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Contact Mechanics Nanohub

nanoHUB-U Fundamentals of AFM L2.5: Tip-Surface Interactions (Contact) - Contact Mechanics nanoHUB-U Fundamentals of AFM L2.4: Tip-Surface Interactions (Contact) - Elasticity of Materials ME 597 Lecture 8: Introduction to Contact Mechanics nanoHUB-U Fundamentals of AFM L1.5: Tip-Surface Interactions (Non-Contact) - Keesom Force nanoHUB-U Fundamentals of AFM L2.2: Tip-Surface Interactions (Contact) - Surface Energies nanoHUB-U Fundamentals of AFM L2.6: Tip-Surface Interactions (Contact) - Hertz, JKR, DMT nanoHUB-U Fundamentals of AFM L2.1: Tip-Surface Interactions (Contact) - Hamaker Contact Mechanics - Part 1 PFM Lecture 2: Contact mechanics and Resolution theory Near-equlibrium Transport Lecture 1: Introduction Quantum Transport, Lecture 6: Quantum Point Contacts II Lecture 1, Quantum Transport, 2017 Fall Cornell, ECE5390/MSE5472 Near-equilibrium Transport Lecture 7: Boltzmann Transport Equation IWCE 2015: Non-Equilibrium Green's Function (NEGF): A Different Perspective Complex Numbers in Quantum Mechanics Decoding nature’s masterful engineering using math (TMEB #2) Measuring Material Stiffness and Adhesion On The Nanoscale With AFM Stress Analysis: Contact Stresses, Energy Method (5 of 17) L15, Mariana Rossi, Ab initio molecular dynamics nanoHUB-U Fundamentals of AFM L1.3: Tip-Surface Interactions (Non-Contact) - Physical Models Multiscale contact mechanics for rough surfaces with applications to fluid flow at interfaces Development and application of asymptotic methods to study fracture and contact mechanics 2_2 nanoHUB-U Fundamentals of AFM L2.3: Tip-Surface Interactions (Contact) - Dejaugin Approximation Lecture on the Method of Dimensionality Reduction (MDR) in Contact Mechanics and Friction Contact Mechanics and Viscoelasticity - Kenneth R. Shull nanoHUB-U Fundamentals of AFM L3.5: AFM-The Instrument - Contact Mode Scans Fundamentals of Friction, day 1, Contact Mechanics, Johnson and Landman nanoHUB-U Fundamentals of AFM L3.1: AFM-The Instrument - The Water Meniscus Reception of Int. Conf. on Contact Mechanics on the occasion of 60th birthday of Prof Valentin Popov nanoHUB-U Fundamentals of Nanoelectronics A L1.1: The New Perspective: Introduction

Continuum Scale Simulation of Engineering Materials
Theory and Practice
Properties and Devices
Integrated Computational Materials Engineering
Atomic Physics
Systems, Devices, and Structures
Initiation and Growth of Explosion in Liquids and Solids
Semiclassical and Quantum Device Modeling and Simulation
Modeling Materials
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Devices and Applications
Lessons from Nanoelectronics
MEMS and NEMS

Contact Mechanics Nanohub *OMB No. 6501896823259 edited by*

CALLAHAN WASHINGTON

Continuum Scale Simulation of Engineering Materials BoD – Books on Demand

Advances in semiconductor technology have made possible the fabrication of structures whose dimensions are much smaller than the mean free path of an electron. This book gives a thorough account of the theory of electronic transport in such mesoscopic systems. After an initial chapter covering fundamental concepts, the transmission function formalism is presented, and used to describe three key topics in mesoscopic physics: the quantum Hall effect; localisation; and double-barrier tunnelling. Other sections include a discussion of optical analogies to mesoscopic phenomena, and the book concludes with a description of the non-equilibrium Green's function formalism and its relation to the transmission formalism. Complete with problems and solutions,

the book will be of great interest to graduate students of mesoscopic physics and nanoelectronic device engineering, as well as to established researchers in these fields.

Theory and Practice

CUP Archive
Since its invention in 1982, scanning tunneling microscopy (STM) has enabled users to obtain images reflecting surface electronic structure with atomic resolution. This technology has proved indispensable as a characterization tool with applications in surface physics, chemistry, materials science, bio-science, and data storage media. It has also shown great potential in areas such as the semiconductor and optical quality control industries. Scanning Force Microscopy, Revised Edition updates the earlier edition's survey of the many rapidly developing subjects concerning the mapping of a variety of forces across surfaces, including basic theory, instrumentation, and applications. It also includes important new research in STM and a thoroughly revised bibliography. Academic and industrial researchers using STM, or wishing to know more about its potential, will find this book an excellent introduction to this rapidly developing field.

Properties and Devices

World Scientific Publishing Company
This book describes the research of Bowden, Yoffe and their collaborators on explosive initiation. What Bowden and Yoffe showed was that explosives are ignited almost invariably by thermal processes and though other processes have been identified their work still holds.

Integrated Computational Materials Engineering

World Scientific
To push MOSFETs to their scaling limits and to explore devices that may complement or even replace them at molecular scale, a clear understanding of device physics at nanometer scale is necessary. Nanoscale Transistors provides a description on the recent development of theory, modeling, and simulation of nanotransistors for electrical engineers, physicists, and chemists working on nanoscale devices. Simple physical pictures and semi-analytical models, which were validated by detailed numerical simulations, are provided for both evolutionary and revolutionary nanotransistors. After basic concepts are reviewed, the text summarizes the essentials of traditional semiconductor devices, digital circuits, and systems to supply a baseline against which new devices can be assessed. A nontraditional view of the MOSFET using concepts that are valid at nanoscale is developed and then applied to nanotube FET as an example of how to extend the concepts to revolutionary nanotransistors. This practical guide then explore the limits of devices by discussing conduction in single molecules

Atomic Physics Oxford University Press on Demand
This book presents the conceptual framework underlying the atomistic theory of matter, emphasizing those aspects that relate to current flow. This includes some of the most advanced concepts of non-equilibrium quantum statistical mechanics. No prior acquaintance with quantum mechanics is assumed. Chapter 1 provides a description of quantum transport in elementary terms accessible to a beginner. The book then works its way from hydrogen to nanostructures, with extensive coverage of current flow. The final chapter summarizes the equations for quantum transport with illustrative examples showing how conductors evolve from the atomic to the ohmic regime as they get larger. Many numerical examples are used to provide concrete illustrations and the corresponding Matlab codes can be downloaded from the web. Videostreamed lectures, keyed to specific sections of the book, are also available through the web. This book is primarily aimed at senior and graduate students.

Systems, Devices, and Structures

CRC Press
This book deals with the adhesion, friction and contact mechanics of living organisms. Further, it presents the remarkable adhesive abilities of the living organisms which inspired the design of novel micro- and nanostructured adhesives that can be used in various applications, such as climbing robots, reusable tapes, and biomedical bandages. The technologies for both the synthesis and construction of bio-inspired adhesive micro- and nanostructures, as well as their performance, are discussed in detail. Representatives of several animal groups, such as insects, spiders, tree frogs, and lizards, are able to walk on (and therefore attach to) tilted, vertical surfaces, and even ceilings in different environments. Studies have demonstrated that their highly specialized micro- and nanostructures, in combination with particular surface chemistries, are responsible for this impressive and reversible adhesion. These structures can maximize the formation of large effective contact areas on surfaces of varying roughness and chemical composition under different environmental conditions.

Morgan & Claypool Publishers
Material properties emerge from phenomena on scales ranging from Angstroms to millimeters, and only a multiscale treatment can provide a complete understanding. Materials researchers must therefore understand fundamental concepts and techniques from different fields, and these are presented in a comprehensive and integrated fashion for the first time in this book. Incorporating continuum mechanics, quantum mechanics, statistical mechanics, atomistic simulations and multiscale techniques, the book explains many of the key theoretical ideas behind multiscale modeling. Classical topics are blended with new techniques to demonstrate the connections between different fields and highlight current research trends. Example applications drawn from modern research on the thermo-mechanical properties of crystalline solids are used as a unifying focus throughout the text. Together with its companion book, Continuum Mechanics and Thermodynamics (Cambridge University Press, 2011), this work presents the complete fundamentals of materials modeling for graduate students and researchers in physics, materials science, chemistry and engineering.

Initiation and Growth of Explosion in Liquids and Solids

World Scientific Publishing Company
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.
Semiclassical and Quantum Device Modeling and Simulation CRC Press
These lecture notes provide a detailed treatment of the thermal energy storage and transport by conduction in natural and fabricated structures. Thermal energy in two carriers, i.e. phonons and electrons — are explored from first principles. For solid-state transport, a common Landauer framework is used for heat flow. Issues including the quantum of thermal conductance, ballistic interface resistance, and carrier scattering are elucidated. Bulk material properties, such as thermal and electrical conductivity, are derived from particle transport theories, and the effects of spatial confinement on these properties are established.
Modeling Materials Springer
This book brings together two broad themes that have generated a great deal of interest and excitement in the scientific and technical community in the last 100 years or so: quantum tunnelling and nonlinear dynamical systems. It applies these themes to nanostructured solid state heterostructures operating at room temperature to gain insight into novel photonic devices, systems and applications.
Proceedings of iCADMA 2020 Springer Science & Business Media
Everyone is familiar with the amazing performance of a modern smartphone, powered by a billion-plus nanotransistors, each having an active region that is barely a few hundred atoms long. The same amazing technology has also led to a deeper understanding of the nature of current flow and heat dissipation on an atomic scale which is of broad relevance to the general problems of non-equilibrium statistical mechanics that pervade many different fields.This book is based on a set of two online courses originally offered in 2012 on nanoHUB-U and more recently in 2015 on edX. In preparing the second edition the author decided to split it into parts A and B titled Basic Concepts and Quantum Transport respectively, along the lines of the two courses. A list of available video lectures corresponding to different sections of this volume is provided upfront.To make these lectures accessible to anyone in any branch of science or engineering, the author assume very little background beyond linear algebra and differential equations. However, the author will be discussing advanced concepts that should be of interest even to specialists, who are encouraged to look at his earlier books for additional technical details.

Surface Acoustic Wave Devices

CRC Press
For modeling the transport of carriers in nanoscale devices, a Green-function formalism is the most accurate approach. Due to the complexity of the formalism, one should have a deep understanding of the underlying principles and use smart approximations and numerical methods for solving the kinetic equations at a reasonable computational time. In this book the required concepts from quantum and statistical mechanics and numerical methods for calculating Green functions are presented. The Green function is studied in detail for systems both under equilibrium and under nonequilibrium conditions. Because the formalism enables rigorous modeling of different scattering mechanisms in terms of self-energies, but an exact evaluation of self-energies for realistic systems is not possible, their approximation and inclusion in the quantum kinetic equations of the Green functions are elaborated. All the elements of the kinetic equations, which are the device Hamiltonian, contact self-energies and scattering self-energies, are examined and efficient methods for their evaluation are explained. Finally, the application of these methods to study novel electronic devices such as nanotubes, graphene, Si-nanowires and low-dimensional thermoelectric devices and photodetectors are discussed.
The Lab on a Tip Now Publishers Inc
Quantum Mechanics: An Introduction for Device Physicists and Electrical Engineers, Third Edition provides a complete course in quantum mechanics for students of semiconductor device physics and electrical engineering. It provides the necessary background to quantum theory for those starting work on micro- and nanoelectronic structures and is particularly useful for those beginning work with modern semiconductors devices, lasers, and qubits. This book was developed from a course the author has taught for many years with a style and order of presentation of material specifically designed for this audience. It introduces the main concepts of quantum mechanics which are important in everyday solid-state physics and electronics. Each topic includes examples which have been carefully chosen to draw upon relevant experimental research. It also includes problems with solutions to test understanding of theory. Full updated throughout, the third edition contains the latest developments, experiments, and device concepts, in addition to three fully revised chapters on operators and expectations and spin angular momentum, it contains completely new material on superconducting devices and approaches to quantum computing.
Advances in Materials Processing and Manufacturing Applications World Scientific
Cloud Computing: Theory and Practice provides students and IT professionals with an in-depth analysis of the cloud from the ground up. Beginning with a discussion of parallel computing and architectures and distributed systems, the book turns to contemporary cloud infrastructures, how they are being deployed at leading companies such as Amazon, Google and Apple, and how they can be applied in fields such as healthcare, banking and science. The volume also examines how to successfully deploy a cloud application across the enterprise using virtualization, resource management and the right amount of networking support, including content delivery networks and storage area networks. Developers will find a complete introduction to application development provided on a variety of platforms. Learn about recent trends in cloud computing in critical areas such as: resource management, security, energy consumption, ethics, and

complex systems Get a detailed hands-on set of practical recipes that help simplify the deployment of a cloud based system for practical use of computing clouds along with an in-depth discussion of several projects Understand the evolution of cloud computing and why the cloud computing paradigm has a better chance to succeed than previous efforts in large-scale distributed computing

Quantum-dot Based Light-emitting Diodes CRC Press

This book presents selected papers from the International Conference on Advances in Materials Processing and Manufacturing Applications (iCADMA 2020), held on November 5–6, 2020, at Malaviya National Institute of Technology, Jaipur, India. iCADMA 2020 proceedings is divided into four topical tracks – Advanced Materials, Materials Manufacturing and Processing, Engineering Optimization and Sustainable Development, and Tribology for Industrial Application.

Devices and Applications Cambridge University Press

the book has been revised to include the postgraduate physics sylabi of indian Universities in addition to the undergraduate honours syllabi covered in the previous edition.Apart from the new addition made in the existing chapters have been added in this edition to deal with the quantum mechanical theories of atomic and molecular structure.

Lessons from Nanoelectronics National Academies Press

This specialist monograph provides an overview of the recent research on the fundamental and applied properties of nanoparticles extracted from cellulose, the most abundant polymer on the planet and an essential renewable resource. The author pioneered the use of cellulose nanoparticles (cellulose nanocrystals or whiskers and cellulose microfibrils) in nanocomposite applications. The book combines a general introduction to cellulose and basic techniques with more advanced chapters on specific properties and applications of nanocellulose.

MEMS and NEMS Springer Science & Business Media

Since their discovery more than a decade ago, carbon nanotubes (CNTs) have held scientists and engineers in captive fascination, seated on the verge of enormous breakthroughs in areas such as medicine, electronics, and materials science, to name but a few. Taking a broad look at CNTs and the tools used to study them, Carbon Nanotubes: Properties and Applications comprises the efforts of leading nanotube researchers led by Michael O'Connell, protégé of the late father of nanotechnology, Richard Smalley. Each chapter is a self-contained treatise on various aspects of CNT synthesis, characterization, modification, and applications. The book opens with a general introduction to the basic characteristics and the history of CNTs, followed by discussions on synthesis methods and the growth of "peapod" structures. Coverage then moves to electronic properties and band structures of single-wall nanotubes (SWNTs), magnetic properties, Raman spectroscopy of electronic and chemical behavior, and electromechanical properties and applications in NEMS (nanoelectromechanical systems). Turning to applications, the final sections of the book explore mechanical properties of SWNTs spun into fibers, sidewall functionalization in composites, and using SWNTs as tips for scanning probe microscopes. Taking a fresh look at this burgeoning field, Carbon Nanotubes: Properties and Applications points the way toward making CNTs commercially viable.

Resonant Tunneling Diode Photonics Cambridge University Press

Cutting-Edge Techniques to Better Analyze and Predict Complex Physical Phenomena Geometric Modeling and Mesh Generation from Scanned Images shows how to integrate image processing, geometric modeling, and mesh generation with the finite element method (FEM) to solve problems in computational biology, medicine, materials science, and engineering. Based on the author's recent research and course at Carnegie Mellon University, the text explains the fundamentals of medical imaging, image processing, computational geometry, mesh generation, visualization, and finite element analysis. It also explores novel and advanced applications in computational biology, medicine, materials science, and other engineering areas. One of the first to cover this emerging interdisciplinary field, the book addresses biomedical/material imaging, image processing, geometric modeling and visualization, FEM, and biomedical and engineering applications. It introduces image-mesh-simulation pipelines, reviews numerical methods used in various modules of the pipelines, and discusses several scanning techniques, including ones to probe polycrystalline materials. The book next presents the fundamentals of geometric modeling and computer graphics, geometric objects and transformations, and curves and surfaces as well as two isocontouring methods: marching cubes and dual contouring. It then describes various triangular/tetrahedral and quadrilateral/hexahedral mesh generation techniques. The book also discusses volumetric T-spline modeling for isogeometric analysis (IGA) and introduces some new developments of FEM in recent years with applications.

Multiscale Modeling of Complex Molecular Structure and Dynamics with MBN Explorer John Wiley & Sons

Learn about the most recent advances in 2D materials with this comprehensive and accessible text. Providing all the necessary materials science and physics background, leading experts discuss the fundamental properties of a wide range of 2D materials, and their potential applications in electronic, optoelectronic and photonic devices. Several important classes of materials are covered, from more established ones such as graphene, hexagonal boron nitride, and transition metal dichalcogenides, to new and emerging materials such as black phosphorus, silicene, and germanene. Readers will gain an in-depth understanding of the electronic structure and optical, thermal, mechanical, vibrational, spin and plasmonic properties of each material, as well as the different techniques that can be used for their synthesis. Presenting a unified perspective on 2D materials, this is an excellent resource for graduate students, researchers and practitioners working in nanotechnology, nanoelectronics, nanophotonics, condensed matter physics, and chemistry.