



Introduction to the Physics of Nanoelectronics (Woodhead Publishing Series in Electronic and Optical Materials)

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This book provides an introduction to the physics of nanoelectronics, with a focus on the theoretical aspects of nanoscale devices. The book begins with an overview of the mathematics and quantum mechanics pertaining to nanoscale electronics, to facilitate the understanding of subsequent chapters. It goes on to encompass quantum electronics, spintronics, Hall effects, carbon and graphene electronics, and topological physics in nanoscale devices.

Theoretical methodology is developed using quantum mechanical and non-equilibrium Green's function (NEGF) techniques to calculate electronic currents and elucidate their transport properties at the atomic scale. The spin Hall effect is explained and its application to the emerging field of spintronics – where an electron's spin as well as its charge is utilised – is discussed. Topological dynamics and gauge potential are introduced with the relevant mathematics, and their application in nanoelectronic systems is explained. Graphene, one of the most promising carbon-based nanostructures for nanoelectronics, is also explored.

- Begins with an overview of the mathematics and quantum mechanics pertaining to nanoscale electronics
- Encompasses quantum electronics, spintronics, Hall effects, carbon and graphene electronics, and topological physics in nanoscale devices
- Comprehensively introduces topological dynamics and gauge potential with the relevant mathematics, and extensively discusses their application in nanoelectronic systems



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