and spaces of continuous functions. The authors also stress the use of bases and basic sequences techniques as a tool for understanding the isomorphic structure of Banach spaces. From the reviews of the First Edition: "The authors of the book...succeeded admirably in creating a very helpful text, which contains essential topics with optimal proofs, while being reader friendly... It is also written in a lively manner, and its involved mathematical proofs are elucidated and illustrated by motivations, explanations and occasional historical comments... I strongly recommend to every graduate student who wants to get acquainted with this exciting part of functional analysis the instructive and pleasant reading of this book..." —Gilles Godefroy, Mathematical Reviews

This book provides an elementary introduction to classical analysis on normed spaces, with special attention paid to fixed points, calculus, and ordinary differential equations. It contains a full treatment of vector measures on delta rings without assuming any scalar measure theory and hence should fit well into existing courses. The relation between group representations and almost periodic functions is presented. The mean values offer an infinite-dimensional analogue of measure theory on finite-dimensional Euclidean spaces. This book is ideal for beginners who want to get through the basic material as soon as possible and then do their own research immediately.

This is a basic course in functional analysis for senior undergraduate and beginning postgraduate students. The reader need only be familiar with elementary real and complex analysis, linear algebra and have studied a course in the analysis of metric spaces; knowledge of integration theory or general topology is not required. The text concerns the structural properties of normed linear spaces in general, especially associated with dual spaces and continuous linear operators on normed linear spaces. The implications of the general theory are illustrated with a great variety of example spaces.

Introduction to Banach Spaces: Preface; Preliminary chapter; 1. Fundamental notions of probability; 2. Bases in Banach spaces; 3. Unconditional convergence; 4. Banach space valued random variables; 5. Type and cotype of Banach spaces. Factorisation through a Hilbert space; 6. p -summing operators. Applications; 7. Some properties of L_p -spaces; 8. The space l_1 ; Annex. Banach algebras, compact Abelian groups; Bibliography; Author index; Notation index; Subject index

Analysis in Banach Spaces

Handbook of the Geometry of Banach Spaces

Summing and Nuclear Norms in Banach Space Theory

Introduction to the Analysis of Normed Linear Spaces

A graduate level text in functional analysis, with an emphasis on Banach algebras. Based on lectures given for Part III of the Cambridge Mathematical Tripos, the text will assume a familiarity with elementary real and complex analysis, and some acquaintance with metric spaces, analytic topology and normed spaces (but not theorems depending on Baire category, or any version of the Hahn-Banach theorem).

Table of contents

This book focuses on applications of martingales to the geometry of Banach spaces, and is accessible to graduate students.

Isoperimetric, measure concentration and random process techniques appear at the basis of the modern understanding of Probability in Banach spaces. Based on these tools, the book presents a complete treatment of the main aspects of Probability in Banach spaces (integrability and limit theorems for vector valued random variables, boundedness and continuity of random processes) and of some of their links to Geometry of Banach spaces (via the type and cotype properties). Its purpose is to present some of the main aspects of this theory, from the foundations to the most important achievements. The main features of the investigation are the systematic use of isoperimetry and concentration of measure and abstract random

process techniques (entropy and majorizing measures). Examples of these probabilistic tools and ideas to classical Banach space theory are further developed.
Introduction to Operator Space Theory
Isometries on Banach Spaces