Matlab Physics I

This book may be used by students and professionals in physics and engineering that have completed first-year calculus and physics. An introductory chapter reviews algebra, trigonometry, units and complex numbers that are frequently used in physics. Examples using MATLAB and Maple for symbolic and numerical calculations in physics with a variety of plotting features are included in all 16 chapters. The book applies many of mathematical concepts covered in Chapters 1-9 to fundamental physics topics in mechanics, electromagnetics; quantum mechanics and relativity in Chapters 10-16. Companion files are included with MATLAB and Maple worksheets and files, and all of the figures from the text. Features: * Each chapter includes the mathematical development of the concept with numerous examples * MATLAB & Maple examples are integrated in each chapter throughout the book * Applies the mathematical concepts to fundamental physics principles such as relativity, mechanics, electromagnetics, etc. * Introduces basic MATLAB and Maple commands and programming structures * Includes companion files with MATLAB and Maple files and worksheets, and all of the figures from the text

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.

This book provides a focused presentation of the physical and mathematical ideas upon which graduate work in fluid mechanics depends. The book includes a self-contained derivation of the governing equations followed by examples of their application. Numerous opportunities are provided to employ MATLAB in the study of fluid flows.

Awarded one of BookAuthority's best new Particle Physics books in 2019! Hands-On Accelerator Physics Using MATLAB® provides an introduction into the design and operational issues of a wide range of particle accelerators, from ion-implanters to the Large Hadron Collider at CERN. Many aspects from the design of beam optical systems and magnets, to the subsystems for acceleration, beam diagnostics, and vacuum are covered. Beam dynamics topics ranging from the beam-beam interaction to free-electron lasers are discussed. Theoretical concepts and the design of key components are explained with the help of MATLAB® code. Practical topics, such as beam size measurements, magnet construction and measurements, and radio-frequency measurements are explored in student labs without requiring access to an accelerator. This unique approach provides a look at what goes on 'under the hood' inside modern accelerators and presents readers with the tools to perform their independent investigations on the computer or in student labs. This book will be of interest to graduate students, postgraduate researchers studying accelerator physics, as well as engineers entering the field. Features: Provides insights into both synchrotron light sources and colliders Discusses technical subsystems, including magnets, radio-frequency engineering, instrumentation and diagnostics, correction of imperfections, control, and cryogenics Accompanied by MATLAB® code, including a 3D-modeler to visualize the accelerators, and additional appendices which are available on the CRC Press website

The first MATLAB® programming book written specifically for clinical radiotherapy medical physicists and medical physics trainees, this much-needed book teaches users how to create their own clinical applications using MATLAB®, as a complement to commercial software particularly when the latter does not cover specific local clinical needs. Chapters explore key radiotherapy areas such as handling volumes, 3D dose calculation, comparing dose distributions, reconstructing treatment plans and their summations, and automated tests for machine quality assurance. Readers will learn to independently analyse and process images, doses, structures, and other radiotherapy clinical data to deal with standard and non-standard situations in radiotherapy. This book will also significantly improve understanding of areas such as data nature, information content, DICOM RT standard, and data flow. It will be an invaluable reference for students of medical physics, in addition to clinical radiotherapy physicists and researchers working in radiotherapy. Features: Includes real clinical medical physics applications derived from actual clinical problems Provides commented MATLAB® scripts working with sample data and/or own data matching input requirements Promotes critical thinking and practical problem solving skills

Not only do modeling and simulation help provide a better understanding of how real-world systems function, they also enable us to predict system behavior before a system is actually built and analyze systems accurately under varying operating conditions. Modeling and Simulation of Systems Using MATLAB® and Simulink® provides comprehensive, state-of-the-art coverage of all the important aspects of modeling and simulating both physical and conceptual systems. Various real-life examples show how simulation plays a key role in understanding real-world systems. The author also explains how to effectively use MATLAB and Simulink software to successfully apply the modeling and simulation techniques presented. After introducing the underlying philosophy of systems, the book offers step-by-step procedures for modeling different types of systems using modeling techniques, such as the graph-theoretic approach, interpretive structural modeling, and system dynamics modeling. It then explores how simulation evolved from pre-computer days into the current science of today. The text also presents modern soft computing techniques, including artificial neural networks, fuzzy systems, and genetic algorithms, for modeling and simulating complex and nonlinear systems. The final chapter addresses discrete systems modeling. Preparing both undergraduate and graduate students for advanced modeling and simulation courses, this text helps them carry out effective simulation studies. In addition, graduate students should be able to comprehend and conduct simulation research after completing this book.

This text continues the exploration of the use of MATLAB tools and features in visualizing physical processes. The symbolic math packages are important in solving those problems which are amenable to closed form solution, while the numerical packages are used for the remaining problems. The results for the solutions use the MATLAB graphics packages to help visualize the properties of the solutions. User dialogues are designed to allow users to change the input parameters in order to see how the dynamics of the solutions depends on the parameters of the specific problem. In particular movies are used to display the dynamical evolution of solutions in time.

This book may be used by students and professionals in physics and engineering that have completed first-year calculus and physics. An introductory chapter reviews algebra, trigonometry, units and complex numbers that are frequently used in physics. Examples using MATLAB and Maple for symbolic and numerical calculations in physics with a variety of plotting features are included in all 16 chapters. The book applies many of mathematical concepts covered in Chapters 1-9 to fundamental physics topics in mechanics, electromagnetics; quantum mechanics and relativity in Chapters 10-16. Companion files are included with MATLAB and Maple worksheets and files, and all of the figures from the text. Features: • Each chapter includes the mathematical development of the concept with numerous examples • MATLAB & Maple examples are integrated in each chapter throughout the book • Applies the mathematical concepts to fundamental physics principles such as relativity, mechanics, electromagnetics, etc. • Introduces basic MATLAB and Maple commands and programming structures • Includes companion files with MATLAB and Maple files and worksheets, and all of the figures from the text

Using Matlab and Maple
A Course in Mathematical Methods for Physicists
Fluid Dynamics
A First Course in Computational Physics
Introductory Solid State Physics with MATLAB Applications
Numerical Methods for Physics
A Problem-Solving Approach
ESSE 2017
A Beginner ' s Introduction
For Beginners and Experienced Users
Introductory Quantum Mechanics with MATLAB

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.

Classical Mechanics with MATLAB Applications is an essential resource for the advanced undergraduate taking introduction to classical mechanics. Filled with comprehensive examples and thorough descriptions, this text guides students through the complex topics of rigid body motion, moving coordinate systems, Lagrange's equations, small vibrations, and the special theory of relativity. Step-by-step illustrations and examples and computational physics tools further enhance learning and understanding by demonstrating accessible ways of obtaining mathematical solutions. In addition to the numerous examples throughout, each chapter contains a section of MATLAB code to introduce the topic of programming scripts and their modification for the reproduction of graphs and simulations.

This is a short, focused introduction to MATLAB, a comprehensive software system for mathematical and technical computing. It contains concise explanations of essential MATLAB commands, as well as easily understood instructions for using MATLAB's programming features, graphical capabilities, simulation models, and rich desktop interface. Written for MATLAB 7, it can also be used with earlier (and later) versions of MATLAB. This book teaches how to graph functions, solve equations, manipulate images, and much more. It contains explicit instructions for using MATLAB's companion software, Simulink, which allows graphical models to be built for dynamical systems. MATLAB's new "publish" feature is discussed, which allows mathematical computations to be combined with text and graphics, to produce polished, integrated, interactive documents. For the beginner it explains everything needed to start using MATLAB, while experienced users making the switch to MATLAB 7 from an earlier version will also find much useful information here.

This book provides visualizations of many topics in general physics. The aim is to have an interactive MATLAB script wherein the user can vary parameters in a specific problem and then immediately see the outcome by way of dynamic movies of the response of the system in question. MATLAB tools are used throughout and the software scripts accompany the text in Symbolic Mathematics, Classical Mechanics, Electromagnetism, Waves and Optics, Gases and Fluid Flow, Quantum Mechanics, Special and General Relativity, and Astrophysics and Cosmology. The emphasis is on building up an intuition by running many different parametric choices chosen actively by the user and watching the subsequent behavior of the system. Physics books using MATLAB do not have the range or the intent of this text. They are rather steeped in technical detail. Symbolic math is used extensively and is integral to the aim of using MATLAB tools to accomplish the technical aspects of problem solving.Contents: Symbolic Mathematics and Math ToolsClassical MechanicsElectromagnetismWaves and OpticsGases and Fluid FlowQuantum MechanicsSpecial and General RelativityAstrophysics and Cosmology Readership: Graduate students and researchers in physics. "

An introductory textbook for people who have not programmed before. Covers basic MATLAB programming with emphasis on modeling and simulation of physical systems.

Physiology, Biophysics and Biomedical Engineering provides a multidisciplinary understanding of biological phenomena and the instrumentation for monitoring these phenomena. It covers the physical phenomena of electricity, pressure, and flow along with the adaptation of the physics of the phenomena to the special conditions and constraints of biological systems. While the text focuses on human biological systems, some of the principles also apply to plants, bacteria, and other animals. The first section of the book presents a general introduction to physiological systems and describes specialized methods used to record electrical events from biological tissue. The next part examines molecules involved in cell transport and signaling as well as the proteins relevant in cells' ability to contract and generate tension. The text goes on to cover the properties of the heart, blood, and circulation and the monitoring of cardiac and circulatory function. It then discusses the importance of the interrelationship of pressures and flows in organ systems, such as the lungs and kidneys, and details the organization and function of the nervous system. After focusing on the systems used to monitor signals, the book explores modeling, biomechanics, and emerging technologies, including the progressive miniaturization of sensors and actuators in biomedical engineering. Developed from the authors' courses in medical biophysics and biomedical instrumentation, this book shows how biophysics and biomedical engineering have advanced modern medicine. It brings together the physical principles underlying human physiological processes and the physical methods used to monitor these processes. Requiring only basic mathematical knowledge, the text supplements mathematical formulae with qualitative explanations and illustrations to encourage an intuitive grasp on the processes discussed.

Environmental science is an interdisciplinary academic field that integrates physical-, biological-, and information sciences to study and solve environmental problems. ESSE - The International Conference on Environmental Science and Sustainable Energy provides a platform for experts, professionals, and researchers to share updated information and stimulate the communication with each other. In 2017 it was held in Suzhou, China June 23-25, 2017.

This comprehensive treatment of multivariable calculus focuses on the numerous tools that MATLAB® brings to the subject, as it presents introductions to geometry, mathematical physics, and kinematics. Covering simple calculations with MATLAB®, relevant plots, integration, and optimization, the numerous problem sets encourage practice with newly learned skills that cultivate the reader's understanding of the material. Significant examples illustrate each topic, and fundamental physical applications such as Kepler's Law, electromagnetism, fluid flow, and energy estimation are brought to prominent position. Perfect for use as a supplement to any standard multivariable calculus text, a "mathematical methods in physics or engineering" class, for independent study, or even as the class text in an "honors" multivariable calculus course, this textbook will appeal to mathematics, engineering, and physical science students. MATLAB® is tightly integrated into every portion of this book, and its graphical capabilities are used to present vibrant pictures of curves and surfaces. Readers benefit from the deep connections made between mathematics and science while learning more about the intrinsic geometry of curves and surfaces. With serious yet elementary explanation of various numerical algorithms, this textbook enlivens the teaching of multivariable calculus and mathematical methods courses for scientists and engineers.

Classical Mechanics with MATLAB Applications
Computational Physics
With Worked Out Examples in FORTRAN and MATLAB
Practical Biomedical Signal Analysis Using MATLAB®
With use of Matlab and Python
MATLAB For Dummies
Hands-On Accelerator Physics Using MATLAB®
Elementary Mechanics Using Matlab
Advanced Nanoelectronics
Diagnostic Radiology Physics with MATLAB®
With Companion Media Pack

In this textbook a combination of standard mathematics and modern numerical methods is used to describe a wide range of natural wave phenomena, such as sound, light and water waves, particularly in specific popular contexts, e.g. colors or the acoustics of musical instruments. It introduces the reader to the basic physical principles that allow the description of the oscillatory motion of matter and classical fields, as well as resulting concepts including interference, diffraction, and coherence. Numerical methods offer new scientific insights and make it possible to handle interesting cases that can't readily be addressed using analytical mathematics; this holds true not only for problem solving but also for the description of phenomena. Essential physical parameters are brought more into focus, rather than concentrating on the details of which mathematical trick should be used to obtain a certain solution. Readers will learn how time-resolved frequency analysis offers a deeper understanding of the interplay between frequency and time, which is relevant to many phenomena involving oscillations and waves. Attention is also drawn to common misconceptions resulting from uncritical use of the Fourier transform. The book offers an ideal guide for upper-level undergraduate physics students and will also benefit physics instructors. Program codes in Matlab and Python, together with interesting files for use in the problems, are provided as free supplementary material.

This book covers a broad spectrum of the most important, basic numerical and analytical techniques used in physics -including ordinary and partial differential equations, linear algebra, Fourier transforms, integration and probability. Now language-independent. Features attractive new 3-D graphics. Offers new and significantly revised exercises. Replaces FORTRAN listings with C++, with updated versions of the FORTRAN programs now available on-line. Devotes a third of the book to partial differential equations-e.g., Maxwell's equations, the diffusion equation, the wave equation, etc. This numerical analysis book is designed for the programmer with a physics background.Previously published by Prentice Hall / Addison-Wesley

Practical Biomedical Signal Analysis Using MATLAB® presents a coherent treatment of various signal processing methods and applications. The book not only covers the current techniques of biomedical signal processing, but it also offers guidance on which methods are appropriate for a given task and different types of data. The first several chapters of the text describe signal analysis techniques—including the newest and most advanced methods—in an easy and accessible way. MATLAB routines are listed when available and freely available software is discussed where appropriate. The final chapter explores the application of the methods to a broad range of biomedical signals, highlighting problems encountered in practice. A unified overview of the field, this book explains how to properly use signal processing techniques for biomedical applications and avoid misinterpretations and pitfalls. It helps readers to choose the appropriate method as well as design their own methods.

This book - specifically developed as a novel textbook on elementary classical mechanics - shows how analytical and numerical methods can be seamlessly integrated to solve physics problems. This approach allows students to solve more advanced and applied problems at an earlier stage and equips them to deal with real-world examples well beyond the typical special cases treated in standard textbooks. Another advantage of this approach is that students are brought closer to the way physics is actually discovered and applied, as they are introduced right from the start to a more exploratory way of understanding phenomena and of developing their physical concepts. While not a requirement, it is advantageous for the reader to have some prior knowledge of scientific programming with a scripting-type language. This edition of the book uses Matlab, and a chapter devoted to the basics of scientific programming with Matlab is included. A parallel edition using Python instead of Matlab is also available. Last but not least, each chapter is accompanied by an extensive set of course-tested exercises and solutions.

Presents numerical methods for reservoir simulation, with efficient implementation and examples using widely-used online open-source code, for researchers, professionals and advanced students. This title is also available as Open Access on Cambridge Core.

Imaging modalities in radiology produce ever-increasing amounts of data which need to be displayed, optimized, analyzed and archived: a "big data" as well as an "image processing" problem. Computer programming skills are rarely emphasized during the education and training of medical physicists, meaning that many individuals enter the workplace without the ability to efficiently solve many real-world clinical problems. This book provides a foundation for the teaching and learning of programming for medical physicists and other professions in the field of Radiology and offers valuable content for novices and more experienced readers alike. It focuses on providing readers with practical skills on how to implement MATLAB® as an everyday tool, rather than on solving academic and abstract physics problems. Further, it recognizes that MATLAB is only one tool in a medical physicist's toolkit and shows how it can be used as the "glue" to integrate other software and processes together. Yet, with great power comes great responsibility. The pitfalls to deploying your own software in a clinical environment are also clearly explained. This book is an ideal companion for all medical physicists and medical professionals looking to learn how to utilize MATLAB in their work. Features Encompasses a wide range of medical physics applications in diagnostic and interventional radiology Advances the skill of the reader by taking them through real-world practical examples and solutions with access to an online resource of example code The diverse examples of varying difficulty make the book suitable for readers from a variety of backgrounds and with different levels of programming experience.

Drawing on examples from various areas of physics, this textbook introduces the reader to computer-based physics using Fortran® and Matlab®. It elucidates a broad palette of topics, including fundamental phenomena in classical and quantum mechanics, hydrodynamics and dynamical systems, as well as effects in field theories and macroscopic pattern formation described by (nonlinear) partial differential equations. A chapter on Monte Carlo methods is devoted to problems typically occurring in statistical physics. Contents Introduction Nonlinear maps Dynamical systems Ordinary differential equations I Ordinary differential equations II Partial differential equations I, basics Partial differential equations II, applications Monte Carlo methods (MC) Matrices and systems of linear equations Program library Solutions of the problems README and a short guide to FE-tools

Presenting a practical, problem-based approach to colour physics, this title describes the key issues encountered in modern colour engineering, including efficient representation of colour information, fourier analysis of reflectance spectra and advanced colorimetric computation. Emphasis is placed on the practical applications rather than the techniques themselves, with material structured around key topics, such as colour calibration of visual displays, computer recipe prediction and models for colour-appearance prediction. Each topic is carefully introduced at three levels to enhance student understanding. Firstly, theoretical ideas and background information are discussed, explanations of mathematical solutions then follow and finally practical solutions are presented using MATLAB. Includes a compendium of equations and numerical data required by the modern colour and imaging scientist. Numerous examples of solutions and algorithms for a wide-range of computational problems in colour science. Provides example scripts using the MATLAB programming language. This text is a must-have for students taking courses in colour science, colour chemistry and colour physics as well as technicians and researchers working in the area.

Computational Colour Science using MATLAB
Multivariable Calculus with MATLAB®
More Physics with MATLAB
MATLAB with Applications to Engineering, Physics and Finance
Cosmology with MATLAB
A Guide to MATLAB
Computational Physics: 2nd edition
(with Companion Media Pack)
User Guide for the MATLAB Reservoir Simulation Toolbox (MRST)
One Hundred Physics Visualizations Using MATLAB
Clinical Radiotherapy Physics with MATLAB

Learn Two Popular Programming Languages in a Single Volume Widely used by scientists and engineers, well-established MATLAB® and open-source Octave are similar software programs providing excellent capabilities for data analysis, visualization, and more. By means of straightforward explanations and examples from different areas in mathematics, engineering, finance, and physics, Essential MATLAB and Octave explains how MATLAB and Octave are powerful tools applicable to a variety of problems. This text provides an introduction that reveals basic structures and syntax, demonstrates the use of functions and procedures, outlines availability in various platforms, and highlights the most important elements for both programs. Effectively Implement Models and Prototypes Using Computational Models This text requires no prior knowledge. Self-contained, it allows the reader to use the material whenever needed rather than follow a particular order. Compatible with both languages, the book material incorporates commands and structures that allow the reader to gain a greater awareness of MATLAB and Octave, write their own code, and implement their scripts and programs within a variety of applicable fields. It is always made clear when particular examples apply only to MATLAB or only to Octave, allowing the book to be used flexibly depending on readers' requirements. Includes brief, simple code that works in both MATLAB and Octave Provides exercise sections at the end of each chapter Introduces framed examples and discussions with a scientific twist Exercises are provided at the end of each chapter Essential MATLAB and Octave offers an introductory course in MATLAB and Octave programming and is an authoritative resource for students in physics, mathematics, statistics, engineering, and any other subjects that require the use of computers to solve numerical problems.

Readers are guided step by step through numerous specific problems and challenges, covering all aspects of electrostatics with an emphasis on numerical procedures. The author focuses on practical examples, derives mathematical equations, and addresses common issues with algorithms. Introduction to Numerical Electrostatics contains problem sets, an accompanying web site with simulations, and a complete list of computer codes. Computer source code listings on accompanying web site Problem sets included with book Readers using MATLAB or other simulation packages will gain insight as to the inner workings of these packages, and how to account for their limitations Example computer code is provided in MATLAB Solutions Manual The first book of its kind uniquely devoted to the field of computational electrostatics

Master the tools of MATLAB through hands-on examples Shows How to Solve Math Problems Using MATLAB The mathematical software MATLAB® integrates computation, visualization, and programming to produce a powerful tool for a number of different tasks in mathematics. Focusing on the MATLAB toolboxes especially dedicated to science, finance, and engineering, MATLAB® with Applications to Engineering, Physics and Finance explains how to perform complex mathematical tasks with relatively simple programs. This versatile book is accessible enough for novices and users with only a fundamental knowledge of MATLAB, yet covers many sophisticated concepts to make it helpful for experienced users as well. The author first introduces the basics of MATLAB, describing simple functions such as differentiation, integration, and plotting. He then addresses advanced topics, including programming, producing executables, publishing results directly from MATLAB programs, and creating graphical user interfaces. The text also presents examples of Simulink® that highlight the advantages of using this software package for system modeling and simulation. The applications-dedicated chapters at the end of the book explore the use of MATLAB in digital signal processing, chemical and food engineering, astronomy, optics, financial derivatives, and much more.

This volume makes explicit use of the synergy between cosmology and high energy physics, for example, supersymmetry and dark matter, or nucleosynthesis and the baryon-to-photon ratio. In particular the exciting possible connection between the recently discovered Higgs scalar and the scalar field responsible for inflation is explored. The recent great advances in the accuracy of the basic cosmological parameters is exploited in that no free scale parameters such as h appear, rather the basic calculations are done numerically using all sources of energy density simultaneously. Scripts are provided that allow the reader to calculate exact results for the basic parameters. Throughout MATLAB tools such as symbolic math, numerical solutions, plots and "movies" of the dynamical evolution of systems are used. The GUI package is also shown as an example of the real time manipulation of parameters which is available to the reader. All the MATLAB scripts are made available to the reader to explore examples of the uses of the suite of tools which are available. Indeed, readers should be able to engage in a command line "dialogue" or go on to edit the scripts and write their own versions.

Solid state physics, the study and prediction of the fundamental physical properties of materials, forms the backbone of modern materials science and has many technological applications. The unique feature of this text is the MATLAB®-based computational approach with several numerical techniques and simulation methods included. This is highly effective in addressing the need for visualization and a direct hands-on approach in learning the theoretical concepts of solid state physics. The code is freely available to all textbook users. Additional Features: Uses the pedagogical tools of computational physics that have become important in enhancing physics teaching of advanced subjects such as solid state physics Adds visualization and simulation to the subject in a way that enables students to participate actively in a hand-on approach Covers the basic concepts of solid state physics and provides students with a deeper understanding of the subject matter Provides unique example exercises throughout the text Obtains mathematical analytical solutions Carries out illustrations of important formulae results using programming scripts that students can run on their own and reproduce graphs and/or simulations Helps students visualize solid state processes and apply certain numerical techniques using MATLAB®, making the process of learning solid state physics much more effective Reinforces the examples discussed within the chapters through the use of end-of-chapter exercises Includes simple analytical and numerical examples to more challenging ones, as well as computational problems with the opportunity to run codes, create new ones, or modify existing ones to solve problems or reproduce certain results

This handbook focuses on special functions in physics in the real and complex domain. It covers more than 170 different functions with additional numerical hints for efficient computation, which are useful to anyone who needs to program with other programming languages as well. The book comes with MATLAB-based programs for each of these functions and a detailed html-based documentation. Some of the explained functions are: Gamma and Beta functions; Legendre functions, which are linked to quantum mechanics and electrodynamics; Bessel functions; hypergeometric functions, which play an important role in mathematical physics; orthogonal polynomials, which are largely used in computational physics; and Riemann zeta functions, which play an important role, e.g., in quantum chaos or string theory. The book's primary audience are scientists, professionals working in research areas of industries, and advanced students in physics, applied mathematics, and engineering.

COMSOL 5 and MATLAB are valuable software modeling tools for engineers and scientists. This book explores a wide range of models in coordinate systems from 0D to 3D and introduces the numerical analysis techniques employed in COMSOL 5 (including Application Builder) and MATLAB software. The text presents electromagnetic, electronic, optical, thermal physics, and biomedical models as examples. It presents the fundamental concepts in the models and the step-by-step instructions needed to build each model. The companion DVD includes all the built models for each step-by-step example presented in the text and the related animations, as specified. The book is designed to introduce modeling to an experienced engineer or can also be used for upper level undergraduate or graduate courses. Features: •Focuses on COMSOL 5 and MATLAB models that demonstrate the use of concepts for later application in engineering, science, medicine, and biophysics for the development of devices and systems •Includes a DVD with executable copies of each model and related animations •Includes detailed discussions of possible modeling errors and results •Uses a step-by-step modeling methodology linked to the Fundamental Laws of Physics

Computers and computation are extremely important components of physics and should be integral parts of a physicist's education. Furthermore, computational physics is reshaping the way calculations are made in all areas of physics. Intended for the physics and engineering students who have completed the introductory physics course, A First Course in Computational Physics, Second Edition covers the different types of computational problems using MATLAB with exercises developed around problems of physical interest. Topics such as root finding, Newton-Cotes integration, and ordinary differential equations are included and presented in the context of physics problems. A few topics rarely seen at this level such as computerized tomography, are also included. Within each chapter, the student is led from relatively elementary problems and simple numerical approaches through derivations of more complex and sophisticated methods, often culminating in the solution to problems of significant difficulty. The goal is to demonstrate how numerical methods are used to solve the problems that physicists face. Read the review published in Computing in Science & Engineering magazine, March/April 2011 (Vol. 13, No. 2) © 2011 IEEE, Published by the IEEE Computer Society

Computational Photonics
Mathematical Methods for Physics
Programming with MATLAB for Scientists
A Modern Course Combining Analytical and Numerical Techniques
Multiphysics Modeling Using COMSOL5 and MATLAB
An Introduction with MATLAB
An Introduction to Reservoir Simulation Using MATLAB/GNU Octave
Proceedings of the International Conference on Environmental Science and Sustainable Energy Ed.by ZhaoYang Dong
Physics of Oscillations and Waves
Physical Modeling in MATLAB
Using MATLAB and Maple

This book offers an introduction to the basics of MATLAB programming to scientists and engineers. The author leads with engaging examples to build a working knowledge, specifically geared to those with science and engineering backgrounds. The reader is empowered to model and simulate real systems, as well as present and analyze everyday data sets. In order to achieve those goals, the contents bypass excessive "under the hood" details, and instead gets right down to the essential, practical foundations for successful programming and modeling. Readers will benefit from the following features: Teaches programming to scientists and engineers using a problem-based approach, leading with illustrative and interesting examples. Emphasizes a hands-on approach, with "must know" information and minimal technical details. Utilizes examples from science and engineering to showcase the application of learned concepts on real problems. Showcases modeling of real systems, gradually advancing from simpler to more challenging problems. Highlights the practical uses of data processing and analysis in everyday life.

Hands-On Accelerator Physics Using MATLAB® provides an introduction into the design and operational issues of a wide range of particle accelerators, from ion-implanters to the Large Hadron Collider at CERN. Many aspects from the design of beam optical systems and magnets, to the subsystems for acceleration, beam diagnostics, and vacuum are covered. Beam dynamics topics ranging from the beam-beam interaction to free-electron lasers are discussed. Theoretical concepts and the design of key components are explained with the help of MATLAB® code. Practical topics, such as beam size measurements, magnet construction and measurements, and radio-frequency measurements are explored in student labs without requiring access to an accelerator. This unique approach provides a look at what goes on 'under the hood' inside modern accelerators and presents readers with the tools to perform their independent investigations on the computer or in student labs. This book will be of interest to graduate students, postgraduate researchers studying accelerator physics, as well as engineers entering the field. Features: Provides insights into both synchrotron light sources and colliders Discusses technical subsystems, including magnets, radio-frequency engineering, instrumentation and diagnostics, correction of imperfections, control, and cryogenics Accompanied by MATLAB® code, including a 3D-modeler to visualize the accelerators, and additional appendices which are available on the CRC Press website

Based on the author's junior-level undergraduate course, this introductory textbook is designed for a course in mathematical physics. Focusing on the physics of oscillations and waves, A Course in Mathematical Methods for Physicists helps students understand the mathematical techniques needed for their future studies in physics. It takes a bottom-u

Go from total MATLAB newbie to plotting graphs and solving equations in a flash! MATLAB is one of the most powerful and commonly used tools in the STEM field. But did you know it doesn't take an advanced degree or a ton of computer experience to learn it? MATLAB For Dummies is the roadmap you've been looking for to simplify and explain this feature-filled tool. This handy reference walks you through every step of the way as you learn the MATLAB language and environment inside-and-out. Starting with straightforward basics before moving on to more advanced material like Live Functions and Live Scripts, this easy-to-read guide shows you how to make your way around MATLAB with screenshots and newly updated procedures. It includes: A comprehensive introduction to installing MATLAB, using its interface, and creating and saving your first file Fully updated to include the 2020 and 2021 updates to MATLAB, with all-new screenshots and up-to-date procedures Enhanced debugging procedures and use of the Symbolic Math Toolbox Brand new instruction on working with Live Scripts and Live Functions, designing classes, creating apps, and building projects Intuitive walkthroughs for MATLAB's advanced features, including importing and exporting data and publishing your work Perfect for STEM students and new professionals ready to master one of the most powerful tools in the fields of engineering, mathematics, and computing, MATLAB For Dummies is the simplest way to go from complete newbie to power user faster than you would have thought possible.

Presents a unique approach to grasping the concepts of quantum theory with a focus on atoms, clusters, and crystals Quantum theory of atoms and molecules is vitally important in molecular physics, materials science, nanoscience, solid state physics and many related fields. Introductory Quantum Mechanics with MATLAB is designed to be an accessible guide to quantum theory and its applications. The textbook uses the popular MATLAB programming language for the analytical and numerical solution of quantum mechanical problems, with a particular focus on clusters and assemblies of atoms. The textbook is written by a noted researcher and expert on the topic who introduces density functional theory, variational calculus and other practice-proven methods for the solution of quantum-mechanical problems. This important guide: -Presents the material in a didactical manner to help students grasp the concepts and applications of quantum theory -Covers a wealth of cutting-edge topics such as clusters, nanocrystals, transitions and organic molecules -Offers MATLAB codes to solve real-life quantum mechanical problems Written for master's and PhD students in physics, chemistry, material science, and engineering sciences, Introductory Quantum Mechanics with MATLAB contains an accessible approach to understanding the concepts of quantum theory applied to atoms, clusters, and crystals.

With Applications to Geometry and Physics
Physiology, Biophysics, and Biomedical Engineering
For Atoms, Molecules, Clusters, and Nanocrystals
Modeling and Simulation of Systems Using MATLAB and Simulink
Special Functions in Physics with MATLAB
Introduction to Numerical Electrostatics Using MATLAB
Essential MATLAB and Octave