

# Matlab Code For Fdtd Simulation

Electromagnetic and Photonic Simulation for the Beginner: Finite-Difference Frequency-Domain in MATLAB® Raymond C. Rumpf.2022-01-31 This book teaches the finite-difference frequency-domain (FDFD) method from the simplest concepts to advanced three-dimensional simulations. It uses plain language and high-quality graphics to help the complete beginner grasp all the concepts quickly and visually. This single resource includes everything needed to simulate a wide variety of different electromagnetic and photonic devices. The book is filled with helpful guidance and computational wisdom that will help the reader easily simulate their own devices and more easily learn and implement other methods in computational electromagnetics. Special techniques in MATLAB® are presented that will allow the reader to write their own FDFD programs. Key concepts in electromagnetics are reviewed so the reader can fully understand the calculations happening in FDFD. A powerful method for implementing the finite-difference method is taught that will enable the reader to solve entirely new differential equations and sets of differential equations in mere minutes. Separate chapters are included that describe how Maxwell's equations are approximated using finite-differences and how outgoing waves can be absorbed using a perfectly matched layer absorbing boundary. With this background, a chapter describes how to calculate guided modes in waveguides and transmission lines. The effective index method is taught as way to model many three-dimensional devices in just two-dimensions. Another chapter describes how to calculate photonic band diagrams and isofrequency contours to quickly estimate the properties of periodic structures like photonic crystals. Next, a chapter presents how to analyze diffraction gratings and calculate the power coupled into each diffraction order. This book shows that many devices can be simulated in the context of a diffraction grating including guided-mode resonance filters, photonic crystals, polarizers, metamaterials, frequency selective surfaces, and metasurfaces. Plane wave sources, Gaussian beam sources, and guided-mode sources are all described in detail, allowing devices to be simulated in multiple ways. An optical integrated circuit is simulated using the effective index method to build a two-dimensional model of the 3D device and then launch a guided-mode source into the circuit. A chapter is included to describe how the code can be modified to easily perform parameter sweeps, such as plotting reflection and transmission as a function of frequency, wavelength, angle of incidence, or a dimension of the device. The last chapter is advanced and teaches FDFD for three-dimensional devices composed of anisotropic materials. It includes simulations of a crossed grating, a doubly-periodic guided-mode resonance filter, a frequency selective surface, and an invisibility cloak. The chapter also includes a parameter retrieval from a left-handed metamaterial. The book includes all the MATLAB codes and detailed explanations of all programs. This will allow the reader to easily modify the codes to simulate their own ideas and devices. The author has created a website where the MATLAB codes can be downloaded, errata can be seen, and other learning resources can be accessed. This is an ideal book for both an undergraduate elective course as well as a graduate course in computational electromagnetics because it covers the background material so well and includes examples of many different types of devices that will be of interest to a very wide audience.

Numerical Sound Synthesis Stefan Bilbao.2009-09-03 Digital sound synthesis has long been approached using standard digital filtering techniques. Newer synthesis strategies, however, make use of physical descriptions of musical instruments, and allow for much more realistic and complex sound production and thereby synthesis becomes a problem of simulation. This book has a special focus on time domain finite difference methods presented within an audio framework. It covers time series and difference operators, and basic tools for the construction and analysis of finite difference schemes, including frequency-domain and energy-based methods, with special attention paid to problems inherent to sound synthesis. Various basic lumped systems and excitation mechanisms are covered, followed by a look at the 1D wave equation, linear bar and string vibration, acoustic tube modelling, and linear membrane and plate vibration. Various advanced topics, such as the nonlinear vibration of strings and plates, are given an elaborate treatment. Key features: Includes a historical overview of digital sound synthesis techniques, highlighting the links between the various physical modelling methodologies. A pedagogical presentation containing over 150 problems and programming exercises, and numerous figures and diagrams, and code fragments in the MATLAB® programming language helps the reader with limited experience of numerical methods reach an understanding of this subject. Offers a complete treatment of all of the major families of musical instruments, including certain audio effects. Numerical Sound Synthesis is suitable for audio and software engineers, and researchers in digital audio, sound synthesis and more general musical acoustics. Graduate students in electrical engineering, mechanical engineering or computer science, working on the more technical side of digital audio and sound synthesis, will also find this book of interest.

**Electromagnetic Simulation Using the FDTD Method** Dennis M. Sullivan.2013-05-17 A straightforward, easy-to-read introduction to the finite-difference time-domain (FDTD) method Finite-difference time-domain (FDTD) is one of the primary computational electrodynamics modeling techniques available. Since it is a time-domain method, FDTD solutions can cover a wide frequency range with a single simulation run and treat nonlinear material properties in a natural way. Written in a tutorial fashion, starting with the simplest programs and guiding the reader up from one-dimensional to the more complex, three-dimensional programs, this book provides a simple, yet comprehensive introduction to the most widely used method for electromagnetic simulation. This fully updated edition presents many new applications, including the FDTD method being used in the design and analysis of highly resonant radio frequency (RF) coils often used for MRI. Each chapter contains a concise explanation of an essential concept and instruction on its implementation into computer code. Projects that increase in complexity are included, ranging from simulations in free space to propagation in dispersive media. Additionally, the text offers downloadable MATLAB and C programming languages from the book support site (<http://booksupport.wiley.com>). Simple to read and classroom-tested, Electromagnetic Simulation Using the FDTD Method is a useful reference for practicing engineers as well as undergraduate and graduate engineering students.

*Computational Electromagnetics with MATLAB, Fourth Edition* Matthew N.O. Sadiku.2018-07-20 This fourth edition of the text reflects the continuing increase in awareness and use of computational electromagnetics and incorporates advances and refinements made in recent years. Most notable among these are the improvements made to the standard algorithm for the finite-difference time-domain (FDTD) method and treatment of absorbing boundary conditions in FDTD, finite element, and transmission-line-matrix methods. It teaches the readers how to pose, numerically analyze, and solve EM problems, to give them the ability to expand their problem-solving skills using a variety of methods, and to prepare them for research in electromagnetism. Includes new homework problems in each chapter. Each chapter is updated with the current trends in CEM. Adds a new appendix on CEM codes, which covers commercial and free codes. Provides updated MATLAB code.

*Optical Tweezers* Philip H. Jones, Onofrio M. Marag-, Giovanni Volpe.2015-12-03 A comprehensive guide to the theory, practice and applications of optical tweezers, combining state-of-the-art research with a strong pedagogic approach.

Smart Intelligent Computing and Applications Suresh Chandra Satapathy, Vikrant Bhateja, Swagatam Das.2018-10-01 The proceedings covers advanced and multi-disciplinary research on design of smart computing and informatics. The theme of the book broadly focuses on various innovation paradigms in system knowledge, intelligence and sustainability that may be applied to provide realistic solution to varied problems in society, environment and industries. The volume publishes quality work pertaining to the scope of the conference which is extended towards deployment of emerging computational and knowledge transfer approaches, optimizing solutions in varied disciplines of science, technology and healthcare.

**Electromagnetic Simulation Using the FDTD Method with Python** Jennifer E. Houle, Dennis M. Sullivan.2020-01-15 Provides an introduction to the Finite Difference Time Domain method and shows how Python

code can be used to implement various simulations This book allows engineering students and practicing engineers to learn the finite-difference time-domain (FDTD) method and properly apply it toward their electromagnetic simulation projects. Each chapter contains a concise explanation of an essential concept and instruction on its implementation into computer code. Included projects increase in complexity, ranging from simulations in free space to propagation in dispersive media. This third edition utilizes the Python programming language, which is becoming the preferred computer language for the engineering and scientific community. Electromagnetic Simulation Using the FDTD Method with Python, Third Edition is written with the goal of enabling readers to learn the FDTD method in a manageable amount of time. Some basic applications of signal processing theory are explained to enhance the effectiveness of FDTD simulation. Topics covered include one-dimensional simulation with the FDTD method, two-dimensional simulation, and three-dimensional simulation. The book also covers advanced Python features and deep regional hyperthermia treatment planning. Electromagnetic Simulation Using the FDTD Method with Python: Guides the reader from basic programs to complex, three-dimensional programs in a tutorial fashion Includes a rewritten fifth chapter that illustrates the most interesting applications in FDTD and the advanced graphics techniques of Python Covers peripheral topics pertinent to time-domain simulation, such as Z-transforms and the discrete Fourier transform Provides Python simulation programs on an accompanying website An ideal book for senior undergraduate engineering students studying FDTD, Electromagnetic Simulation Using the FDTD Method with Python will also benefit scientists and engineers interested in the subject.

Adjoint Sensitivity Analysis of High Frequency Structures with MATLAB® Mohamed H. Bakr, Atef Z. Elsherbeni, Veysel Demir. 2017-03-24 This unique reference is the first to cover the theory of adjoint sensitivity analysis and explains how it can be applied to different types of electromagnetic structures. It is an invaluable book for anyone looking for an in-depth understanding of this useful theory for application in high-frequency electromagnetic problems. It uses the popular FDTD method to show how wideband sensitivities can be efficiently estimated for different types of materials and structures, and includes plenty of well-explained MATLAB(R) examples to help readers absorb the content more easily. Topics covered include a review of FDTD and an introduction to adjoint sensitivity analysis; sensitivity of the fields to changes in material parameters; sensitivity of S parameters; extension to dispersive material parameters, where the underlying FDTD algorithm must be modified; second-order sensitivity analysis; time-domain responses; and applications to nonlinear and anisotropic materials. This book will make the theory more understandable to the broadest possible audience. It will be useful for researchers and advanced students involved in computational techniques for electromagnetics, and other disciplines such as microwave, optics, acoustics, and semiconductor modelling.

Silicon Photonics Design Lukas Chrostowski, Michael Hochberg. 2015-03-12 This hands-on introduction to silicon photonics engineering equips students with everything they need to begin creating foundry-ready designs.

**Computational Science and Its Applications - ICCSA 2007** Osvaldo Gervasi. 2007-08-29 This three-volume set constitutes the refereed proceedings of the International Conference on Computational Science and its Applications. These volumes feature outstanding papers that present a wealth of original research results in the field of computational science, from foundational issues in computer science and mathematics to advanced applications in almost all sciences that use computational techniques.

Scattering Analysis of Periodic Structures using Finite-Difference Time-Domain Method Khaled ElMahgoub, Fan Yang, Atef Elsherbeni. 2022-06-01 Periodic structures are of great importance in electromagnetics due to their wide range of applications such as frequency selective surfaces (FSS), electromagnetic band gap (EBG) structures, periodic absorbers, meta-materials, and many others. The aim of this book is to develop efficient computational algorithms to analyze the scattering properties of various electromagnetic periodic structures using the finite-difference time-domain periodic boundary condition (FDTD/PBC) method. A new FDTD/PBC-based algorithm is introduced to analyze general skewed grid periodic structures while another algorithm is developed to analyze dispersive periodic structures. Moreover, the proposed algorithms are successfully integrated with the generalized scattering matrix (GSM) technique, identified as the hybrid FDTD-GSM algorithm, to efficiently analyze multilayer periodic structures. All the developed algorithms are easy to implement and are efficient in both computational time and memory usage. These algorithms are validated through several numerical test cases. The computational methods presented in this book will help scientists and engineers to investigate and design novel periodic structures and to explore other research frontiers in electromagnetics. Table of Contents: Introduction / FDTD Method and Periodic Boundary Conditions / Skewed Grid Periodic Structures / Dispersive Periodic Structures / Multilayered Periodic Structures / Conclusions

Fundamentals of Electromagnetics with MATLAB Karl Erik Lonngren, Sava Vasilev Savov, Randy J. Jost. 2007 Accompanying CD-ROM contains a MATLAB tutorial.

**FDTD Modeling of Metamaterials: Theory and Applications** Yang Hao, Raj Mittra. 2008-10-01 Master powerful new modeling tools that let you quantify and represent metamaterial properties with never-before accuracy. This first-of-its-kind book brings you up to speed on breakthrough finite-difference time-domain techniques for modeling metamaterial characteristics and behaviors in electromagnetic systems. This practical resource comes complete with sample FDTD scripts to help you pave the way to new metamaterial applications and advances in antenna, microwave, and optics engineering. You get in-depth coverage of state-of-the-art FDTD modeling techniques and applications for electromagnetic bandgap (EBG) structures, left-handed metamaterials (LHMs), wire medium, metamaterials for optics, and other practical metamaterials. You find steps for computing dispersion diagrams, dealing with material dispersion properties, and verifying the left-handedness. Moreover, this comprehensive volume offers guidance for handling the unique properties possessed by metamaterials, including how to define material parameters, characterize the interface of metamaterial slabs, and quantify their spatial as well as frequency dispersion characteristics. The book also presents conformal and dispersive FDTD modeling of electromagnetic cloaks, perfect lens, and plasmonic waveguides, as well as other novel antenna, microwave, and optical applications. Over 190 illustrations support key topics throughout the book.

The Finite-difference Time-domain Method for Electromagnetics with MATLAB Simulations Atef Z. Elsherbeni, Veysel Demir. 2009 Helping students to construct a program with sufficient functionality to solve some basic problems, this book presents the construction of equations accompanied by 3D illustrations. It also explains the transformation of the concepts into programming.

**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.

Numerical Electromagnetics Umran S. Inan, Robert A. Marshall. 2011-04-07 Beginning with the development of finite difference equations, and leading to the complete FDTD algorithm, this is a coherent introduction to the FDTD method (the method of choice for modeling Maxwell's equations). It provides students and professional engineers with everything they need to know to begin writing FDTD simulations from scratch and to develop a thorough understanding of the inner workings of commercial FDTD software. Stability, numerical dispersion, sources and boundary conditions are all discussed in detail, as are dispersive and anisotropic materials. A comparative introduction of the finite volume and finite element methods is also provided. All concepts are introduced from first principles, so no prior modeling experience is required, and they are made easier to understand through numerous illustrative examples and the inclusion of both intuitive explanations and mathematical derivations.

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.

**Scientific and Engineering Applications Using MATLAB** Emilson Pereira Leite.2011-08-01 The purpose of this book is to present 10 scientific and engineering works whose numerical and graphical analysis were all constructed using the power of MATLAB® tools. The first five chapters of this book show applications in seismology, meteorology and natural environment. Chapters 6 and 7 focus on modeling and simulation of Water Distribution Networks. Simulation was also applied to study wide area protection for interconnected power grids (Chapter 8) and performance of conical antennas (Chapter 9). The last chapter deals with depth positioning of underwater robot vehicles. Therefore, this book is a collection of interesting examples of where this computational package can be applied.

**FDTD Analysis of Guided Electromagnetic Wave Interaction with Time-Modulated Dielectric Medium** Debdeep Sarkar.2022-04-22 This book presents a detailed analytical and computational electromagnetic (CEM) treatment of guided electromagnetic (EM) wave propagation in independently time-varying dielectric medium, using the finite-difference time-domain (FDTD) simulation technique. The contents provide an extensive literature review, explaining the importance of time-varying media (temporal photonic crystals) in new exotic applications that involve rich EM phenomena such as parametric amplification, frequency conversion, non-reciprocal gain, electromagnetic energy accumulation, temporal coating and temporal aiming (beam-forming). A one-dimensional (1D) FDTD simulation paradigm is then formulated in this book, starting from Maxwell's equations and boundary conditions. The issues of hard/soft source realizations, perfectly matched layers (PMLs), choice of simulation parameters (cell-size and time-stepping) are thoroughly explained through new visualization tools. This book provides a unique combination of rigorous analytical techniques, several FDTD simulation examples with reproducible source-codes, and new visualization/post-processing mechanisms. The contents of this book should prove to be useful for students, research scholars, scientists and engineers, working in the field of applied electromagnetics, and aiming to design cutting-edge microwave/optical devices based on time-varying medium.

**Computational Electromagnetics for RF and Microwave Engineering** David B. Davidson.2005-02-24 Publisher Description

**Electromagnetic Waves, Materials, and Computation with MATLAB** Dikshitulu K. Kalluri.2016-04-19 Readily available commercial software enables engineers and students to perform routine calculations and design without necessarily having a sufficient conceptual understanding of the anticipated solution. The software is so user-friendly that it usually produces a beautiful colored visualization of that solution, often camouflaging the fact that t

**Introduction to the Finite-Difference Time-Domain (FDTD) Method for Electromagnetics** Stephen Gedney.2022-05-31 Introduction to the Finite-Difference Time-Domain (FDTD) Method for Electromagnetics provides a comprehensive tutorial of the most widely used method for solving Maxwell's equations -- the Finite Difference Time-Domain Method. This book is an essential guide for students, researchers, and professional engineers who want to gain a fundamental knowledge of the FDTD method. It can accompany an undergraduate or entry-level graduate course or be used for self-study. The book provides all the background required to either research or apply the FDTD method for the solution of Maxwell's equations to practical problems in engineering and science. Introduction to the Finite-Difference Time-Domain (FDTD) Method for Electromagnetics guides the reader through the foundational theory of the FDTD method starting with the one-dimensional transmission-line problem and then progressing to the solution of Maxwell's equations in three dimensions. It also provides step by step guides to modeling physical sources, lumped-circuit components, absorbing boundary conditions, perfectly matched layer absorbers, and sub-cell structures. Post processing methods such as network parameter extraction and far-field transformations are also detailed. Efficient implementations of the FDTD method in a high level language are also provided. Table of Contents: Introduction / 1D FDTD Modeling of the Transmission Line Equations / Yee Algorithm for Maxwell's Equations / Source Excitations / Absorbing Boundary Conditions / The Perfectly Matched Layer (PML) Absorbing Medium / Subcell Modeling / Post Processing

**Computational Electrodynamics** Allen Taflove,Susan C. Hagness.2005 This extensively revised and expanded third edition of the Artech House bestseller, Computational Electrodynamics: The Finite-Difference Time-Domain Method, offers you the most up-to-date and definitive resource on this critical method for solving Maxwell's equations. There has been considerable advancement in FDTD computational technology over the past few years, and this new edition brings you the very latest details with four new invited chapters on advanced techniques for PSTD, unconditional stability, provably stable FDTD-FETD hybrids, and hardware acceleration. Moreover, you find many completely new sections throughout the book, including major updates on convolutional PML ABCs; dispersive, nonlinear, classical-gain, and quantum-gain materials; and micro-, nano-, and bio- photonics.

**Theory and Computation of Electromagnetic Fields** Jian-Ming Jin.2015-08-10 Reviews the fundamental concepts behind the theory and computation of electromagnetic fields The book is divided in two parts. The first part covers both fundamental theories (such as vector analysis, Maxwell's equations, boundary condition, and transmission line theory) and advanced topics (such as wave transformation, addition theorems, and fields in layered media) in order to benefit students at all levels. The second part of the book covers the major computational methods for numerical analysis of electromagnetic fields for engineering applications. These methods include the three fundamental approaches for numerical analysis of electromagnetic fields: the finite difference method (the finite difference time-domain method in particular), the finite element method, and the integral equation-based moment method. The second part also examines fast algorithms for solving integral equations and hybrid techniques that combine different numerical methods to seek more efficient solutions of complicated electromagnetic problems. Theory and Computation of Electromagnetic Fields, Second Edition: Provides the foundation necessary for graduate students to learn and understand more advanced topics Discusses electromagnetic analysis in rectangular, cylindrical and spherical coordinates Covers computational electromagnetics in both frequency and time domains Includes new and updated homework problems and examples Theory and Computation of Electromagnetic Fields, Second Edition is written for advanced undergraduate and graduate level electrical engineering students. This book can also be used as a reference for professional engineers interested in learning about analysis and computation skills.

**Advances in Time-Domain Computational Electromagnetic Methods** Qiang Ren,Su Yan,Atef Z. Elsherbeni.2022-11-15 Discover state-of-the-art time domain electromagnetic modeling and simulation algorithms Advances in Time-Domain Computational Electromagnetic Methods delivers a thorough exploration of recent developments in time domain computational methods for solving complex electromagnetic problems. The book discusses the main time domain computational electromagnetics techniques, including finite-difference time domain (FDTD), finite-element time domain (FETD), discontinuous Galerkin time domain (DGTD), time domain integral equation (TDIE), and other methods in electromagnetic, multiphysics modeling and simulation, and antenna designs. The book bridges the gap between academic research and real engineering applications by comprehensively surveying the full picture of current state-of-the-art time domain electromagnetic simulation techniques. Among other topics, it offers readers discussions of automatic load balancing schemes for DG DG-FETD/SETD methods and convolution quadrature time domain integral equation methods for electromagnetic scattering. Advances in Time-Domain Computational Electromagnetic Methods also includes: Introductions to cylindrical, spherical, and symplectic FDTD, as well as FDTD for metasurfaces with GSTC and FDTD for nonlinear metasurfaces Explorations of FETD for dispersive and nonlinear media and SETD-DDM for periodic/quasi-periodic arrays Discussions of TDIE, including explicit marching-on-in-time solvers for second-kind time domain integral equations, TD-SIE DDM, and convolution quadrature time domain integral equation methods for electromagnetic scattering Treatments of deep learning, including time domain electromagnetic forward and inverse modeling using a differentiable programming platform Ideal for undergraduate

and graduate students studying the design and development of various kinds of communication systems, as well as professionals working in these fields, *Advances in Time-Domain Computational Electromagnetic Methods* is also an invaluable resource for those taking advanced graduate courses in computational electromagnetic methods and simulation techniques.

**Introduction to Numerical Electrostatics Using MATLAB** Lawrence N. Dworsky.2014-04-07 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

**The Finite-Difference Time-Domain Method for Electromagnetics with MATLAB® Simulations** Atef Z. Elsherbeni, Veysel Demir.2015-11-25 This is one of the best books on computational electromagnetics both for graduate students focusing on electromagnetics problems and for practicing engineering professionals in industry and government. It is designed as an advanced textbook and self-study guide to the FDTD method of solving EM problems and simulations. This latest edition has been expanded to include 5 entirely new chapters on advanced topics in the mainstream of FDTD practice. In addition to advanced techniques it also includes applications and examples, and some 'tricks and traps' of using MATLAB to achieve them. Compared to the previous version the second edition is more complete and is a good reference for someone who is performing FDTD research. This book is part of the ACES Series on Computational Electromagnetics and Engineering. Supplementary material can be found at the IET's ebook page Supplementary materials for professors are available upon request via email to books@theiet.org.

*Introductory Solid State Physics with MATLAB Applications* Javier E. Hasbun, Trinanjan Datta.2019-10-08 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

*Programming the Finite Element Method* I. M. Smith, D. V. Griffiths.2005-06-10 This title demonstrates how to develop computer programmes which solve specific engineering problems using the finite element method. It enables students, scientists and engineers to assemble their own computer programmes to produce numerical results to solve these problems. The first three editions of *Programming the Finite Element Method* established themselves as an authority in this area. This fully revised 4th edition includes completely rewritten programmes with a unique description and list of parallel versions of programmes in Fortran 90. The Fortran programmes and subroutines described in the text will be made available on the Internet via anonymous ftp, further adding to the value of this title.

*Vibration Simulation Using MATLAB and ANSYS* Michael R. Hatch.2000-09-21 Transfer function form, zpk, state space, modal, and state space modal forms. For someone learning dynamics for the first time or for engineers who use the tools infrequently, the options available for constructing and representing dynamic mechanical models can be daunting. It is important to find a way to put them all in perspective and have them available for quick reference. It is also important to have a strong understanding of modal analysis, from which the total response of a system can be constructed. Finally, it helps to know how to take the results of large dynamic finite element models and build small MATLAB® state space models. *Vibration Simulation Using MATLAB and ANSYS* answers all those needs. Using a three degree-of-freedom (DOF) system as a unifying theme, it presents all the methods in one book. Each chapter provides the background theory to support its example, and each chapter contains both a closed form solution to the problem-shown in its entirety-and detailed MATLAB code for solving the problem. Bridging the gap between introductory vibration courses and the techniques used in actual practice, *Vibration Simulation Using MATLAB and ANSYS* builds the foundation that allows you to simulate your own real-life problems. Features Demonstrates how to solve real problems, covering the vibration of systems from single DOF to finite element models with thousands of DOF Illustrates the differences and similarities between different models by tracking a single example throughout the book Includes the complete, closed-form solution and the MATLAB code used to solve each problem Shows explicitly how to take the results of a realistic ANSYS finite element model and develop a small MATLAB state-space model Provides a solid grounding in how individual modes of vibration combine for overall system response

*Fourier Modal Method and Its Applications in Computational Nanophotonics* Hwi Kim, Junghyun Park, Byoung-ho Lee.2017-12-19 Most available books on computational electrodynamics are focused on FDTD, FEM, or other specific technique developed in microwave engineering. In contrast, *Fourier Modal Method and Its Applications in Computational Nanophotonics* is a complete guide to the principles and detailed mathematics of the up-to-date Fourier modal method of optical analysis. It takes readers through the implementation of MATLAB® codes for practical modeling of well-known and promising nanophotonic structures. The authors also address the limitations of the Fourier modal method. Features Provides a comprehensive guide to the principles, methods, and mathematics of the Fourier modal method Explores the emerging field of computational nanophotonics Presents clear, step-by-step, practical explanations on how to use the Fourier modal method for photonics and nanophotonics applications Includes the necessary MATLAB codes, enabling readers to construct their own code Using this book, graduate students and researchers can learn about nanophotonics simulations through a comprehensive treatment of the mathematics underlying the Fourier modal method and examples of practical problems solved with MATLAB codes.

**RF Coaxial Slot Radiators: Modeling, Measurements, and Applications** Kok Yeow You.2016-01-01 This authoritative resource presents theoretical models of coaxial slot radiators. Numerical methods are used to present the solutions of those models, as well as focus on radiator applications, including measurements and calibration techniques. In each chapter, the experimental results are used to confirm the theoretical computer calculations. Both industry application aspects and academic theories and formulations are explored many with numerical calculations written in MATLAB code. In addition, this book contains many configurations and technical drawings providing the reader with more effective interpretation and explanation. This book provides easy to understand mathematical symbols, design guidelines, measurements, and applications for coaxial radiators suitable for both engineers and scientists.

**Photonic Crystals** Igor A. Sukhoivanov, Igor V. Guryev.2009-09-21 The great interest in photonic crystals and their applications in the last 15 years is being expressed in the publishing of a large number of monographs, collections, textbooks and tutorials, where existing knowledge concerning - eration principles of photonic crystal devices and microstructured ?bers, their mathematicaldescription,well-knownandnovelapplicationsofsuchtechno- gies in photonics and optical communications are presented. They challenges authors of new books to cover the gaps still existing in the literature and highlight and popularize of already known material in a new and original manner. Authorsofthisbookbelievethatthenextsteptowardswideapplicationof photoniccrystalsisthesolutionofmanypracticalproblemsofdesignandc- putation of the speci?c photonic crystal-based devices aimed at the speci?c technicalapplication.Inordertomakethisstep,itisnecessarytoincreasethe number of practitioners who can solve such problems independently. The aim of this book is to extend the group of researchers, developers and students, who could practically use the knowledge on the physics of photonic crystals together with the knowledge and skills of independent calculation of basic

characteristics of photonic crystals and modeling of various elements of integrated circuits and optical communication systems created on the basis of photonic crystals. The book is intended for qualified readers, specialists in the field of optics and photonics, students of higher courses, master degree students and PhD students. As an introduction to the subject, the book contains the basics of wave optics and radiation propagation in simple guiding media such as planar waveguides and step-index fibers.

**Electromagnetic Diffraction Modeling and Simulation with MATLAB** Gökhan Apaydin, Levent Sevgi. 2021-02-28 This exciting new resource presents a comprehensive introduction to the fundamentals of diffraction of two-dimensional canonical structures, including wedge, strip, and triangular cylinder with different boundary conditions. Maxwell equations are discussed, along with wave equation and scattered, diffracted and fringe fields. Geometric optics, as well as the geometric theory of diffraction are explained. With MATLAB scripts included for several well-known electromagnetic diffraction problems, this book discusses diffraction fundamentals of two-dimensional structures with different boundary conditions and analytical numerical methods that are used to show diffraction. The book introduces fundamental concepts of electromagnetic problems, identities, and definitions for diffraction modeling. Basic coordinate systems, boundary conditions, wave equation, and Green's function problem are given. The scattered fields, diffracted fields, and fringe fields, radar cross section for diffraction modeling are presented. Behaviors of electromagnetic waves around the two-dimensional canonical wedge and canonical strip are also explored. Diffraction of trilateral cylinders and wedges with rounded edges is investigated as well as double tip diffraction using Finite Difference Time Domain and Method of Moments. A MATLAB based virtual tool, developed with graphical user interface (GUI), for the visualization of both fringe currents and fringe waves is included, using numerical FDTD and MoM algorithm and High-Frequency Asymptotics approaches.

Electromagnetic Pulse Simulations Using Finite-Difference Time-Domain Method Shahid Ahmed. 2021-04-14 Electromagnetic Pulse Simulations Using Finite-Difference Time-Domain Method Discover the utility of the FDTD approach to solving electromagnetic problems with this powerful new resource Electromagnetic Pulse Simulations Using Finite-Difference Time-Domain Method delivers a comprehensive overview of the generation and propagation of ultra-wideband electromagnetic pulses. The book provides a broad cross-section of studies of electromagnetic waves and their propagation in free space, dielectric media, complex media, and within guiding structures, like waveguide lines, transmission lines, and antennae. The distinguished author offers readers a fresh new approach for analyzing electromagnetic modes for pulsed electromagnetic systems designed to improve the reader's understanding of the electromagnetic modes responsible for radiating far-fields. The book also provides a wide variety of computer programs, data analysis techniques, and visualization tools with state-of-the-art packages in MATLAB® and Octave. Following an introduction and clarification of basic electromagnetics and the frequency and time domain approach, the book delivers explanations of different numerical methods frequently used in computational electromagnetics and the necessity for the time domain treatment. In addition to a discussion of the Finite-difference Time-domain (FDTD) approach, readers will also enjoy: A thorough introduction to electromagnetic pulses (EMPs) and basic electromagnetics, including common applications of electromagnetics and EMP coupling and its effects An exploration of time and frequency domain analysis in electromagnetics, including Maxwell's equations and their practical implications A discussion of electromagnetic waves and propagation, including waves in free space, dielectric mediums, complex mediums, and guiding structures A treatment of computational electromagnetics, including an explanation of why we need modeling and simulations Perfect for undergraduate and graduate students taking courses in physics and electrical and electronic engineering, Electromagnetic Pulse Simulations Using Finite-Difference Time-Domain Method will also earn a place in the libraries of scientists and engineers working in electromagnetic research, RF and microwave design, and electromagnetic interference.

**Advanced Reactor Modeling with MATLAB** Riccardo Tesser, Vincenzo Russo. 2020-12-07 Offers the reader a modern approach to reactor description and modelling. Using the widely applied numerical language MATLAB, it provides the reader with categorized groups of general code for a wide variety of chemical reactors. Being designed as a tool for researchers and professionals, the code can easily be extended and adapted by the reader to their own specific problems.

**The Finite Difference Time Domain Method for Electromagnetics** Karl S. Kunz, Raymond J. Luebbers. 2018-05-04 The Finite-Difference Time-domain (FDTD) method allows you to compute electromagnetic interaction for complex problem geometries with ease. The simplicity of the approach coupled with its far-reaching usefulness, create the powerful, popular method presented in The Finite Difference Time Domain Method for Electromagnetics. This volume offers timeless applications and formulations you can use to treat virtually any material type and geometry. The Finite Difference Time Domain Method for Electromagnetics explores the mathematical foundations of FDTD, including stability, outer radiation boundary conditions, and different coordinate systems. It covers derivations of FDTD for use with PEC, metal, lossy dielectrics, gyrotropic materials, and anisotropic materials. A number of applications are completely worked out with numerous figures to illustrate the results. It also includes a printed FORTRAN 77 version of the code that implements the technique in three dimensions for lossy dielectric materials. There are many methods for analyzing electromagnetic interactions for problem geometries. With The Finite Difference Time Domain Method for Electromagnetics, you will learn the simplest, most useful of these methods, from the basics through to the practical applications.

Electromagnetic Modeling and Simulation Levent Sevgi. 2014-03-13 This unique book presents simple, easy-to-use, but effective short codes as well as virtual tools that can be used by electrical, electronic, communication, and computer engineers in a broad range of electrical engineering problems. Electromagnetic modeling is essential to the design and modeling of antenna, radar, satellite, medical imaging, and other applications. In this book, author Levent Sevgi explains techniques for solving real-time complex physical problems using MATLAB-based short scripts and comprehensive virtual tools. Unique in coverage and tutorial approach, Electromagnetic Modeling and Simulation covers fundamental analytical and numerical models that are widely used in teaching, research, and engineering designs—including mode and ray summation approaches with the canonical 2D nonpenetrable parallel plate waveguide as well as FDTD, MoM, and SSPE scripts. The book also establishes an intelligent balance among the essentials of EMMODSIM: The Problem (the physics), The Theory and Models (mathematical background and analytical solutions), and The Simulations (code developing plus validation, verification, and calibration). Classroom tested in graduate-level and short courses, Electromagnetic Modeling and Simulation: Clarifies concepts through numerous worked problems and quizzes provided throughout the book Features valuable MATLAB-based, user-friendly, effective engineering and research virtual design tools Includes sample scenarios and video clips recorded during characteristic simulations that visually impact learning—available on wiley.com Provides readers with their first steps in EM MODSIM as well as tools for medium and high-level code developers and users Electromagnetic Modeling and Simulation thoroughly covers the physics, mathematical background, analytical solutions, and code development of electromagnetic modeling, making it an ideal resource for electrical engineers and researchers.

Advanced Electromagnetic Computation Dikshitulu K. Kalluri. 2017-11-28 Advanced Electromagnetic Computation with MATLAB® discusses commercial electromagnetic software, widely used in the industry. Algorithms of Finite Differences, Moment method, Finite Element method and Finite Difference Time Domain method are illustrated. Hand-computed simple examples and MATLAB-coded examples are used to explain the concepts behind the algorithms. Case studies of practical examples from transmission lines, waveguides, and electrostatic problems are given so students are able to develop the code and solve the problems. Two new chapters including advanced methods based on perturbation techniques and three dimensional finite element examples from radiation scattering are included.

*Advances in Communication Systems and Networks* J. Jayakumari, George K. Karagiannidis, Maode Ma, Syed Akhter Hossain. 2020-06-13 This book presents the selected peer-reviewed papers from the International Conference on Communication Systems and Networks (ComNet) 2019. Highlighting the latest findings, ideas, developments and applications in all areas of advanced communication systems and networking, it covers a variety of topics, including next-generation wireless technologies such as 5G, new hardware platforms, antenna design, applications of artificial intelligence (AI), signal processing and optimization techniques. Given its scope, this book can be useful for beginners, researchers and professionals working in wireless communication and networks, and other allied fields.

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