

[Book] Nuclear Physics And Reactor Theory Atomic Physics The Chart Of The Nuclides Radioactivity Radioactive Decay Neutron Interaction Fission Reactor Theory Neutron Characteristics

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Doe Fundamentals Handbook-U. S. Department Of Energy 2013 Nuclear Reactor Theory-George I. Bell 1970 In a part of North Africa where, within miles, the backdrop can change dramatically from snow-blasted mountains to wind-scoured dunes live the Berber people of the Atlas Mountains. In the third book of her trilogy on African women, world-renowned photojournalist Margaret Courtney-Clarke examines the difficult lives and remarkable arts of Berber women. As modern times and modern warfare in Algeria, Morocco, and Tunisia have encroached on their centuries-old traditions, Berber women have begun to give up the old ways. Imazighen: The Vanishing Traditions of Berber Women is a record of a quickly disappearing way of life. As in her earlier books, Ndebele: The Art of an African Tribe and African Canvases: The Art of West African Women, Courtney-Clarke succeeds in capturing the spirit of the women by experiencing their world from season to season and by respecting their values and traditions. Through photographs, interviews, and observations, Courtney-Clarke documents the Berber women as they stoically carry water and firewood on their backs for miles of rocky terrain. And she records the beauty they have magically produced in their lives - through their spinning and weaving and their carefully coiled pottery - a metaphor for survival and creativity. Geraldine Brooks, award-winning journalist and an expert on life in the Middle East, accompanied Courtney-Clarke on her last trip to North Africa, and has written moving, thoughtful essays on the struggle of existence among the Berbers. With a glossary of Berber terms and a detailed map of the region, this book is not only a handsomely illustrated volume of the triumph of the arts of the Berber women, but a dramatic record of a people yielding to the pressures of the twentieth century.

Nuclear Reactor Physics-Weston M. Stacey 2018-06-05 The third, revised edition of this popular textbook and reference, which has been translated into Russian and Chinese, expands the comprehensive and balanced coverage of nuclear reactor physics to include recent advances in understanding of this topic. The first part of the book covers basic reactor physics, including, but not limited to nuclear reaction data, neutron diffusion theory, reactor criticality and dynamics, neutron energy distribution, fuel burnup, reactor types and reactor safety. The second part then deals with such physically and mathematically more advanced topics as neutron transport theory, neutron slowing down, resonance absorption, neutron thermalization, perturbation and variational methods, homogenization, nodal and synthesis methods, and space-time neutron dynamics. For ease of reference, the detailed appendices contain nuclear data, useful mathematical formulas, an overview of special functions as well as introductions to matrix algebra and Laplace transforms. With its focus on conveying the in-depth knowledge needed by advanced student and professional nuclear engineers, this text is ideal for use in numerous courses and for self-study by professionals in basic nuclear reactor physics, advanced nuclear reactor physics, neutron transport theory, nuclear reactor dynamics and stability, nuclear reactor fuel cycle physics and other important topics in the field of nuclear reactor physics.

Introduction to Nuclear Reactor Physics-Robert E. Masterson 2017-11-22 INTRODUCTION TO NUCLEAR REACTOR PHYSICS is the most comprehensive, modern and readable textbook for this course/module. It explains reactors, fuel cycles, radioisotopes, radioactive materials, design, and operation. Chain reaction and fission reactor concepts are presented, plus advanced coverage including neutron diffusion theory. The diffusion equation, Fisk's Law, and steady state/time-dependent reactor behavior. Numerical and analytical solutions are also covered. The text has full color illustrations throughout, and a wide range of student learning features.

Fundamentals of Nuclear Reactor Physics-Elmer E. Lewis 2008-01-18 Fundamentals of Nuclear Reactor Physics offers a one-semester treatment of the essentials of how the fission nuclear reactor works, the various approaches to the design of reactors, and their safe and efficient operation . It provides a clear, general overview of atomic physics from the standpoint of reactor functionality and design, including the sequence of fission reactions and their energy release In-depth discussion of neutron reactions, including neutron kinetics and the neutron energy spectrum, as well as neutron spatial distribution Ample worked-out examples and over 100 end-of-chapter problems Full Solutions Manual

Nuclear Reactor Physics and Engineering-John C. Lee 2020-03-17 An introductory text for broad areas of nuclear reactor physics Nuclear Reactor Physics and Engineering offers information on analysis, design, control, and operation of nuclear reactors. The author—a noted expert on the topic—explores the fundamentals and presents the mathematical formulations that are grounded in differential equations and linear algebra. The book puts the focus on the use of neutron diffusion theory for the development of techniques for lattice physics and global reactor system analysis. The author also includes recent developments in numerical algorithms, including the Krylov subspace method, and the MATLAB software, including the Simulink toolbox, for efficient studies of steady-state and transient reactor configurations. In addition, nuclear fuel cycle and associated economics analysis are presented, together with the application of modern control theory to reactor operation. This important book: Provides a comprehensive introduction to the fundamental concepts of nuclear reactor physics and engineering Contains information on nuclear reactor kinetics and reactor design analysis Presents illustrative examples to enhance understanding of fluid conservation equations Written for undergraduate and graduate students in nuclear engineering and practicing engineers, Nuclear Reactor Physics and Engineering covers the fundamental concepts and tools of nuclear reactor physics and analysis.

The Physics of Nuclear Reactors-Serge Marquet 2018-02-26 This comprehensive volume offers readers a progressive and highly detailed introduction to the complex behavior of neutrons in general, and in the context of nuclear power generation. A compendium and handbook for nuclear engineers, a source of teaching material for academic lecturers as well as a graduate text for advanced students and other non-experts wishing to enter this field, it is based on the author's teaching and research experience and his recognized expertise in nuclear safety. After recapping a number of points in nuclear physics, placing the theoretical notions in their historical context, the book successively reveals the latest quantitative theories concerning: • The slowing-down of neutrons in matter • The charged particles and electromagnetic rays • The calculation scheme, especially the simplification hypothesis • The concept of criticality based on chain reactions • The theory of homogeneous and heterogeneous reactors • The problem of self-shielding • The theory of the nuclear reflector, a subject largely ignored in literature • The computational methods in transport and diffusion theories Complemented by more than 400 bibliographical references, some of which are commented and annotated, and augmented by an appendix on the history of reactor physics at EDF (Electricité De France), this book is the most comprehensive and up-to-date introduction to and reference resource in neutronics and reactor theory.

Theoretical Nuclear Physics-John Markus Blatt 2013-04

Nuclear Fission Reactors-I. R. Cameron 2012-12-06 This book is intended to provide an introduction to the basic principles of nuclear fission reactors for advanced undergraduate or graduate students of physics and engineering. The presentation is also suitable for physicists or engineers who are entering the nuclear power field without previous experience with nuclear reactors. No background knowledge is required beyond that typically acquired in the first two years of an undergraduate program in physics or engineering. Throughout, the emphasis is on explaining why particular reactor systems have evolved in the way they have, without going into great detail about reactor physics or methods of design analysis, which are already covered in a number of excellent specialist texts. The first two chapters serve as an introduction to the basic physics of the atom and the nucleus and to nuclear fission and the nuclear chain reaction. Chapter 3 deals with the fundamentals of nuclear reactor theory, covering neutron slowing down and the spatial dependence of the neutron flux in the reactor, based on the solution of the diffusion equations. The chapter includes a major section on reactor kinetics and control, including tempera ture and void coefficients and xenon poisoning effects in power reactors. Chapter 4 describes various aspects of fuel management and fuel cycles, while Chapter 5 considers materials problems for fuel and other constituents of the reactor. The processes of heat generation and removal are covered in Chapter 6.

Introduction to Nuclear Reactor Theory-John R. Lamarsh 1966

Modelling of Nuclear Reactor Multi-physics-Christophe Demazière 2019-11-19 Modelling of Nuclear Reactor Multiphysics: From Local Balance Equations to Macroscopic Models in Neutronics and Thermal-Hydraulics is an accessible guide to the advanced methods used to model nuclear reactor systems. The book addresses the frontier discipline of neutronic/thermal-hydraulic modelling of nuclear reactor cores, presenting the main techniques in a generic manner and for practical reactor calculations. The modelling of nuclear reactor systems is one of the most challenging tasks in complex system modelling, due to the many different scales and intertwined physical phenomena involved. The nuclear industry as well as the research institutes and universities heavily rely on the use of complex numerical codes. All the commercial codes are based on using different numerical tools for resolving the various physical fields, and to some extent the different scales, whereas the latest research platforms attempt to adopt a more integrated approach in resolving multiple scales and fields of physics. The book presents the main algorithms used in such codes for neutronic and thermal-hydraulic modelling, providing the details of the underlying methods, together with their assumptions and limitations. Because of the rapidly expanding use of coupled calculations for performing safety analyses, the analysts should be equally knowledgeable in all fields (i.e. neutron transport, fluid dynamics, heat transfer). The first chapter introduces the book's subject matter and explains how to use its digital resources and interactive features. The following chapter derives the governing equations for neutron transport, fluid transport, and heat transfer, so that readers not familiar with any of these fields can comprehend the book without difficulty. The book thereafter examines the peculiarities of nuclear reactor systems and provides an overview of the relevant modelling strategies. Computational methods for neutron transport, first at the cell and assembly levels, then at the core level, and for one-/two-phase flow transport and heat transfer are treated in depth in respective chapters. The coupling between neutron transport solvers and thermal-hydraulic solvers for coarse mesh macroscopic models is given particular attention in a dedicated chapter. The final chapter summarizes the main techniques presented in the book and their interrelation, then explores beyond state-of-the-art modelling techniques relying on more integrated approaches. Covers neutron transport, fluid dynamics, and heat transfer, and their interdependence, in one reference Analyses the emerging area of multi-physics and multi-scale reactor modelling Contains 71 short videos explaining the key concepts and 77 interactive quizzes allowing the readers to test their understanding

Nuclear Energy-Raymond L. Murray 2013-10-22 This expanded, revised, and updated fourth edition of Nuclear Energy maintains the tradition of providing clear and comprehensive coverage of all aspects of the subject, with emphasis on the explanation of trends and developments. As in earlier editions, the book is divided into three parts that achieve a natural flow of ideas: Basic Concepts, including the fundamentals of energy, particle interactions, fission, and fusion; Nuclear Systems, including accelerators, isotope separators, detectors, and nuclear reactors; and Nuclear Energy and Man, covering the many applications of radionuclides, radiation, and reactors, along with a discussion of wastes and weapons. A minimum of mathematical background is required, but there is ample opportunity to learn characteristic numbers through the illustrative calculations and the exercises. An updated Solution Manual is available to the instructor. A new feature to aid the student is a set of some 50 Computer Exercises, using a diskette of personal computer programs in BASIC and spreadsheet, supplied by the author at a nominal cost. The book is of principal value as an introduction to nuclear science and technology for early college students, but can be of benefit to science teachers and lecturers, nuclear utility trainees and engineers in other fields.

Nuclear Reactor Engineering-Samuel Glasstone 2012-12-06 Dr. Samuel Glasstone, the senior author of the previous editions of this book, was anxious to live until his ninetieth birthday, but passed away in 1986, a few months short of this milestone. I am grateful for the many years of stimulation received during our association, and in preparing this edition have attempted to maintain his approach. Previous editions of this book were intended to serve as a text for students and a reference for practicing engineers. Emphasis was given to the broad perspective, particularly for topics important to reactor design and oper ation, with basic coverage provided in such supporting areas as neutronics, thermal-hydraulics, and materials. This, the Fourth Edition, was prepared with these same general objectives in mind. However, during the past three decades, the nuclear industry and university educational programs have matured considerably, presenting some challenges in meeting the objec tives of this book. Nuclear power reactors have become much more complex, with an ac companying growth in supporting technology. University programs now offer separate courses covering such basic topics as reactor physics, thermal hydraulics, and materials. Finally, the general availability of inexpensive xv Preface powerful micro-and minicomputers has transformed design and analysis procedures so that sophisticated methods are now commonly used instead of earlier, more approximate approaches.

Nuclear Physics-National Research Council 2013-02-25 The principal goals of the study were to articulate the scientific rationale and objectives of the field and then to take a long-term strategic view of U.S. nuclear science in the global context for setting future directions for the field. Nuclear Physics: Exploring the Heart of Matter provides a long-term assessment of an outlook for nuclear physics. The first phase of the report articulates the scientific rationale and objectives of the field, while the second phase provides a global context for the field and its long-term priorities and proposes a framework for progress through 2020 and beyond. In the second phase of the study, also developing a framework for progress through 2020 and beyond, the committee carefully considered the balance between universities and government facilities in terms of research and workforce development and the role of international collaborations in leveraging future investments. Nuclear physics today is a diverse field, encompassing research that spans dimensions from a tiny fraction of the volume of the individual particles (neutrons and protons) in the atomic nucleus to the enormous scales of astrophysical objects in the cosmos. Nuclear Physics: Exploring the Heart of Matter explains the research objectives, which include the desire not only to better understand the nature of matter interacting at the nuclear level, but also to describe the state of the universe that existed at the big bang. This report explains how the universe can now be studied in the most advanced colliding-beam accelerators, where strong forces are the dominant interactions, as well as the nature of neutrinos.

Nuclear Physics-National Research Council 1999-03-31 Dramatic progress has been made in all branches of physics since the National Research Council's 1986 decadal survey of the field. The physics in a New Era series explores these advances and looks ahead to future goals. The series includes assessments of the major subfields and reports on several smaller subfields, and preparation has begun on an overview volume on the unity of physics, its relationships to other fields, and its contributions to national needs. Nuclear Physics is the latest volume of the series. The book describes current activity in understanding nuclear structure and symmetries, the behavior of matter at extreme densities, the role of nuclear physics in astrophysics and cosmology, and the instrumentation and facilities used by the field. It makes recommendations on the resources needed for experimental and theoretical advances in the coming decade.

Over 200 U.S. Department of Energy Manuals Combined: CLASSICAL PHYSICS; ELECTRICAL SCIENCE; THERMODYNAMICS, HEAT TRANSFER AND FLUID FUNDAMENTALS; INSTRUMENTATION AND CONTROL; MATHEMATICS; CHEMISTRY; ENGINEERING SYMBOLOGY; MATERIAL SCIENCE; MECHANICAL SCIENCE; AND NUCLEAR PHYSICS AND REACTOR THEORY. Over 19,000 total pages ... Public Domain U.S. Government published manual: Numerous illustrations and matrices. Published in the 1990s and after 2000. TITLES and CONTENTS: ELECTRICAL SCIENCES - Contains the following manuals: Electrical Science, Vol 1 - Electrical Science, Vol 2 - Electrical Science, Vol 3 - Electrical Science, Vol 4 - Thermodynamics, Heat Transfer, And Fluid Flow, Vol 1 - Thermodynamics, Heat Transfer, And Fluid Flow, Vol 2 - Thermodynamics, Heat Transfer, And Fluid Flow, Vol 3 - Instrumentation And Control, Vol 1 - Instrumentation And Control, Vol 2 Mathematics, Vol 1 - Mathematics, Vol 2 - Chemistry, Vol 1 - Chemistry, Vol 2 - Engineering Symboly, Prints, And Drawings, Vol 1 - Engineering Symboly, Prints, And Drawings, Vol 2 - Material Science, Vol 1 - Material Science, Vol 2 - Mechanical Science, Vol 1 - Mechanical Science, Vol 2 - Nuclear Physics And Reactor Theory, Vol 1 - Nuclear Physics And Reactor Theory, Vol 2. CLASSICAL PHYSICS - The Classical Physics Fundamentals includes information on the units used to measure physical properties; vectors, and how they are used to show the net effect of various forces; Newton's Laws of motion, and how to use these laws in force and motion applications; and the concepts of energy, work, and power, and how to measure and calculate the energy involved in various applications. * Scalar And Vector Quantities * Vector Identification * Vectors: Resultants And Components * Graphic Method Of Vector Addition * Component Addition Method * Analytical Method Of Vector Addition * Newton's Laws Of Motion * Momentum Principles * Force And Weight * Free-Body Diagrams * Force Equilibrium * Types Of Force * Energy And Work * Law Of Conservation Of Energy * Power - ELECTRICAL SCIENCE: The Electrical Science Fundamentals Handbook includes information on alternating current (AC) and direct current (DC) theory, circuits, motors, and generators; AC power and reactive components; batteries; AC and DC voltage regulators; transformers; and electrical test instruments and measuring devices. * Atom And Its Forces * Electrical Terminology * Units Of Electrical Measurement * Methods Of Producing Voltage (Electricity) * Magnetism * Magnetic Circuits * Electrical Symbols * DC Sources * DC Circuit Terminology * Basic DC Circuit Calculations * Voltage Polarity And Current Direction * Kirchoff's Laws * DC Circuit Analysis * DC Circuit Faults * Inductance * Capacitance * Battery Terminology * Battery Theory * Battery Operations * Types Of Batteries * Battery Hazards * DC Equipment Terminology * DC Equipment Construction * DC Generator Theory * DC Generator Construction * DC Motor Theory * Types Of DC Motors * DC Motor Operation * AC Generation * AC Generation Analysis * Inductance * Capacitance * Impedance * Resonance * Power Triangle * Three-Phase Circuits * AC Generator Components * AC Generator Theory * AC Generator Operation * Voltage Regulators * AC Motor Theory * AC Motor Types * Transformer Theory * Transformer Types * Meter Movements * Voltmeters * Ammeters * Ohm Meters * Wattmeters * Other Electrical Measuring Devices * Test Equipment * System Components And Protection Devices * Circuit Breakers * Motor Controllers * Wiring Schemes And Grounding THERMODYNAMICS, HEAT TRANSFER AND FLUID FUNDAMENTALS. The Thermodynamics, Heat Transfer, and Fluid Flow Fundamentals Handbook includes information on thermodynamics and the properties of fluids; the three modes of heat transfer - conduction, convection, and radiation; and fluid flow, and the energy relationships in fluid systems. * Thermodynamic Properties * Temperature And Pressure Measurements * Energy, Work, And Heat * Thermodynamic Systems And Processes * Change Of Phase * Property Diagrams And Steam Tables * First Law Of Thermodynamics * Second Law Of Thermodynamics * Compression Processes * Heat Transfer Terminology * Conduction Heat Transfer * Convection Heat Transfer * Radiant Heat Transfer * Heat Exchangers * Boiling Heat Transfer * Heat Generation * Decay Heat * Continuity Equation * Laminar And Turbulent Flow * Bernoulli's Equation * Head Loss * Natural Circulation * Two-Phase Fluid Flow * Centrifugal Pumps INSTRUMENTATION AND CONTROL. The Instrumentation and Control Fundamentals Handbook includes information on temperature, pressure, flow, and level detection systems; position indication systems; process control systems; and radiation detection principles. * Resistance Temperature Detectors (RTds) * Thermocouples * Functional Uses Of Temperature Detectors * Temperature Detection Circuitry * Pressure Detectors * Pressure Detector Functional Uses * Pressure Detection Circuitry * Level Detectors * Density Compensation * Level Detection Circuitry * Head Flow Meters * Steam Flow Detectors * Flow Circuitry * Synchro Equipment * Switches * Variable Output Devices * Position Indication Circuitry * Radiation Detection Terminology * Radiation Types * Gas-Filled Detector * Detector Voltage * Proportional Counter * Proportional Counter Circuitry * Ionization Chamber * Compensated Ion Chamber * Electroscopes Ionization Chamber * Geiger-Müller Detector * Scintillation Counter * Gamma Spectroscopy * Miscellaneous Detectors * Circuitry And Circuit Elements * Source Range Nuclear Instrumentation * Intermediate Range Nuclear Instrumentation * Power Range Nuclear Instrumentation * Principles Of Control Systems * Control Loop Diagrams * Two Position Control Systems * Proportional Control Systems * Reset (Integral) Control Systems * Proportional Plus Reset Control Systems * Proportional-Integral-Derivative Control Systems * Controllers * Valve Actuators MATHEMATICS The Mathematics Fundamentals Handbook includes a review of introductory mathematics and the concepts and functional use of algebra, geometry, trigonometry, and calculus. Word problems, equations, calculations, and practical exercises that require the use of each of the mathematical concepts are also presented. * Calculator Operations * Four Basic Arithmetic Operations * Averages * Fractions * Decimals * Signed Numbers * Significant Digits * Percentages * Scientific Notation * Radicals * Algebraic Laws * Linear Equations * Quadratic Equations * Simultaneous Equations * Word Problems * Graphing * Slopes * Interpolation And Extrapolation * Basic Concepts Of Geometry * Shapes And Figures Of Plane Geometry * Solid Geometric Figures * Pythagorean Theorem * Trigonometric Functions * Radians * Statistics * Imaginary And Complex Numbers * Matrices And Determinants * Calculus CHEMISTRY The Chemistry Handbook includes information on the atomic structure of matter; chemical bonding; chemical equations; chemical interactions involved with corrosion processes; water chemistry control, including the principles of water treatment; the hazards of chemicals and gases, and basic gaseous diffusion processes. * Characteristics Of Atoms * The Periodic Table * Chemical Bonding * Chemical Equations * Acids, Bases, Salts, And Ph * Converters * Corrosion Theory * General Corrosion * Crud And Galvanic Corrosion * Specialized Corrosion * Effects Of Radiation On Water Chemistry (Synthesis) * Chemistry Parameters * Purpose Of Water Treatment * Water Treatment Processes * Dissolved Gases, Suspended Solids, And Ph Control * Water Purity * Corrosives (Acids And Alkalies) * Toxic Compound * Compressed Gases * Flammable And Combustible Liquids ENGINEERING SYMBOLOGY. The Engineering Symboly, Prints, and Drawings Handbook includes information on engineering fluid drawings and prints; piping and instrument drawings; major symbols and conventions; electronic diagrams and schematics; logic circuits and diagrams; and fabrication, construction, and architectural drawings. * Introduction To Print Reading * Introduction To The Types Of Drawings, Views, And Perspectives * Engineering Fluids Diagrams And Prints * Reading Engineering P&IDs * P&ID Print Reading Example * Fluid Power P&IDs * Electrical Diagrams And Schematics * Electrical Wiring And Schematic Diagram Reading Examples * Electronic Diagrams And Schematics * Examples * Engineering Logic Diagrams * Truth Tables And Exercises * Engineering Fabrication, Construction, And Architectural Drawings * Engineering Fabrication, Construction, And Architectural Drawing, Examples MATERIAL SCIENCE. The Material Science Handbook includes information on the structure and properties of metals, stress mechanisms in metals, failure modes, and the characteristics of metals that are commonly used in DOE nuclear facilities. * Bonding * Common Lattice Types * Grain Structure And Boundary * Polymorphism * Alloys * Imperfections In Metals * Stress * Strain * Young's Modulus * Stress-Strain Relationship * Physical Properties * Working Of Metals * Corrosion * Hydrogen Embrittlement * Tritium/Material Compatibility * Thermal Stress * Pressurized Thermal Shock * Brittle Fracture Mechanism * Minimum Pressurization-Temperature Curves * Heatup And Cooldown Rate Limits * Properties Considered * When Selecting Materials * Fuel Materials * Cladding And Reflectors * Control Materials * Shielding Materials * Nuclear Reactor Core Problems * Plant Material Problems * Atomic Displacement Due To Irradiation * Thermal And Displacement Spikes * Due To Irradiation * Effect Due To Neutron Capture * Radiation Effects In Organic Compounds * Reactor Use Of Aluminum MECHANICAL SCIENCE. The Mechanical Science Handbook includes information on diesel engines, heat exchangers, pumps, valves, and miscellaneous mechanical components. * Diesel Engines * Fundamentals Of The Diesel Cycle * Diesel Engine Speed, Fuel Controls, And Protection * Types Of Heat Exchangers * Heat Exchanger Applications * Centrifugal Pumps * Centrifugal Pump Operation * Positive Displacement Pumps * Valve Functions And Basic Parts * Types Of Valves * Valve Actuators * Air Compressors * Hydraulics * Boilers * Cooling Towers * Demineralizers * Pressurizers * Steam Traps * Valves And Strainers NUCLEAR PHYSICS AND REACTOR THEORY. The Nuclear Physics and Reactor Theory Handbook includes information on atomic and nuclear physics; neutron characteristics; reactor theory and nuclear parameters; and the theory of reactor operation. * Atomic Nature Of Matter * Chart Of The Nuclides * Mass Defect And Binding Energy * Modes Of Radioactive Decay * Radioactivity * Neutron Interactions * Nuclear Fission * Energy Release From Fission * Interaction Of Radiation With Matter * Neutron Sources * Nuclear Cross Sections And Neutron Flux * Reaction Rates * Neutron Moderation * Prompt And Delayed Neutrons * Neutron Flux Spectrum * Neutron Life Cycle * Reactivity * Reactivity Coefficients * Neutron Poisons * Xenon * Samarium And Other Fission Product Poisons * Control Rods * Subcritical Multiplication * Reactor Kinetics * Reactor

Fractional Calculus with Applications for Nuclear Reactor Dynamics-Santanu Saha Ray 2015-07-29 Introduces Novel Applications for Solving Neutron Transport Equations While deemed nonessential in the past, fractional calculus is now gaining momentum in the science and engineering community. Various disciplines have discovered that realistic models of physical phenomenon can be achieved with fractional calculus and are using them in numerous ways. Since fractional calculus represents a reactor more closely than classical integer order calculus, Fractional Calculus with Applications for Nuclear Reactor Dynamics focuses on the application of fractional calculus to describe the physical behavior of nuclear reactors. It applies fractional calculus to incorporate the mathematical methods used to analyze the diffusion theory model of neutron transport and explains the role of neutron transport in reactor theory. The author discusses fractional calculus and the numerical solution for fractional neutron point kinetic equation (FNPKE), introduces the technique for efficient and accurate numerical computation for FNPKE with different values of reactivity, and analyzes the fractional neutron point kinetic (FNPK) model for the dynamic behavior of neutron motion. The book begins with an overview of nuclear reactors, explains how nuclear energy is extracted from reactors, and explores the behavior of neutron density using reactivity functions. It also demonstrates the applicability of the Haar wavelet method and introduces the neutron diffusion concept to aid readers in understanding the complex behavior of average neutron motion. This text: Applies the effective analytical and numerical methods to obtain the solution for the NDE Determines the numerical solution for one-group delayed neutron FNPKE by the explicit finite difference method Provides the numerical solution for classical as well as fractional neutron point kinetic equations Proposes the Haar wavelet operational method (HWOM) to obtain the numerical approximate solution of the neutron point kinetic equation, and more Fractional Calculus with Applications for Nuclear Reactor Dynamics thoroughly and systematically presents the concepts of fractional calculus and emphasizes the relevance of its application to the nuclear reactor.

Nuclear-reactor Analysis-Allan F. Henry 1975

Fundamentals in Nuclear Physics-Jean-Louis Basdevant 2006-01-16 Covers all the phenomenological and experimental data on nuclear physics and demonstrates the latest experimental developments that can be obtained. Introduces modern theories of fundamental processes, in particular the electroweak standard model, without using the sophisticated underlying quantum field theoretical tools. Incorporates all major present applications of nuclear physics at a level that is both understandable by a majority of physicists and scientists of many other fields, and usefull as a first introduction for students who intend to pursue in the domain.

Nuclear Reactor Analysis-James J. Duderstadt 1976-01-16 Classic textbook for an introductory course in nuclear reactor analysis that introduces the nuclear engineering student to the basic scientific principles of nuclear fission chain reactions and lays a foundation for the subsequent application of these principles to the nuclear design and analysis of reactor cores. This text introduces the student to the fundamental principles governing nuclear fission chain reactions in a manner that renders the transition to practical nuclear reactor design methods most natural. The authors stress throughout the very close interplay between the nuclear analysis of a reactor core and those nonnuclear aspects of core analysis, such as thermal-hydraulics or materials studies, which play a major role in determining a reactor design.

The Physical Theory of Neutron Chain Reactors-Alvin Martin Weinberg 1958

Nuclear Reactor Kinetics and Control-Jeffery Lewins 2013-10-22 Nuclear Reactor Kinetics and Control highlights the application of classical control methods in the frequency space to the dynamic processes of a nuclear reactor. This book contains nine chapters and begins with an introduction to some important mathematical theories related to nuclear engineering, such as the Laplace and Fourier transforms, linear system stability, and the probability theory. The succeeding chapters deal with the frequency space of classical linear design. A chapter describes a stochastic model for the "lumped reactor and presents equations that measure the departure from the mean, as well as representative experiments or applications of the theory to neutron detection. The discussion then shifts to the aspects of reliability and its consequences for safety of nuclear reactors, and some techniques for nonlinear systems centered on the use of the state space and its equations in the time domain. The final chapter introduces the modern electric analogue computer and derives the patching or programming rules that can be use to find solutions to problems of interest using the analogous behavior of electric circuits. This chapter also provide examples of intrinsic interest in nuclear engineering showing the programming involved and typical results, including the slower transients of xenon poisoning and fuel burn-up. This book is intended for nuclear engineers, physicists, applied mathematicians, and nuclear engineering undergraduate and postgraduate students.

Physics of High-Temperature Reactors-Luigi Massimo 2013-10-22 Physics of High-Temperature Reactors focuses on the physics of high-temperature reactors (HTRs) and covers topics ranging from fuel cycles and refueling strategies to neutron cross-sections, transport and diffusion theory, and resonance absorption. Spectrum calculations and cross-section averaging are also discussed, along with the temperature coefficient and reactor control. Comprised of 16 chapters, this book begins with a general description of the HTR core as well as its performance limitations. The next chapter deals with general considerations about HTR physics, including quantities to be determined and optimized in the design of nuclear reactors. Potential scattering and resonance reactions between neutrons and atomic nuclei are then considered, together with basic aspects of transport and diffusion theory. Subsequent chapters explore methods for solving the diffusion equation; slowing-down and neutron thermalization in graphite; HTR core design, fuel management, and cost calculations; and core dynamics and accident analysis. The final chapter describes the sequence of reactor design calculations. This monograph is written primarily for students of HTR physics who are preparing to enter the field as well as technologists of other disciplines who are working on the system.

Nuclear Physics-M. G. Bowler 2013-09-11 Nuclear Physics is concerned primarily with low-energy nuclear physics rather than high-energy or elementary particle physics, although examples from particle physics are used where appropriate. The Fermi Golden Rule is given emphasis throughout. This text consists of six chapters and begins with an introduction to nuclear physics, followed by a discussion on nuclear structure at a fairly basic level. This book also discusses the nuclear periodic table, radioactivity, and unstable nuclear states as well as nuclear mass and nuclear binding energy. Spin and static electric and magnetic moments are then examined from the perspective of quantum mechanics rather than through the vector model of angular momentum. Quantum mechanics is also used to treat nuclear decay in the next chapter. The theory of nuclear reactions is discussed by highlighting the concepts of cross-section and resonance. The penultimate chapter deals with self-sustaining nuclear reactions, with particular reference to the nuclear physics of fission reactors and the nuclear aspects of stellar physics. This chapter ends with the application of the theory of thermonuclear reactions to the design of a thermonuclear power plant. The final chapter is devoted to charge independence and isospin in low-energy nuclear physics.

The Technology of Nuclear Reactor Safety-Henry Bamford Parkes

Fundamentals of Nuclear Engineering-Brent J. Lewis 2017-03-24 Fundamental of Nuclear Engineering is derived from over 25 years of teaching undergraduate and graduate courses on nuclear engineering. The material has been extensively class tested and provides the most comprehensive textbook and reference on the fundamentals of nuclear engineering. It includes a broad range of important areas in the nuclear engineering field; nuclear and atomic theory; nuclear reactor physics, design, control/dynamics, safety and thermal-hydraulics; nuclear fuel engineering; and health physics/radiation protection. It also includes the latest information that is missing in traditional texts, such as space radiation. The aim of the book is to provide a source for upper level undergraduate and graduate students studying nuclear engineering.

Neutronic Analysis For Nuclear Reactor Systems-Bahman Zohuri 2016-11-01 This book covers the entire spectrum of the science and technology of nuclear reactor systems, from underlying physics, to next generation system applications and beyond. Beginning with neutron physics background and modeling of transport and diffusion, this self-contained learning tool progresses step-by-step to discussions of reactor kinetics, dynamics, and stability that will be invaluable to anyone with a college-level mathematics background wishing to develop an understanding of nuclear power. From fuels and reactions to full systems and plants, the author provides a clear picture of how nuclear energy works, how it can be optimized for safety and efficiency, and why it is important to the future.

Plasma Physics and Nuclear Fusion Research-Richard D. Gill 2013-09-03 Plasma Physics and Nuclear Fusion Research covers the theoretical and experimental aspects of plasma physics and nuclear fusion. The book starts by providing an overview and survey of plasma physics; the theory of the electrodynamic of deformable media and magnetohydrodynamics; and the particle orbit theory. The text also describes the plasma waves; the kinetic theory; the transport theory; and the MHD stability theory. Advanced theories such as microinstabilities, plasma turbulence, anomalous transport theory, and nonlinear laser plasma interaction theory are also considered. The book further tackles the pinch and tokamak confinement devices; the stellarator confinement devices; the mirror devices; and the next generation tokamaks. The text also encompasses the fusion reactor studies; heating; and diagnostics. Physicists and people involved in the study of plasma physics and nuclear fusion will find the book invaluable.

Fundamentals of Nuclear Science and Engineering Second Edition-J. Kenneth Shultis 2007-09-07 Since the publication of the bestselling first edition, there have been numerous advances in the field of nuclear science. In medicine, accelerator based teletherapy and electron-beam therapy have become standard. New demands in national security have stimulated major advances in nuclear instrumentation.An ideal introduction to the fundamentals of nuclear science and engineering, this book presents the basic nuclear science needed to understand and quantify an extensive range of nuclear phenomena. New to the Second Edition— A chapter on radiation detection by Douglas McGregor Up-to-date coverage of radiation hazards, reactor designs, and medical applications Flexible organization of material that allows for quick reference This edition also takes an in-depth look at particle accelerators, nuclear fusion reactions and devices, and nuclear technology in medical diagnostics and treatment. In addition, the author discusses applications such as the direct conversion of nuclear energy into electricity. The breadth of coverage is unparalleled, ranging from the theory and design characteristics of nuclear reactors to the identification of biological risks associated with ionizing radiation. All topics are supplemented with extensive nuclear data compilations to perform a wealth of calculations. Providing extensive coverage of physics, nuclear science, and nuclear technology of all types, this up-to-date second edition of Fundamentals of Nuclear Science and Engineering is a key reference for any physicist or engineer.

Neutron Physics for Nuclear Reactors-Salvatore Esposito 2010 This unique volume gives an accurate and very detailed description of the functioning and operation of basic nuclear reactors, as emerging from yet unpublished papers by Nobel Laureate Enrico Fermi. In the first part, the entire course of lectures on Neutron Physics delivered by Fermi at Los Alamos is reported, according to the version made by Anthony P French. Here, the fundamental physical phenomena are described very clearly and comprehensively, giving the appropriate physics grounds for the functioning of nuclear piles. In the second part, all the patents issued by Fermi (and coworkers) on the functioning, construction and operation of several different kinds of nuclear reactors are reported. Here, the main engineering problems are encountered and solved by employing simple and practical methods, which are described in detail. This seminal work mainly caters to students, teachers and researchers working in nuclear physics and engineering, but it is of invaluable interest to historians of physics too, since the material presented here is entirely novel.

Nuclear Engineering-Malcolm Joyce 2017-09-18 Nuclear Engineering: A Conceptual Introduction to Nuclear Power provides coverage of the introductory, salient principles of nuclear engineering in a comprehensive manner for those entering the profession at the end of their degree. The nuclear power industry is undergoing a renaissance because of the desire for low-carbon baseload electricity, the growing population, and environmental concerns about shale gas, so this book is a welcomed addition to the science. In addition, users will find a great deal of information on the change in the industry, along with other topical areas of interest that are uniquely covered. Intended for undergraduate students or early postgraduate students studying nuclear engineering, this new text will also be appealing to scientifically-literate non-experts wishing to be better informed about the 'nuclear option'. Presents a succinct and clear explanation of the key facts and concepts on how nuclear

engineering power systems function and how their related fuel supply cycles operate Provides full coverage of the nuclear fuel cycle, including its scientific and historical basis Describes a comprehensive range of relevant reactor designs, from those that are defunct, current, and in plan/construction for the future, including SMRs and GenIV Summarizes all major accidents and their impact on the industry and society

Fundamentals of Nuclear Models-David J Rowe 2010-03-23 This book reviews the basic models and theories of nuclear structure and gives an in-depth analysis of their experimental and mathematical foundations. It shows the relationships between the models and exhibits the value of following the strategy of: looking for patterns in all the data available, developing phenomenological models to explain them, and finally giving the models a foundation in a fundamental microscopic theory of interacting neutrons and protons. This unique book takes a newcomer from an introduction to nuclear structure physics to the frontiers of the subject along a painless path. It provides both the experimental and mathematical foundations of the essential models in a way that is accessible to a broad range of experimental and theoretical physicists. Thus, the book provides a unique resource and an exposition of the essential principles, mathematical structures, assumptions, and observational data on which the models and theories are based. It avoids discussion of many non-essential variations and technical details of the models.

Nuclear Energy-David Bodansky 2007-06-25 This second edition represents an extensive revision of the 1st edition. - though the motivation for the book and the intended audiences, as described in the previous preface, remain the same. The overall length has been increased substantially, with revised or expanded discussions of a number of topics, including Yucca Mountain repository plans, new reactor designs, health effects of radiation, costs of electricity, and dangers from terrorism and weapons proliferation. The overall status of nuclear power has changed rather little over the past eight years. Nuclear reactor construction remains at a very low ebb in much of the world, with the exception of Asia, while nuclear power's share of the electricity supply continues to be about 75% in France and 20% in the United States. However, there are signs of a heightened interest in considering possible nuclear growth. In the late 1990s, the U. S. Department of Energy began new programs to stimulate research and planning for future reactors, and many candidate designs are now contending—at least on paper—to be the next generation leaders. Outside the United States, the commercial development of the Pebble Bed Modular Reactor is being pursued in South Africa, a French-German consortium has won an order from Finland for the long-planned EPR (European Pressurized Water Reactor), and new reactors have been built or planned in Asia. In an unanticipated positive development for nuclear energy, the capacity factor of U. S. reactors has increased dramatically in recent years, and most operating reactors now appear headed for 20-year license renewals.

Principles of Nuclear Rocket Propulsion-William J. Emrich, Jr. 2016-07-28 Principles of Nuclear Rocket Propulsion provides an understanding of the physical principles underlying the design and operation of nuclear fission-based rocket engines. While there are numerous texts available describing rocket engine theory and nuclear reactor theory, this is the first book available describing the integration of the two subject areas. Most of the book's emphasis is primarily on nuclear thermal rocket engines, wherein the energy of a nuclear reactor is used to heat a propellant to high temperatures and then expel it through a nozzle to produce thrust. Other concepts are also touched upon such as a section devoted to the nuclear pulse rocket concept wherein the force of externally detonated nuclear explosions is used to accelerate a spacecraft. Future crewed space missions beyond low earth orbit will almost certainly require propulsion systems with performance levels exceeding that of today's best chemical engines. A likely candidate for that propulsion system is the solid core Nuclear Thermal Rocket or NTR. Solid core NTR engines are expected to have performance levels which significantly exceed that achievable by any currently conceivable chemical engine. The challenge is in the engineering details of the design which includes not only the thermal, fluid, and mechanical aspects always present in chemical rocket engine development, but also nuclear interactions and some unique materials restrictions. Sorts and organizes information on various types of nuclear thermal rocket engines into a coherent curriculum Includes a number of example problems to illustrate the concepts being presented Features a companion site with interactive calculators demonstrating how variations in the constituent parameters affect the physical process being described Includes 3D figures that may be scaled and rotated to better visualize the nature of the object under study Numerical Methods of Reactor Analysis-Melville Jr. Clark 2012-12-02 Nuclear Science and Technology, Volume 3: Numerical Methods of Reactor Analysis presents the numerical analysis frequently used in the nuclear reactor field. This book discusses the numerical approximation for the multigroup diffusion method, which results in simple algebraic equations. Organized into six chapters, this volume starts with an overview of the simplified formulation of linear algebra by defining the matrices and operations with matrices. This text then discusses the properties of special matrices and reviews the elementary properties of finite difference equations. Other chapters consider a variety of methods of obtaining numerical solutions to the approximating equations. The final chapter deals with Monte Carlo method, which is a statistical method for solving statistical or deterministic problems. This book is a valuable resource for nuclear engineers. Students at the graduate level who had an introductory course in reactor physics and a basic course in differential equations will also find this book useful.

Nuclear Methods in Science and Technology-Yuri M. Tsipenyuk 2019-05-20 The application of nuclear physics methods is now widespread throughout physics, chemistry, metallurgy, biology, clinical medicine, geology, and archaeology. Accelerators, reactors, and various instruments that have developed together with nuclear physics have often been found to offer the basis for increasingly productive and more sensitive analytical techniques. Nuclear Methods in Science and Technology provides scientists and engineers with a clear understanding of the basic principles of nuclear methods and their potential for applications in a wide range of disciplines. The first part of the book covers the major points of basic theory and experimental methods of nuclear physics, emphasizing concepts and simple models that give a feel for the behavior of real systems. Using many examples, the second part illustrates the extraordinary possibilities offered by nuclear methods. It covers the Mossbauer effect, slow neutron physics, activation analysis, radiography, nuclear geochronology, channeling effects, nuclear microprobe, and numerous other topics in modern applied nuclear physics. The book explores applications such as tomography, the use of short-lived isotopes in clinical diagnoses, and nuclear physics in ecology and agriculture. Where alternative nonnuclear analytical techniques are available, the author compares the relevant nuclear method, enabling readers to judge which technique may be most useful for them. Complete with a bibliography and extensive reference list for readers who want to delve deeper into a particular topic, this book applies various methods of nuclear physics to a wide range of disciplines.

Fundamentals of Nuclear Physics-N. A. Jelley 1990-03-22 This textbook on nuclear physics will be of value to all undergraduates studying nuclear physics, as well as to first-year graduates.

Neutron Physics-Karl-Heinrich Beckurts 2013-06-29 This book is based upon a series of lectures I have occasionally given at the University of Gottingen since 1951. They were meant to introduce the students of experimental physics to the work in a neutron physics laboratory dealing with the problem of measuring neutron flux, diffusion length, Fermi age, effective neutron temperature, absorption cross sections and similar problems. Moreover, these lectures were intended to prepare the students for a subsequent lecture covering the physics of nuclear reactors. The original character of this series of lectures has been retained in the book. It is intended for use by students as well as anyone desiring to work on neutron physics measurements. The first half mainly covers the theory of neutron fields, i. e. essentially diffusion and slowing down theory. The second half is largely concerned with measurements in neutron fields. The appendix contains information and data which, in our experience, are frequently required in a neutron laboratory. The field of nuclear physics proper is briefly touched upon in the first two chapters, but only to the extent necessary for the understanding of the following chapters. The multitude of applications of neutron radiation has not been covered. The conclusion of this manuscript coincided with the end of my long period of activity with the Max-Planck-Institut fur Physik at Gottingen. To Professor HEISENBERG I owe thanks for his advice and suggestions for many of the subjects treated here.

Selected Topics in Applications of Quantum Mechanics-Mohammad Reza Pahlavani 2015-05-13 This book has two sections. The section Selected Topics in Applications of Quantum Mechanics provides seven chapters about different applications of quantum mechanics in science and technology. The section Selected Topics in Foundations of Quantum Mechanics provides seven chapters about the foundations of quantum mechanics. This book is written by a community of expert scientists from different research institutes and universities from all over the world. Without a doubt, quantum mechanics is the greatest discovery of the 20th century. Therefore, its history and foundations are of great interest to scientists and students. This book covers some of the applications of quantum mechanics in nuclear physics, medical science, information technology, atomic physics and material science, as well as selected topics of quantum mechanics through different bases and ideas about quantum mechanics. The basic idea of the publication of this book is to make scientists and researchers, as well as graduate students, familiar with the foundations of quantum mechanics.

Nuclear Physics and Nuclear Reactors-Apollon Nikolaevich Klimov 1975

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