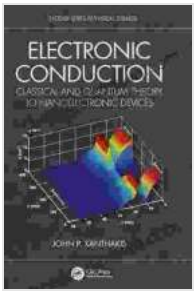
Classical And Quantum Theory To Nanoelectronic Devices: A Textbook In Physical Phenomena, Modeling, and Simulation

: Bridging the Gap Between Two Worlds

The convergence of classical and quantum theory has revolutionized our understanding of the physical world, particularly in the realm of nanoelectronics. This textbook provides a comprehensive exploration of the fundamental principles and cutting-edge applications that underpin this rapidly evolving field.



Electronic Conduction: Classical and Quantum Theory to Nanoelectronic Devices (Textbook Series in Physical Sciences) by Iwan Rhys Morus

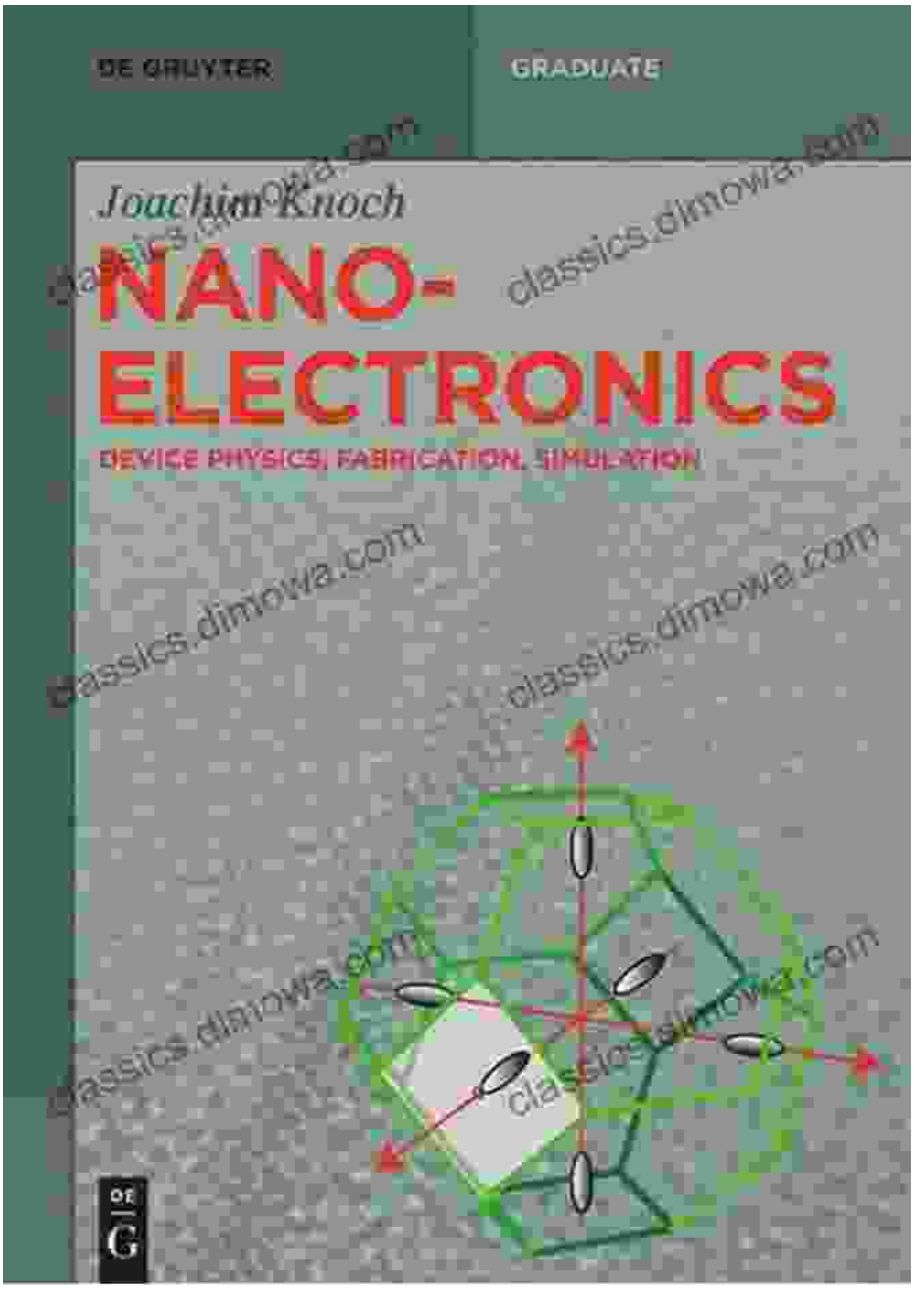
★★★★★ 5 out of 5

Language	: English
File size	: 7256 KB
Text-to-Speech	: Enabled
Enhanced typesetting	: Enabled
Print length	: 310 pages
Screen Reader	: Supported
Paperback	: 288 pages
Item Weight	: 10.6 ounces
Dimensions	: 4.33 x 0.87 x 7.09 inches
X-Ray for textbooks	: Enabled

Nanoelectronics deals with electronic devices and systems that operate at the nanoscale, where quantum effects become significant. Understanding the interplay between classical and quantum physics is crucial for designing and optimizing these devices, which hold immense potential for advancements in computation, communication, and energy technologies.

Chapter 1: Classical Physics and Semiconductor Physics

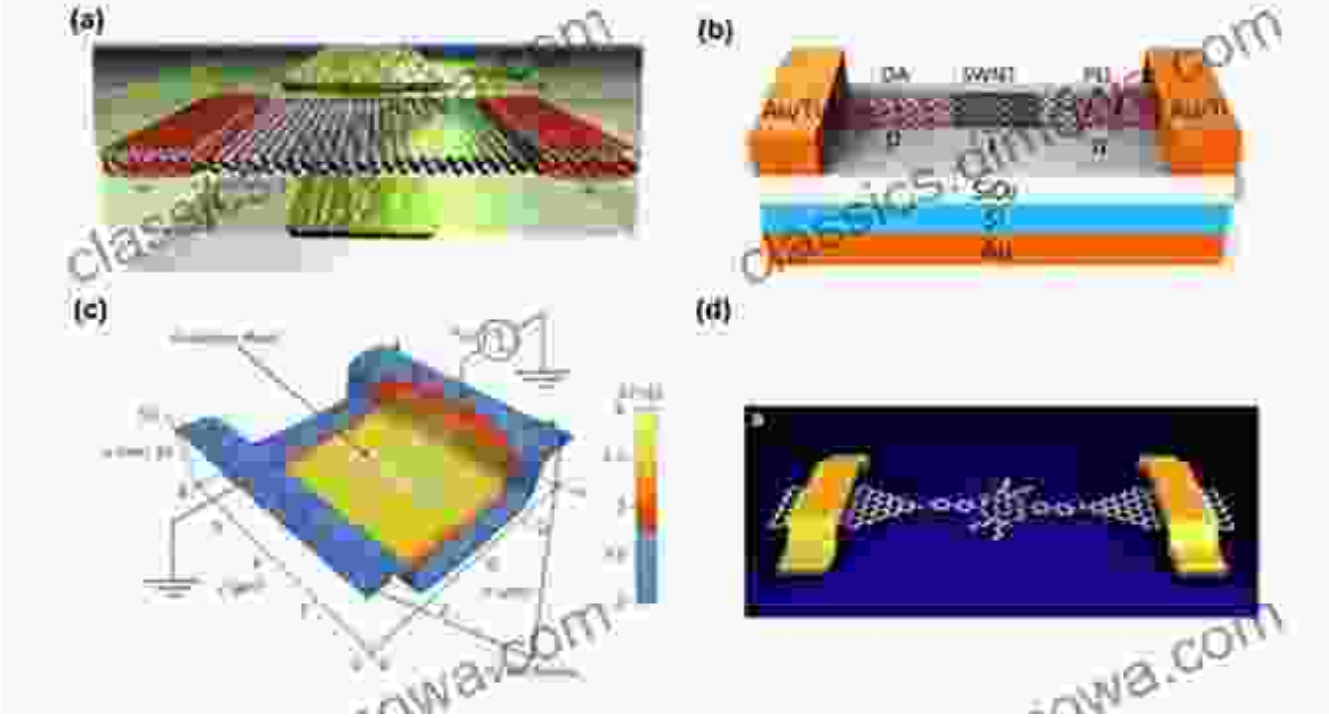
This chapter lays the foundation by introducing the fundamental concepts of classical physics that govern electronic devices. It covers topics such as electromagnetism, semiconductor materials, and device structures.



Chapter 2: Quantum Mechanics and Quantum Effects

Chapter 2 delves into the realm of quantum mechanics, introducing the principles that govern the behavior of electrons at the nanoscale. It covers concepts such as wave-particle duality, quantization, and quantum states.

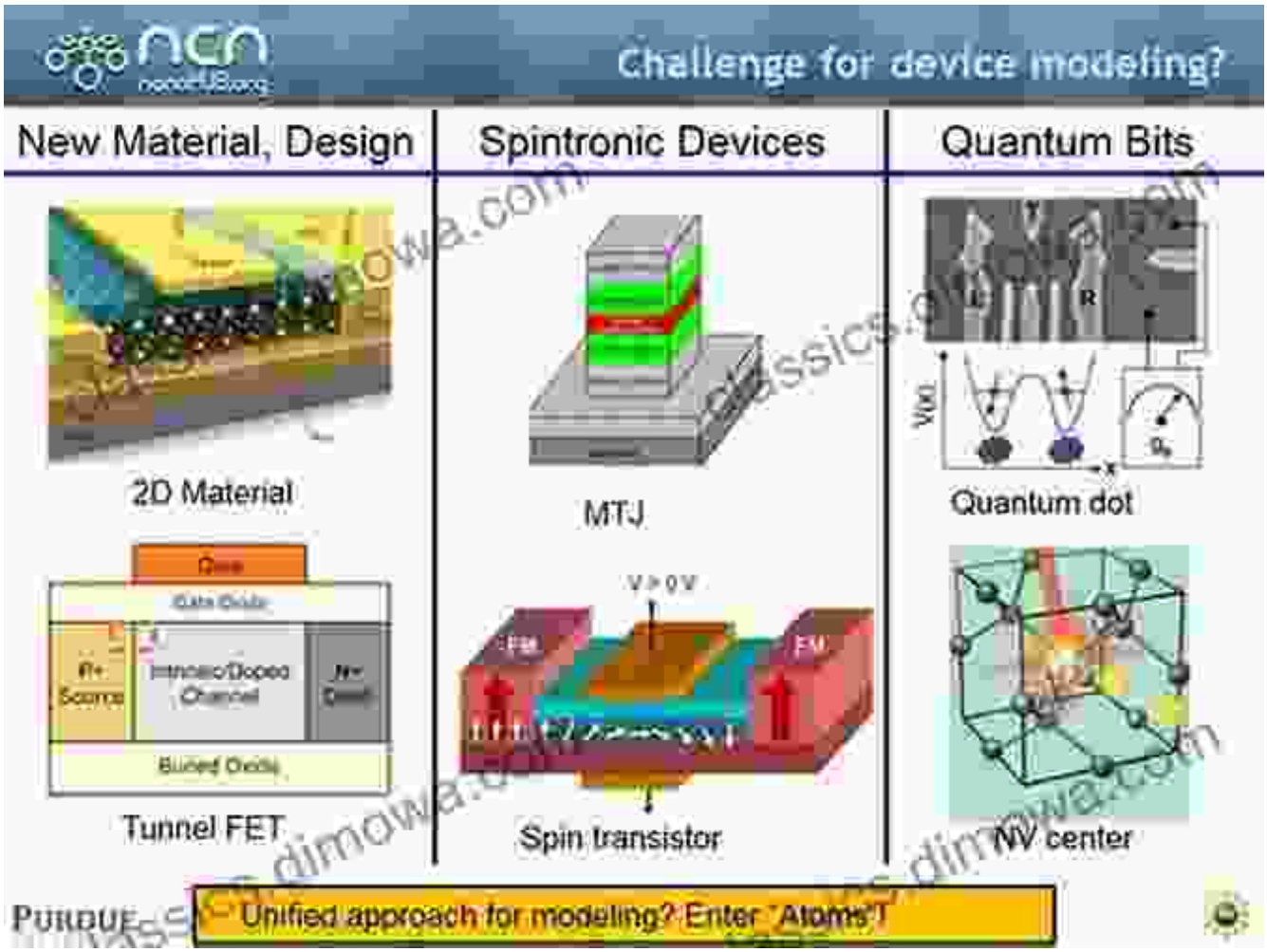
epicts various types of nanoelectronic devices, including a metal-oxide-semiconductor field-effect
) [18], a carbon-nanotube-based transistor [19], a graphene-sheet-based transistor [20–22], and a
23–26].



Quantum mechanics plays a pivotal role in understanding electron behavior at the nanoscale.

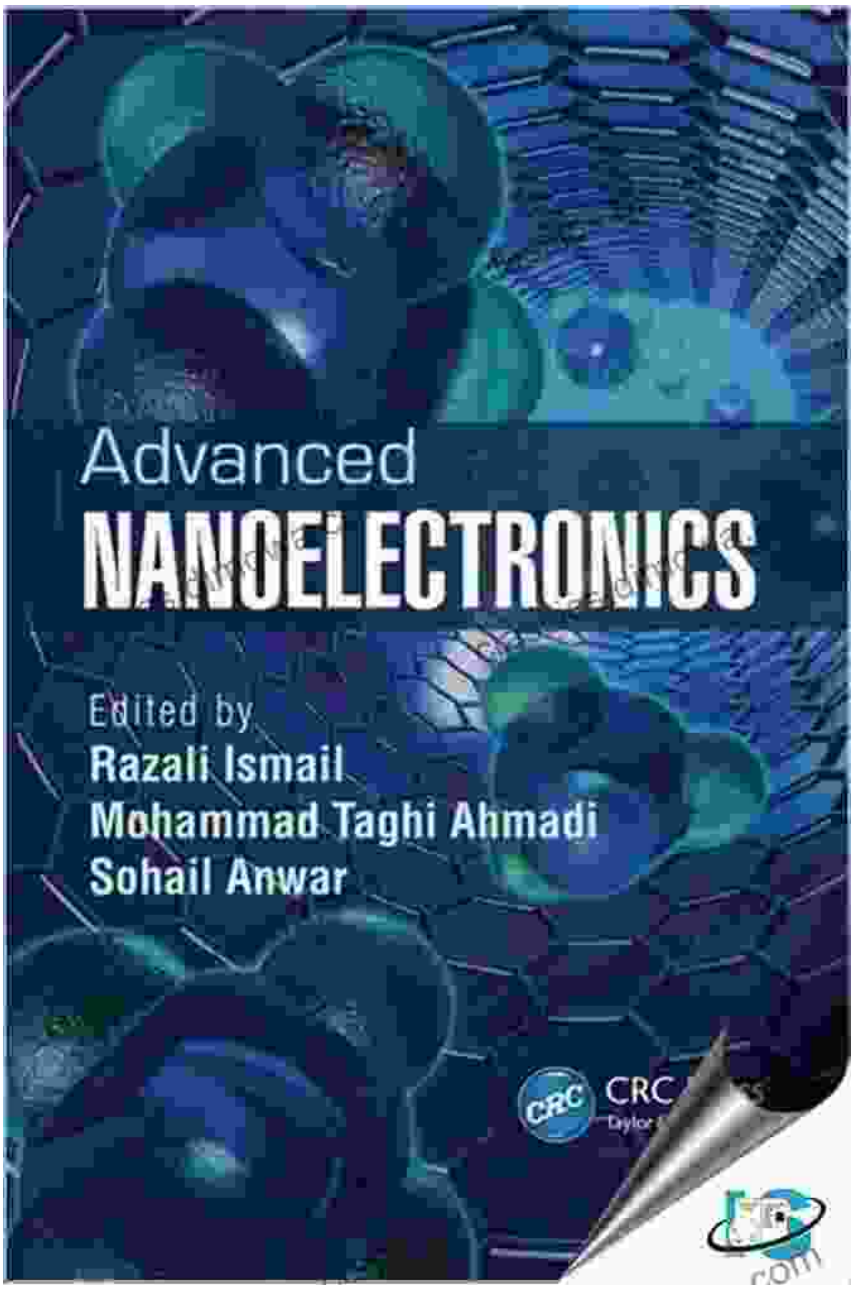
Chapter 3: Device Modeling and Simulation

Chapter 3 bridges the gap between theory and practice, demonstrating how classical and quantum principles are used to model and simulate nanoelectronic devices. It covers techniques such as the Schrödinger equation, density functional theory, and Monte Carlo methods.



Chapter 4: Advanced Topics in Nanoelectronics

This chapter explores advanced topics at the forefront of nanoelectronics research, including spintronics, plasmonics, and molecular electronics. It discusses the potential applications of these technologies in emerging fields such as quantum computing and nanomedicine.



Cutting-edge technologies are pushing the boundaries of nanoelectronics.

: The Future of Nanoelectronics

In the concluding chapter, the authors provide a glimpse into the future of nanoelectronics, highlighting emerging trends and future research directions. They emphasize the importance of interdisciplinary collaboration

and ongoing advancements in both classical and quantum physics to unlock the full potential of this transformative technology.

Target Audience

This textbook is intended for:

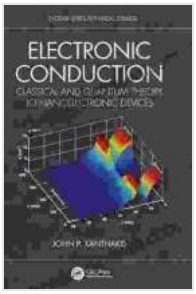
- Undergraduate and graduate students pursuing degrees in electrical engineering, physics, and materials science
- Researchers and engineers working in the field of nanoelectronics
- Anyone interested in understanding the convergence of classical and quantum theory in the design and application of nanoelectronic devices

Key Features

- Comprehensive coverage of classical and quantum theory in nanoelectronics
- Detailed explanations with clear examples and illustrations
- In-depth exploration of device modeling and simulation techniques
- Discussion of advanced topics and emerging trends in nanoelectronics
- Real-world applications and case studies

About the Authors

The authors are renowned experts in the field of nanoelectronics with extensive experience in teaching, research, and industry. Their expertise ensures the accuracy and depth of the textbook's content.



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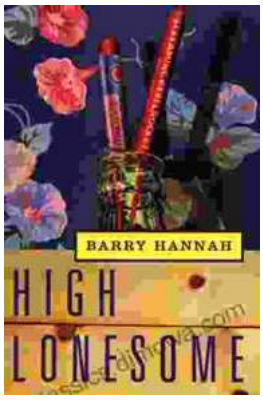

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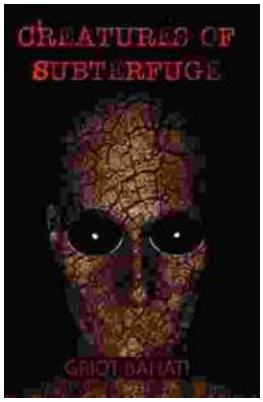

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