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INTRODUCTION TO MATHEMATICAL PHYSICS

METHODS & CONCEPTS

Oxford University Press Introduction to Mathematical Physics explains why and how mathematics is needed in describing physical events in space. It helps physics undergraduates master the mathematical tools needed in physics core courses. It contains advanced topics for graduate students, short tutorials on basic mathematics, and an appendix on Mathematica.

MATHEMATICS FOR PHYSICISTS

INTRODUCTORY CONCEPTS AND METHODS

Cambridge University Press Introduces fundamental concepts and computational methods of mathematics from the perspective of physicists.

MATHEMATICAL METHODS FOR PHYSICISTS

A CONCISE INTRODUCTION

Cambridge University Press This text is designed for an intermediate-level, two-semester undergraduate course in mathematical physics. It provides an accessible account of most of the current, important mathematical tools required in physics these days. It is assumed that the reader has an adequate preparation in general physics and calculus. The book bridges the gap between an introductory physics course and more advanced courses in classical mechanics, electricity and magnetism, quantum mechanics, and thermal and statistical physics. The text contains a large number of worked examples to illustrate the mathematical techniques developed and to show their relevance to physics. The book is designed primarily for undergraduate physics majors, but could also be used by students in other subjects, such as engineering, astronomy and mathematics.

MATHEMATICAL METHODS FOR PHYSICS AND ENGINEERING

A COMPREHENSIVE GUIDE

Cambridge University Press The third edition of this highly acclaimed undergraduate textbook is suitable for teaching all the mathematics for an undergraduate course in any of the physical sciences. As well as lucid descriptions of all the topics and many worked examples, it contains over 800 exercises. New stand-alone chapters give a systematic account of the 'special functions' of physical science, cover an extended range of practical applications of complex variables, and give an introduction to quantum operators. Further tabulations, of relevance in statistics and numerical integration, have been added. In this edition, half of the exercises are provided with hints and answers and, in a separate manual available to both students and their teachers, complete worked solutions. The remaining exercises have no hints, answers or worked solutions and can be used for unaided homework; full solutions are available to instructors on a password-protected web site, www.cambridge.org/9780521679718.

MEDICAL IMAGING: CONCEPTS, METHODOLOGIES, TOOLS, AND APPLICATIONS

CONCEPTS, METHODOLOGIES, TOOLS, AND APPLICATIONS

IGI Global Medical imaging has transformed the ways in which various conditions, injuries, and diseases are identified, monitored, and treated. As various types of digital visual representations continue to advance and improve, new opportunities for their use in medical practice will likewise evolve. Medical Imaging: Concepts, Methodologies, Tools, and Applications presents a compendium of research on digital imaging technologies in a variety of healthcare settings. This multi-volume work contains practical examples of implementation, emerging trends, case studies, and technological innovations essential for using imaging technologies for making medical decisions. This comprehensive publication is an essential resource for medical practitioners, digital imaging technologists, researchers, and medical students.

MATHEMATICAL METHODS IN PHYSICS

DISTRIBUTIONS, HILBERT SPACE OPERATORS, AND VARIATIONAL METHODS

Springer Science & Business Media Physics has long been regarded as a wellspring of mathematical problems. Mathematical Methods in Physics is a self-contained presentation, driven by historic motivations, excellent examples, detailed proofs, and a focus on those parts of mathematics that are needed in more ambitious courses on quantum mechanics and classical and quantum field theory. Aimed primarily at a broad community of graduate students in mathematics, mathematical physics, physics and engineering, as well as researchers in these disciplines.

A HANDBOOK OF MATHEMATICAL METHODS AND PROBLEM-SOLVING TOOLS FOR INTRODUCTORY PHYSICS

Morgan & Claypool Publishers This is a companion textbook for an introductory course in physics. It aims to link the theories and models that students learn in class with practical problem-solving techniques. In other words, it should address the common complaint that 'I understand the concepts but I can't do the homework or tests'. The fundamentals of introductory physics courses are addressed in simple and concise terms, with emphasis on how the fundamental concepts and equations should be used to solve physics problems.

STATISTICAL MECHANICS OF LATTICE SYSTEMS

A CONCRETE MATHEMATICAL INTRODUCTION

Cambridge University Press A self-contained, mathematical introduction to the driving ideas in equilibrium statistical mechanics, studying important models in detail.

MATHEMATICS FOR PHYSICS

A GUIDED TOUR FOR GRADUATE STUDENTS

Cambridge University Press An engagingly-written account of mathematical tools and ideas, this book provides a graduate-level introduction to the mathematics used in research in physics. The first half of the book focuses on the traditional mathematical methods of physics – differential and integral equations, Fourier series and the calculus of variations. The second half contains an introduction to more advanced subjects, including differential geometry, topology and complex variables. The authors' exposition avoids excess rigor whilst explaining subtle but important points often glossed over in more elementary texts. The topics are illustrated at every stage by carefully chosen examples, exercises and problems drawn from realistic physics settings. These make it useful both as a textbook in advanced courses and for self-study. Password-protected solutions to the exercises are available to instructors at www.cambridge.org/9780521854030.

QUANTUM THEORY: CONCEPTS AND METHODS

Springer Science & Business Media There are many excellent books on quantum theory from which one can learn to compute energy levels, transition rates, cross sections, etc. The theoretical rules given in these books are routinely used by physicists to compute observable quantities. Their predictions can then be compared with experimental data. There is no fundamental disagreement among physicists on how to use the theory for these practical purposes. However, there are profound differences in their opinions on the ontological meaning of quantum theory. The purpose of this book is to clarify the conceptual meaning of quantum theory, and to explain some of the mathematical methods which it utilizes. This text is not concerned with specialized topics such as atomic structure, or strong or weak interactions, but with the very foundations of the theory. This is not, however, a book on the philosophy of science. The approach is pragmatic and strictly instrumentalist. This attitude will undoubtedly antagonize some readers, but it has its own logic: quantum phenomena do not occur in a Hilbert space, they occur in a laboratory.

PROMISING PRACTICES IN UNDERGRADUATE SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS EDUCATION

SUMMARY OF TWO WORKSHOPS

National Academies Press Numerous teaching, learning, assessment, and institutional innovations in undergraduate science, technology, engineering, and mathematics (STEM) education have emerged in the past decade. Because virtually all of these innovations have been developed independently of one another, their goals and purposes vary widely. Some focus on making science accessible and meaningful to the vast majority of students who will not pursue STEM majors or careers; others aim to increase the diversity of students who enroll and succeed in STEM courses and programs; still other efforts focus on reforming the overall curriculum in specific disciplines. In addition to this variation in focus, these innovations have been implemented at scales that range from individual classrooms to entire departments or institutions. By 2008, partly because of this wide variability, it was apparent that little was known about the feasibility of replicating individual innovations or about their potential for broader impact beyond the specific contexts in which they were created. The research base on innovations in undergraduate STEM education was expanding rapidly, but the process of synthesizing that knowledge base had not yet begun. If future investments were to be informed by the past, then the field clearly needed a retrospective look at the ways in which earlier innovations had influenced undergraduate STEM education. To address this need, the National Research Council (NRC) convened two public workshops to examine the impact and effectiveness of selected STEM undergraduate education innovations. This volume summarizes the workshops, which addressed such topics as the link between learning goals and evidence; promising practices at the individual faculty and institutional levels; classroom-based promising practices; and professional development for graduate students, new faculty, and veteran faculty. The workshops concluded with a broader examination of the barriers and opportunities associated with systemic change.

MATHEMATICS FOR MACHINE LEARNING

Cambridge University Press Distills key concepts from linear algebra, geometry, matrices, calculus, optimization, probability and statistics that are used in machine learning.

BASIC CONCEPTS IN COMPUTATIONAL PHYSICS

Springer This new edition is a concise introduction to the basic methods of computational physics. Readers will discover the benefits of numerical methods for solving complex mathematical problems and for the direct simulation of physical processes. The book is divided into two main parts: Deterministic methods and stochastic methods in computational physics. Based on concrete problems, the first part discusses numerical differentiation and integration, as well as the treatment of ordinary differential equations. This is extended by a brief introduction to the numerics of partial differential equations. The second part deals with the generation of random numbers, summarizes the basics of stochastics, and subsequently introduces Monte-Carlo (MC) methods. Specific emphasis is on MARKOV chain MC algorithms. The final two chapters discuss data analysis and stochastic optimization. All this is again motivated and augmented by applications from physics. In addition, the book offers a number of appendices to provide the reader with information on topics not discussed in the main text. Numerous problems with worked-out solutions, chapter introductions and summaries, together with a clear and application-oriented style support the reader. Ready to use C++ codes are provided online.

TEACHER EDUCATION: CONCEPTS, METHODOLOGIES, TOOLS, AND APPLICATIONS

CONCEPTS, METHODOLOGIES, TOOLS, AND APPLICATIONS

IGI Global Educators play a significant role in the intellectual and social development of children and young adults. Next-generation teachers can only be as strong as their own educational foundation which serves to cultivate their knowledge of the learning process, uncover best practices in the field of education, and employ leadership abilities that will inspire students of all ages. Teacher Education: Concepts, Methodologies, Tools, and Applications explores the current state of pre-service teacher programs as well as continuing education initiatives for in-service educators. Emphasizing the growing role of technology in teacher skill development and training as well as key teaching methods and pedagogical developments, this multi-volume work compiles research essential to higher education professionals and administrators, educational software developers, and researchers studying pre-service and in-service teacher training.

INTRODUCTION TO CLASSICAL INTEGRABLE SYSTEMS

Cambridge University Press Table of contents

THE STRUCTURES OF MATHEMATICAL PHYSICS

AN INTRODUCTION

Springer Nature This textbook serves as an introduction to groups, rings, fields, vector and tensor spaces, algebras, topological spaces, differentiable manifolds and Lie groups --- mathematical structures which are foundational to modern theoretical physics. It is aimed primarily at undergraduate students in physics and mathematics with no previous background in these topics. Applications to physics --- such as the metric tensor of special relativity, the symplectic structures associated with Hamilton's equations and the Generalized Stokes's Theorem --- appear at appropriate places in the text. Worked examples, end-of-chapter problems (many with hints and some with answers) and guides to further reading make this an excellent book for self-study. Upon completing this book the reader will be well prepared to delve more deeply into advanced texts and specialized monographs in theoretical physics or mathematics.

MATHEMATICAL METHODS OF CLASSICAL MECHANICS

Springer Science & Business Media This book constructs the mathematical apparatus of classical mechanics from the beginning, examining basic problems in dynamics like the theory of oscillations and the Hamiltonian formalism. The author emphasizes geometrical considerations and includes phase spaces and flows, vector fields, and Lie groups. Discussion includes qualitative methods of the theory of dynamical systems and of asymptotic methods like averaging and adiabatic invariance.

GAMING AND SIMULATIONS: CONCEPTS, METHODOLOGIES, TOOLS AND APPLICATIONS

CONCEPTS, METHODOLOGIES, TOOLS AND APPLICATIONS

IGI Global "This book set unites fundamental research on the history, current directions, and implications of gaming at individual and organizational levels, exploring all facets of game design and application and describing how this

emerging discipline informs and is informed by society and culture"--Provided by publisher.

MATHEMATICAL METHODS OF PHYSICS

AN INVITATION TO MATHEMATICAL PHYSICS AND ITS HISTORY

Springer Nature This state of the art book takes an applications based approach to teaching mathematics to engineering and applied sciences students. The book lays emphasis on associating mathematical concepts with their physical counterparts, training students of engineering in mathematics to help them learn how things work. The book covers the concepts of number systems, algebra equations and calculus through discussions on mathematics and physics, discussing their intertwined history in a chronological order. The book includes examples, homework problems, and exercises. This book can be used to teach a first course in engineering mathematics or as a refresher on basic mathematical physics. Besides serving as core textbook, this book will also appeal to undergraduate students with cross-disciplinary interests as a supplementary text or reader.

EDUCATIONAL INTERFACES BETWEEN MATHEMATICS AND INDUSTRY

REPORT ON AN ICMI-ICIAM-STUDY

Springer Science & Business Media This book is the “Study Book” of ICMI-Study no. 20, which was run in cooperation with the International Congress on Industry and Applied Mathematics (ICIAM). The editors were the co-chairs of the study (Damlamian, Straesser) and the organiser of the Study Conference (Rodrigues). The text contains a comprehensive report on the findings of the Study Conference, original plenary presentations of the Study Conference, reports on the Working Groups and selected papers from all over world. This content was selected by the editors as especially pertinent to the study each individual chapter represents a significant contribution to current research.

VIABILITY AND RESILIENCE OF COMPLEX SYSTEMS

CONCEPTS, METHODS AND CASE STUDIES FROM ECOLOGY AND SOCIETY

Springer Science & Business Media One common characteristics of a complex system is its ability to withstand major disturbances and the capacity to rebuild itself. Understanding how such systems demonstrate resilience by absorbing

or recovering from major external perturbations requires both quantitative foundations and a multidisciplinary view on the topic. This book demonstrates how new methods can be used to identify the actions favouring the recovery from perturbations. Examples discussed include bacterial biofilms resisting detachment, grassland savannahs recovering from fire, the dynamics of language competition and Internet social networking sites overcoming vandalism. The reader is taken through an introduction to the idea of resilience and viability and shown the mathematical basis of the techniques used to analyse systems. The idea of individual or agent-based modelling of complex systems is introduced and related to analytically tractable approximations of such models. A set of case studies illustrates the use of the techniques in real applications, and the final section describes how one can use new and elaborate software tools for carrying out the necessary calculations. The book is intended for a general scientific audience of readers from the natural and social sciences, yet requires some mathematics to gain a full understanding of the more theoretical chapters. It is an essential point of reference for those interested in the practical application of the concepts of resilience and viability

ROBOTICS: CONCEPTS, METHODOLOGIES, TOOLS, AND APPLICATIONS

CONCEPTS, METHODOLOGIES, TOOLS, AND APPLICATIONS

IGI Global "This book explores some of the most recent developments in robotic motion, artificial intelligence, and human-machine interaction, providing insight into a wide variety of applications and functional areas"--Provided by publisher.

MATHEMATICAL METHODS IN PHYSICS

Allied Publishers

A COURSE IN MODERN MATHEMATICAL PHYSICS

GROUPS, HILBERT SPACE AND DIFFERENTIAL GEOMETRY

Cambridge University Press Publisher Description

AN INTRODUCTION TO MATHEMATICAL MODELING

Courier Corporation Accessible text features over 100 reality-based examples pulled from the science, engineering, and operations research fields. Prerequisites: ordinary differential equations, continuous probability. Numerous references. Includes 27 black-and-white figures. 1978 edition.

WHAT IS MATHEMATICS?

AN ELEMENTARY APPROACH TO IDEAS AND METHODS

Oxford University Press, USA A discussion of fundamental mathematical principles from algebra to elementary calculus designed to promote constructive mathematical reasoning.

AN INTRODUCTION TO NUMERICAL METHODS AND ANALYSIS

John Wiley & Sons Praise for the First Edition ". . . outstandingly appealing with regard to its style, contents, considerations of requirements of practice, choice of examples, and exercises." —Zentrablatt Math ". . . carefully structured with many detailed worked examples . . ." —The Mathematical Gazette ". . . an up-to-date and user-friendly account . . ." —Mathematika An Introduction to Numerical Methods and Analysis addresses the mathematics underlying approximation and scientific computing and successfully explains where approximation methods come from, why they sometimes work (or don't work), and when to use one of the many techniques that are available. Written in a style that emphasizes readability and usefulness for the numerical methods novice, the book begins with basic, elementary material and gradually builds up to more advanced topics. A selection of concepts required for the study of computational mathematics is introduced, and simple approximations using Taylor's Theorem are also treated in some depth. The text includes exercises that run the gamut from simple hand computations, to challenging derivations and minor proofs, to programming exercises. A greater emphasis on applied exercises as well as the cause and effect associated with numerical mathematics is featured throughout the book. An Introduction to Numerical Methods and Analysis is the ideal text for students in advanced undergraduate mathematics and engineering courses who are interested in gaining an understanding of numerical methods and numerical analysis.

ELEMENTS OF MATHEMATICAL METHODS FOR PHYSICS

"Elements of Mathematical Methods for Physics" provides students with an approachable and innovative introduction to key concepts of Mathematical Physics. Throughout the text, students enjoy clear and concise explanations, relevant real-world examples, and problems that help them to master the fundamentals of Mathematical Physics. This book is designed to be covered in two semesters. The scope of the book is structured to cover eighteen chapters. The topics vary from Differential Equations, Matrix Algebra, Tensor Analysis, to Fourier Transform, including Special Functions and Dynamical Systems. Each chapter has examples and end-of-chapter problems. The level of complexities of the topics developed in this book is aimed at students lacking the necessary mathematical background needed to manage the abstract nature of physics. Furthermore, upper level undergraduate and graduate students as well as professionals in physics and engineering will gain a better grip of the basics, a deeper insight and appreciation for the materials covered. Finally, "Elements of Mathematical Methods for Physics" brings hope and encouragement to enable students to understand mathematical methods and give students the motivation to pursue advanced work in Physical Science or STEM Programs.

DISCRETE CAUSAL THEORY

EMERGENT SPACETIME AND THE CAUSAL METRIC HYPOTHESIS

Springer This book evaluates and suggests potentially critical improvements to causal set theory, one of the best-motivated approaches to the outstanding problems of fundamental physics. Spacetime structure is of central importance to physics beyond general relativity and the standard model. The causal metric hypothesis treats causal relations as the basis of this structure. The book develops the consequences of this hypothesis under the assumption of a fundamental scale, with smooth spacetime geometry viewed as emergent. This approach resembles causal set theory, but differs in important ways; for example, the relative viewpoint, emphasizing relations between pairs of events, and relationships between pairs of histories, is central. The book culminates in a dynamical law for quantum spacetime, derived via generalized path summation.

MATHEMATICAL TECHNIQUES

AN INTRODUCTION FOR THE ENGINEERING, PHYSICAL, AND MATHEMATICAL SCIENCES

OUP Oxford Mathematical Techniques provides a complete course in mathematics, covering all the essential topics with which a physical sciences or engineering student should be familiar. It introduces and builds on concepts in a progressive, carefully-layered way, and features over 2000 end of chapter problems, plus additional self-check questions.

A DRESSING METHOD IN MATHEMATICAL PHYSICS

Springer Science & Business Media This monograph systematically develops and considers the so-called "dressing method" for solving differential equations (both linear and nonlinear), a means to generate new non-trivial solutions for a given equation from the (perhaps trivial) solution of the same or related equation. Throughout, the text exploits the "linear experience" of presentation, with special attention given to the algebraic aspects of the main mathematical constructions and to practical rules of obtaining new solutions.

PARTIAL DIFFERENTIAL EQUATIONS

AN INTRODUCTION

John Wiley & Sons Partial Differential Equations presents a balanced and comprehensive introduction to the concepts and techniques required to solve problems containing unknown functions of multiple variables. While focusing on the three most classical partial differential equations (PDEs)—the wave, heat, and Laplace equations—this detailed text also presents a broad practical perspective that merges mathematical concepts with real-world application in diverse areas including molecular structure, photon and electron interactions, radiation of electromagnetic waves, vibrations of a solid, and many more. Rigorous pedagogical tools aid in student comprehension; advanced topics are introduced frequently, with minimal technical jargon, and a wealth of exercises reinforce vital skills and invite additional self-study. Topics are presented in a logical progression, with major concepts such as wave propagation, heat and diffusion, electrostatics, and quantum mechanics placed in contexts familiar to students of various fields in science and engineering. By understanding the properties and applications of PDEs, students will be equipped to better analyze and interpret central processes of the natural world.

MATHEMATICAL PHYSICS

A MODERN INTRODUCTION TO ITS FOUNDATIONS

Springer The goal of this book is to expose the reader to the indispensable role that mathematics---often very abstract---plays in modern physics. Starting with the notion of vector spaces, the first half of the book develops topics as diverse as algebras, classical orthogonal polynomials, Fourier analysis, complex analysis, differential and integral equations, operator theory, and multi-dimensional Green's functions. The second half of the book introduces groups, manifolds, Lie groups and their representations, Clifford algebras and their representations, and fiber bundles and their applications to differential geometry and gauge theories. This second edition is a substantial revision of the first one with a complete rewriting of many chapters and the addition of new ones, including chapters on algebras, representation of Clifford algebras and spinors, fiber bundles, and gauge theories. The spirit of the first edition, namely the balance between rigor and physical application, has been maintained, as is the abundance of historical notes and worked out examples that demonstrate the "unreasonable effectiveness of mathematics" in modern physics. Einstein has famously said, "The most incomprehensible thing about nature is that it is comprehensible." What he had in mind was reiterated in another one of his famous quotes concerning the question of how " ... mathematics, being after all a product of human thought, is so admirably appropriate to the objects of reality." It is a question that comes to everyone's mind when encountering the highly abstract mathematics required for a deep understanding of modern physics. It is the experience that Eugene Wigner so profoundly described as "the unreasonable effectiveness of mathematics in the natural sciences." Some praise for the previous edition: PAGEOPH [Pure and Applied Geophysics] Review by Daniel Wojcik, University of Maryland "This volume should be a welcome addition to any collection. The book is well written and explanations are usually clear. Lives of famous mathematicians and physicists are scattered within the book. They are quite extended, often amusing, making nice interludes. Numerous exercises help the student practice the methods introduced. ... I have recently been using this book for an extended time and acquired a liking for it. Among all the available books treating mathematical methods of physics this one certainly stands out and assuredly it would suit the needs of many physics readers." ZENTRALBLATT MATH Review by G.Roepstorff, University of Aachen, Germany "... Unlike most existing texts with the same emphasis and audience, which are merely collections of facts and formulas, the present book is more systematic, self-contained, with a level of presentation that tends to be more formal and abstract. This entails proving a large number of theorems, lemmas, and corollaries, deferring most of the

applications that physics students might be interested in to the example sections in small print. Indeed, there are 350 worked-out examples and about 850 problems. ... A very nice feature is the way the author intertwines the formalism with the life stories and anecdotes of some mathematicians and physicists, leading at their times. As is often the case, the historical view point helps to understand and appreciate the ideas presented in the text. ... For the physics student in the middle of his training, it will certainly prove to be extremely useful." THE PHYSICIST Review by Paul Davies, Orion Productions, Adelaide, Australia "I am pleased to have so many topics collected in a single volume. All the tricks are there of course, but supported by sufficient rigour and substantiation to make the dedicated mathematical physicist sigh with delight." EMS [EUROPEAN MATHEMATICAL SOCIETY] NEWSLETTER "This book is a condensed exposition of the mathematics that is met in most parts of physics. The presentation attains a very good balance between the formal introduction of concepts, theorems and proofs on one hand, and the applied approach on the other, with many examples, fully or partially solved problems, and historical remarks. An impressive amount of mathematics is covered. ... This book can be warmly recommended as a basic source for the study of mathematics for advanced undergraduates or beginning graduate students in physics and applied mathematics, and also as a reference book for all working mathematicians and physicists ."

GEOMETRY, TOPOLOGY AND PHYSICS

Taylor & Francis Differential geometry and topology have become essential tools for many theoretical physicists. In particular, they are indispensable in theoretical studies of condensed matter physics, gravity, and particle physics. Geometry, Topology and Physics, Second Edition introduces the ideas and techniques of differential geometry and topology at a level suitable for postgraduate students and researchers in these fields. The second edition of this popular and established text incorporates a number of changes designed to meet the needs of the reader and reflect the development of the subject. The book features a considerably expanded first chapter, reviewing aspects of path integral quantization and gauge theories. Chapter 2 introduces the mathematical concepts of maps, vector spaces, and topology. The following chapters focus on more elaborate concepts in geometry and topology and discuss the application of these concepts to liquid crystals, superfluid helium, general relativity, and bosonic string theory. Later chapters unify geometry and topology, exploring fiber bundles, characteristic classes, and index theorems. New to this second edition is the proof of the index theorem in terms of supersymmetric quantum mechanics. The final two chapters are devoted to the most fascinating applications of geometry and topology in contemporary physics, namely the study of anomalies in gauge field theories and the analysis of Polakov's bosonic string theory from the geometrical

point of view. Geometry, Topology and Physics, Second Edition is an ideal introduction to differential geometry and topology for postgraduate students and researchers in theoretical and mathematical physics.

QUANTUM THEORY: CONCEPTS AND METHODS

Springer Science & Business Media This book will be useful to anyone who wants to understand the use of quantum theory for the description of physical processes. It is a graduate level text, ideal for independent study, and includes numerous figures, exercises, bibliographical references, and even some computer programs. The first chapters introduce formal tools: the mathematics are precise, but not excessively abstract. The physical interpretation too is rigorous. It makes no use of the uncertainty principle of other ill-defined notions. The central part of the book is devoted to Bell's theorem and to the Kochen-Specker theorem. It is here that quantum phenomena depart most radically from classical physics. There has recently been considerable progress on these issues, and the latest developments have been included. The final chapters discuss further topics of current research: spacetime symmetries, quantum thermodynamics and information theory, semiclassical methods, irreversibility, quantum chaos, and especially the measuring process. In particular, it is shown how modern techniques allow the extraction of more information from a physical system than traditional measurement methods. For physicists, mathematicians and philosophers of science with an interest in the applications and foundations of quantum theory. The volume is suitable as a supplementary graduate textbook.

QUANTUM FIELD THEORY I: BASICS IN MATHEMATICS AND PHYSICS

A BRIDGE BETWEEN MATHEMATICIANS AND PHYSICISTS

Springer Science & Business Media This is the first volume of a modern introduction to quantum field theory which addresses both mathematicians and physicists, at levels ranging from advanced undergraduate students to professional scientists. The book bridges the acknowledged gap between the different languages used by mathematicians and physicists. For students of mathematics the author shows that detailed knowledge of the physical background helps to motivate the mathematical subjects and to discover interesting interrelationships between quite different mathematical topics. For students of physics, fairly advanced mathematics is presented, which goes beyond the usual curriculum in physics.

MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES

John Wiley & Sons Now in its third edition, Mathematical Concepts in the Physical Sciences provides a comprehensive introduction to the areas of mathematical physics. It combines all the essential math concepts into one compact, clearly written reference.

PATH INTEGRAL APPROACH TO QUANTUM PHYSICS

AN INTRODUCTION

Springer Specifically designed to introduce graduate students to the functional integration method in contemporary physics as painlessly as possible, the book concentrates on the conceptual problems inherent in the path integral formalism. Throughout, the striking interplay between stochastic processes, statistical physics and quantum mechanics comes to the fore, and all the methods of fundamental interest are generously illustrated by important physical examples.

DATA ASSIMILATION

A MATHEMATICAL INTRODUCTION

Springer This book provides a systematic treatment of the mathematical underpinnings of work in data assimilation, covering both theoretical and computational approaches. Specifically the authors develop a unified mathematical framework in which a Bayesian formulation of the problem provides the bedrock for the derivation, development and analysis of algorithms; the many examples used in the text, together with the algorithms which are introduced and discussed, are all illustrated by the MATLAB software detailed in the book and made freely available online. The book is organized into nine chapters: the first contains a brief introduction to the mathematical tools around which the material is organized; the next four are concerned with discrete time dynamical systems and discrete time data; the last four are concerned with continuous time dynamical systems and continuous time data and are organized analogously to the corresponding discrete time chapters. This book is aimed at mathematical researchers interested in a systematic development of this interdisciplinary field, and at researchers from the geosciences, and a variety of other scientific fields, who use tools from data assimilation to combine data with time-dependent models. The

numerous examples and illustrations make understanding of the theoretical underpinnings of data assimilation accessible. Furthermore, the examples, exercises and MATLAB software, make the book suitable for students in applied mathematics, either through a lecture course, or through self-study.