

Christoph Jungemann, Bernd Meinerzhagen

Hierarchical Device Simulation

The Monte-Carlo Perspective

This monograph is intended for scientists and TCAD engineers who are interested in physics-based simulation of Si and SiGe devices. The common theoretical background of the drift-diffusion, hydrodynamic, and Monte-Carlo models and their synergy are discussed and it is shown how these models form a consistent hierarchy of simulation tools.

The basis of this hierarchy is the full-band Monte-Carlo device model which is discussed in detail, including its numerical and stochastic properties. The drift-diffusion and hydrodynamic models for large-signal, small-signal, and noise analysis are derived from the Boltzmann transport equation in such a way that all transport and noise parameters can be obtained by Monte-Carlo simulations. With this hierarchy of simulation tools the device characteristics of strained Si MOSFETs and SiGe HBTs are analysed and the accuracy of the momentum-based models is assessed by comparison with the Monte-Carlo device simulator.

for contents please see overleaf

SpringerEngineering

2003. XVI, 254 pages. 147 figures.

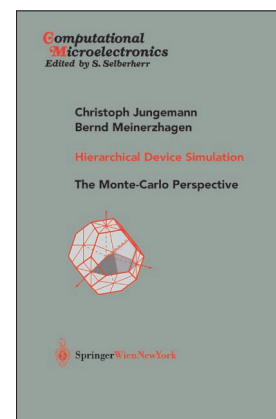
Hardcover **EUR 120,-**

(Recommended retail price)

Net-price subject to local VAT.

ISBN 3-211-01361-X

Computational Microelectronics



SpringerWienNewYork

Table of Contents:

Introduction

References

Semiclassical Transport Theory

The Boltzmann Transport Equation • Balance Equations • The Microscopic Relaxation Time • Fluctuations in the Steady-State • References

The Monte-Carlo Method

Basic Monte-Carlo Methods • The Monte-Carlo Solver of the Boltzmann Equation • Velocity Autocorrelation Function • Basic Statistics • Convergence Estimation • References

Scattering Mechanisms

Phonon Scattering • Alloy Scattering • Impurity Scattering • Impact Ionization by Electrons • Surface Roughness Scattering • References

Full-Band Structure

Basic Properties of the Band Structure of Relaxed Silicon • Basic Properties of the Band Structure of Strained SiGe • k-Space Grid • Calculation of the Density of States • Mass Tensor Evaluation • Particle Motion in Phase-Space • Selection of a Final State in k-Space • References

Device Simulation

Device Discretization • Band Edges • Poisson Equation • Self-Consistent Device Simulation • Nonlinear Poisson Equation • Nonself-Consistent Device Simulation • Statistical Enhancement • Terminal Current Estimation • Contact Resistance • Normalization of Physical Quantities • References

Momentum-Based Transport Models

The Hydrodynamic Model • Small-Signal Analysis • Noise Analysis • The Drift-Diffusion Model • Transport and Noise Parameter Simulation • References

Stochastic Properties of Monte-Carlo Device Simulations

Stochastic Error • In-Advance CPU Time Estimation • References

Results

N+ NN+ and P+ PP+ Structures • MOSFETs • SiGe HBTs

Subject Index

Order Form

I order herewith copy/ies:

Christoph Jungemann, Bernd Meinerzhagen,

Hierarchical Device Simulation

2003. Hardcover EUR 120,-

ISBN 3-211-01361-X

Computational Microelectronics

Name

Address

Date/Signature

Please bill me

Please charge my credit card

Visa Mastercard Amex Diners

Card No. Expiry date

Please order through your bookseller or directly from

Springer-Verlag

- A-1201 Wien, P.O. Box 89, Tel. +43.1.330 24 15-0
Fax +43.1.330 24 26, e-mail: books@springer.at, www.springer.at
- D-69126 Heidelberg, Haberstraße 7, Tel. +49.6221.345-0
Fax +49.6221.345-4229, e-mail: orders@springer.de
- USA, Secaucus, NJ 07096-2485, P.O. Box 2485, Toll-Free:
1-800-Springer, Fax +1.201.348-4505, e-mail: orders@springer-ny.com
- Eastern Book Service, Japan, Tokyo 113-8480, Hongo 3-chome
Bunkyo-ku, 3-13, Tel. +81.3.38 18 08 61, Fax +81.3.38 18 08 64
e-mail: orders@svt-eps.co.jp

Recommended retail price. Net-price subject to local VAT.
WB 1620.06.03.VI. Printed in Austria. Prices are subject to change without notice.



SpringerWienNewYork