

Quantum Electronics

This graduate-level text explains the modern in-depth approaches to the calculation of electronic structure and the properties of molecules. Largely self-contained, it features more than 150 exercises. 1989 edition.

This book gives clear explanations of the technical aspects of electronics engineering from basic classical device formulations to the use of nanotechnology to develop efficient quantum electronic systems. As well as being up to date, this book provides a broader range of topics than found in many other electronics books. This book is written in a clear, accessible style and covers topics in a comprehensive manner. This book's approach is strongly application-based with key mathematical techniques introduced, helpful examples used to illustrate the design procedures, and case studies provided where appropriate. By including the fundamentals as well as more advanced techniques, the author has produced an up-to-date reference that meets the requirements of electronics and communications students and professional engineers. Features

- Discusses formulation and classification of integrated circuits
- Develops a hierarchical structure of functional logic blocks to build more complex digital logic circuits
- Outlines the structure of transistors (bipolar, JFET, MOSFET or MOS, CMOS), their processing techniques, their arrangement forming logic gates and digital circuits, optimal pass transistor stages of buffered chain, sources and types of noise, and performance of designed circuits under noisy conditions
- Explains data conversion processes, choice of the converter types, and inherent errors
- Describes electronic properties of nanomaterials, the crystallites' size reduction effect, and the principles of nanoscale structure fabrication
- Outlines the principles of quantum electronics leading to the development of lasers, masers, reversible quantum gates, and circuits and applications of quantum cells and fabrication methods, including self-assembly (quantum-dot cellular automata) and tunneling (superconducting circuits), and describes quantum error-correction techniques

Problems are provided at the end of each chapter to challenge the reader's understanding

This textbook, based on the authors' class-tested material, is accessible to students at the advanced undergraduate and graduate level in physics and engineering. While its primary function is didactic, this book's comprehensive choice of topics and its clear and authoritative synthesis of ideas make it a useful reference for researchers, device engineers, and course instructors who wish to consolidate their knowledge of this field. The book takes the semi-classical approach where light is treated as a wave in accordance with the classical Maxwell equations, while matter is governed by quantum theory. It begins by introducing the postulates and mathematical framework of quantum theory, followed by the formalism of the density matrix which allows the transition from microscopic (quantum) quantities to macroscopic (classical) ones. Consequently, the equations describing the reaction of matter to the electromagnetic field in the

form of polarization, magnetization, and current are derived. These equations (together with the Maxwell equations) form the complete system of equations sufficient to model a wide class of problems surrounding linear and nonlinear interactions of electromagnetic fields with matter. The nonlinear character of the governing equations determines parameters of the steady-state mode of the quantum generator and is also demonstrated in harmonic generation via propagation of laser radiation in various media. The touchstone description of magnetic phenomena will be of interest to scientists who deal with applications of magneto-resonance phenomena in biology and medicine. Other advanced topics covered include electric dipole transitions, magnetic dipole transitions, plasma transitions, and the devices that can be based on these and other electro-optical and nonlinear-optical systems. This textbook features numerous exercises, some of which are investigatory and some of which require computational solutions. Quantum Electronics: A Treatise, Volume I: Nonlinear Optics, Part A deals with the theoretical and experimental aspects of the nonlinear optical susceptibilities and process. This volume is composed of two parts encompassing seven chapters. After a brief overview of the field, this book goes on discussing experimental determination of the susceptibility coefficients and numerical values for a variety of materials appearing in the nonlinear constitutive relationships. The second part describes several nonlinear optical phenomena to which these nonlinear susceptibilities give rise. The characteristics of these basic nonlinear interactions are also presented in a unified and cohesive manner. This book is of value to quantum electronics scientists, engineers, and researchers.

Quantum Electronics, Volume 2: Maser Amplifiers and Oscillators deals with the experimental and theoretical aspects of maser amplifiers and oscillators which are based on the principles of quantum electronics. It shows how the concepts and equations used in quantum electronics follow from the basic principles of theoretical physics. Comprised of three chapters, this volume begins with a discussion on the elements of the theory of quantum oscillators and amplifiers working in the microwave region, along with the practical achievements in this field. Attention is paid to two-level paramagnetic masers and the dependence of the form of the emitted signal on the different parameters. The maser oscillator operating with a beam of active molecules is described in the next chapter, which considers the three-level paramagnetic oscillator, the molecular beam oscillator, and the two-level solid-state quantum oscillator. The final chapter is devoted to lasers, including gas lasers and solid-state lasers. Methods of obtaining negative temperatures are described, together with the elements of laser theory and the kinetics of oscillation processes in solid-state lasers. This book is intended for university students with knowledge of theoretical physics, particularly quantum mechanics.

Starting with the simplest semiclassical approaches and ending with the description of complex fully quantum-mechanical methods for quantum transport analysis of state-of-the-art devices, Computational Electronics: Semiclassical and

Quantum Device Modeling and Simulation provides a comprehensive overview of the essential techniques and methods for effectively analyzing transport in semiconductor devices. With the transistor reaching its limits and new device designs and paradigms of operation being explored, this timely resource delivers the simulation methods needed to properly model state-of-the-art nanoscale devices. The first part examines semiclassical transport methods, including drift-diffusion, hydrodynamic, and Monte Carlo methods for solving the Boltzmann transport equation. Details regarding numerical implementation and sample codes are provided as templates for sophisticated simulation software. The second part introduces the density gradient method, quantum hydrodynamics, and the concept of effective potentials used to account for quantum-mechanical space quantization effects in particle-based simulators. Highlighting the need for quantum transport approaches, it describes various quantum effects that appear in current and future devices being mass-produced or fabricated as a proof of concept. In this context, it introduces the concept of effective potential used to approximately include quantum-mechanical space-quantization effects within the semiclassical particle-based device simulation scheme. Addressing the practical aspects of computational electronics, this authoritative resource concludes by addressing some of the open questions related to quantum transport not covered in most books. Complete with self-study problems and numerous examples throughout, this book supplies readers with the practical understanding required to create their own simulators.

Quantum Electronics for Atomic Physics provides a course in quantum electronics for researchers in atomic physics and other related areas such as telecommunications. The book covers the usual topics, such as Gaussian beams, lasers, nonlinear optics and modulation techniques, but also includes a number of areas not usually found in a textbook on quantum electronics. Among the latter are such practical matters as the enhancement of nonlinear processes in a build-up cavity or periodically polled waveguide, impedance matching into a cavity, laser frequency stabilization (including servomechanism theory), astigmatism in ring cavities, and frequency locking a laser to an atomic or molecular line. The second edition includes a new complete chapter on optical waveguide theory, fiber optic components and fiber lasers. Other updates include new coverage of mode locked fiber lasers, comb generation in a micro-resonator, and periodically poled optical waveguides. To request a copy of the Solutions Manual, visit <http://global.oup.com/uk/academic/physics/admin/solutions>.

Principles of Quantum Electronics focuses on the concept of quantum electronics as the application of quantum theory to engineering problems. It examines the principles that govern specific quantum electronics devices and presents their theoretical applications to typical problems. Comprised of 10 chapters, this book starts with an overview of the Dirac formulation of quantum mechanics. This text then considers the derivation of the formalism of field quantization and discusses the properties of photons and phonons. Other chapters examine the interaction between the electromagnetic field and charged particles. This book discusses as well the interaction of radiation with free and bound electrons, with focus on the spontaneous and stimulated emission of

radiation by bound electrons. The final chapter provides the investigation that Maxwell's theory can be regarded as the quantum theory of a single photon. This book is a valuable resource for graduate students, specialists, and engineers who are interested in the field of quantum electrodynamics.

Principles of Optical Fiber Measurements focuses on the optical fiber systems, which are being added to the telephone networks of various countries around the world. This book explores the significance of optical fiber systems in the increasing variety of fiber-related products on the market. Comprised of seven chapters, this book starts with an overview of the fiber fabrication process with emphasis on the method of measurements to reduce fiber loss in the field of optical communication. This text then examines the special methods to measure extremely low dispersion in single-mode fibers. Other chapters consider the measurement requirements of commercial fiber manufacturers to allow them to specify their products as well as for fiber users to verify that they get what they expect. The final chapter deals with the various measurement methods for determining the V value of fibers as well as the geometrical dimensions of fibers and preforms. This book is a valuable resource for specialists and readers who desire a better understanding of fiber specifications.

The basic concepts of quantum mechanics are explained in this book in a concise and easy-to-read manner, leading toward applications in solid-state electronics and optics. Following a logical sequence, the book focuses on key ideas and is conceptually and mathematically self-contained.

Based on a Cal Tech course, this is an outstanding introduction to formal quantum mechanics for advanced undergraduates in applied physics. The treatment's exploration of a wide range of topics culminates in two eminently practical subjects, the semiconductor transistor and the laser. Each chapter concludes with a set of problems. 1982 edition.

With the surprising discovery of superconductivity at temperatures above 100 K, this field was not only brought into the public eye, but also stimulated research in universities, scientific institutions and industry, thus continuing the fascinating development which began with the discovery of the Josephson effect in the sixties. Cryoelectronics has become a special branch of cryophysics and cryotechnics and today plays a prominent role whenever high resolution and precision measurements are required. Motivated by this development, seven years ago scientists working in cryoelectronics in the Federal Republic of Germany felt the necessity for regular meetings allowing a free exchange of ideas and results achieved. Seminars under the title of "Kryoelektronische Bauelemente" were held for the first time at the Physikalisch-Technische Bundesanstalt in Braunschweig in 1982 on the occasion of the 100th anniversary of the birth of Walther Meißner, a pioneer in superconductivity. Since then, meetings have been held every year at different venues in Germany. It is now felt that the status of this field necessitates a review of the results of the past, a description of the current state of the art, and a discussion of future perspectives. This book, entitled SUPERCONDUCTING QUANTUM ELECTRONICS is a collection of invited lectures and contributions which will inform the reader on the most interesting problems involving fundamentals, sensitive detectors and precision metrology being studied by different groups.

This book is a course of lectures given for senior students at the Moscow Institute

of Physics and Technology. For those who have graduated in the USSR this information should be sufficient to give an idea of the level and the manner in which the subject matter is presented. On the other hand, readers outside of this country may never have heard about this well-known Soviet institution, and so we would like to say a few words about it now. The Moscow Institute of Physics and Technology (MFTI or Fiztekh) was founded in 1947 as the result of a special directive of Stalin in order to supply the space and nuclear program with highly educated experts. The best scientists in the country were involved in the foundation process. They invented an effective and flexible educational system that includes basic education according to an university program followed by specialization at leading scientific centers. Being organized initially as a department of Moscow State University, MFTI recently separated into an independent institution. In the sixties it lost its mainly top secret and military character and became the most prestigious place in the country for an education in physics. The political changes of the last few years have opened it to contacts with other countries. The course of lectures comprising this book is dedicated to the subject of the intense resonant interaction of laser radiation with matter and contains a significant part of the Ph. D.

Electronic Conduction: Classical and Quantum Theory to Nanoelectronic Devices provides a concise, complete introduction to the fundamental principles of electronic conduction in microelectronic and nanoelectronic devices, with an emphasis on integrating the quantum aspects of conduction. The chapter coverage begins by presenting the classical theory of conduction, including introductory chapters on quantum mechanics and the solid state, then moving to a complete presentation of essential theory for understanding modern electronic devices. The author's unique approach is applicable to microscale and nanoscale device simulation, which is particularly timely given the explosion in the nanoelectronics field. Features Self-contained Gives a complete account of classical and quantum aspects of conduction in nanometer scale devices Emphasises core principles, the book can be useful to electrical engineers and material scientists, and no prior course in semiconductors is necessary Highlights the bridge to modern electronics, first presenting the physics, and then the engineering complications related to quantum behaviour Includes many clear, illustrative diagrams and chapter problem sets Gives an account of post-Silicon devices such as the GaAs MOSFET, the CNT-FET and the vacuum transistor Showcases why quantum mechanics is necessary with modern devices due to their size and corresponding electron transport properties Discusses all the issues that will enable readers to conduct their own research

This book provides the information necessary for the reader to achieve a thorough understanding of all aspects of QW lasers - from the basic mechanism of optical gain, through the current technological state of the art, to the future technologies of quantum wires and quantum dots. In view of the growing importance of QW lasers, this book should be read by all those with an active

interest in laser science and technology, from the advanced student to the experienced laser scientist. * The first comprehensive book-length treatment of quantum well lasers * Provides a detailed treatment of quantum well laser basics * Covers strained quantum well lasers * Explores the different state-of-the-art quantum well laser types * Provides key information on future laser technologies

The text has been revised to incorporate new developments in lasers and quantum electronics. Other subjects covered include phase-conjugate optics, long wavelength quaternary semiconductor lasers, the physics of semiconductor lasers, laser arrays and free-electron lasers.

A textbook that introduces a graduate student to the various fields of physics related to the interaction between radiation and matter. It emphasizes analogies and relations between seemingly different phenomena and different fields of quantum electronics.

Quantum Electronics John Wiley & Sons Incorporated

"This text on plasma physics is written for students at the senior or first-year graduate level ... It is intended to serve both as an introduction to the theory of plasmas for students planning to do further work in the subject and as a survey for students with out research interests who want to have some knowledge of plasmas"--Preface.

This unique collection of papers by leading German scientists reviews recent accomplishments, presents new results and discusses possible future developments of superconducting quantum electronics and high T_c superconductivity. The three main parts of the book deal with fundamentals, sensitive detectors, and precision metrology. The book will be valuable to researchers and students at academic and industrial institutions who are interested in theory and precision experiments. New results reported include: correct equivalent circuits modelling superconducting electronic devices; exact solution of the Mattis-Bardeen equations describing perfectly various experiments for thin films; complete theoretical description and first experimental results for a new broad band spectrum analyzer; a new Josephson junction potentiometer allowing tracing of unknown voltage ratios back to well-known frequency ratios; and fast superconducting SQUID shift registers enabling the production of calculable noise power spectra in the microwave region.

This volume brings together contributions from world renowned researchers on molecular nonlinear optics. It takes as its impetus work done over the last five years in which newly developed optoelectronic devices have deepened our understanding of the fundamental physics and chemistry underlying these materials. Organic materials involving thin films, polymers, and resulting devices will be emphasized.

Quantum Electronics

In this book, leading experts on quantum dot theory and technology provide comprehensive reviews of all aspects of quantum dot systems. The following topics are covered: (1) energy states in quantum dots, including the effects of

strain and many-body effects; (2) self-assembly and self-ordering of quantum dots in semiconductor systems; (3) growth, structures, and optical properties of III-nitride quantum dots; (4) quantum dot lasers.

Introduction to Quantum Electronics is based on a one-semester lecture of electrical engineering for German students. The book is an introduction to the fundamentals of lasers and masers and a presentation of the principles of physics, their theory, and methods of analysis that seek to analyze, explain, and quantify related important phenomena. The properties of a laser is then discussed, the author comparing it to the properties of the maser. Although masers are based on the same physical properties as that of the lasers, masers amplify microwaves by induced emission. How the laser is amplified, its power and frequency of oscillation, and which media are suitable for lasers are analyzed. Descriptions of the laser take more emphasis as it is considered to have more technical applications than the maser. An example given is the operation of the gas laser, because it exhibits coherence in time and space, considered as the most important quality of laser beams. Physicists, students, and academicians in the field of electrical engineering and quantum electronics will find that this book addresses many of their interests.

Problems after each chapter

The science and technology relating to nanostructures continues to receive significant attention for its applications to various fields including microelectronics, nanophotonics, and biotechnology. This book describes the basic quantum mechanical principles underlining this fast developing field. From the fundamental principles of quantum mechanics to nanomaterial properties, from device physics to research and development of new systems, this title is aimed at undergraduates, graduates, postgraduates, and researchers.

Quantum Information Processing and Quantum Error Correction is a self-contained, tutorial-based introduction to quantum information, quantum computation, and quantum error-correction. Assuming no knowledge of quantum mechanics and written at an intuitive level suitable for the engineer, the book gives all the essential principles needed to design and implement quantum electronic and photonic circuits. Numerous examples from a wide area of application are given to show how the principles can be implemented in practice. This book is ideal for the electronics, photonics and computer engineer who requires an easy- to-understand foundation on the principles of quantum information processing and quantum error correction, together with insight into how to develop quantum electronic and photonic circuits. Readers of this book will be ready for further study in this area, and will be prepared to perform independent research. The reader completed the book will be able design the information processing circuits, stabilizer codes, Calderbank-Shor-Steane (CSS) codes, subsystem codes, topological codes and entanglement-assisted quantum error correction codes; and propose corresponding physical implementation. The reader completed the book will be proficient in quantum fault-tolerant design as well. Unique Features Unique in covering both quantum information processing and quantum error correction - everything in one book that an engineer needs to understand and implement quantum-level circuits. Gives an intuitive understanding by not assuming knowledge of quantum mechanics,

thereby avoiding heavy mathematics. In-depth coverage of the design and implementation of quantum information processing and quantum error correction circuits. Provides the right balance among the quantum mechanics, quantum error correction, quantum computing and quantum communication. Dr. Djordjevic is an Assistant Professor in the Department of Electrical and Computer Engineering of College of Engineering, University of Arizona, with a joint appointment in the College of Optical Sciences. Prior to this appointment in August 2006, he was with University of Arizona, Tucson, USA (as a Research Assistant Professor); University of the West of England, Bristol, UK; University of Bristol, Bristol, UK; Tyco Telecommunications, Eatontown, USA; and National Technical University of Athens, Athens, Greece. His current research interests include optical networks, error control coding, constrained coding, coded modulation, turbo equalization, OFDM applications, and quantum error correction. He presently directs the Optical Communications Systems Laboratory (OCSL) within the ECE Department at the University of Arizona. Provides everything an engineer needs in one tutorial-based introduction to understand and implement quantum-level circuits Avoids the heavy use of mathematics by not assuming the previous knowledge of quantum mechanics Provides in-depth coverage of the design and implementation of quantum information processing and quantum error correction circuits

Quantum Electronics for Atomic Physics provides a course in quantum electronics for researchers in atomic physics and other related areas such as telecommunications. The book covers the usual topics, such as Gaussian beams, lasers, nonlinear optics and modulation techniques, but also includes a number of areas not usually found in a textbook on quantum electronics. Among the latter are such practical matters as the enhancement of nonlinear processes in a build-up cavity or periodically poled waveguide, impedance matching into a cavity, laser frequency stabilization (including servomechanism theory), astigmatism in ring cavities, and frequency locking a laser to an atomic or molecular line. The second edition includes a new complete chapter on optical waveguide theory, fiber optic components and fiber lasers. Other updates include new coverage of mode locked fiber lasers, comb generation in a micro-resonator, and periodically poled optical waveguides.

Modern Semiconductor Quantum Physics has the following constituents: (1) energy band theory: pseudopotential method (empirical and ab initio); density functional theory; quasi-particles; LCAO method; k.p method; spin-orbit splitting; effective mass and Luttinger parameters; strain effects and deformation potentials; temperature effects. (2) Optical properties: absorption and exciton effect; modulation spectroscopy; photo luminescence and photo luminescence excitation; Raman scattering and polaritons; photoionization. (3) Defects and Impurities: effective mass theory and shallow impurity states; deep state cluster method, super cell method, Green's function method; carrier recombination kinetics; trapping transient measurements; electron spin resonance; electron lattice interaction and lattice relaxation effects; multi-phonon nonradiative recombination; negative U center, DX center and EL2 Defects. (4) Semiconductor surfaces: two dimensional periodicity and surface reconstruction; surface electronic states; photo-electron spectroscopy; LEED, STM and other experimental methods. (5) Low-dimensional structures: Heterojunctions, quantum wells; superlattices, quantum-confined Stark effect and Wannier-Stark ladder effects; resonant tunneling, quantum

Hall effect, quantum wires and quantum dots. This book can be used as an advanced textbook on semiconductor physics for graduate students in physics and electrical engineering departments. It is also useful as a research reference for solid state scientists and semiconductor device engineers.

This book is based on a course of lectures for advanced students. Part 1 is devoted to an introductory treatment of general concepts and methods to be used for describing nonlinear processes. Part 2 is concerned with the application of these concepts and methods to significant effects and processes, covering also the particular experimental arrangements, measuring methods, and empirical data connected with them.

[Copyright: 4904d97f63f9629c4466d89e3206d57d](#)