

Computational Nanotechnology Modeling And Applications With Matlab Nano And Energy

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Nanoscale Flow - Sarhan M. Musa 2018-09-03
Understanding the physical properties and dynamical behavior of nanochannel flows has been of great interest in recent years and is important for the theoretical study of fluid dynamics and engineering applications in physics, chemistry, medicine, and electronics. The flows inside nanoscale pores are also important due to their highly beneficial drag and heat transfer properties. *Nanoscale Flow: Advances, Modeling, and Applications* presents the latest research in the multidisciplinary area of nanoscale flow. Featuring contributions from top inventors in industry, academia, and government, this comprehensive book: Highlights the current status of research on nucleate pool boiling heat transfer, flow boiling heat transfer, and critical heat flux (CHF) phenomena of nanofluids Describes two novel fractal models for pool boiling heat transfer of nanofluids,

including subcooled pool boiling and nucleate pool boiling Explores thermal conductivity enhancement in nanofluids measured with a hot-wire calorimeter Discusses two-phase laminar mixed convection AL₂O₃-water nanofluid in an elliptic duct Explains the principles of molecular and omics imaging and spectroscopy techniques for cancer detection Analyzes fluid dynamics modeling of the tumor vasculature and drug transport Studies the properties of nanoscale particles and their impact on diagnosis, therapeutics, and theranostics Provides a brief background and review of medical nanoscale flow applications Contains useful appendices of physical constants, equations, common symbols, mathematical formulas, the periodic table, and more A valuable reference for engineers, scientists, and biologists, *Nanoscale Flow: Advances, Modeling, and Applications* is also designed for researchers, universities, industrial institutions, and

government, giving it broad appeal.

Nanoelectromechanics in Engineering and Biology -

Michael Pycraft Hughes
2018-10-03

The success, growth, and virtually limitless applications of nanotechnology depend upon our ability to manipulate nanoscale objects, which in turn depends upon developing new insights into the interactions of electric fields, nanoparticles, and the molecules that surround them. In the first book to unite and directly address particle electrokinetics and nanotechnology, *Nanoelectromechanics in Engineering and Biology* provides a thorough grounding in the phenomena associated with nanoscale particle manipulation. The author delivers a wealth of application and background knowledge, from using electric fields for particle sorting in lab-on-a-chip devices to electrode fabrication, electric field simulation, and computer analysis. It also explores how

electromechanics can be applied to sorting DNA molecules, examining viruses, constructing electronic devices with carbon nanotubes, and actuating nanoscale electric motors. The field of nanotechnology is inherently multidisciplinary-in its principles, in its techniques, and in its applications-and meeting its current and future challenges will require the kind of approach reflected in this book. Unmatched in its scope, *Nanoelectromechanics in Engineering and Biology* offers an outstanding opportunity for people in all areas of research and technology to explore the use and precise manipulation of nanoscale structures. *Hybrid Nanocomposites -*
Kaushik Pal 2019-03-11
Understanding surfaces and interfaces is a key challenge for those working on hybrid nanomaterials and where new imaging and analysis spectroscopy/electron microscopy responses are vital. The variability and site recognition of biopolymers, such as DNA molecules, offer a

wide range of opportunities for the self-organization of wire nanostructures into much more complex patterns, while the combination of 1D nanostructures consisting of biopolymers and inorganic compounds opens up a number of scientific and technological opportunities. This book discusses the novel synthesis of nanomaterials and their hybrid composites; nanobiocomposites; transition metal oxide nanocomposites; spectroscopic and electron microscopic studies; social, ethical, and regulatory implications of various aspects of nanotechnology; and significant foreseeable applications of some key hybrid nanomaterials. The book also looks at how technology might be used in the future, estimating, where possible, the likely timescales in which the most far-reaching applications of technology might become a reality. Current research trends and potential future advances, such as nanomaterials, nanometrology, electronics, optoelectronics,

and nanobiotechnology, are discussed, in addition to the benefits they are currently providing in the short, medium, and long terms. Furthermore, the book explains the current and possible future industrial applications of nanotechnology, examines some of the barriers to its adoption by industry, and identifies what environmental, health and safety, ethical, or societal implications or uncertainties may arise from the use of the technology, both current and future.

Introduction to Integrative Engineering - Guigen Zhang
2017-03-03

This textbook is designed for an introductory course at undergraduate and graduate levels for bioengineering students. It provides a systematic way of examining bioengineering problems in a multidisciplinary computational approach. The book introduces basic concepts of multidiscipline-based computational modeling methods, provides detailed step-by-step techniques to build a model with

consideration of underlying multiphysics, and discusses many important aspects of a modeling approach including results interpretation, validation, and assessment.

Analog Filters using MATLAB -

Lars Wanhammar 2009-06-02

This textbook provides a complete introduction to analog filters for senior undergraduate and graduate students. Coverage includes the synthesis of analog filters and many other filter types including passive filters and filters with distributed elements.

Nanoscale Spectroscopy with Applications - Sarhan M.

Musa 2018-10-08

This book introduces the key concepts of nanoscale spectroscopy methods used in nanotechnologies in a manner that is easily digestible for a beginner in the field. It discusses future applications of nanotechnologies in technical industries. It also covers new developments and interdisciplinary research in engineering, science, and medicine. An overview of

nanoscale spectroscopy for nanotechnologies, the book describes the technologies with an emphasis on how they work and on their key benefits. It also serves as a reference for veterans in the field.

Computational

Nanotechnology - Sarhan M.

Musa 2017-10-12

Applications of nanotechnology continue to fuel significant innovations in areas ranging from electronics, microcomputing, and biotechnology to medicine, consumer supplies, aerospace, and energy production. As progress in nanoscale science and engineering leads to the continued development of advanced materials and new devices, improved methods of modeling and simulation are required to achieve a more robust quantitative understanding of matter at the nanoscale. Computational Nanotechnology: Modeling and Applications with MATLAB(R) provides expert insights into current and emerging methods, opportunities, and challenges associated with the

computational techniques involved in nanoscale research. Written by, and for, those working in the interdisciplinary fields that comprise nanotechnology--including engineering, physics, chemistry, biology, and medicine--this book covers a broad spectrum of technical information, research ideas, and practical knowledge. It presents an introduction to computational methods in nanotechnology, including a closer look at the theory and modeling of two important nanoscale systems: molecular magnets and semiconductor quantum dots. Topics covered include: Modeling of nanoparticles and complex nano and MEMS systems Theory associated with micromagnetics Surface modeling of thin films Computational techniques used to validate hypotheses that may not be accessible through traditional experimentation Simulation methods for various nanotubes and modeling of carbon nanotube and silicon nanowire transistors In regard

to applications of computational nanotechnology in biology, contributors describe tracking of nanoscale structures in cells, effects of various forces on cellular behavior, and use of protein-coated gold nanoparticles to better understand protein-associated nanomaterials. Emphasizing the importance of MATLAB for biological simulations in nanomedicine, this wide-ranging survey of computational nanotechnology concludes by discussing future directions in the field, highlighting the importance of the algorithms, modeling software, and computational tools in the development of efficient nanoscale systems.

Computational Nanotechnology Using Finite Difference Time Domain - Sarhan M. Musa
2013-12-16

The Finite Difference Time Domain (FDTD) method is an essential tool in modeling inhomogeneous, anisotropic, and dispersive media with random, multilayered, and periodic fundamental (or

device) nanostructures due to its features of extreme flexibility and easy implementation. It has led to many new discoveries concerning guided modes in nanoplasmonic waveguides and continues to attract attention from researchers across the globe. Written in a manner that is easily digestible to beginners and useful to seasoned professionals, *Computational Nanotechnology Using Finite Difference Time Domain* describes the key concepts of the computational FDTD method used in nanotechnology. The book discusses the newest and most popular computational nanotechnologies using the FDTD method, considering their primary benefits. It also predicts future applications of nanotechnology in technical industry by examining the results of interdisciplinary research conducted by world-renowned experts. Complete with case studies, examples, supportive appendices, and FDTD codes accessible via a companion website,

Computational Nanotechnology Using Finite Difference Time Domain not only delivers a practical introduction to the use of FDTD in nanotechnology but also serves as a valuable reference for academia and professionals working in the fields of physics, chemistry, biology, medicine, material science, quantum science, electrical and electronic engineering, electromagnetics, photonics, optical science, computer science, mechanical engineering, chemical engineering, and aerospace engineering.

Computational Finite Element Methods in Nanotechnology - Sarhan M. Musa 2017-03-29
Computational Finite Element Methods in Nanotechnology demonstrates the capabilities of finite element methods in nanotechnology for a range of fields. Bringing together contributions from researchers around the world, it covers key concepts as well as cutting-edge research and applications to inspire new developments and future interdisciplinary research. In particular, it

emphasizes the importance of finite element methods (FEMs) for computational tools in the development of efficient nanoscale systems. The book explores a variety of topics, including: A novel FE-based thermo-electrical-mechanical-coupled model to study mechanical stress, temperature, and electric fields in nano- and microelectronics. The integration of distributed element, lumped element, and system-level methods for the design, modeling, and simulation of nano- and micro-electromechanical systems (N/MEMS). Challenges in the simulation of nanorobotic systems and macro-dimensions. The simulation of structures and processes such as dislocations, growth of epitaxial films, and precipitation. Modeling of self-positioning nanostructures, nanocomposites, and carbon nanotubes and their composites. Progress in using FEM to analyze the electric field formed in needleless electrospinning. How molecular dynamic (MD) simulations can

be integrated into the FEM. Applications of finite element analysis in nanomaterials and systems used in medicine, dentistry, biotechnology, and other areas. The book includes numerous examples and case studies, as well as recent applications of microscale and nanoscale modeling systems with FEMs using COMSOL Multiphysics(R) and MATLAB(R). A one-stop reference for professionals, researchers, and students, this is also an accessible introduction to computational FEMs in nanotechnology for those new to the field.

Nanotechnology - Shilpi Birla
2022

"This reference text discusses recent advances in the field of nanotechnology with applications in the fields of electronics sector, agriculture, health services, smart cities, food industry, and energy sector in a comprehensive manner. The text begins by discussing important concepts including bio nanotechnology, nano electronics, nano devices, nano medicine, and nano

memories. It then comprehensively covers applications of nanotechnology in different areas including healthcare, energy sector, environment, security and defense, agriculture sector, food industry, automotive sector, smart cities, and Internet of Things (IoT)"--
Software Technology and Engineering -

Fundamentals and Source Characteristics of Renewable Energy Systems -

Radian Belu 2019-09-10
This textbook is intended for an audience with little or no power engineering or renewable energy background. The book covers electric energy from alternative energy sources, including solar, wind, water, hydropower, geothermal, and ocean energy. Core issues discussed include wind and solar resource estimates and analysis, solar thermal systems, solar collectors, photovoltaics, wind turbines, geothermal energy, energy small hydropower, wave, tide and ocean energy,

and characteristics of energy conversion, control, and electrical aspects. This is one of the most comprehensive textbooks for students, engineers, and professionals who study renewable energy. There are several questions and problems, presented with increasing difficulty, most of which focus on practical applications. The materials and problems are drawn from the author's extensive experience in renewable energy analysis, assessment, design, control, and the power electronics of wind and solar energy conversion systems. Each section of the book contains several solved examples, as well as practical and advanced discussions, that instill critical thinking and apply to industrial applications. The book is divided into eight chapters and covers the most important aspects of renewable energy sources and technologies.

Computational Nanoscience -
Elena Bichoutskaia 2011

This comprehensive and up-to-date survey of new developments and applications

in computational nanoscience is suitable for theoreticians, researchers and students.

Computational Intelligence and Its Applications - H K Lam 2012-07-17

This book focuses on computational intelligence techniques and their applications — fast-growing and promising research topics that have drawn a great deal of attention from researchers over the years. It brings together many different aspects of the current research on intelligence technologies such as neural networks, support vector machines, fuzzy logic and evolutionary computation, and covers a wide range of applications from pattern recognition and system modeling, to intelligent control problems and biomedical applications. Fundamental concepts and essential analysis of various computational techniques are presented to offer a systematic and effective tool for better treatment of different applications, and simulation and experimental results are included to

illustrate the design procedure and the effectiveness of the approaches. Sample Chapter(s) Chapter 1: Maximal Margin Algorithms for Pose Estimation (658 KB) Contents:Evolutionary Computation and Its Applications:Maximal Margin Algorithms for Pose Estimation (Ying Guo and Jiaming Li)Polynomial Modeling in a Dynamic Environment Based on a Particle Swarm Optimization (Kit Yan Chan and Tharam S Dillon)Restoration of Half-toned Color-quantized Images Using Particle Swarm Optimization with Multi-wavelet Mutation (Frank H F Leung, Benny C W Yeung and Y H Chan)Fuzzy Logics and Their Applications:Hypoglycemia Detection for Insulin-dependent Diabetes Mellitus: Evolved Fuzzy Inference System Approach (S H Ling, P P San and H T Nguyen)Neural Networks and Their Applications:Study of Limit Cycle Behavior of Weights of Perceptron (C Y F Ho and B W K Ling)Artificial Neural Network Modeling with Application to Nonlinear

Dynamics (Yi Zhao) Solving Eigen-problems of Matrices by Neural Networks (Yiguang Liu, Zhisheng You, Bingbing Liu and Jiliu Zhou) Automated Screw Insertion Monitoring Using Neural Networks: A Computational Intelligence Approach to Assembly in Manufacturing (Bruno Lara, Lakmal D Seneviratne and Kaspar Althoefer) Support Vector Machines and Their Applications: On the Applications of Heart Disease Risk Classification and Hand-written Character Recognition Using Support Vector Machines (S R Alty, H K Lam and J Prada) Nonlinear Modeling Using Support Vector Machine for Heart Rate Response to Exercise (Weidong Chen, Steven W Su, Yi Zhang, Ying Guo, Nghir Nguyen, Branko G Celler and Hung T Nguyen) Machine Learning-based Nonlinear Model Predictive Control for Heart Rate Response to Exercise (Yi Zhang, Steven W Su, Branko G Celler and Hung T Nguyen) Intelligent Fault Detection and Isolation of

HVAC System Based on Online Support Vector Machine (Davood Dehestani, Ying Guo, Sai Ho Ling, Steven W Su and Hung T Nguyen) Readership: Graduates and researchers in computer science, especially those specialising in artificial intelligence, neural networks, fuzzy logic and pattern recognition.

Keywords: Evolutionary Computation; Fuzzy Logic; Neural Networks; Support Vector Machine Key Features: Covers wide-ranging applications from pattern recognition, control systems to biomedical applications. Various computational techniques are proposed and presented in detail for the treatment of various problems Most of the applications in this book are real and high impact, such as hypoglycaemia, detection for diabetes patients, cardio respiratory response estimation, pattern recognition and pose estimation Addresses important related problems and difficulties using the collective experiences and

knowledge from the contributors, who are each prominent in their own area of research

Nanotechnology - Ahmed S. Khan 2012-05-17

Advances in nanotechnology are transforming the ways of creating materials and products, leading society to the threshold of a second industrial revolution. However, future opportunities will depend significantly on how nanotechnology stakeholders deal with the short-term and long-term benefits, limitations, uncertainties and risks of nanotechnology. They will be tasked with navigating a variety of new social and ethical challenges associated with areas such as privacy, the environment, energy, population, genetics, agriculture, food, and security. Unique in its depth, breadth, and variety of viewpoints, *Nanotechnology: Ethical and Social Implications* stimulates, inspires, and builds awareness of nanotechnology's impact on society. Spanning the immense range of disciplines at work in

nanotechnology, the book's selection of chapters focuses on how advances in science, and the convergence of multiple technologies, will impact society at individual, community, national, and international levels. The book focuses on raising the awareness of nanotechnology stakeholders, which includes undergraduate and graduate students; educators in sciences, engineering, business, and public policy; engineers; business and finance professionals; and policymakers. It also addresses the demands on the future workforce to learn new skill sets. The book uses an interactive format—which includes case studies, scenarios, and Web exercises—to promote critical thinking and problem solving skills. Content includes numerous tables, statistics, and figures to supplement and enhance the topics covered in each chapter. The result is a must-read for anyone seeking either a technical or nontechnical understanding of

the societal impact of nanotechnology.

Computational Nanophotonics - Sarhan Musa
2018-10-08

This reference offers tools for engineers, scientists, biologists, and others working with the computational techniques of nanophotonics. It introduces the key concepts of computational methods in a manner that is easily digestible for newcomers to the field. The book also examines future applications of nanophotonics in the technical industry and covers new developments and interdisciplinary research in engineering, science, and medicine. It provides an overview of the key computational nanophotonics and describes the technologies with an emphasis on how they work and their key benefits.

Computational Finite Element Methods in Nanotechnology - Sarhan M. Musa
2017-12-19

Computational Finite Element Methods in Nanotechnology demonstrates the capabilities of finite element methods in

nanotechnology for a range of fields. Bringing together contributions from researchers around the world, it covers key concepts as well as cutting-edge research and applications to inspire new developments and future interdisciplinary research. In particular, it emphasizes the importance of finite element methods (FEMs) for computational tools in the development of efficient nanoscale systems. The book explores a variety of topics, including: A novel FE-based thermo-electrical-mechanical-coupled model to study mechanical stress, temperature, and electric fields in nano- and microelectronics. The integration of distributed element, lumped element, and system-level methods for the design, modeling, and simulation of nano- and micro-electromechanical systems (N/MEMS). Challenges in the simulation of nanorobotic systems and macro-dimensions. The simulation of structures and processes such as dislocations, growth of epitaxial films, and

precipitation Modeling of self-positioning nanostructures, nanocomposites, and carbon nanotubes and their composites Progress in using FEM to analyze the electric field formed in needleless electrospinning How molecular dynamic (MD) simulations can be integrated into the FEM Applications of finite element analysis in nanomaterials and systems used in medicine, dentistry, biotechnology, and other areas The book includes numerous examples and case studies, as well as recent applications of microscale and nanoscale modeling systems with FEMs using COMSOL Multiphysics® and MATLAB®. A one-stop reference for professionals, researchers, and students, this is also an accessible introduction to computational FEMs in nanotechnology for those new to the field.

Nanoscale Devices - Brajesh Kumar Kaushik 2018-11-16
The primary aim of this book is to discuss various aspects of nanoscale device design and their applications including

transport mechanism, modeling, and circuit applications. . Provides a platform for modeling and analysis of state-of-the-art devices in nanoscale regime, reviews issues related to optimizing the sub-nanometer device performance and addresses simulation aspect and/or fabrication process of devices Also, includes design problems at the end of each chapter

Applied Mathematics for the Analysis of Biomedical Data - Peter J. Costa 2017-02-21
Features a practical approach to the analysis of biomedical data via mathematical methods and provides a MATLAB® toolbox for the collection, visualization, and evaluation of experimental and real-life data
Applied Mathematics for the Analysis of Biomedical Data: Models, Methods, and MATLAB® presents a practical approach to the task that biological scientists face when analyzing data. The primary focus is on the application of mathematical models and scientific computing methods

to provide insight into the behavior of biological systems. The author draws upon his experience in academia, industry, and government-sponsored research as well as his expertise in MATLAB to produce a suite of computer programs with applications in epidemiology, machine learning, and biostatistics. These models are derived from real-world data and concerns. Among the topics included are the spread of infectious disease (HIV/AIDS) through a population, statistical pattern recognition methods to determine the presence of disease in a diagnostic sample, and the fundamentals of hypothesis testing. In addition, the author uses his professional experiences to present unique case studies whose analyses provide detailed insights into biological systems and the problems inherent in their examination. The book contains a well-developed and tested set of MATLAB functions that act as a general toolbox for

practitioners of quantitative biology and biostatistics. This combination of MATLAB functions and practical tips amplifies the book's technical merit and value to industry professionals. Through numerous examples and sample code blocks, the book provides readers with illustrations of MATLAB programming. Moreover, the associated toolbox permits readers to engage in the process of data analysis without needing to delve deeply into the mathematical theory. This gives an accessible view of the material for readers with varied backgrounds. As a result, the book provides a streamlined framework for the development of mathematical models, algorithms, and the corresponding computer code. In addition, the book features: Real-world computational procedures that can be readily applied to similar problems without the need for keen mathematical acumen Clear delineation of topics to accelerate access to data analysis Access to a book

companion website containing the MATLAB toolbox created for this book, as well as a Solutions Manual with solutions to selected exercises

Applied Mathematics for the Analysis of Biomedical Data: Models, Methods, and MATLAB® is an excellent textbook for students in mathematics, biostatistics, the life and social sciences, and quantitative, computational, and mathematical biology. This book is also an ideal reference for industrial scientists, biostatisticians, product development scientists, and practitioners who use mathematical models of biological systems in biomedical research, medical device development, and pharmaceutical submissions.

Nanomaterials-Based Composites for Energy Applications - Keka Talukdar
2019-12-11

This volume, **Nanomaterials-Based Composites for Energy Applications: Emerging Technology and Trends**, covers the importance of nanomaterials-based

composites for renewable and alternative energy applications. Taking a multidisciplinary approach, it looks at using composites without losing the extraordinary strength of the nanomaterials, preparing new composites with high dielectric permittivity, improving load-carrying capacity, and more. Simulation and experimental work is included, providing a current view of the research that is going on in laboratories all over the world. The book will be a rich reference for professors and instructors, professionals, researchers, and engineering students interested in applying the emerging field of nanoscience and nanotechnology to energy applications.

Computational Ecology: Artificial Neural Networks And Their Applications -

Wenjun Zhang 2010-06-25
Due to the complexity and non-linearity of most ecological problems, artificial neural networks (ANNs) have attracted attention from ecologists and environmental scientists in recent years. As

these networks are increasingly being used in ecology for modeling, simulation, function approximation, prediction, classification and data mining, this unique and self-contained book will be the first comprehensive treatment of this subject, by providing readers with overall and in-depth knowledge on algorithms, programs, and applications of ANNs in ecology. Moreover, a new area of ecology, i.e., computational ecology, is proposed and its scopes and objectives are defined and discussed. Computational Ecology consists of two parts: the first describes the methods and algorithms of ANNs, interpretability and mathematical generalization of neural networks, Matlab neural network toolkit, etc., while the second provides case studies of applications of ANNs in ecology, Matlab codes, and comparisons of ANNs with conventional methods. This publication will be a valuable reference for research

scientists, university teachers, graduate students and high-level undergraduates in the areas of ecology, environmental sciences, and computational science.

Building Electrical Systems and Distribution Networks -

Radian Belu 2020-03-10

This book covers all important, new, and conventional aspects of building electrical systems, power distribution, lighting, transformers and rotating electric machines, wiring, and building installations. Solved examples, end-of-chapter questions and problems, case studies, and design considerations are included in each chapter, highlighting the concepts, and diverse and critical features of building and industrial electrical systems, such as electric or thermal load calculations; wiring and wiring devices; conduits and raceways; lighting analysis, calculation, selection, and design; lighting equipment and luminaires; power quality; building monitoring; noise control; building energy envelope; air-conditioning and

ventilation; and safety. Two chapters are dedicated to distributed energy generation, building integrated renewable energy systems, microgrids, DC nanogrids, power electronics, energy management, and energy audit methods, topics which are not often included in building energy textbooks. Support materials are included for interested instructors. Readers are encouraged to write their own solutions while solving the problems, and then refer to the solved examples for more complete understanding of the solutions, concepts, and theory.

Computational Photonics -

Marek S. Wartak 2013-01-10

A comprehensive manual on the efficient modeling and analysis of photonic devices through building numerical codes, this book provides graduate students and researchers with the theoretical background and MATLAB programs necessary for them to start their own numerical experiments.

Beginning by summarizing topics in optics and

electromagnetism, the book discusses optical planar waveguides, linear optical fiber, the propagation of linear pulses, laser diodes, optical amplifiers, optical receivers, finite-difference time-domain method, beam propagation method and some wavelength division devices, solitons, solar cells and metamaterials.

Assuming only a basic knowledge of physics and numerical methods, the book is ideal for engineers, physicists and practising scientists. It concentrates on the operating principles of optical devices, as well as the models and numerical methods used to describe them.

Designer Biopolymers -

Ayae Sugawara-Narutaki 2020-12-14

Nature has evolved sequence-controlled polymers, such as DNA and proteins, over its long history. The recent progress of synthetic chemistry, DNA recombinant technology, and computational science, as well as the elucidation of molecular mechanisms in biological processes, drive us to design ingenious polymers that are

inspired by naturally occurring polymers, but surpass them in specialized functions. The term “designer biopolymers” refers to polymers which consist of biological building units, such as nucleotides, amino acids, and monosaccharides, in a sequence-controlled manner. This book particularly focuses on the self-assembling aspect of designer biopolymers. Self-assembly is one common feature in biopolymers that is used to realize their dynamic biological activities and is strictly controlled by the sequence of biopolymers. In a broad sense, the self-assembly of biopolymers includes a double-helix formation of DNA, protein folding, and higher-order protein assembly (e.g., viral capsids). Designer biopolymers are now going beyond what nature evolved: researchers have generated DNA origami, protein cages, peptide nanofibers, and gels. This book illustrates the latest interdisciplinary work on self-assembling designer biopolymers. As shown by this book, the self-assembly of

biopolymers has a great impact on a variety of research fields, including molecular biology, neurodegenerative diseases, drug delivery, gene therapy, regenerative medicine, and biomineralization. Designer biopolymers will help researchers to better understand biological processes, as well as to create innovative molecular systems. We believe that this book will provide readers with new ideas for their molecular design strategies for frontier research.

Computational

Nanotechnology - Sarhan M. Musa 2018-09-03

Applications of nanotechnology continue to fuel significant innovations in areas ranging from electronics, microcomputing, and biotechnology to medicine, consumer supplies, aerospace, and energy production. As progress in nanoscale science and engineering leads to the continued development of advanced materials and new devices, improved methods of modeling and simulation are required to achieve a more

robust quantitative understanding of matter at the nanoscale. Computational Nanotechnology: Modeling and Applications with MATLAB® provides expert insights into current and emerging methods, opportunities, and challenges associated with the computational techniques involved in nanoscale research. Written by, and for, those working in the interdisciplinary fields that comprise nanotechnology—including engineering, physics, chemistry, biology, and medicine—this book covers a broad spectrum of technical information, research ideas, and practical knowledge. It presents an introduction to computational methods in nanotechnology, including a closer look at the theory and modeling of two important nanoscale systems: molecular magnets and semiconductor quantum dots. Topics covered include: Modeling of nanoparticles and complex nano and MEMS systems Theory associated with micromagnetics Surface

modeling of thin films Computational techniques used to validate hypotheses that may not be accessible through traditional experimentation Simulation methods for various nanotubes and modeling of carbon nanotube and silicon nanowire transistors In regard to applications of computational nanotechnology in biology, contributors describe tracking of nanoscale structures in cells, effects of various forces on cellular behavior, and use of protein-coated gold nanoparticles to better understand protein-associated nanomaterials. Emphasizing the importance of MATLAB for biological simulations in nanomedicine, this wide-ranging survey of computational nanotechnology concludes by discussing future directions in the field, highlighting the importance of the algorithms, modeling software, and computational tools in the development of efficient nanoscale systems. **Quantum Mechanics with Applications to Nanotechnology and**

Information Science - Yehuda
B. Band 2013-01-10

Quantum mechanics transcends and supplants classical mechanics at the atomic and subatomic levels. It provides the underlying framework for many subfields of physics, chemistry and materials science, including condensed matter physics, atomic physics, molecular physics, quantum chemistry, particle physics, and nuclear physics. It is the only way we can understand the structure of materials, from the semiconductors in our computers to the metal in our automobiles. It is also the scaffolding supporting much of nanoscience and nanotechnology. The purpose of this book is to present the fundamentals of quantum theory within a modern perspective, with emphasis on applications to nanoscience and nanotechnology, and information-technology. As the frontiers of science have advanced, the sort of curriculum adequate for students in the sciences and

engineering twenty years ago is no longer satisfactory today. Hence, the emphasis on new topics that are not included in older reference texts, such as quantum information theory, decoherence and dissipation, and on applications to nanotechnology, including quantum dots, wires and wells. This book provides a novel approach to Quantum Mechanics whilst also giving readers the requisite background and training for the scientists and engineers of the 21st Century who need to come to grips with quantum phenomena. The fundamentals of quantum theory are provided within a modern perspective, with emphasis on applications to nanoscience and nanotechnology, and information-technology. Older books on quantum mechanics do not contain the amalgam of ideas, concepts and tools necessary to prepare engineers and scientists to deal with the new facets of quantum mechanics and their application to quantum information science and

nanotechnology As the frontiers of science have advanced, the sort of curriculum adequate for students in the sciences and engineering twenty years ago is no longer satisfactory today

There are many excellent quantum mechanics books available, but none have the emphasis on nanotechnology and quantum information science that this book has
Low-Energy Ion Irradiation of Materials - Bernd Rauschenbach

2022-08-19

This book provides a comprehensive introduction to all aspects of low-energy ion-solid interaction from basic principles to advanced applications in materials science. It features a balanced and insightful approach to the fundamentals of the low-energy ion-solid surface interaction, focusing on relevant topics such as interaction potentials, kinetics of binary collisions, ion range, radiation damages, and sputtering. Additionally, the book incorporates key updates reflecting the latest relevant results of modern research on

topics such as topography evolution and thin-film deposition under ion bombardment, ion beam figuring and smoothing, generation of nanostructures, and ion beam-controlled glancing angle deposition. Filling a gap of almost 20 years of relevant research activity, this book offers a wealth of information and up-to-date results for graduate students, academic researchers, and industrial scientists working in these areas.

Nanotechnology in Aerospace and Structural Mechanics -

Noureddine Ramdani

2019-02-15

"This book provides the latest developments in the field of space research and structural mechanics. It also explores the mechanics of nanomaterials, the advancement of their electronic properties, the development of the methods of synthesis of the nanomaterials for fabricating nanodevices, and related technological expertise to assemble the nano components for fabricating the devices"--

Advanced Nanoelectronics -

Razali Ismail 2018-09-03

While theories based on classical physics have been very successful in helping experimentalists design microelectronic devices, new approaches based on quantum mechanics are required to accurately model nanoscale transistors and to predict their characteristics even before they are fabricated. Advanced Nanoelectronics provides research information on advanced nanoelectronics concepts, with a focus on modeling and simulation. Featuring contributions by researchers actively engaged in nanoelectronics research, it develops and applies analytical formulations to investigate nanoscale devices. The book begins by introducing the basic ideas related to quantum theory that are needed to better understand nanoscale structures found in nanoelectronics, including graphenes, carbon nanotubes, and quantum wells, dots, and wires. It goes on to highlight some of the key concepts

required to understand nanotransistors. These concepts are then applied to the carbon nanotube field effect transistor (CNTFET). Several chapters cover graphene, an unzipped form of CNT that is the recently discovered allotrope of carbon that has gained a tremendous amount of scientific and technological interest. The book discusses the development of the graphene nanoribbon field effect transistor (GNRFET) and its use as a possible replacement to overcome the CNT chirality challenge. It also examines silicon nanowire (SiNW) as a new candidate for achieving the downscaling of devices. The text describes the modeling and fabrication of SiNW, including a new top-down fabrication technique. Strained technology, which changes the properties of device materials rather than changing the device geometry, is also discussed. The book ends with a look at the technical and economic challenges that face the

commercialization of nanoelectronics and what universities, industries, and government can do to lower the barriers. A useful resource for professionals, researchers, and scientists, this work brings together state-of-the-art technical and scientific information on important topics in advanced nanoelectronics.

MATLAB - Kelly Bennett
2014-09-08

MATLAB is an indispensable asset for scientists, researchers, and engineers. The richness of the MATLAB computational environment combined with an integrated development environment (IDE) and straightforward interface, toolkits, and simulation and modeling capabilities, creates a research and development tool that has no equal. From quick code prototyping to full blown deployable applications, MATLAB stands as a de facto development language and environment serving the technical needs of a wide range of users. As a collection of

diverse applications, each book chapter presents a novel application and use of MATLAB for a specific result.

MATLAB-based Finite Element Programming in

Electromagnetic Modeling -
Özlem Özgün 2018-09-03

This book is a self-contained, programming-oriented and learner-centered book on finite element method (FEM), with special emphasis given to developing MATLAB® programs for numerical modeling of electromagnetic boundary value problems. It provides a deep understanding and intuition of FEM programming by means of step-by-step MATLAB® programs with detailed descriptions, and eventually enabling the readers to modify, adapt and apply the provided programs and formulations to develop FEM codes for similar problems through various exercises. It starts with simple one-dimensional static and time-harmonic problems and extends the developed theory to more complex two- or three-dimensional problems. It

supplies sufficient theoretical background on the topic, and it thoroughly covers all phases (pre-processing, main body and post-processing) in FEM. FEM formulations are obtained for boundary value problems governed by a partial differential equation that is expressed in terms of a generic unknown function, and then, these formulations are specialized to various electromagnetic applications together with a post-processing phase. Since the method is mostly described in a general context, readers from other disciplines can also use this book and easily adapt the provided codes to their engineering problems. After forming a solid background on the fundamentals of FEM by means of canonical problems, readers are guided to more advanced applications of FEM in electromagnetics through a survey chapter at the end of the book. Offers a self-contained and easy-to-understand introduction to the theory and programming of finite element method. Covers

various applications in the field of static and time-harmonic electromagnetics. Includes one-, two- and three-dimensional finite element codes in MATLAB®. Enables readers to develop finite element programming skills through various MATLAB® codes and exercises. Promotes self-directed learning skills and provides an effective instruction tool.

Energy Storage, Grid Integration, Energy Economics, and the Environment - Radian Belu 2019-09-10

The book covers energy storage systems, bioenergy and hydrogen economy, grid integration of renewable energy systems, distributed generation, economic analysis, and environmental impacts of renewable energy systems. The overall approaches are interdisciplinary and comprehensive, covering economic, environmental, and grid integration issues as well as the physical and engineering aspects. Core issues discussed include mechanical, electrical, and thermal energy storage

systems, batteries, fuel cells, biomass and biofuels, hydrogen economy, distributed generation, a brief presentation of microgrids, and in-depth discussions of economic analysis and methods of renewable energy systems, environmental impacts, life-cycle analysis, and energy conservation issues. With several solved examples, holistic material presentation, in-depth subject matter discussions and self-content material presentation, this textbook will appeal strongly to students and professional and nonprofessional readers who wish to understand this fascinating subject. Readers are encouraged to solve the problems and questions, which are useful ways to understand and apply the concepts and the topics included.

Alternative Energy Technologies - Gavin Buxton
2017-12-19

Alternative energy sources are becoming increasingly important in a world striving for energy independence, clean air, and a reprieve from global

warming. Solar cells, wind power, and biofuels are some of the competing alternative energy sources hoping to gain a foothold in our future energy mix, and the economic advantages of these technologies are continually increasing as costs are reduced and efficiencies increased.

Alternative Energy Technologies: An Introduction with Computer Simulations explores the science and engineering behind a number of emerging alternative energy technologies, including polymer solar cells, algae biofuels, and artificial leaves. It also addresses the environmental need for these technologies. However, unlike its predecessors, this book employs simple computer models implemented within spreadsheet environments to simulate different aspects of the alternative energy technologies and therefore teach the subject matter. This unique approach: Provides a dual introduction to alternative energy technologies and computer simulation Elucidates

the fundamental behaviors and complex interactions within the alternative energy systems. Makes computer simulation straightforward and accessible to readers with no prior programming experience. Featuring investigative exercises that deepen understanding and inspire further research, *Alternative Energy Technologies: An Introduction with Computer Simulations* makes an ideal introductory textbook for undergraduate students and a valuable professional reference for experimental researchers. [Handbook of Nanoindentation](#) - Michelle L. Oyen 2019-04-01 Nanoindentation is ideal for the characterization of inhomogeneous biological materials. However, the use of nanoindentation techniques in biological systems is associated with some distinctively different techniques and challenges. The book presents the basic science of nanoindentation, including the background of contact mechanics underlying indentation technique and the

instrumentation used to gather mechanical data. It provides perspectives that are optimized for biological applications, including discussions on hydrated materials and adaptations for low-stiffness materials. The book also covers the applications of nanoindentation technique in biological materials. Highlighting current challenges, it concludes with an insightful forecast of the future.

Nanoscale Spectroscopy with Applications - Sarhan M. Musa 2013-11-04

This book introduces the key concepts of nanoscale spectroscopy methods used in nanotechnologies in a manner that is easily digestible for a beginner in the field. It discusses future applications of nanotechnologies in technical industries. It also covers new developments and interdisciplinary research in engineering, science, and medicine. An overview of nanoscale spectroscopy for nanotechnologies, the book describes the technologies with

an emphasis on how they work and on their key benefits. It also serves as a reference for veterans in the field.

Nanoscale Flow - Sarhan M. Musa 2017-07-26

Understanding the physical properties and dynamical behavior of nanochannel flows has been of great interest in recent years and is important for the theoretical study of fluid dynamics and engineering applications in physics, chemistry, medicine, and electronics. The flows inside nanoscale pores are also important due to their highly beneficial drag and heat transfer properties. *Nanoscale Flow: Advances, Modeling, and Applications* presents the latest research in the multidisciplinary area of nanoscale flow. Featuring contributions from top inventors in industry, academia, and government, this comprehensive book: Highlights the current status of research on nucleate pool boiling heat transfer, flow boiling heat transfer, and critical heat flux (CHF)

phenomena of nanofluids Describes two novel fractal models for pool boiling heat transfer of nanofluids, including subcooled pool boiling and nucleate pool boiling Explores thermal conductivity enhancement in nanofluids measured with a hot-wire calorimeter Discusses two-phase laminar mixed convection Al_2O_3 -water nanofluid in an elliptic duct Explains the principles of molecular and omics imaging and spectroscopy techniques for cancer detection Analyzes fluid dynamics modeling of the tumor vasculature and drug transport Studies the properties of nanoscale particles and their impact on diagnosis, therapeutics, and theranostics Provides a brief background and review of medical nanoscale flow applications Contains useful appendices of physical constants, equations, common symbols, mathematical formulas, the periodic table, and more A valuable reference for engineers, scientists, and biologists, *Nanoscale Flow*:

Advances, Modeling, and Applications is also designed for researchers, universities, industrial institutions, and government, giving it broad appeal.

Introduction to Computational Mathematics

- Xin-She Yang 2014-11-26

This unique book provides a comprehensive introduction to computational mathematics, which forms an essential part of contemporary numerical algorithms, scientific computing and optimization. It uses a theorem-free approach with just the right balance between mathematics and numerical algorithms. This edition covers all major topics in computational mathematics with a wide range of carefully selected numerical algorithms, ranging from the root-finding algorithm, numerical integration, numerical methods of partial differential equations, finite element methods, optimization algorithms, stochastic models, nonlinear curve-fitting to data modelling, bio-inspired algorithms and swarm

intelligence. This book is especially suitable for both undergraduates and graduates in computational mathematics, numerical algorithms, scientific computing, mathematical programming, artificial intelligence and engineering optimization. Thus, it can be used as a textbook and/or reference book.

Relocating the History of Science - Theodore Arabatzis 2015-05-19

This volume is put together in honor of a distinguished historian of science, Kostas Gavroglu, whose work has won international acclaim, and has been pivotal in establishing the discipline of history of science in Greece, its consolidation in other countries of the European Periphery, and the constructive dialogue of these emerging communities with an extended community of international scholars. The papers in the volume reflect Gavroglu's broad range of intellectual interests and touch upon significant themes in recent history and philosophy of science. They include topics

in the history of modern physical sciences, science and technology in the European periphery, integrated history and philosophy of science, historiographical considerations, and intersections with the history of mathematics, technology and contemporary issues. They are authored by eminent scholars whose academic and personal trajectories crossed with Gavroglu's. The book will interest historians and philosophers of science and technology alike, as well as science studies scholars, and generally readers interested in the role of the sciences in the past in various geographical contexts.

MATLAB Numerical Calculations - Cesar Lopez
2015-01-05

MATLAB is a high-level language and environment for numerical computation, visualization, and programming. Using MATLAB, you can analyze data, develop algorithms, and create models and applications. The language, tools, and built-in

math functions enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages, such as C/C++ or Java. This book is designed for use as a scientific/business calculator so that you can get numerical solutions to problems involving a wide array of mathematics using MATLAB. Just look up the function you want in the book and you are ready to use it in MATLAB or use the book to learn about the enormous range of options that MATLAB offers. MATLAB Numerical Calculations focuses on MATLAB capabilities to give you numerical solutions to problems you are likely to encounter in your professional or scholastic life. It introduces you to the MATLAB language with practical hands-on instructions and results, allowing you to quickly achieve your goals. Starting with a look at basic MATLAB functionality with integers, rational numbers and real and complex numbers, and MATLAB's relationship

with Maple, you will learn how to solve equations in MATLAB, and how to simplify the results. You will see how MATLAB incorporates vector, matrix and character variables, and functions thereof. MATLAB is a powerful tool used to defined, manipulate and simplify complex algebraic expressions. With MATLAB you can also work with ease in matrix algebra, making use of commands which allow you to find eigenvalues, eigenvectors, determinants, norms and various matrix decompositions, among many other features. Lastly, you will see how you can write scripts and use MATLAB to explore numerical analysis, finding approximations of integrals, derivatives and numerical solutions of differential equations.

Programming for Computations - MATLAB/Octave - Svein Linge

2016-08-01

This book presents computer programming as a key method for solving mathematical problems. There are two versions of the book, one for MATLAB and one for Python. The book was inspired by the Springer book TCSE 6: A Primer on Scientific Programming with Python (by Langtangen), but the style is more accessible and concise, in keeping with the needs of engineering students. The book outlines the shortest possible path from no previous experience with programming to a set of skills that allows the students to write simple programs for solving common mathematical problems with numerical methods in engineering and science courses. The emphasis is on generic algorithms, clean design of programs, use of functions, and automatic tests for verification.