Linear Operators For Quantum Mechanics Thomas F Jordan

This classic textbook by two mathematicians from the USSR's prestigious Kharkov Mathematics Institute introduces linear operators in Hilbert space, and presents in detail the geometry of Hilbert space and the spectral theory of unitary and self-adjoint operators. It is directed to students at graduate and advanced undergraduate levels, but because of the exceptional clarity of its theoretical presentation and the inclusion of results obtained by Soviet mathematicians, it should prove invaluable for every mathematician and physicist. 1961, 1963 edition.

Introduction to problems of molecular structure and motion covers calculus of orthogonal functions, algebra of vector spaces, and Lagrangian and Hamiltonian formulation of classical mechanics. Answers to problems. 1966 edition.

Quantum mechanics is the foundation of modern technology, due to its innumerable applications in physics, chemistry and even biology. This second volume studies Schrödingers equation and its applications in the study of wells, steps and potential barriers. It examines the properties of orthonormal bases in the space of square-summable wave functions and Dirac notations in the space of states. This book has a special focus on the notions of the linear operators, the Hermitian operators, observables, Hermitian conjugation, commutators and the representation of kets, bras and operators in the space of states. The eigenvalue equation, the characteristic equation and the evolution equation of the mean value of an observable are introduced. The book goes on to investigate the study of conservative systems through the time evolution operator and Ehrenfests theorem. Finally, this second volume is completed by the introduction of the notions of quantum wire, quantum wells of semiconductor materials and quantum dots in the appendices.

This book provides a comprehensive introduction to Fock space theory and its applications to mathematical quantum field theory. The first half of the book, Part I, is devoted to detailed descriptions of analysis on abstract Fock spaces (full Fock space, boson Fock space, fermion Fock space and boson-fermion Fock space). It includes the mathematics of second quantization, representation theory of canonical commutation relations and canonical anti-commutation relations, Bogoliubov transformations, infinite-dimensional Dirac operators and supersymmetric quantum field in an abstract form. The second half of the book, Part II, covers applications of the mathematical theories in Part I to quantum field theory. Four kinds of free quantum fields are constructed and detailed analyses are made. A simple interacting quantum field model, called the van Hove model, is fully analyzed in an abstract form. Moreover, a list of interacting quantum field models is presented and a short description to each model is given. To graduate students in mathematics or physics who are interested in the mathematical aspects of quantum field theory, this book is a good introductory text. It is also well suited for self-study and will provide readers a firm foundation of knowledge and mathematical techniques for reading more advanced books and current research articles in the field of mathematical analysis on quantum fields. Also, numerous problems are added to aid readers to develop a deeper understanding of the field. Contents: Linear Operators on Hilbert SpaceTensor Product of Hilbert SpacesTensor Product of Linear Operators on Hilbert SpacesFull Fock SpaceBoson Fock SpaceFermion Fock SpaceBoson-Fermion Fock SpaceTheory of Infinite-Dimensional Dirac Operators and Abstract Supersymmetric Quantum Fields General Theory of Quantum FieldsQuantum de Broglie FieldQuantum Klein–Gordon FieldQuantum Radiation FieldQuantum Dirac Fieldvan Hove ModelOverview of Interacting Quantum Field Models Readership: Advanced undergraduate and graduate students in mathematics or physics, mathematicians and mathematical physicists. Keywords: Fock Space;Second Quantization;Canonical Commutation Relation;Canonical Anti-Commutation Relation;Quantum Field;Bose Field;Fermi Field;Dirac Operator;Supersymmetry;Supersymmetric Quantum Field; Quantum Electrodynamics;van Hove ModelReview: Key Features: Detailed description of the theory of Fock spaces including full Fock spaces, boson Fock spaces, fermion Fock spaces and boson-fermion Fock spacesNew topics are included, such as the theory of infinite dimensional Dirac operators and an abstract supersymmetric quantum field theory, which have been originally developed by the authorDetailed treatment of mathematical constructions of free quantum field models as well as a simple interacting model

The spectral theory of linear operators plays a key role in the mathematical formulation of quantum theory. This textbook provides a concise and comprehensible introduction to the spectral theory of (unbounded) self-adjoint operators and its application in quantum dynamics. Many examples and exercises are included that focus on quantum mechanics.

This concise text for advanced undergraduates and graduate students covers eigenvalue problems, orthogonal functions and expansions, the Sturm-Liouville theory and linear operators on functions, and linear vector spaces. 1962 edition.

Introductory text for graduate students in physics taking a year-long course in quantum mechanics in which the third quarter is devoted to relativistic wave equations and field theory. Answers to selected problems. 1972 edition.

Taking a conceptual approach to the subject, Concepts in Quantum Mechanics provides complete coverage of both basic and advanced topics. Following in the footsteps of Dirac's classic work Principles of Quantum Mechanics, it explains all themes from first principles.The authors present alternative ways of representing the state of a physical system,

Suitable for advanced undergraduates and graduate students, this compact treatment examines linear space, functionals, and operators; diagonalizing operators; operator algebras; and equations of motion. 1969 edition.

This book gives a comprehensive introduction to modern quantum mechanics, emphasising the underlying Hilbert space theory and generalised function theory. All the major modern techniques and approaches used in quantum mechanics are introduced, such as Berry phase, coherent and squeezed states, quantum computing, solitons and quantum mechanics. Audience: The book is suitable for graduate students in physics and mathematics.

This book was written as a text, although many may consider it a mono graph. As a text it has been used several times in both the one-year graduate quantum-mechanics course and (in its shortened version) in a senior quantum mechanics course that I taught at the University of Texas at Austin. It is self-contained and does not require any prior knowledge of quantum mechanics. It also introduces the mathematical language of quantum mechanics, starting with the definitions, and attempts to teach this language by using it. Therefore, it can, in principle, be read without prior knowledge of the theory of linear operators and linear spaces, though some familiarity with linear algebra would be helpful. Prerequisites are knowledge of calculus and of vector algebra and analysis. Also used in a few places are some elementary facts of Fourier analysis and differential equations. Most physical examples are taken from the fields of atomic and molecular physics, as it is these fields that are best known to students at the stage when they learn quantum mechanics. This book may be considered a monograph because the presentation here is different from the usual treatment in many standard textbooks on quantum mechanics. It is not that a "different kind" of quantum mechanics is pre sented here; this is conventional quantum mechanics (" Copenhagen inter pretation ").

Quantum mechanics and the theory of operators on Hilbert space have been deeply linked since their beginnings in the early twentieth century. States of a quantum system correspond to certain elements of the configuration space and observables correspond to certain operators on the space. This book is a brief, but self-contained, introduction to the mathematical methods of quantum mechanics, with a view towards applications to Schrodinger operators. Part 1 of the book is a concise introduction to the spectral theory of unbounded operators. Only those topics that will be needed for later applications are covered. The spectral theorem is a central topic in this approach and is introduced at an early stage. Part 2 starts with the free Schrodinger equation and computes the free resolvent and time evolution. Position, momentum, and angular momentum are discussed via algebraic methods. Various mathematical methods are developed, which are then used to compute the spectrum of the hydrogen atom. Further topics include the nondegeneracy of the ground state, spectra of atoms, and scattering theory. This book serves as a self-contained introduction to spectral theory of unbounded operators in Hilbert space with full proofs and minimal prerequisites: Only a solid knowledge of advanced calculus and a one-semester introduction to complex analysis are required. In particular, no functional analysis and no Lebesgue integration theory are assumed. It develops the mathematical tools necessary to prove some key results in nonrelativistic quantum mechanics. Mathematical Methods in Quantum Mechanics is intended for beginning graduate students in both mathematics and physics and provides a solid foundation for reading more advanced books and current research literature. It is well suited for self-study and includes numerous exercises (many with hints).

This graduate-level text is based on a course in advanced quantum mechanics, taught many times at the University of Massachusetts, Amherst. Topics include propagator methods, scattering theory, charged particle interactions, alternate approximate methods, and Klein-Gordon and Dirac equations. Problems appear in the flow of the discussion, rather than at the end of chapters. 1992 edition.

This text systematically presents the basics of quantum mechanics, emphasizing the role of Lie groups, Lie algebras, and their unitary representations. The mathematical structure of the subject is brought to the fore, intentionally avoiding significant overlap with material from standard physics courses in quantum mechanics and quantum field theory. The level of presentation is attractive to mathematics students looking to learn about both quantum mechanics and representation theory, while also appealing to physics students who would like to know more about the mathematics underlying the subject. This text showcases the numerous differences between typical mathematical and physical treatments of the subject. The latter portions of the book focus on central mathematical objects that occur in the Standard Model of particle physics, underlining the deep and intimate connections between mathematics and the physical world. While an elementary physics course of some kind would be helpful to the reader, no specific background in physics is assumed, making this book accessible to students with a grounding in multivariable calculus and linear algebra. Many exercises are provided to develop the reader's understanding of and facility in quantum-theoretical concepts and calculations.

"The standard work in the fundamental principles of quantum mechanics, indispensable both to the advanced student and to the mature research worker, who will always find it a fresh source of knowledge and stimulation." --Nature "This is the classic text on quantum mechanics. No graduate student of quantum theory should leave it unread"--W.C Schieve, University of Texas

The core content of even the most intricate intellectual edifices is often a simple fact or idea. So is it with quantum mechanics; the entire mathematical fabric of the formal description of quantum mechanics stems essentially from the fact that quantum probabilities interfere (i.e., from the superposition principle). This book is dedicated to substantiating this claim. In the process, the book tries to demonstrate how the factual content of quantum mechanics can be transcribed in the formal language of vector spaces and linear transformations by disentangling the empirical content from the usual formal description. More importantly, it tries to bring out what this transcription achieves. The book uses a pedagogic strategy which reverse engineers the postulates of quantum mechanics to device a schematic outline of the empirical content of quantum mechanics from which the postulates are then reconstructed step by step. This strategy is adopted to avoid the disconcerting details of actual experiments (however simplified) to spare the beginner of issues that lurk in the fragile foundations of the subject. In the Copenhagen interpretation of quantum mechanics, the key idea is measurement. But "measurement" carries an entirely different meaning from the connotation that the term carries elsewhere in physics. This book strives to underline this as strongly as possible. The book is intended as an undergraduate text for a first course in quantum mechanics. Since the book is self contained, it may also be used by enthusiastic outsiders interested to get a glimpse of the core content of the subject. Features: Demonstrates why linear algebra is the appropriate mathematical language for quantum mechanics. Uses a reconstructive approach to motivate the postulates of quantum mechanics. Builds the vocabulary of quantum mechanics by showing how the entire body of its conceptual ingredients can be constructed from the single notion of quantum measurement.

This book is a unique introduction to the theory of linear operators on Hilbert space. The authors' goal is to present the basic facts of functional analysis in a form suitable for engineers, scientists, and applied mathematicians. Although the Definition-Theorem-Proof format of mathematics is used, careful attention is given to motivation of the material covered and many illustrative examples are presented. First published in 1971, Linear Operator in Engineering and Sciences has since proved to be a popular and very useful textbook.

The biggest change in the years since the first edition is the proliferation of computational chemistry programs that calculate molecular properties. McQuarrie presents step-by-step SCF calculations of a helium atom and a hydrogen molecule, in addition to including the Hartree-Fock method and post-Hartree-Fock methods.

Linear Operators for Quantum MechanicsCourier Corporation

This textbook is intended to accompany a two-semester course on quantum mechanics for physics students. Along with the traditional material covered in such a course (states, operators, Schrödinger equation, hydrogen atom), it offers in-depth discussion of the Hilbert space, the nature of measurement, entanglement, and decoherence – concepts that are crucial for the understanding of quantum physics and its relation to the macroscopic world, but rarely covered in entry-level textbooks. The book uses a mathematically simple physical system – photon polarization – as the visualization tool, permitting the student to see the entangled beauty of the quantum world from the very first pages. The formal concepts of quantum physics are illustrated by examples from the forefront of modern quantum research, such as quantum communication, teleportation and nonlocality. The author adopts a Socratic pedagogy: The student is guided to develop the machinery of quantum physics independently by solving sets of carefully chosen problems. Detailed solutions are provided.

Intended to serve as a textbook for honours and postgraduate students of physics, this book provides a comprehensive introduction to the fundamental concepts, mathematical formalism and methodology of quantum mechanics.

The new edition of this book detailing the theory of linear-Hilbert space operators and their use in quantum physics contains two new chapters devoted to properties of quantum waveguides and quantum graphs. The bibliography contains 130 new items.

The book is an introduction to quantum mechanics at a level suitable for the second year in a European university (junior or senior year in an American college). The matrix formulation of quantum mechanics is emphasized throughout, and the student is introduced to Dirac notation from the start. A number of major examples illustrate the workings of quantum mechanics. Several of these examples are taken from solid state physics, with the purpose of showing that quantum mechanics forms the common basis for understanding atoms, molecules and condensed matter. The book contains an introductory chapter which puts the concepts of quantum mechanics into a historical framework. The solid-state applications discussed in this text include the quantum Hall effect, spin waves, quantum wells and energy bands. Other examples feature the two-dimensional harmonic oscillator, coherent states, two-electron atoms, the ammonia molecule and the chemical bond. A large number of homework problems are included.

This exposition is devoted to a consistent treatment of quantization problems, based on appealing to some nontrivial items of functional analysis concerning the theory of linear operators in Hilbert spaces. The authors begin by considering quantization problems in general, emphasizing the nontriviality of consistent operator construction by presenting paradoxes to the naive treatment. It then builds the necessary mathematical background following it by the theory of self-adjoint extensions. By considering several problems such as the one-dimensional Calogero problem, the Aharonov-Bohm problem, the problem of delta-like potentials and relativistic Coulomb problemIt then shows how quantization problems associated with correct definition of observables can be treated consistently for comparatively simple quantum-mechanical systems. In the end, related problems in quantum field theory are briefly introduced. This well-organized text is most suitable for students and post graduates interested in deepening their understanding of mathematical problems in quantum mechanics. However, scientists in mathematical and theoretical physics and mathematicians will also find it useful.

Essential mathematical tools for the study of modern quantum theory. Linear Algebra for Quantum Theory offers an excellent survey of those aspects of set theory and the theory of linear spaces and their mappings that are indispensable to the study of quantum theory. Unlike more conventional treatments, this text postpones its discussion of the binary product concept until later chapters, thus allowing many important properties of the mappings to be derived without it. The book begins with a thorough exploration of set theory fundamentals, including mappings, cardinalities of sets, and arithmetic and theory of complex numbers. Next is an introduction to linear spaces, with coverage of linear operators, eigenvalue and the stability problem of linear operators, and matrices with special properties. Material on binary product spaces features self-adjoint operators in a space of indefinite metric, binary product spaces with a positive definite metric, properties of the Hilbert space, and more. The final section is devoted to axioms of quantum theory formulated as trace algebra. Throughout, chapter-end problem sets help reinforce absorption of the material while letting readers test their problem-solving skills. Ideal for advanced undergraduate and graduate students in theoretical and computational chemistry and physics, Linear Algebra for Quantum Theory provides the mathematical means necessary to access and understand the complex world of quantum theory.

Graduate-level text offers unified treatment of mathematics applicable to many branches of physics. Theory of vector spaces, analytic function theory, theory of integral equations, group theory, and more. Many problems. Bibliography.

Structured as a dialogue between a mathematician and a physicist, Symmetry and Quantum Mechanics unites the mathematical topics of this field into a compelling and physically-motivated narrative that focuses on the central role of symmetry. Aimed at advanced undergraduate and beginning graduate students in mathematics with only a minimal background in physics, this title is also useful to physicists seeking a mathematical introduction to the subject. Part I focuses on spin, and covers such topics as Lie groups and algebras, while part II offers an account of position and momentum in the context of the representation theory of the Heisenberg group, along the way providing an informal discussion of fundamental concepts from analysis such as self-adjoint operators on Hilbert space and the Stone-von Neumann Theorem. Mathematical theory is applied to physical examples such as spin-precession in a magnetic field, the harmonic oscillator, the infinite spherical well, and the hydrogen atom.

First-ever comprehensive introduction to the major new subject of quantum computing and quantum information.

With this text, basic quantum mechanics becomes accessible to undergraduates with no background in mathematics beyond algebra. Includes more than 100 problems and 38 figures. 1986 edition.

The territory of preserver problems has grown continuously within linear analysis. This book presents a cross-section of the modern theory of preservers on infinite dimensional spaces (operator spaces and function spaces) through the author's corresponding results. Special emphasis is placed on preserver problems concerning some structures of Hilbert space operators which appear in quantum mechanics. In addition, local automorphisms and local isometries of operator algebras and function algebras are discussed in detail.

Emphasizes a molecular approach to physical chemistry, discussing principles of quantum mechanics first and then using those ideas in development of thermodynamics and kinetics. Chapters on quantum subjects are interspersed with ten math chapters reviewing mathematical topics used in subsequent chapters. Includes material on current physical chemical research, with chapters on computational quantum chemistry, group theory, NMR spectroscopy, and lasers. Units and symbols used in the text follow IUPAC recommendations. Includes exercises. Annotation copyrighted by Book News, Inc., Portland, OR

This book studies the foundations of quantum theory through its relationship to classical physics. This idea goes back to the Copenhagen Interpretation (in the original version due to Bohr and Heisenberg), which the author relates to the mathematical formalism of operator algebras originally created by von Neumann. The book therefore includes comprehensive appendices on functional analysis and C*-algebras, as well as a briefer one on logic, category theory, and topos theory. Matters of foundational as well as mathematical interest that are covered in detail include symmetry (and its "spontaneous" breaking), the measurement problem, the Kochen-Specker, Free Will, and Bell Theorems, the Kadison-Singer conjecture, quantization, indistinguishable particles, the quantum theory of large systems, and quantum logic, the latter in connection with the topos approach to quantum theory. This book is Open Access under a CC BY licence.
Focusing on the principles of quantum mechanics, this text for upper-level undergraduates and graduate students introduces and resolves special physical problems with more than 100 exercises. 1967 edition.
From the reviews: "[...] An excellent textbook in the theory of linear operators in Banach and Hilbert spaces. It is a thoroughly worthwhile reference work both for graduate students in functional analysis as well as for researchers in perturbation, spectral, and scattering theory. [...] I can recommend it for any mathematician or physicist interested in this field." Zentralblatt MATH