Solid State And Semiconductor Physics

Topics in the Applications of Semiconductors, Superconductors, and the Nonlinear Optical Properties of Solids
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High Speed Semiconductor Physics. Theoretical Approaches and Device Physics
An Introduction

HOWE BARKER

Topics in the Applications of Semiconductors, Superconductors, and the Nonlinear Optical Properties of Solids CRC Press
Describes activities in France at CNET and CNRS, and in Germany at the Max Planck Institute in Stuttgart, research facilities in the Wurzburg/Regensburg/Munchen area, in Berlin and in the eastern part of Germany, including Jena.
Solid-State Physics CRC Press

The aim of this book is a discussion, at the introductory level, of some applications of solid state physics. The book evolved from notes written for a course offered three times in the Department of Physics of the University of California at Berkeley. The objects of the course were (a) to broaden the knowledge of graduate students in physics, especially those in solid state physics; (b) to provide a useful course covering the physics of a variety of solid state devices for students in several areas of physics; (c) to indicate some areas of research in applied solid state physics. To achieve these ends, this book is designed to be a survey of the physics of a number of solid state devices. As the italics indicate, the key words in this description are physics and survey. Physics is a key word because the book stresses the basic qualitative physics of the applications, in enough depth to explain the essentials of how a device works but not deeply enough to allow the reader to design one. The question emphasized is how the solid state physics of the application results in the basic useful property of the device. An example is how the physics of the tunnel diode results in a negative dynamic resistance. Specific circuit applications of

devices are mentioned, but not emphasized, since expositions are available in the elec trical engineering textbooks given as references.
Physics of Semiconductors and Nanostructures World Scientific Publishing Company
DIVThorough, modern study of solid state physics; solid types and symmetry, electron states, electronic properties and cooperative phenomena. /div
Physics of Semiconductor Devices Wiley
This book is a comprehensive text on the physics of semiconductors and nanostructures for a large spectrum of students at the final undergraduate level studying physics, material science and electronics engineering. It offers introductory and advanced courses on solid state and semiconductor physics on one hand and the physics of low dimensional semiconductor structures on the other in a single text book. Key Features Presents basic concepts of quantum theory, solid state physics, semiconductors, and quantum nanostructures such as quantum well, quantum wire, quantum dot and superlattice In depth description of semiconductor heterojunctions, lattice strain and modulation doping technique Covers transport in nanostructures under an electric and magnetic field with the topics: quantized conductance, Coulomb blockade, and integer and fractional quantum Hall effect Presents the optical processes in nanostructures under a magnetic field Includes illustrative problems with hints for solutions in each chapter Physics of Semiconductors and Nanostructures will be helpful to students initiating PhD work in the field of semiconductor nanostructures and devices. It follows a unique tutorial approach meeting the requirements of students who find learning the concepts difficult and want to study from a physical perspective.
Aspects of Solid-State and Semiconductor Physics Research in France and Germany Springer Science & Business Media
Solid State Physics opens with the adiabatic approximation to the many-body problem of a system of ions and valence electrons. After chapters on lattice symmetry, structure and dynamics, it then proceeds with four chapters devoted to the single-electron theory of the solid state. Semiconductors and dielectrics are covered in depth and chapters on magnetism and superconductivity follow. The book concludes with a chapter on solid surfaces. Every section is followed by solved problems, some of them illustrating areas of current interest in solid state physics, to give the student a practical working knowledge of the subject, and the text is illustrated by many supplementary examples.
Physics and Materials Properties Academic Press
Since the publication of the first edition over 50 years ago, Introduction to Solid State Physics has been the standard solid state physics text for physics students. The author's goal from the beginning has been to write a book that is accessible to undergraduates and consistently teachable. The emphasis in the book has always been on physics rather than formal mathematics. With each new edition, the author has attempted to add important new developments in the field without sacrificing the book's accessibility and teachability. * A very important chapter on nanophysics has been written by an active

worker in the field. This field is the liveliest addition to solid state science during the past ten years * The text uses the simplifications made possible by the wide availability of computer technology. Searches using keywords on a search engine (such as Google) easily generate many fresh and useful references
Oxford University Press
Festkorperprobleme X: Advances in Solid State Physics is a compilation of papers and lectures on semiconductor physics, low temperature physics, thermodynamics, and metal physics of the German Physical Society, Freudenstadt, on April 6-11, 1970. This volume is a collection of 13 papers in English and German on the abovementioned subjects. The book describes some characteristics of the different families of narrow bandgap semiconductors; the result arising from the interaction between free carriers and acoustic waves in solids; and the advances made in the field of modulation spectroscopy. The text further discusses the relations between the state of the photoemitted electrons and the absorption process in the solid. In Chapter 8, applications to various problems in semiconductor physics are dealt with. The Empirical Pseudopotential Method and the theory of phonon dispersion curves from a pseudopotential point of view are also considered. Further examined is the Ginzburg-Landau theory of superconductivity in relation to the probability distribution of the electric field strength of laser light that has a form completely analogous to that of the pair wave function of the theory. The implications of the thermodynamics of point defects in imperfect crystals and the association of foreign ions and vacancies due to their Coulomb interaction, resulting in complexes, are investigated. This book is of interest to electrical engineers, research engineers, professors, and students in theoretical or experimental physics.
Modern Semiconductor Quantum Physics
Springer Nature
This textbook provides a theoretical background for contemporary trends in solid-state theory and semiconductor device physics. It discusses advanced methods of quantum mechanics and field theory and is therefore primarily intended for graduate students in theoretical and experimental physics who have already studied electrodynamics, statistical physics, and quantum mechanics. It also relates solid-state physics fundamentals to semiconductor device applications and includes auxiliary results from mathematics and quantum mechanics, making the book useful also for graduate students in electrical engineering and material science. Key Features: Explores concepts common in textbooks on semiconductors, in addition to topics not included in similar books currently available on the market, such as the topology of Hilbert space in crystals Contains the latest research and developments in the field Written in an accessible yet rigorous manner
Fundamentals of Semiconductors CRC Press
Solid State Electronic Devices is intended for undergraduate electrical engineering students or for practicing engineers and scientists interested in updating their understanding of modern electronics ¿ One of the most widely used introductory books on semiconductor materials, physics, devices and technology, Solid State Electronic Devices aims to: 1)

develop basic semiconductor physics concepts, so students can better understand current and future devices; and 2) provide a sound understanding of current semiconductor devices and technology, so that their applications to electronic and optoelectronic circuits and systems can be appreciated. Students are brought to a level of understanding that will enable them to read much of the current literature on new devices and applications. ¿¿ Teaching and Learning Experience This program will provide a better teaching and learning experience-for you and your students. It will help: Provide a Sound Understanding of Current Semiconductor Devices: With this background, students will be able to see how their applications to electronic and optoelectronic circuits and systems are meaningful. Incorporate the Basics of Semiconductor Materials and Conduction Processes in Solids: Most of the commonly used semiconductor terms and concepts are introduced and related to a broad range of devices. Develop Basic Semiconductor Physics Concepts: With this background, students will be better able to understand current and future devices.

Introduction to Semiconductor Physics Firewall Media

This compact undergraduate textbook provides a concise yet thorough introduction to the fundamentals of solid-state physics, while also briefly discussing the historical context surrounding key scholars in the field. The vivid explanations and unique didactic approach adopted in the book aim to generate interest in these subjects while also serving as a motivating primer and supporting companion for studying more detailed and advanced textbooks in solid-state physics. The book is also suitable as a quick refresher for students preparing for examinations. The third edition features many extensions, including an up-to-date discussion of topological materials, a rapidly developing area at the forefront of solid-state physics. Primarily concentrating on the electric and magnetic properties of materials, the book will benefit undergraduate students in the fields of physics, materials science, and electrical engineering.

Semiconductor Physics Springer Science & Business Media

Provides a multidisciplinary introduction to quantum mechanics, solid state physics, advanced devices, and fabrication Covers wide range of topics in the same style and in the same notation Most up to date developments in semiconductor physics and nano-engineering Mathematical derivations are carried through in detail with emphasis on clarity Timely application areas such as biophotonics , bioelectronics

Solid State Physics Academic Press

This book has been designed primarily as a text book for a three-semester, three· hour per week senior or graduate course in semiconductor physics for students In electrical engineering and physics, It may be supplemented by a solid state phy .. ics course. Prerequisites are courses in electrodynamics and -for some of the chapters -basic quantum mechanics. Emphasis has been laid on physical rather than technological aspects. Semiconductor physics is in fact an excellent and d ... · manding training ground for a future physicist or electrical engineer givina him an opportunity to practice a large variety of physical laws he was introduced to in the more fundamental courses. A detailed treatment of the transport and optical

properties of semiconducton is given. It was decided to omit the usual description of the material propertkl of certain semiconductors and instead to include the "in· between" equations In mathematical derivations which I hope will make life simpler for a non·theorell· ciano In view of the many thousands of papers which appear every y ... ar in th ... field of semiconductor physics and which are distributed amona more than 30 journals, it would have been impossible for a single person to writ ... comprehen· sive book unless there had not been some excellent review art ides on speCial top ics published in the series "Solid State Physics", "FestkOrper·Probleme! Ad· vances in Solid State Physics", "Semiconductors and Semimetals". and "Proareu in Semiconductors", and I have leaned heavily on such review articles

Introduction to Solid State Physics Cambridge University Press

Semiconductor Device Physics and Design teaches readers how to approach device design from the point of view of someone who wants to improve devices and can see the opportunity and challenges. It begins with coverage of basic physics concepts, including the physics behind polar heterostructures and strained heterostructures. The book then details the important devices ranging from p-n diodes to bipolar and field effect devices. By relating device design to device performance and then relating device needs to system use the student can see how device design works in the real world.

Solid State Electronic Devices Springer Science & Business Media

The first edition of "Semiconductor Physics" was published in 1973 by Springer-Verlag Wien-New York as a paperback in the Springer Study Edition. In 1977, a Russian translation by Professor Yu. K. Pozhela and coworkers at Vilnius/USSR was published by Izdatelstvo "MIR", Mo scow. Since then new ideas have been developed in the field of semi conductors such as electron hole droplets, dangling bond saturation in amorphous silicon by hydrogen, or the determination of the fine struc ture constant from surface quantization in inversion layers. New tech niques such as molecular beam epitaxy which has made the realization of the Esaki superlattice possible, deep level transient spectroscopy, and refined a. c. Hall techniques have evolved. Now that the Viennese edition is about to go out of print, Springer-Verlag, Berlin-Heidelberg-New York is giving me the opportunity to include these new subjects in a monograph to appear in the Solid-State Sciences series. Again it has been the intention to cover the field of semiconductor physics comprehensively, although some chapters such as diffusion of hot carriers and their galvanomagnetic phenomena, as well as super conducting degenerate semiconductors and the appendices, had to go for commercial reasons. The emphasis is more on physics than on device as pects.

Solid State Physics Anchor Academic Publishing

Intended for a two semester advanced undergraduate or graduate course in Solid State Physics, this treatment offers modern coverage of the theory and related experiments, including the group theoretical approach to band structures, Moessbauer recoil free fraction, semi-classical electron theory, magnetoconductivity, electron self-energy and Landau theory of Fermi liquid, and both quantum and fractional quantum Hall

effects. Integrated throughout are developments from the newest semiconductor devices, e.g. space charge layers, quantum wells and superlattices. The first half includes all material usually covered in the introductory course, but in greater depth than most introductory textbooks. The second half includes most of the important developments in solid-state researches of the past half century, addressing e.g. optical and electronic properties such as collective bulk and surface modes and spectral function of a quasiparticle, which is a basic concept for understanding LEED intensities, X ray fine structure spectroscopy and photoemission. So both the fundamental principles and most recent advances in solid state physics are explained in a class-tested tutorial style, with end-of-chapter exercises for review and reinforcement of key concepts and calculations.

Principles and Modern Applications Springer Science & Business Media

The explosion of the science of mesoscopic structures is having a great impact on physics and electrical engineering because of the possible applications of these structures in microelectronic and optoelectronic devices of the future. This volume of Solid State Physics consists of two comprehensive and authoritative articles that discuss most of the physical problems that have so far been identified as being of importance in semiconductor nanostructures. Much of the volume is tutorial in characture--while at the same time time presenting current and vital theoretical and experimental results and a copious reference list--so it will be essential reading to all those taking a part in the research and development of this emerging technology.

Introduction to the Theory Springer Science & Business Media

Solid state physics is a fascinating sub-genre of condensed matter physics - though some graduate students consider it a very boring and tedious subject area in Physics and others even call it a “squalid state”. Topics covered in this book are built on standard solid state physics references available in most online libraries or in other books on solid state physics. The complexity of high speed semiconductor physics and related devices arose from condensed solid state matter. The content covered in this book gives a deep coverage on some topics or sections that may be covered only superficially in other literature. Therefore, these topics are likely to differ a great deal from what is deemed important elsewhere in other books or available literature. There are many extremely good books on solid-state physics and condensed matter physics but very few of these books are restricted to high speed semiconductor physic though. Chapter one covers the general semiconductor qualities that make high speed semiconductor devices effect and includes the theory of crystals, diffusion and ist mechanisms, while chapter two covers solid state materials, material processing for high speed semiconductor devices and an introduction to quantum theory for materials in relation to density of states of the radiation for a black body and ist radiation properties. Chapter three discuss high speed semiconductor energy band theory, energy bands in general solid semiconductor materials, the Debye model, the Einstein model the Debye model and semiconductor transport carriers in 3D semiconductors while chapter four discuss effect of external

force on current flow based on the concept of holes valence band, and lattice scattering in high speed devices. Chapter five briefly describes solid state thermoelectric fundamentals, thermoelectric material and thermoelectric theory of solids in lattice and phonons while chapter six scattering in high field effect in semiconductors in inter-valley electron scattering and the associated Fermi Dirac statistics and Maxwell-Boltzmann approximation on their carrier concentration variation with energy in extrinsic doping chapter seven covers p-n junction diodes, varactor diode, pin diode Schottky diode and their transient response of diode in multi-valley semiconductors. Chapter eight discusses high speed metal semiconductor field effect transistors.

Physics of Semiconductor Devices

Springer Science & Business Media

Physics of Semiconductor Devices covers both basic classic topics such as energy band theory and the gradual-channel model of the MOSFET as well as advanced concepts and devices such as MOSFET short-channel effects, low-dimensional devices and single-electron transistors. Concepts are introduced to the reader in a simple way, often using comparisons to everyday-life experiences such as simple fluid mechanics. They are then explained in depth and mathematical developments are fully described. Physics of Semiconductor Devices contains a list of problems that can be used as homework assignments or can be solved in class to exemplify the theory. Many of these problems make use of Matlab and are aimed at illustrating theoretical concepts in a graphical manner.

Solid State and Semiconductor Physics

Prentice Hall

While the standard solid state topics are covered, the basic ones often have more detailed derivations than is customary (with an empasis on crystalline solids). Several recent topics are introduced, as are some subjects normally included only in condensed matter physics. Lattice vibrations, electrons, interactions, and spin effects (mostly in magnetism) are discussed the most comprehensively. Many problems are included whose level is from "fill in the steps" to long and challenging, and the text is equipped with references and several comments about experiments with figures and tables.

Solid State Physics John Wiley & Sons

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; effect 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.

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