



Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation

Dragica Vasileska, Stephen M. Goodnick, Gerhard Klimeck

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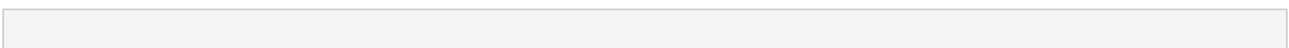
Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation Dragica Vasileska, Stephen M. Goodnick, Gerhard Klimeck

Starting with the simplest semiclassical approaches and ending with the description of complex fully quantum-mechanical methods for quantum transport analysis of state-of-the-art devices, **Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation** provides a comprehensive overview of the essential techniques and methods for effectively analyzing transport in semiconductor devices.

With the transistor reaching its limits and new device designs and paradigms of operation being explored, this timely resource delivers the simulation methods needed to properly model state-of-the-art nanoscale devices. The first part examines semiclassical transport methods, including drift-diffusion, hydrodynamic, and Monte Carlo methods for solving the Boltzmann transport equation. Details regarding numerical implementation and sample codes are provided as templates for sophisticated simulation software.

The second part introduces the density gradient method, quantum hydrodynamics, and the concept of effective potentials used to account for quantum-mechanical space quantization effects in particle-based simulators. Highlighting the need for quantum transport approaches, it describes various quantum effects that appear in current and future devices being mass-produced or fabricated as a proof of concept. In this context, it introduces the concept of effective potential used to approximately include quantum-mechanical space-quantization effects within the semiclassical particle-based device simulation scheme.

Addressing the practical aspects of computational electronics, this authoritative resource concludes by addressing some of the open questions related to quantum transport not covered in most books. Complete with self-study problems and numerous examples throughout, this book supplies readers with the practical understanding required to create their own simulators.



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