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Sommario/riassunto

This book charts the exciting transition from nanotechnology to picotechnology, moving from manipulating matter at the nanoscale to engineering structures at atomic and molecular levels. Beginning with the fundamentals of nanotechnology, it describes how materials and devices designed at the nanoscale (1 to 100 nanometers) have already revolutionized fields like electronics and medicine. It then discusses advancements in sub-nanometer precision, enabled by techniques such as scanning probe microscopy (SPM), which allow scientists to manipulate individual atoms and molecules with exceptional accuracy. This book further examines atomic-scale engineering, where tools like scanning tunneling microscopy (STM) and atomic force microscopy (AFM) facilitate the precise arrangement of atoms to create specific structures. It also covers molecular nanotechnology, which extends these principles to the design and assembly of complex molecular structures and machines, drawing inspiration from biological systems. In exploring applications, this book highlights how atomic and molecular scale engineering could revolutionize electronics with single-atom transistors and molecular-scale circuits, and transform medicine with advanced drug delivery systems and nanoscale sensors. In addition, applications in environmental remediation, energy storage, computing, and communication systems are presented. Despite the significant challenges, such as achieving precise control and ensuring scalability, the potential for breakthroughs is immense. The journey from nanotechnology to atomic and molecular scale engineering is a crucial step towards the vision of picotechnology, promising groundbreaking advancements with profound impacts on science, technology, and society.