

Ying Fu

Physical Models of Semiconductor Quantum Devices

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Physical Models Of Semiconductor Quantum Devices

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Physical Models Of Semiconductor Quantum Devices:

Physical Models of Semiconductor Quantum Devices Ying Fu, Magnus Willander, 2013-11-27 Solid state electronics is undergoing rapid changes driven by heteroepitaxy lithography and new device concepts While ten years ago Si was the material of choice in solid state electronics now GaAs InGaAs AlAs InP Ge etc have all become quite important The advent of semiconductor lasers and integrated optoelectronic circuits has led to a flurry of activities in compound semiconductors Additionally the remarkable advances in the thin film epitaxy have allowed active semiconductor devices with sub three dimensional properties and built in controlled biaxial strain due to lattice mismatch This book addresses three main areas of interest i electronic and optical properties of low dimensional semiconductor materials ii principal physics of quantum electronic devices iii principal physics of quantum optical devices These areas will provide readers with an intimate knowledge of the new material properties on which novel solid state electronic devices such as quantum diode and small size transistor high electron mobility transistor are based leading to the very front of the development of material and device research The link between basic physics on which the real devices are based and the output from the real devices is closely observed in the book Chapter 1 Elemental and compound semiconductors 1.1 Crystalline nature of solids The intrinsic property of a crystal is that the environment around a given atom or group of atoms is exactly the same as the environment around another atom or similar group of atoms

Physical Models of Semiconductor Quantum Devices Ying Fu, 2013-09-30 *Physical Models of Semiconductor Quantum Devices* Ying Fu, 2013-08-29 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

Transport of Information-Carriers in Semiconductors and Nanodevices El-Saba, Muhammad, 2017-03-31 Rapid developments in technology have led to enhanced electronic systems and applications When utilized correctly these can have significant impacts on communication and computer systems Transport of Information Carriers in Semiconductors and Nanodevices is an innovative source of academic material on transport modelling in semiconductor material and nanoscale devices Including a range of perspectives on relevant topics such as charge carriers semiclassical transport theory and organic semiconductors this is an ideal publication for engineers researchers academics professionals and practitioners interested in emerging developments on transport equations that govern information carriers

Light-Driven Materials and Devices - Fundamentals and Emerging Applications Murat Kabatas, 2025-07-02 This book brings together key concepts and case studies that showcase the evolving role of semiconductors in optoelectronic devices and clean energy technologies It concisely explores materials and methods relevant to photodiodes photodetectors and photocatalytic systems

Topics include a simulation based understanding of GaAs PIN photodiodes the fundamentals and historical context of semiconductors and insights into advanced photovoltaic detectors including avalanche structures for enhanced sensitivity The book also highlights recent approaches in the photodeposition of co catalysts over 2D heterostructures to improve hydrogen production and solar water splitting performance With a balance of foundational knowledge and current research trends this volume offers practical insights into device design light matter interactions and nanomaterial integration It is intended for researchers and engineers in materials science electronics and renewable energy The content is accessible well organized and suitable as a reference or learning resource for those interested in the intersection of semiconductors photonics and sustainable technologies Modeling of Semiconductor Quantum Devices and Its Applications Jianping Sun,1993 Device and Circuit Cryogenic Operation for Low Temperature Electronics Francis Balestra,G.

Ghibaudo,2013-11-11 Device and Circuit Cryogenic Operation for Low Temperature Electronics is a first in reviewing the performance and physical mechanisms of advanced devices and circuits at cryogenic temperatures that can be used for many applications The first two chapters cover bulk silicon and SOI MOSFETs The electronic transport in the inversion layer the influence of impurity freeze out the special electrical properties of SOI structures the device reliability and the interest of a low temperature operation for the ultimate integration of silicon down to nanometer dimensions are described The next two chapters deal with Silicon Germanium and III V Heterojunction Bipolar Transistors as well as III V High Electron Mobility Transistors HEMT The basic physics of the SiGe HBT and its unique cryogenic capabilities the optimization of such bipolar devices and the performance of SiGe HBT BiCMOS technology at liquid nitrogen temperature are examined The physical effects in III V semiconductors at low temperature the HEMT and HBT static high frequency and noise properties and the comparison of various cooled III V devices are also addressed The next chapter treats quantum effect devices made of silicon materials The major quantum effects at low temperature quantum wires quantum dots as well as single electron devices and applications are investigated The last chapter overviews the performances of cryogenic circuits and their applications The low temperature properties and performance of inverters multipliers adders operational amplifiers memories microprocessors imaging devices circuits and systems sensors and read out circuits are analyzed Device and Circuit Cryogenic Operation for Low Temperature Electronics is useful for researchers engineers Ph D and M S students working in the field of advanced electron devices and circuits new semiconductor materials and low temperature electronics and physics

SOI Lubistors Yasuhisa Omura,2013-08-27 Advanced level consolidation of the technology physics and design aspects of silicon on insulator SOI lubistors No comprehensive description of the physics and possible applications of the Lubistor can be found in a single source even though the Lubistor is already being used in SOI LSIs The book provides for the first time a comprehensive understanding of the physics of the Lubistor The author argues that a clear understanding of the fundamental physics of the pn junction is essential to allowing scientists and engineers to propose new devices Since 2001 IBM has been

applying the Lubistor to commercial SOI LSIs large scale integrated devices used in PCs and game machines It is a key device in that it provides electrostatic protection to the LSIs The book explains the device modeling for such applications and covers the recent analog circuit application of the voltage reference circuit The author also reviews the physics and the modeling of ideal and non ideal pn junctions through reconsideration of the Shockley s theory offering readers an opportunity to study the physics of pn junction Pn junction devices are already applied to the optical communication system as the light emitter and the receiver Alternatively optical signal modulators are proposed for coupling the Si optical waveguide with the pn junction injector The book also explores the photonic crystal physics and device applications of the Lubistor Advanced level consolidation of the technology physics and design aspects of silicon on insulator SOI lubistors Written by the inventor of the Lubistor this volume describes the technology for readers to understand the physics and applications of the device First book devoted to the Lubistor transistor presently being utilized in electrostatic discharge ESD applications in SOI technology a growing market for semiconductor devices and advanced technologies Approaches the topic in a systematic manner from physical theory through to modelling and finally circuit applications This is an advanced level book requiring knowledge of electrical and electronics engineering at graduate level Contents includes Concept of Ideal pn Junction Proposal of Lateral Unidirectional Bipolar Type Insulated Gate Transistor Lubistor Noise Characteristics and Modeling of Lubistor Negative Conductance Properties in Extremely Thin SOI Lubistors Two Dimensionally Confined Injection Phenomena at Low Temperatures in Sub 10 nm Thick SOI Lubistors Experimental Study of Two Dimensional Confinement Effects on Reverse Biased Current Characteristics of Ultra Thin SOI Lubistors Gate Controlled Bipolar Action in Ultra thin Dynamic Threshold SOI MOSFET Sub Circuit Models of SOI Lubistors for Electrostatic Discharge Protection Circuit Design and Their Applications A New Basic Element for Neural Logic Functions and Functionality in Circuit Applications Possible Implementation of SOI Lubistors into Conventional Logic Circuits Potentiality of Electro Optic Modulator Based on SOI Waveguide Principles of Parameter Extraction Feasibility of Lubistor Based Avalanche Photo Transistor NISTIR ,2001

BiOMEMS and Nanotechnology ,2003 **Quantum Transport in Ultrasmall Devices** David K. Ferry,1995-07-31 The operation of semiconductor devices depends upon the use of electrical potential barriers such as gate depletion in controlling the carrier densities electrons and holes and their transport Although a successful device design is quite complicated and involves many aspects the device engineering is mostly to devise a best device design by defining optimal device structures and manipulating impurity profiles to obtain optimal control of the carrier flow through the device This becomes increasingly difficult as the device scale becomes smaller and smaller Since the introduction of integrated circuits the number of individual transistors on a single chip has doubled approximately every three years As the number of devices has grown the critical dimension of the smallest feature such as a gate length which is related to the transport length defining the channel has consequently declined The reduction of this design rule proceeds approximately by a factor of 1.4 each generation which

means we will be using 0.1-0.15 μm rules for the 4 Gb chips a decade from now. If we continue this extrapolation current technology will require 30 nm design rules and a cell size of 3-2 nm.

Physics Briefs, 1994 **Quantum Electronics**, 2000

Quantum Electronics is the English edition of the Russian journal Kvantovaya Elektronika, a leading journal in all aspects of laser research, founded in 1971. Published research papers are on topics which include Laser Active Media Interaction of Laser Radiation with Matter, Laser Plasma Non-linear Optical Phenomena, Quantum Electronic Devices, Optical Processing of Information, Laser Applications and Other Topics in Quantum Electronics.

Physics and Simulation of Optoelectronic Devices, 2001 **Computational Methods in Science and Engineering** George Maroulis, Theodore E. Simos, 2009-09-02

The aim of ICCMSE 2008 is to bring together computational scientists and engineers from several disciplines in order to share methods, methodologies and ideas. The potential readers are all the scientists with interest in Computational Mathematics, Theoretical Physics, Computational Physics, Theoretical Chemistry, Computational Chemistry, Mathematical Chemistry, Computational Engineering, Computational Mechanics, Computational Biology and Medicine, Scientific Computation, High Performance Computing, Parallel and Distributed Computing, Visualization, Problem Solving Environments, Software Tools, Advanced Numerical Algorithms, Modelling and Simulation of Complex Systems, Web based Simulation and Computing, Grid based Simulation and Computing, Computational Grids and Computer Science.

International Conference on Simulation of Semiconductor Processes and Devices, 2002 *Physics of Semiconductors*, 2005 Bulletin of the Institute of Mathematics, Academia Sinica, 2007 CAS ... Proceedings, 1996 Cumulated Index to the Books, 1999

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