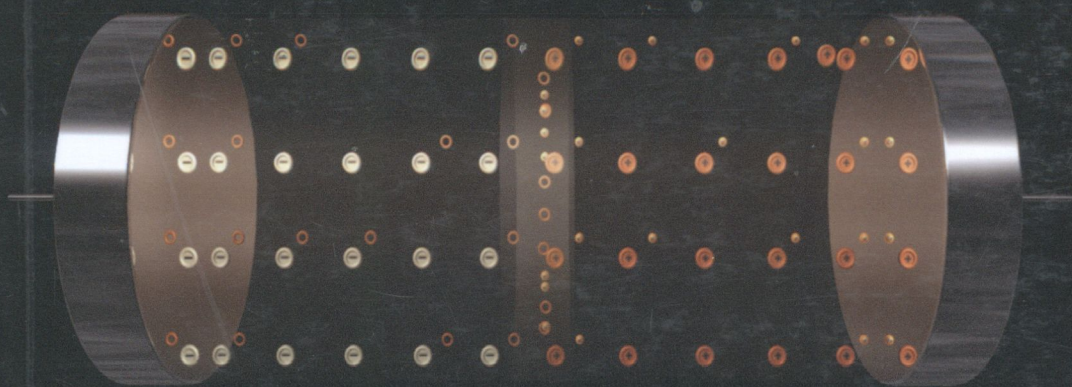


ESSENTIALS OF SEMICONDUCTOR DEVICE PHYSICS



EMILIANO R. MARTINS

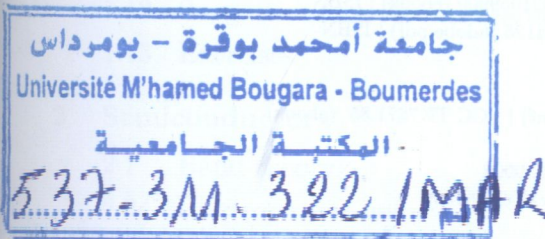
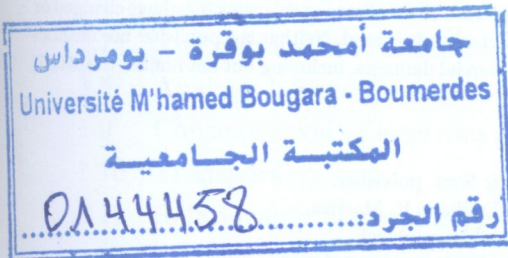
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Essentials of Semiconductor Device Physics

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An introductory semiconductor device physics textbook that is accessible to readers without a background in statistical physics

The subject of this book is the physics of semiconductor devices, which is an important topic in engineering and physics because it forms the background for electronic and optoelectronic devices including solar cells. The author aims to provide students and teachers with a concise text that focuses on semiconductor devices and covers the necessary background in statistical physics.

This text introduces the key prerequisite knowledge in a simple, clear, and friendly manner. It distills the key concepts of semiconductor devices down to their essentials, enabling students to master this key subject in engineering, physics, and materials. The subject matter treated in this book is directly connected to the physics of p-n junctions and solar cells, which has become a topic of intense interest in the last decade. Sample topics covered within the text include:

- Chemical potential, Fermi level, Fermi-Dirac distribution, drift current and diffusion current
- The physics of semiconductors, band theory and intuitive derivations of the concentration of charge carriers.
- The p-n junction, with qualitative analysis preceding the mathematical descriptions.
- A derivation of the current vs voltage relation in p-n junctions (Shockley equation).
- Important applications of p-n junctions, including solar cells
- The two main types of transistors: Bipolar Junction Transistors (BJT) and Metal Oxide Semiconductor Field Effect Transistors (MOSFET)

For students and instructors, it may be used as a primary textbook for an introductory semiconductor device physics course and is suitable for a course of approximately 30-50 hours. Scientists studying and researching semiconductor devices in general, and solar cells in particular, will also benefit from the clear and intuitive explanations found in this book.

Emiliano R. Martins obtained his PhD in 2014 from the University of St. Andrews (UK) in the field of photonics, which deals with the interaction between light and matter in semiconductor devices. His research field involves solar cells and other optoelectronic devices and he has been teaching a course on semiconductor device physics since 2016 at the University of São Paulo in Brazil. He has written unpublished books for other undergraduate disciplines that he teaches including signals and systems and digital signal processing.

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