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The Physics of Low-dimensional SemiconductorsLow-dimensional SemiconductorsExcitons in Low-Dimensional SemiconductorsAnalysis and Simulation of Semiconductor DevicesAdvanced Nanomaterials for Solution-Processed Flexible Optoelectronic DevicesLayered Nanomaterials for Solution-Processed OptoelectronicsNew Problems and New Solutions for Device and Process ModellingNonlinearityElectronic Properties of Semiconductor InterfacesA Finite Element Method for Numerically Solving the Semiconductor Device EquationsFizika tverdogo telaMethods and Applications of AnalysisSemiconductorsSolution of the Hydrodynamic Device Model Using High-order Non-oscillatory Shock Capturing AlgorithmsMathematical ReviewsDiscrete and Continuous Dynamical SystemsThe Adaptive Solution to the Three-dimensional Semiconductor Device ProblemsProceedings of the IRE.Numerical Analysis of Semiconductor Devices and Integrated CircuitsProceedings of the IRE. John H. Davies M. J. Kelly Stephan Glutsch S. Selberherr Manjeet Singh Manjeet Singh John J. H. Miller Winfried Mönch Ioana Alexandra Triandaf Institute for Computer Applications in Science and Engineering J. V. Ashby Institute of Radio Engineers B. T. Browne

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the composition of modern semiconductor heterostructures can be controlled precisely on the atomic scale to create low dimensional systems these systems have revolutionised semiconductor physics and their impact on technology particularly for semiconductor lasers and ultrafast transistors is widespread and burgeoning this book provides an introduction to the general principles that underlie low dimensional semiconductors as far as possible simple physical explanations are used with reference to examples from actual devices the author shows how beginning with fundamental results from quantum mechanics and solid state physics a formalism can be developed that describes the properties of low dimensional semiconductor systems among numerous examples two key systems are studied in detail the two dimensional electron gas employed in field effect transistors and the quantum well whose optical properties find application in lasers and other opto electronic devices the book includes many exercises and will be invaluable to undergraduate and first year graduate physics or electrical engineering students taking courses in low dimensional systems or heterostructure device physics

this text is a first attempt to pull together the whole of semiconductor science and technology since 1970 in so far as semiconductor multilayers are concerned material technology physics and device issues are described with approximately equal emphasis and form a single coherant point of view the subject matter is the concern of over half of today s active semiconductor scientists and technologists the remainder working on bulk semiconductors and devices it is now routine to design and the prepare semiconductor multilayers at a time with independent control over the dropping and composition in each layer in turn these multilayers can be patterned with features that as a small as a few atomic layers in lateral extent the resulting structures open up many new ares of exciting solid state and quantum physics they have also led to whole new generations of electronic and optoelectronic devices whose superior performance relates back to the multilayer structures the principles established in the field have several decades to go advancing towards the ultimate of materials engineering the design and preparation of solids atom by atom the book should appeal equally to physicists electronic engineers and materials scientists

low dimensional semiconductors have become a vital part of today s semiconductor physics and excitons in these systems are ideal objects that bring textbook quantum mechanics to life furthermore their theoretical understanding is important for experiments and optoelectronic devices the author develops the effective mass theory of excitons in low dimensional semiconductors and describes numerical methods for calculating the optical absorption including coulomb interaction geometry and external fields the theory is applied to fano resonances in low dimensional semiconductors and the zener breakdown in superlattices comparing theoretical results with experiments the book is essentially self contained it is a hands on approach with detailed derivations worked examples illustrative figures and computer programs the book is clearly structured and will be valuable as an advanced level self study or course book for graduate students lecturers and researchers

the invention of semiconductor devices is a fairly recent one considering classical time scales in human life the bipolar transistor was announced in 1947 and the mos transistor in a practically usable manner was demonstrated in 1960 from these beginnings the semiconductor device field has grown rapidly the first integrated circuits which contained just a few devices became commercially available in the early 1960s immediately thereafter an evolution has taken place so that today less than 25 years later the manufacture of integrated circuits with over 400 000 devices per single chip is possible coincident with the growth in semiconductor device development the literature concerning semiconductor device and technology issues has literally exploded in the last decade about 50 000 papers have been published on these subjects the advent of so called very large scale integration vlsi has certainly revealed the need for a better understanding of basic device behavior the miniaturization of the single transistor which is the major prerequisite for vlsi nearly led to a breakdown of the classical models of semiconductor devices

this book covers the recent advancements in the fabrication of flexible optoelectronic devices using advanced nanomaterials it provides information on how to process non layered advanced nanomaterials such as carbon nanotubes fullerenes nanowires colloidal quantum dots inorganic halide perovskite perovskite nanomaterials stabilized in porous materials doped zno lead chalcogenide nano crystals for the easy fabrication of the optoelectronic devices at an industrial scale advanced nanomaterials for solution processed flexible optoelectronic devices provides up to date knowledge centered on the various non layered nanomaterials and their different types of application in optoelectronic device fabrication the first few chapters focus on the processing and applications of carbon nanotubes and fullerenes into devices for photovoltaics throughout the book the authors demonstrate not only device fabrication but processing of the advanced nanomaterials to make them suitable for wide applications as different components in optoelectronics the book also presents discussions on the current challenges and future perspective for the proper processing and utilization of advanced nanomaterials for the fabrication of devices this book is intended for graduate students researchers and engineers working in the area of advanced nanomaterials energy conversion energy storage sensors and different types of optoelectronic devices

this book will provide different strategies and deliberate engineering concepts for the processing and application of advanced nanomaterials with layered structures for optoelectronic devices to enable device production at an industrial scale layered nanomaterials for solution processed optoelectronics provides exhaustive state of the art knowledge centered on the various two dimensional 2d nanomaterials and their different types of applications in optoelectronic device fabrication the first few chapters focus on the processing and application of the 2d mxene in devices for energy conversion and storage then there is discussion on 2d perovskite based nanomaterials for fabrication of photovoltaic devices and flexible light emitting diodes the readers will gain insight into large area fabrication methods of flexible devices using advanced nanomaterials with layered structures such as graphene conjugated cofs 2d hbn hexagonal boron nitride silicene 2d polymers transition metal dichalcogenides and black phosphorous each chapter discusses the strategies and challenges for applications of layered nanomaterials in optoelectronics this book is intended for graduate students researchers and engineers working in the area of advanced nanomaterials energy conversion energy storage sensors and different types of optoelectronic devices

almost all semiconductor devices contain metal semiconductor insulator semiconductor insulator metal and or semiconductor semiconductor interfaces and their electronic properties determine the device characteristics this is the first monograph that treats the electronic properties of all different types of semiconductor interfaces using the continuum of interface induced gap states ifigs as a unifying theme mönch explains the band structure lineup at all types of semiconductor interfaces these intrinsic ifigs are the wave function tails of electron states which overlap a semiconductor band gap exactly at the interface so they originate from the quantum mechanical tunnel effect he shows that a more chemical view relates the ifigs to the partial ionic character of the covalent interface bonds and that the charge transfer across the interface may be modeled by generalizing pauling s electronegativity concept the ifigs and electronegativity theory is used to quantitatively explain the barrier heights and band offsets of well characterized schottky contacts and semiconductor heterostructures respectively a micron n n n silicon diode is simulated via the hydrodynamic model for carrier transport the numerical algorithms employed are for the non steady case and a limiting process is used to reach steady state the novelty of our simulation lies in the shock capturing algorithms employed and indeed shocks or very rapid transition regimes are observed in the transient case for the coupled system consisting of the potential equation and the conservation equations describing charge momentum and energy transfer for the electron carriers these algorithms termed essentially non oscillatory have been successfully applied in other contests to models the flow in gas dynamics magnetohydrodynamics and other physical situations involving the conservation laws of fluid mechanics the method here is first order in time but the use of small time steps allows for good accuracy runge kutta methods allow one to achieve higher accuracy in time of desired the spatial accuracy is of high order in regions of smoothness jhd

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