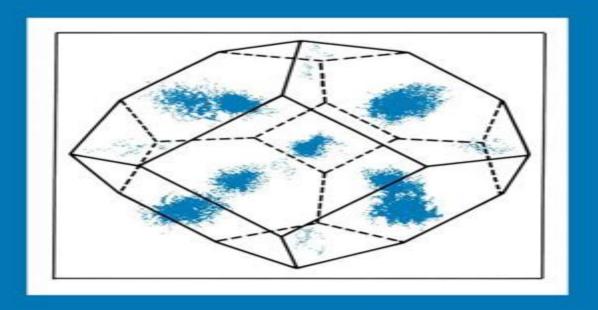# Monte Carlo Simulation of Semiconductor Devices

C. MOGLESTUE

Monte Carlo Method For Semiconductor Device Simulation The

Christopher M. Snowden,Robert E. Miles

Monte Carlo Method For Semiconductor Device Simulation The:

   The Monte Carlo Method for Semiconductor Device Simulation Carlo Jacoboni,Paolo Lugli,1989-10-30 This volume presents the application of the Monte Carlo method to the simulation of semiconductor devices reviewing the physics of transport in semiconductors followed by an introduction to the physics of semiconductor devices   **Hierarchical Device Simulation** Christoph Jungemann,Bernd Meinerzhagen,2003-06-05 This monograph is the first on physics based simulations of novel strained Si and SiGe devices It provides an in depth description of the full band monte carlo method for SiGe and discusses the common theoretical background of the drift diffusion hydrodynamic and Monte Carlo models and their synergy
   The Monte Carlo Method for Semiconductor Device Simulation Carlo Jacoboni,Paolo Lugli,2012-12-06 The application of the Monte Carlo method to the simulation of semiconductor devices is presented A review of the physics of transport in semiconductors is given followed by an introduction to the physics of semiconductor devices The Monte Carlo algorithm is discussed in great details and specific applications to the modelling of semiconductor devices are given A comparison with traditional simulators is also presented   *Monte Carlo Device Simulation* Karl Hess,2012-10-11 Monte Carlo simulation is now a well established method for studying semiconductor devices and is particularly well suited to highlighting physical mechanisms and exploring material properties Not surprisingly the more completely the material properties are built into the simulation up to and including the use of a full band structure the more powerful is the method Indeed it is now becoming increasingly clear that phenomena such as reliabil ity related hot electron effects in MOSFETs cannot be understood satisfac torily without using full band Monte Carlo The IBM simulator DAMOCLES therefore represents a landmark of great significance DAMOCLES sums up the total of Monte Carlo device modeling experience of the past and reaches with its capabilities and opportunities into the distant future This book therefore begins with a description of the IBM simulator The second chapter gives an advanced introduction to the physical basis for Monte Carlo simulations and an outlook on why complex effects such as collisional broadening and intracollisional field effects can be important and how they can be included in the simulations References to more basic intro the book The third chapter ductory material can be found throughout describes a typical relationship of Monte Carlo simulations to experimental data and indicates a major difficulty the vast number of deformation poten tials required to simulate transport throughout the entire Brillouin zone The fourth chapter addresses possible further extensions of the Monte Carlo approach and subtleties of the electron electron interaction
   A Variance-reduced Electrothermal Monte Carlo Method for Semiconductor Device Simulation Orazio Muscato,Vincenza Di Stefano,Wolfgang Wagner,2012   Monte Carlo Simulation of Semiconductor Devices C. Moglestue,2013-04-17 Particle simulation of semiconductor devices is a rather new field which has started to catch the interest of the world s scientific community It represents a time continuous solution of Boltzmann s transport equation or its quantum mechanical equivalent and the field equation without encountering the usual numerical problems associated with

the direct solution The technique is based on first physical principles by following in detail the transport histories of indi vidual particles and gives a profound insight into the physics of semiconductor devices The method can be applied to devices of any geometrical complexity and material composition It yields an accurate description of the device which is not limited by the assumptions made behind the alternative drift diffusion and hydrodynamic models which represent approximate solutions to the transport equation While the development of the particle modelling technique has been hampered in the past by the cost of computer time today this should not be held against using a method which gives a profound physical insight into individual devices and can be used to predict the properties of devices not yet manufactured Employed in this way it can save the developer much time and large sums of money both important considerations for the laboratory which wants to keep abreast of the field of device research Applying it to al ready existing electronic components may lead to novel ideas for their improvement The Monte Carlo particle simulation technique is applicable to microelectronic components of any arbitrary shape and complexity **Simulation of Semiconductor Devices and Processes** Heiner Ryssel,Peter Pichler,2012-12-06 SISDEP 95 provides an international forum for the presentation of state of the art research and development results in the area of numerical process and device simulation Continuously shrinking device dimensions the use of new materials and advanced processing steps in the manufacturing of semiconductor devices require new and improved software The trend towards increasing complexity in structures and process technology demands advanced models describing all basic effects and sophisticated two and three dimensional tools for almost arbitrarily designed geometries The book contains the latest results obtained by scientists from more than 20 countries on process simulation and modeling simulation of process equipment device modeling and simulation of novel devices power semiconductors and sensors on device simulation and parameter extraction for circuit models practical application of simulation numerical methods and software *Simulation of Semiconductor Devices and Processes, Vol. 5* Siegfried Selberherr,Hannes Stippel,Ernst Strasser,1993 **Compound Semiconductor Device Modelling** Christopher M. Snowden,Robert E. Miles,2012-12-06 Compound semiconductor devices form the foundation of solid state microwave and optoelectronic technologies used in many modern communication systems In common with their low frequency counterparts these devices are often represented using equivalent circuit models but it is often necessary to resort to physical models in order to gain insight into the detailed operation of compound semiconductor devices Many of the earliest physical models were indeed developed to understand the unusual phenomena which occur at high frequencies Such was the case with the Gunn and IMPATI diodes which led to an increased interest in using numerical simulation methods Contemporary devices often have feature sizes so small that they no longer operate within the familiar traditional framework and hot electron or even quantum mechanical models are required The need for accurate and efficient models suitable for computer aided design has increased with the demand for a wider range of integrated devices for operation at microwave millimetre and optical frequencies The apparent complexity of equivalent

circuit and physics based models distinguishes high frequency devices from their low frequency counterparts Over the past twenty years a wide range of modelling techniques have emerged suitable for describing the operation of compound semiconductor devices This book brings together for the first time the most popular techniques in everyday use by engineers and scientists The book specifically addresses the requirements and techniques suitable for modelling GaAs InP ternary and quaternary semiconductor devices found in modern technology   Progress In Computational Physics Of Matter: Methods, Software And Applications Franca Manghi,Luciano Reatto,1995-12-21 The aim of the book is to describe some of the recent advances through computer simulation in a broad sense in the understanding of the complex processes occurring in solids and liquids The rapid growth of computer power including the new parallel processors has stimulated a ferment of new theoretical and computational ideas which have been developed in particular by the authors in a pluriennal research project supported by Consiglio Nazionale delle Ricerche CNR for the development of novel software for large scale computations The book will cover advances in ab initio Car Parrinello molecular dynamics quantum monte carlo simulations self consistent density functional computation of electronic states classical molecular dynamics simulation of thermodynamic processes chemical reactions and transport properties Besides the description of the results of these techniques in leading edge applications the book will address specific aspects of the algorithms and software which have been developed by the authors in order to implement in an efficient way the new theoretical advances in these computationally intensive problems These aspects which are generally not discussed in any detail in the literature can be of great help for newcomers in the field

Physics of Semiconductor Devices K. N. Bhat,A. Dasgupta,2004 Contributed papers of the workshop held at IIT Madras in 2003   **Springer Handbook of Semiconductor Devices** Massimo Rudan,Rossella Brunetti,Susanna Reggiani,2022-11-10 This Springer Handbook comprehensively covers the topic of semiconductor devices embracing all aspects from theoretical background to fabrication modeling and applications Nearly 100 leading scientists from industry and academia were selected to write the handbook s chapters which were conceived for professionals and practitioners material scientists physicists and electrical engineers working at universities industrial R D and manufacturers Starting from the description of the relevant technological aspects and fabrication steps the handbook proceeds with a section fully devoted to the main conventional semiconductor devices like e g bipolar transistors and MOS capacitors and transistors used in the production of the standard integrated circuits and the corresponding physical models In the subsequent chapters the scaling issues of the semiconductor device technology are addressed followed by the description of novel concept based semiconductor devices The last section illustrates the numerical simulation methods ranging from the fabrication processes to the device performances Each chapter is self contained and refers to related topics treated in other chapters when necessary so that the reader interested in a specific subject can easily identify a personal reading path through the vast contents of the handbook   **Deterministic Solvers for the Boltzmann Transport Equation** Sung-Min Hong,Anh-Tuan Pham,Christoph

Jungemann,2011-07-31 The book covers all aspects from the expansion of the Boltzmann transport equation with harmonic functions to application to devices where transport in the bulk and in inversion layers is considered The important aspects of stabilization and band structure mapping are discussed in detail This is done not only for the full band structure of the 3D k space but also for the warped band structure of the quasi 2D hole gas Efficient methods for building the Schr dinger equation for arbitrary surface or strain directions gridding of the 2D k space and solving it together with the other two equations are presented **Algorithms & Architectures** Tatsuo Ishiguro,1993-01-01 **Handbook of Integrated Circuit Industry** Yangyuan Wang,Min-Hwa Chi,Jesse Jen-Chung Lou,Chun-Zhang Chen,2023-11-27 Written by hundreds experts who have made contributions to both enterprise and academics research these excellent reference books provide all necessary knowledge of the whole industrial chain of integrated circuits and cover topics related to the technology evolution trends fabrication applications new materials equipment economy investment and industrial developments of integrated circuits Especially the coverage is broad in scope and deep enough for all kind of readers being interested in integrated circuit industry Remarkable data collection update marketing evaluation enough working knowledge of integrated circuit fabrication clear and accessible category of integrated circuit products and good equipment insight explanation etc can make general readers build up a clear overview about the whole integrated circuit industry This encyclopedia is designed as a reference book for scientists and engineers actively involved in integrated circuit research and development field In addition this book provides enough guide lines and knowledges to benefit enterprisers being interested in integrated circuit industry **Dynamic Flowsheet Simulation of Solids Processes** Stefan Heinrich,2020-06-20 This book presents the latest advances in flowsheet simulation of solids processes focusing on the dynamic behaviour of systems with interconnected solids processing units but also covering stationary simulation The book includes the modelling of solids processing units for example for comminution sifting and particle formulation and also for reaction systems Furthermore it examines new approaches for the description of solids and their property distributions and for the mathematical treatment of flowsheets with multivariate population balances **Technologies for the Information Society** Jean-Yves Roger,Brian Stanford-Smith,Paul T. Kidd,1998 GATEWAYS TO DEMOCRACY continues with its framework of gateways to help readers conceptualize participation and civic engagement even democracy itself with reference to how individuals access the political system This approach helps readers better see the relevance of government in their lives GATEWAYS uniquely incorporates policy into a section at the end of each chapter helping readers better understand the connection between public opinion policy making and how public policy applies to their lives The second edition complete with 2012 election updates emphasizes critical thinking by clearly outlining learning outcomes and enhancing learning with self assessment Checkpoints and a clear chapter study plan Chapters in this ESSENTIALS version are condensed to accommodate a shorter format but preserve the integrity of the text s hallmarks **The Physics of Submicron Semiconductor Devices** Harold L.

Grubin,David K. Ferry,C. Jacoboni,2013-11-11 The papers contained in the volume represent lectures delivered as a 1983 NATO ASI held at Urbino Italy The lecture series was designed to identify the key submicron and ultrasubmicron device physics transport materials and contact issues Nonequilibrium transport quantum transport interfacial and size constraints issues were also highlighted The ASI was supported by NATO and the European Research Office H L Grubin D K Ferry C Jacoboni v CONTENTS MODELLING OF SUB MICRON DEVICES 1 E Constant BOLTZMANN TRANSPORT EQUATION 33 K Hess TRANSPORT AND MATERIAL CONSIDERATIONS FOR SUBMICRON DEVICES 45 H L Grubin EPITAXIAL GROWTH FOR SUB MICRON STRUCTURES 179 C E C Wood INSULATOR SEMICONDUCTOR INTERFACES 195 C W Wilms en THEORY OF THE ELECTRONIC STRUCTURE OF SEMICONDUCTOR SURFACES AND INTERFACES 223 C Calandra DEEP LEVELS AT COMPOUND SEMICONDUCTOR INTERFACES 253 W Monch ENSEMBLE MONTE CARLO TECHNIqUES 289 C Jacoboni NOISE AND DIFFUSION IN SUBMICRON STRUCTURES 323 L Reggiani SUPERLATTICES 361 K Hess SUBMICRON LITHOGRAPHY 373 C D W Wilkinson and S P Beaumont QUANTUM EFFECTS IN DEVICE STRUCTURES DUE TO SUBMICRON CONFINEMENT IN ONE DIMENSION 401 B D McCombe vii viii CONTENTS PHYSICS OF HETEROSTRUCTURES AND HETEROSTRUCTURE DEVICES 445 P J Price CORRELATION EFFECTS IN SHORT TIME NONS TAT I ONARY TRANSPORT 477 J J Niez DEVICE DEVICE INTERACTIONS 503 D K Ferry QUANTUM TRANSPORT AND THE WIGNER FUNCTION 521 G J Iafrate FAR INFRARED MEASUREMENTS OF VELOCITY OVERSHOOT AND HOT ELECTRON DYNAMICS IN SEMICONDUCTOR DEVICES 577 S J Allen Jr **Compound Semiconductor Electronics, The Age Of Maturity** T W Crowe,Tor A Fjeldly,Steve Long,Michael S Shur,R J Trew,1996-11-26 In many respects compound semiconductor technology has reached the age of maturity when applications will have been defined yields are high enough and well established and gallium arsenide and related compounds have carved many important niches in electronics This book reviews the state of the art of compound semiconductor electronics It covers the microwave millimeter wave and submillimeter wave devices monolithic microwave and digital integrated circuits made from compound semiconductors and emerging wide band semiconductor materials The book is written by leading experts in compound semiconductor electronics from industry and academia and strikes the balance between practical applications record breaking results and design and modeling tools specific for compound semiconductor technology Engineers scientists and graduate students working in solid state electronics and especially in the area of compound semiconductor electronics will find this book very useful It could also be used as a text or a supplementary text for graduate courses in this field **POWER/HVMOS Devices Compact Modeling** Wladyslaw Grabinski,Thomas Gneiting,2010-07-20 Semiconductor power electronics plays a dominant role due its increased efficiency and high reliability in various domains including the medium and high electrical drives automotive and aircraft applications electrical power conversion etc Power HVMOS Devices Compact Modeling will cover very extensive range of topics related to the development and characterization power high voltage HV semiconductor technologies as well

as modeling and simulations of the power HV devices and smart power integrated circuits ICs Emphasis is placed on the practical applications of the advanced semiconductor technologies and the device level compact spice modeling This book is intended to provide reference information by selected leading authorities in their domain of expertise They are representing both academia and industry All of them have been chosen because of their intimate knowledge of their subjects as well as their ability to present them in an easily understandable manner

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