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This graduate-level text collects and synthesizes a series of ten lectures on the nuclear quantum many-body problem. Starting from our current understanding of the underlying forces, it presents recent advances within the field of lattice quantum chromodynamics before going on to discuss effective field theories, central many-body methods like Monte Carlo methods, coupled cluster theories, the similarity renormalization group approach, Green's function methods and large-scale diagonalization approaches. Algorithmic and computational advances show particular promise for breakthroughs in predictive power, including proper error estimates, a better understanding of the underlying effective degrees of freedom and of the respective forces at play. Enabled by recent improvements in theoretical, experimental and numerical techniques, the state-of-the art applications considered in this volume span the entire range, from our smallest components – quarks and gluons as the mediators of the strong force – to the computation of the equation of state for neutron star matter. The lectures presented provide an in-depth exposition of the underlying theoretical and algorithmic approaches as well details of the numerical implementation of the methods discussed. Several also include links to numerical software and benchmark calculations, which readers can use to develop their own programs for tackling challenging nuclear many-body problems.

An attempt to provide a formal analysis of joint production, the text of which was originally the author's PhD thesis. The work is designed to lead from the most abstract and general concepts of the theory of value to applications in the areas of the measurement of capital and growth, of international trade, and of natural resources.

This book describes the latest advances in intelligent techniques such as fuzzy logic, neural networks, and optimization algorithms, and their relevance in building intelligent information systems in combination with applied mathematics. The authors also outline the applications of these systems in areas like intelligent control and robotics, pattern recognition, medical diagnosis, time series prediction, and optimization of complex problems. By sharing fresh ideas and identifying new targets/problems it offers young researchers and students new directions for their future research. The book is intended for readers from mathematics and computer science, in particular professors and students working on theory and applications of intelligent systems for real-world applications.

This book provides an introduction to dynamical systems with multiple time scales. The approach it takes is to provide an overview of key areas, particularly topics that are less available in the introductory form. The broad range of topics included makes it accessible for students and researchers new to the field to gain a quick and thorough overview. The first of its kind, this book merges a wide variety of different mathematical techniques into a more unified framework. The book is highly illustrated with many examples and exercises and an extensive bibliography. The target audience of this book are senior undergraduates, graduate students as well as researchers interested in using the multiple time scale dynamics theory in nonlinear science, either from a theoretical or a mathematical modeling perspective.

A Textbook on Ordinary Differential Equations

Electron Paramagnetic Resonance

Recent Advances in Intelligent Information Systems and Applied Mathematics

Multiple Time Scale Dynamics

Spatial-Energy Principles of the Processes for Complex Structure Formation

Complex Numbers from A to ...Z

This is the first English-language collection of Mendeleev's most important writings on the subject, consisting of 13 essays and offering a history of the law's development by its own founder.

This book, part of the seven-volume series Major American Universities PhD Qualifying Questions and Solutions contains detailed solutions to 483 questions/problems on atomic, molecular, nuclear and particle physics, as well as experimental methodology. The problems are of a standard appropriate to advanced undergraduate and graduate syllabi, and blend together two objectives – understanding of physical principles and practical application. The volume is an invaluable supplement to textbooks.

The book contains methodology for evaluating formation processes for multi-component systems based on the understanding of spatial-energy parameter, as well as vast computation and informative material.

Offering an unparalleled level of assessment support, IB Prepared: Chemistry has been developed directly with the IB to provide the most up-to-date, authentic and authoritative guidance on DP assessment.

An Advanced Course in Computational Nuclear Physics

Introductory Nuclear Physics

Walks, Trees, Tableaux, and More

Models and Theory

Problems and Solutions on Atomic, Nuclear and Particle Physics

Numerical Computations with GPUs

The manufacture of silicon single crystals is one of the most important processes in the information technology industry. This book explains the details of liquid metal convection, providing a guide for the elegant operation and control of Czochralski crystal growth, including the effect of magnetic control. Also covered is the newly emerging research field of the application of strong magnetic field using a superconducting magnet. Model equations for the phenomena in the magnetic field are treated in detail, which will be of much use to researchers and engineers in the field. The coverage includes the effect of the Lorentz force in materials processing and the magnetic force of recently developed superconducting magnets. It examines heat, mass and momentum transfer in electro-conducting and non-conducting fluids under normal and very strong magnetic fields. The book also treats the Czochralski single crystal growth process and continuous steel casting process as the most important current applications of magnetic fields. Numerical approaches are compared with the corresponding experimental measurements. Contents: Application of a Magnetic Field for Materials ProcessingNatural Convection of Liquid Metal without a Magnetic FieldTwo-Dimensional Numerical Analyses for Natural Convection of Liquid Metal in a Magnetic FieldEnhanced Heat Transfer Rate of Natural Convection Due to a Magnetic FieldFlow Visualization of Oscillatory Czochralski ConvectionLiquid Encapsulated Czochralski Bulk Flow with Flow VisualizationEffect of an Axial Magnetic Field on the Melt Convection of Czochralski Crystal GrowthEffect of a Cusp-Shaped Magnetic Field on the Melt Convection of Czochralski Crystal GrowthContinuous Steel-Casting Systems with Various Magnetic FieldsConvection Induced by a Cusp-Shaped Magnetic Field for Air in a Cube Heated from Above and Cooled from BelowRayleigh-Benard Convection of Diagmanetic FluidMagnetothermal Wind Tunneland other topics Readership: Graduate students and researchers in materials science, chemical and mechanical engineering, applied physics, and related fields. Key Features:Includes numerical analyses for the oscillatory convection of liquid metal and its suppression by the application of an external magnetic fieldExplains enhanced natural convection due to magnetic fields using numerical analysesColor visualization of the oscillatory flow in Czochralski convectionFour different configurations of magnetic field for the Czochralski crystal growth systemSeebeck effect and continuous steel casting systemsDetailed description of model equations on the magnetization force due to strong magnetic fieldsKeywords:Magnetic Field;Superconducting Magnet;Liquid Metal;Czochralski Crystal Growth;Single Crystal;Magnetic Czochralski Method;Continuous Steel Casting;Numerical Analyses;Natural Convection;Flow Visualization;Liquid Crystal This book presents several fundamental questions in mathematical biology such as Turing instability, pattern formation, reaction-diffusion systems, invasion waves and Fokker-Planck equations. These are classical modeling tools for mathematical biology with applications to ecology and population dynamics, the neurosciences, enzymatic reactions, chemotaxis, invasion waves etc. The book presents these aspects from a mathematical perspective, with the aim of identifying those qualitative properties of the models that are relevant for biological applications. To do so, it uncovers the mechanisms at work behind Turing instability, pattern formation and invasion waves. This involves several mathematical tools, such as stability and instability analysis, blow-up in finite time, asymptotic methods and relative entropy properties. Given the content presented, the book is well suited as a textbook for master-level coursework.

Written by renowned experts in the field of photon management in solar cells, this one-stop reference gives an introduction to the physics of light management in solar cells, and discusses the different concepts and methods of applying photon management. The authors cover the physics, principles, concepts, technologies, and methods used, explaining how to increase the efficiency of solar cells by splitting or modifying the solar spectrum before they absorb the sunlight. In so doing, they present novel concepts and materials allowing for the cheaper, more flexible manufacture of solar cells and systems. For educational purposes, the authors have split the reasons for photon management into spatial and spectral light management. Bridging the gap between the photonics and the photovoltaics communities, this is an invaluable reference for materials scientists, physicists in industry, experimental physicists, lecturers in physics, Ph.D. students in physics and material sciences, engineers in power technology, applied and surface physicists.

"...this edition is useful and effective in teaching Bayesian inference at both elementary and intermediate levels. It is a well-written book on elementary Bayesian inference, and the material is easily accessible. It is both concise and timely, and provides a good collection of overviews and reviews of important tools used in Bayesian statistical methods." There is a strong upsurge in the use of Bayesian methods in applied statistical analysis, yet most introductory statistics texts only present frequentist methods. Bayesian statistics has many important advantages that students should learn about if they are going into fields where statistics will be used. In this third Edition, four newly-added chapters address topics that reflect the rapid advances in the field of Bayesian statistics. The authors continue to provide a Bayesian treatment of introductory statistical topics, such as scientific data gathering, discrete random variables, robust Bayesian methods, and Bayesian approaches to inference for discrete random variables, binomial proportions, Poisson, and normal means, and simple linear regression. In addition, more advanced topics in the field are presented in four new chapters: Bayesian inference for a normal with unknown mean and variance; Bayesian inference for a Multivariate Normal mean vector; Bayesian inference for the Multiple Linear Regression Model; and Computational Bayesian Statistics including Markov Chain Monte Carlo. The inclusion of these topics will facilitate readers' ability to advance from a minimal understanding of Statistics to the ability to tackle topics in more applied, advanced level books. Minitab macros and R functions are available on the book's related website to assist with chapter exercises. Introduction to Bayesian Statistics, Third Edition also features: Topics including the Joint Likelihood function and inference using independent Jeffreys priors and join conjugate prior The cutting-edge topic of computational Bayesian Statistics in a new chapter, with a unique focus on Markov Chain Monte Carlo methods Exercises throughout the book that have been updated to reflect new applications and the latest software applications Detailed appendices that guide readers through the use of R and Minitab software for Bayesian analysis and Monte Carlo simulations, with all related macros available on the book's website Introduction to Bayesian Statistics, Third Edition is a textbook for upper-undergraduate or first-year graduate level courses on introductory statistics course with a Bayesian emphasis. It can also be used as a reference work for statisticians who require a working knowledge of Bayesian statistics.

Growth, reaction, movement and diffusion

An Introduction

Oxford IB Diploma Programme: IB Prepared: Chemistry (Online)

Modeling in Fluid Mechanics

Numerical Algorithms

IB Chemistry Course Book

The topics covered in this volume describe contrasting types of Electron Paramagnetic Resonance (EPR) application, including inorganic paramagnetic systems, spin-labeling in highly dynamic systems such as RNAs and IDPs and applications of nitroxides in host:guest chemistry. EPR applications remain very significant in modern science and this volume compiles critical coverage of developments in the recent literature by a hand-picked group of researchers at the cutting-edge of the field. Providing a snap shot of the area, this book is a useful addition to any library supporting this research.

This volume is dedicated to modeling in fluid mechanics and is divided into four chapters, which contain a significant number of useful exercises with solutions. The authors provide relatively complete references on relevant topics in the bibliography at the end of each chapter.

A rigorous introduction to geometric and topological inference, for anyone interested in a geometric approach to data science.

** Learn how complex numbers may be used to solve algebraic equations, as well as their geometric interpretation * Theoretical aspects are augmented with rich exercises and problems at various levels of difficulty * A special feature is a selection of outstanding Olympiad problems solved by employing the methods presented * May serve as an engaging supplemental text for an introductory undergrad course on complex numbers or number theory*

Parabolic Equations in Biology

Immunoassay and Other Bioanalytical Techniques

Process Dynamics and Control

Selected Writings, 1869 - 1905

Algebraic Combinatorics

The Principles of Chemistry

This book offers readers a primer on the theory and applications of Ordinary Differential Equations. The style used is simple, yet thorough and rigorous. Each chapter ends with a broad set of exercises that range from the routine to the more challenging and thought-provoking. Solutions to selected exercises can be found at the end of the book. The book contains many interesting examples on topics such as electric circuits, the pendulum equation, the logistic equation, the Lotka-Volterra system, the Laplace Transform, etc., which introduce students to a number of interesting aspects of the theory and applications. The work is mainly intended for students of Mathematics, Physics, Engineering, Computer Science and other areas of the natural and social sciences that use ordinary differential equations, and who have a firm grasp of Calculus and a minimal understanding of the basic concepts used in Linear Algebra. It also studies a few more advanced topics, such as Stability Theory and Boundary Value Problems, which may be suitable for more advanced undergraduate or first-year graduate students. The second edition has been revised to correct minor errata, and features a number of carefully selected new exercises, together with more detailed explanations of some of the topics. A complete Solutions Manual, containing solutions to all the exercises published in the book, is available. Instructors who wish to adopt the book may request the manual by writing directly to one of the authors.

Numerical AlgorithmsMethods for Computer Vision, Machine Learning, and GraphicsCRC Press

In 1984 Desmond O'Connor and David Phillips published their comprehensive book „Time-correlated Single Photon Counting“. At that time time-correlated single photon counting, or TCSPC, was used primarily to record fluorescence decay functions of dye solutions in cuvettes. From the beginning, TCSPC was an am- ingly sensitive and accurate technique with excellent time-resolution. However, acquisition times were relatively slow due to the low repetition rate of the light sources and the limited speed of the electronics of the 70s and early 80s. Moreover, TCSPC was intrinsically one-dimensional, i.e. limited to the recording of the waveform of a periodic light signal. Even with these limitations, it was a wonderful technique. More than 20 years have elapsed, and electronics and laser techniques have made impressive progress. The number of transistors on a single chip has approximately doubled every 18 months, resulting in a more than 1,000-fold increase in complexity and speed. The repetition rate and power of pulsed light sources have increased by about the same factor.

Numerical Algorithms: Methods for Computer Vision, Machine Learning, and Graphics presents a new approach to numerical analysis for modern computer scientists. Using examples from a broad base of computational tasks, including data processing, computational photography, and animation, the textbook introduces numerical modeling and algorithmic design

Nonlinear Functional Analysis and Its Applications

Ordinary Level Physics

For the IB diploma

A Comprehensive Survey of Energetic Materials

Photon Management in Solar Cells

Mr Sraffa on Joint Production and Other Essays

Quantum mechanics is arguably one of the most successful scientific theories ever and its applications to chemistry, optics, and information theory are innumerable. This book provides the reader with a rigorous treatment of the main mathematical tools from harmonic analysis which play an essential role in the modern formulation of quantum mechanics. This allows us at the same time to suggest some new ideas and methods, with a special focus on topics such as the Wigner phase space formalism and its applications to the theory of the density operator and its entanglement properties. This book can be used with profit by advanced undergraduate students in mathematics and physics, as well as by confirmed researchers.

The most comprehensive match to the new 2014 Chemistry syllabus, this completely revised edition gives you unrivalled support for the new concept-based approach, the Nature of science. The only DP Chemistry resource that includes support directly from the IB, focused exam practice, TOK links and real-life applications drive achievement.

This 3rd edition provides chemical engineers with process control techniques that are used in practice while offering detailed mathematical analysis. Numerous examples and simulations are used to illustrate key theoretical concepts. New exercises are integrated throughout several chapters to reinforce concepts.

The goal of this book is to provide an introduction to the practical use of mobile NMR at a level as basic as the operation of a smart phone. Each description follows the same didactic pattern: introduction, basic theory, pulse sequences and parameters, beginners-level measurements, advanced-level measurements, and data processing. Nuclear Magnetic Resonance (NMR) spectroscopy is the most popular method for chemists to analyze molecular structures while Magnetic Resonance Imaging (MRI) is a non-invasive diagnostic tool for medical doctors that provides high-contrast images of biological tissue depicting the brain function and the beating heart. In both applications large super-conducting magnets are employed which magnetize atomic nuclei of an object positioned inside the magnet. Their circulating motion is interrogated by radio-frequency waves. Depending on the operating mode, the frequency spectrum provides the chemist with molecular information, the medical doctor with anatomic images, while the materials scientist is interested in NMR relaxation parameters, which scale with material properties and determine the contrast in magnetic resonance images. Recent advances in magnet technology led to a variety of small permanent magnets, by which NMR spectra, images, and relaxation parameters can be measured with mobile and low-cost instruments.

Advanced Time-Correlated Single Photon Counting Techniques

Magnetic Convection

Molecular Nanomagnets

Chemical Rocket Propulsion

Ewa Orłowska on Relational Methods in Logic and Computer Science

Free Energy Calculations

This book is a tribute to Professor Ewa Orłowska, a Polish logician who was celebrating the 60th year of her scientific career in 2017. It offers a collection of contributed papers by different authors and covers the most important areas of her research. Prof. Orłowska made significant contributions to many fields of logic, such as proof theory, algebraic methods in logic and knowledge representation, and her work has been published in 3 monographs and over 100 articles in internationally acclaimed journals and conference proceedings. The book also includes Prof. Orłowska's autobiography, bibliography and a dialogue between her and the editors of the volume, as well as contributors' biographical notes, and is suitable for scholars and students of logic who are interested in understanding more about Prof. Orłowska's work.

This book brings together research on numerical methods adapted for Graphics Processing Units (GPUs). It explains recent efforts to adapt classic numerical methods, including solution of linear equations and FFT, for massively parallel GPU architectures. This volume consolidates recent research and adaptations, covering widely used methods that are at the core of many scientific and engineering computations. Each chapter is written by authors working on a specific group of methods; these leading experts provide mathematical background, parallel algorithms and implementation details leading to reusable, adaptable and scalable code fragments. This book also serves as a GPU implementation manual for many numerical algorithms, sharing tips on GPUs that can increase application efficiency. The valuable insights into parallelization strategies for GPUs are supplemented by ready-to-use code fragments. Numerical Computations with GPUs targets professionals and researchers working in high performance computing and GPU programming. Advanced-level students focused on computer science and mathematics will also find this book useful as secondary text book or reference.

Taking an interdisciplinary approach that emphasizes the adaptability of immunochemical and related bioanalytical methods to a variety of matrices, Immunoassay and Other Bioanalytical Techniques describes the strength and the versatility of these methods in a wide range of environmental and biological measurement applications. With contribut

A comprehensive, unified treatment of present-day nuclear physics-the fresh edition of a classic text/reference. "A fine and thoroughly up-to-date textbook on nuclear physics . . . most welcome." -Physics Today (on the First Edition). What sets Introductory Nuclear Physics apart from other books on the subject is its presentation of nuclear physics as an integral part of modern physics. Placing the discipline within a broad historical and scientific context, it makes important connections to other fields such as elementary particle physics and astrophysics. Now fully revised and updated, this Second Edition explores the changing directions in nuclear physics, emphasizing new developments and current research-from superdeformation to quark-gluon plasma. Author Samuel S.M. Wong preserves those areas that established the First Edition as a standard text in university physics departments, focusing on what is exciting about the discipline and providing a concise, thorough, and accessible treatment of the fundamental aspects of nuclear properties. In this new edition, Professor Wong: * Includes a chapter on heavy-ion reactions-from high-spin states to quark-gluon plasma * Adds a new chapter on nuclear astrophysics * Relates observed nuclear properties to the underlying nuclear interaction and the symmetry principles governing subatomic particles * Regroups material and appendices to make the text easier to use * Lists Internet links to essential databases and research projects * Features end-of-chapter exercises using real-world data. Introductory Nuclear Physics, Second Edition is an ideal text for courses in nuclear physics at the senior undergraduate or first-year graduate level. It is also an important resource for scientists and engineers working with nuclei, for astrophysicists and particle physicists, and for anyone wishing to learn more about trends in the field.

**Instabilities and Turbulence
Quantum Harmonic Analysis
Theory and Applications in Chemistry and Biology
Introduction to Bayesian Statistics**

Europa

Geometric and Topological Inference

This book consists of nine papers covering a number of basic ideas, concepts, and methods of nonlinear analysis, as well as some current research problems. Thus, the reader is introduced to the fascinating theory around Brouwer's fixed point theorem, to Granas' theory of topological transversality, and to some advanced techniques of critical point theory and fixed point theory. Other topics include discontinuous differential equations, new results of metric fixed point theory, robust tracker design problems for various classes of nonlinear systems, and periodic solutions in computer virus propagation models.

The two most important developments in nuclear physics were the shell model and the collective model. The former gives the formal framework for a description of nuclei in terms of interacting neutrons and protons. The latter provides a very physical but phenomenological framework for interpreting the observed properties of nuclei. A third approach, based on variational and mean-field methods, brings these two perspectives together in terms of the so-called unified models. Together, these three approaches provide the foundations on which nuclear physics is based. They need to be understood by everyone practicing or teaching nuclear physics, and all those who wish to gain an understanding of the foundations of the models and their relationships to microscopic theory as given by recent developments in terms of dynamical symmetries.This book provides a simple presentation of the models and theory of nuclear collective structure, with an emphasis on the physical content and the ways they are used to interpret data. Part 1 presents the basic phenomenological collective vibrational and rotational models as introduced by Bohr and Mottelson and their many colleagues. It also describes the extensions of these models to parallel unified models in which neutrons and protons move in a mean-field with collective degrees of freedom. Part 2 presents the predominant theories used to describe the collective properties of nuclei in terms of interacting nucleons. These theories, which are shared with other many-body systems, are shown to emerge naturally from the unified models of Part 1.

Free energy constitutes the most important thermodynamic quantity to understand how chemical species recognize each other, associate or react. Examples of problems in which knowledge of the underlying free energy behaviour is required, include conformational equilibria and molecular association, partitioning between immiscible liquids, receptor-drug interaction, protein-protein and protein-DNA association, and protein stability. This volume sets out to present a coherent and comprehensive account of the concepts that underlie different approaches devised for the determination of free energies. The reader will gain the necessary insight into the theoretical and computational foundations of the subject and will be presented with relevant applications from molecular-level modelling and simulations of chemical and biological systems. Both formally accurate and approximate methods are covered using both classical and quantum mechanical descriptions. A central theme of the book is that the wide variety of free energy calculation techniques available today can be understood as different implementations of a few basic principles. The book is aimed at a broad readership of graduate students and researchers having a background in chemistry, physics, engineering and physical biology.

This text bridges the gap between the classic texts on potential theory and modern books on applied geophysics. It opens with an introduction to potential theory, emphasising those aspects particularly important to earth scientists, such as Laplace's equation, Newtonian potential, magnetic and electrostatic fields, and conduction of heat. The theory is then applied to the interpretation of gravity and magnetic anomalies, drawing on examples from modern geophysical literature. Topics explored include regional and global fields, forward modeling, inverse methods, depth-to-source estimation, ideal bodies, analytical continuation, and spectral analysis. The book includes numerous exercises and a variety of computer subroutines written in FORTRAN. Graduate students and researchers in geophysics will find this book essential.

Nuclear Collective Motion

Mendeleev on the Periodic Law

Chorion Villus Sampling

NMR: Principles and Applications to Biomedical Research

Potential Theory in Gravity and Magnetic Applications

Written by one of the foremost experts in the field, Algebraic Combinatorics is a unique undergraduate textbook that will prepare the next generation of pure and applied mathematicians. The combination of the author's extensive knowledge of combinatorics and classical and practical tools from algebra will inspire motivated students to delve deeply into the fascinating interplay between algebra and combinatorics. The author is able to apply their newfound knowledge to mathematical, engineering, and business models. The text is primarily intended for use in a one-semester advanced undergraduate course in algebraic combinatorics, enumerative combinatorics, or graph theory. Prerequisites include a basic knowledge of linear algebra over a field, existence of finite fields, and group theory. The topics in each chapter build on each other, with extensive problem sets as well as hints to selected exercises. Key topics include walks on graphs, cubes and the Radon transform, the Matrix-Tree Theorem, and the Sperner property. There are also three appendices on purely enumerative aspects of combinatorics related to the chapter material: the RSK algorithm, plane partitions, and the enumeration of labeled trees. Richard Stanley is currently

Professor of Mathematics at the Massachusetts Institute of Technology. Stanley has received several awards including the George Polya Prize in applied combinatorics, the Guggenheim Fellowship, and the Leroy P. Steele Prize for mathematical exposition. Also by the author: Combinatorics and Commutative Algebra, Second Edition, © Birkhauser.

Developed and expanded from the work presented at the New Energetic Materials and Propulsion Techniques for Space Exploration workshop in June 2014, this book contains new scientific results, up-to-date reviews, and inspiring perspectives in a number of areas related to the energetic aspects of chemical rocket propulsion. This collection covers the entire life of energetic materials from the synthesis to the manufacturing: it includes coverage of theoretical and experimental ballistics, performance properties, as well as laboratory-scale and full system-scale, handling, hazards, environment, ageing, and disposal. Chemical Rocket Propulsion is a unique work, where a selection of accomplished experts from the pioneering era of space propulsion and current technologists from the most advanced international space agencies share their views on the future of chemical rocket propulsion for access to, and exploration of, space. It will be of interest to both postgraduate and final-year undergraduate students in aerospace engineering, and practicing aeronautical engineers and designers, especially those with an interest in propulsion, as well as researchers in energetic materials.

Few worlds are as tantalizing and enigmatic as Europa, whose complex icy surface intimates the presence of an ocean below. Europa beckons for our understanding and future exploration, enticing us with the possibilities of a water-rich environment and the potential for life beyond Earth. This volume in the Space Science Series, with more than 80 contributing authors, reveals the discovery and exploration of Europa's icy shell, subsurface ocean, presumably active interior, and myriad inherent interactions within the Jupiter environment. Europa is the foundation upon which the coming decades of scientific advancement and exploration of this world will be built, making it indispensable for researchers, students, and all who hold a passion for exploration.

Nuclear magnetic resonance (NMR) is having an enormous impact on biomedical research both at the basic science and clinical levels. In order to appreciate the elegance and power of this technology a historical perspective is in order. In 1924 Pauli suggested that hydrogen nuclei might possess a magnetic moment. This was in fact confirmed by Rabi in 1939 who demonstrated that a beam of hydrogen atoms could be deflected by a magnetic field. The presence of a magnetic field could be mutated by radio frequency fields resonating at the Larmor frequency. The first successful NMR experiments in condensed matter were independently conducted in late 1945 by Purcell, Torrey and Pound and by Bloch, Hansen and Packard. The Purcell group detected proton NMR in solid paraffin and the Bloch group detected proton in liquid water. Bloch and Purcell were awarded the Nobel Prize in physics in 1952 for these observations. Until about 1952, studies of liquids and solids with broad resonance lines dominated the field of NMR. However, the reports of 31P NMR chemical shifts in several compounds in 1949 by Kight, of 14N resonances in several ions by Proctor and Yu in 1950, and of 19F resonances in several compounds in 1950 by Dickinson led to the development of high resolution NMR. The molecular motions in liquids result in very narrow lines compared to those in solids, much smaller chemical shifts could be detected.

Bridging the Scales from Quarks to Neutron Stars

Compact NMR

Advanced Fluid Mechanics

Methods for Computer Vision, Machine Learning, and Graphics

Fluid mechanics is the study of how fluids behave and interact under various forces and in various applied situations, whether in liquid or gas state or both. The author of Advanced Fluid Mechanics compiles pertinent information that are introduced in the more advanced classes at the senior level and at the graduate level. "Advanced Fluid Mechanics courses typically cover a variety of topics involving fluids in various multiple states (phases), with both elastic and non-elastic qualities, and flowing in complex ways. This new text will integrate both the simple stages of fluid mechanics ("Fundamentals") with those involving more complex parameters, including Inviscid Flow in multi-dimensions, Viscous Flow and Turbulence, and a succinct introduction to Computational Fluid Dynamics. It will offer exceptional pedagogy, for both classroom use and self-instruction, including many worked-out examples, end-of-chapter problems, and actual computer programs that can be used to reinforce theory with real-world applications. Professional engineers as well as Physicists and Chemists working in the analysis of fluid behavior in complex systems will find the contents of this book useful. All manufacturing companies involved in any sort of systems that encompass fluids and fluid flow analysis (e.g., heat exchangers, air conditioning and refrigeration, chemical processes, etc.) or energy generation (steam boilers, turbines and internal combustion engines, jet propulsion systems, etc.), or fluid systems and fluid power (e.g., hydraulics, piping systems, and so on) will reap the benefits of this text. Offers detailed derivation of fundamental equations for better comprehension of more advanced mathematical analysis Provides groundwork for more advanced topics on boundary layer analysis, unsteady flow, turbulent modeling, and computational fluid dynamics Includes worked-out examples and end-of-chapter problems as well as a companion web site with sample computational programs and Solutions Manual

Nanomagnetism is a rapidly expanding area of research which appears to be able to provide novel applications. Magnetic molecules are at the very bottom of the possible size of nanomagnets and they provide a unique opportunity to observe the coexistence of classical and quantum properties. The discovery in the early 90's that a cluster comprising twelve manganese ions shows hysteresis of molecular origin, and later proved evidence of quantum effects, opened a new research area which is still flourishing through the collaboration of chemists and physicists. This book is the first attempt to cover in detail the new area of molecular nanomagnetism, for which no other book is available. In fact research and review articles, and book chapters are the only tools available for newcomers and the experts in the field. It is written by the chemists originators and by a theorist who has been one of the protagonists of the development of the field, and is explicitly addressed to an audience of chemists and physicists, aiming to use a language suitable for the two communities.