Introduction To Computational Electromagnetics The Finite

The authors present a broad overview of the recent efforts in computational electromagnetics to develop and implement more robust, accurate and efficient algorithms. With the recent improvement in available computing power, this is a timely overview of a rapidly developing subject.

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.

Nanoplasmonics is a young topic of research, which is part of nanophotonics and nano-optics. Nanoplasmonics concerns to the investigation of electron oscillations in metallic nanostructures and nanoparticles. Surface plasmons have optical properties, which are very interesting. For instance, surface plasmons have the unique capacity to confine light at the nanoscale. Moreover, surface plasmons are very sensitive to the surrounding medium and the properties of the materials on which they propagate. In addition to the above, the surface plasmon resonances can be controlled by adjusting the size, shape, periodicity, and materials' nature. All these optical properties can enable a great number of applications, such as biosensors, optical modulators, photodetectors, and photovoltaic devices. This book is intended for a broad audience and provides an overview of some of the fundamental knowledges and applications of nanoplasmonics.

The first book of its kind to cover a wide range of computational methods for electromagnetic phenomena, from atomistic to continuum scales, this integrated and balanced treatment of mathematical formulations, algorithms and the underlying physics enables us to engage in innovative and advanced interdisciplinary computational research.

Computational Electromagnetics for RF and Microwave Engineering

Essentials of Computational Electromagnetics

The Least-Squares Finite Element Method

Numerical Methods in Electromagnetism
The Method of Moments in Electromagnetics

Describes most popular computational methods used to solve problems in electromagnetics Matlab code is included throughout, so that the reader can implement the various techniques discussed Exercises included

Computational electrodynamics is a vast research field with a wide variety of tools. In physics, the principle of gauge invariance plays a pivotal role as a guide towards a sensible formulation of the laws of nature as well as for computing the properties of elementary particles using the lattice formulation of gauge theories. However, the gauge principle has played a much less pronounced role in performing computation in classical electrodynamics. In this work, the author demonstrates that starting from the gauge formulation of electrodynamics using the electromagnetic potentials leads to computational tools that can very well compete with the conventional electromagnetic field-based tools. Once accepting the formulation based on gauge fields, the computational code is very transparent due to the mimetic mapping of the electrodynamic variables on the computational grid. Although the illustrations and applications originate from microelectronic engineering, the method has a much larger range of applicability. Therefore this book will be useful to everyone having interest in computational electrodynamics. The volume is organized as follows: In part 1, a detailed introduction and overview is presented of the Maxwell equations as well as the derivation of the current and charge densities in different materials. Semiconductors are responding to electromagnetic fields in a non-linear way, and the induced complications are discussed in detail. Part 2, using the gauge potentials, presents the transition of electrodynamics theory to a formulation that can serve as the gateway to computational code. In part 3, a collection of microelectronic device designs demonstrate the feasibility and success of the methods in Part 2. Part 4 focuses on a set of topical themes that brings the reader to the frontier of research in building the simulation tools, using the gauge principle in computational electrodynamics. Technical topics discussed in the book include: - Electromagnetic Field Equations - Constitutive Relations

- Discretization and Numerical Analysis - Finite Element and Finite Volume Methods - Design of Integrated Passive Components

This text should serve as an introduction to the application of electromagnetics EM, following an initial course in basic EM theory. A particular feature of the book is that it examines time domain rather than frequency domain methods in depth.; This book is intended for advanced undergraduate and graduates in electrical and electronic engineering. Research and practitioners in electromagnetics in electrical and electronic engineering and physics.

This hands-on introduction to computational electromagnetics (CEM) links theoretical coverage of the three key methods - the FDTD, MoM and FEM - to open source MATLAB codes (freely available online) in 1D, 2D and 3D, together with many practical hints and tips gleaned from the author's 25 years of experience in the field. Updated and extensively revised, this second edition includes a new chapter on 1D FEM analysis, and extended 3D treatments of the FDTD, MoM and FEM, with entirely new 3D MATLAB codes. Coverage of higher-order finite elements in 1D, 2D and 3D is also provided, with supporting code, in addition to a detailed 1D example of the FDTD from a FEM perspective. With running examples through the book and end-of-chapter problems to aid understanding, this is ideal for professional engineers and senior undergraduate/graduate students who need to master CEM and avoid common pitfalls in writing code and using existing software.

Introduction to the Finite-difference Time-domain (FDTD) Method for Electromagnetics

Introduction to the Finite Element Method in Electromagnetics

Photonics and Nanotechnology

Cetraro, Italy 2014

Integral Equation Methods for Electromagnetic and Elastic Waves

Computational Electromagnetism refers to the modern concept of computer-aided analysis, and design, of virtually all electric devices such as motors, machines, transformers, etc., as well as of the equipment inthe currently booming field of telecommunications, such as antennas, radars, etc. The present book is uniquely written to enable the reader-- be it a student, a scientist, or a practitioner-- to successfully perform important simulation techniques and to design efficient computer software for electromagnetic device analysis. Numerous illustrations, solved exercises, original ideas, and an extensive and up-to-date bibliography make it a valuable reference for both experts and beginners in the field. A researcher and practitioner will find in it information rarely available in other sources, such as on symmetry, bilateral error bounds by complimentarity, edge and face elements, treatment of infinite domains, etc. At the same time, the book is a useful teaching tool for courses in computational techniques in certain fields of physics and electrical engineering. As a self-contained text, it presents an extensive coverage of the most important concepts from Maxwells equations to computer-solvable algebraic systems-- for both static, quasi-static, and harmonic high-frequency problems. Benefits To the Engineer A sound background necessary not only to understand the principles behind variational methods and finite elements, but also to design pertinent and well-structured software. To the Specialist in Numerical Modeling The book offers new perspectives of practical importance on classical issues: the underlying symmetry of Maxwell equations, their interaction with other fields of physics in real-life modeling, the benefits of edge and face elements, approaches to error analysis, and "complementarity." To the Teacher An expository strategy that will allow you to guide the student along a safe and easy route through otherwise difficult concepts: weak formulations and their relation to fundamental conservation principles of physics, functional spaces, Hilbert spaces, approximation principles, finite elements, and algorithms for solving linear systems. At a higher level, the book provides a concise and self-contained introduction to edge elements and their application to mathematical modeling of the basic electromagnetic phenomena, and static problems, such as eddy-current problems and microwaves in cavities. To the Student Solved exercises, with "hint" and "full solution" sections, will both test and enhance the understanding of the material. Numerous illustrations will help in grasping difficult mathematical concepts.

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.

Essentials of Computational Electromagnetics provides an in-depth introduction of the three main full-wave numerical methods in computational electromagnetics (CEM); namely, the method of moment (MoM), the finite element method (FEM), and the finite-difference time-domain (FDTD) method. Numerous monographs can be found addressing one of the above three methods. However, few give a broad general overview of essentials embodied in these methods, or were published too early to include recent advances. Furthermore, many existing monographs only present the final numerical results without specifying practical issues, such as how to convert discretized formulations into computer programs, and the numerical characteristics of the computer programs. In this book, the authors elaborate the above three methods in CEM using practical case studies, explaining their own research experiences along with a review of current literature. A full analysis is provided for typical cases, including characteristics of numerical methods, helping beginners to develop a quick and deep understanding of the essentials of CEM. Outlines practical issues, such as how to convert discretized formulations into computer programs Gives typical computer programs and their numerical characteristics along with line by line explanations of programs Uses practical examples from the authors' own work as well as in the current literature Includes exercise problems to give readers a better understanding of the material Introduces the available commercial software and their limitations This book is intended for graduate-level students in antennas and propagation, microwaves, microelectronics, and electromagnetics. This text can also be used by researchers in electrical and electronic engineering, and software developers interested in writing their own code or understanding the detailed workings of code. Companion website for the book: www.wiley.com/go/sheng/cem

Integral Equation Methods for Electromagnetic and Elastic Waves is an outgrowth of several years of work. There have been no recent books on integral equation methods. There are books written on integral equations, but either they have been around for a while, or they were written by mathematicians. Much of the knowledge in integral equation methods still resides in journal papers. With this book, important relevant knowledge for integral equations are consolidated in one place and researchers need only read the pertinent chapters in this book to gain important knowledge needed for integral equation research. Also, learning the fundamentals of linear elastic wave theory does not require a quantum leap for electromagnetic practitioners.

Electrostatics in Solvation, Scattering, and Electron Transport

The Finite-difference Time-domain Method

The Finite Difference Time Domain Method for Electromagnetics

Computational Electrodynamics

The FDTD Method

Introduction to the Finite Element Method in ElectromagneticsMorgan & Claypool Publishers

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-doma (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, ar 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.

This textbook teaches students to create computer codes used to engineer antennas, microwave circuits, and other critical technologies for wireless communications and other applications of electromagnetic fields and waves. Worked code examples are provided for MATLAB technical computing software. It is the only textbook on numerical methods that begins at the undergraduate engineering student level but bring students to the state-of-the by the end of the book. It focuses on the most important and popular numerical methods, going into depth with examples and problem sets of escalatir complexity. This book requires only one core course of electromagnetics, allowing it to be useful both at the senior and beginning graduate levels. Developing and using numerical methods in a powerful tool for students to learn the principles of intermediate and advanced electromagnetics. This bo fills the missing space of current textbooks that either lack depth on key topics (particularly integral equations and the method of moments) and where treatment is not accessible to students without an advanced theory course. Important topics include: Method of Moments; Finite Difference Time Doma Method; Finite Element Method; Finite Element Method-Boundary Element Method; Numerical Optimization; and Inverse Scattering.

Higher-order Techniques in Computational Electromagnetics takes a different approach to computational electromagnetics and looks at it from the viewpoint of vector fields and vector currents. It gives a more detailed treatment of vector basis function than that currently available in other books. It a describes the approximation of vector quantities by vector basis functions, explores the error in that representation, and considers various other aspect the vector approximation problem. This unique guide is the perfect reference guide for those who need to understand and use numerical techniques fo electromagnetic fields.

New Trends in Computational Electromagnetics

An Introduction Using MATLAB® and Computational Electromagnetics Examples

A Gauge Approach with Applications in Microelectronics

Fundamentals and Applications

Computational Electromagnetism

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

Achieve optimal microwave system performance by mastering the principles and methods underlying today's powerful computational tools and commercial software in electromagnetics. This authoritative resource offers you clear and complete explanation of this essential electromagnetics knowledge, providing you with the analytical background you need to understand such key approaches as MoM (method of moments), FDTD (Finite Difference Time Domain) and FEM (Finite Element Method), and Green's functions. This comprehensive book includes all math necessary to master the material. Moreover, it features numerous solved problems that help ensure your understanding of key concepts throughout the book. 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.

The Multilevel Fast Multipole Algorithm (MLFMA) for Solving Large-Scale Computational Electromagnetic Problems provides a detailed and instructional overview of implementing MLFMA. The book: Presents a comprehensive treatment of the MLFMA algorithm, including basic linear algebra concepts, recent developments on the parallel computation, and a number of application examples Covers solutions of electromagnetic

problems involving dielectric objects and perfectly-conducting objects Discusses applications including scattering from airborne targets, scattering from red blood cells, radiation from antennas and arrays, metamaterials etc. Is written by authors who have more than 25 years experience on the development and implementation of MLFMA The book will be useful for post-graduate students, researchers, and academics, studying in the areas of computational electromagnetics, numerical analysis, and computer science, and who would like to implement and develop rigorous simulation environments based on MLFMA.

Electromagnetic Simulation Using the FDTD Method

Theory and Applications in Computational Fluid Dynamics and Electromagnetics

Reduction of a Ship's Magnetic Field Signatures

Molecular Electromagnetism: A Computational Chemistry Approach

A comprehensive, step-by-step reference to the Nyström Method for solving Electromagnetic problems using integral equations Computational electromagnetics studies the numerical methods or techniques that solve electromagnetic problems by computer programming. Currently, there are mainly three numerical methods for electromagnetic problems: the finite-difference time-domain (FDTD), finite element method (FEM), and integral equation methods (IEMs). In the IEMs, the method of moments (MoM) is the most widely used method, but much attention is being paid to the Nyström method as another IEM, because it possesses some unique merits which the MoM lacks. This book focuses on that method—providing information on everything that students and professionals working in the field need to know. Written by the top researchers in electromagnetics, this complete reference book is a consolidation of advances made in the use of the Nyström method for solving electromagnetic integral equations. It begins by introducing the fundamentals of the electromagnetic theory and computational electromagnetics, before proceeding to illustrate the advantages unique to the Nyström method through rigorous worked out examples and equations. Key topics include quadrature rules, singularity treatment techniques, applications to conducting and penetrable media, multiphysics electromagnetic problems, time-domain integral equations, inverse scattering problems and incorporation with multilevel fast multiple algorithm. Systematically introduces the fundamental principles, equations, and advantages of the Nyström method for solving electromagnetic problems Features the unique benefits of using the Nyström method through numerical comparisons with other numerical and analytical methods Covers a broad range of application examples that will point the way for future research The Nystrom Method in Electromagnetics is ideal for graduate students, senior undergraduates, and researchers studying engineering electromagnetics, computational methods, and applied mathematics. Practicing engineers

and other industry professionals working in engineering electromagnetics and engineering mathematics will also find it to be incredibly helpful.

Electromagnetics is the foundation of our electric technology. It describes the fundamental principles upon which electricity is generated and used. This includes electric machines, high voltage transmission, telecommunication, radar, and recording and digital computing. Numerical Methods in Electromagnetism will serve both as an introductory text for graduate students and as a reference book for professional engineers and researchers. This book leads the uninitiated into the realm of numerical methods for solving electromagnetic field problems by examples and illustrations. Detailed descriptions of advanced techniques are also included for the benefit of working engineers and research students. Comprehensive descriptions of numerical methods In-depth introduction to finite differences, finite elements, and integral equations Illustrations and applications of linear and nonlinear solutions for multi-dimensional analysis Numerical examples to facilitate understanding of the methods Appendices for quick reference of mathematical and numerical methods employed

This resource discusses advances in computational electromagnetics. It offers information on the multi-level fast multipole algorithm in both the time and frequency domains, as well as developments in fast algorithms for low frequencies and specialized structures, such as the planar and layered media. These algorithms solve large electromagnetics problems with shorter turn-around time, using less computer memory.

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.

Numerical Methods for Engineering

Introduction to the Finite Element Method in Electromagnetics (Synthesis Lectures on Computational Electromagnetics).
Introduction to Electromagnetic and Microwave Engineering
Numerical Electromagnetics
An Introduction To Electromagnetic Wave Propagation And Antennas

Advances in photonics and nanotechnology have the potential to revolutionize humanity's ability to communicate and compute. To pursue these advances, it is mandatory to understand and properly model interactions of light with materials such as silicon and gold at the nanoscale, i.e., the span of a few tens of atoms laid side by side. These interactions are governed by the fundamental Maxwell's equations of classical electrodynamics, supplemented by quantum electrodynamics. This book presents the current state-of-the-art in formulating and implementing computational models of these interactions. Maxwell's equations are solved using the finite-difference time-domain (FDTD) technique, pioneered by the senior editor, whose prior Artech House books in this area are among the top ten most-cited in the history of engineering. This cutting-edge resource helps readers understand the latest developments in computational modeling of nanoscale optical microscopy and microchip lithography, as well as nanoscale plasmonics and biophotonics.
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.
Filled with illustrations, examples and approximately 300 homework problems, this accessible and informative text provides an extensive treatment of electromagnetism and microwave engineering with particular emphasis on microwave

and telecommunications applications. Also stresses computational electromagnetics through the use of MathCad and finite element methods to elucidate design problems, analysis and applications. Tutorials on the use of MathCad and PSpice are included. An accessible textbook for students and valuable reference for engineers already in the field.
Decreasing the magnetic field signature of a naval vessel will reduce its susceptibility to detonating naval influence mines and the probability of a submarine being detected by underwater barriers and maritime patrol aircraft. Both passive and active techniques for reducing the magnetic signatures produced by a vessel's ferromagnetism, roll-induced eddy currents, corrosion-related sources, and stray fields are presented. Mathematical models of simple hull shapes are used to predict the levels of signature reduction that might be achieved through the use of alternate construction materials. Also, the process of demagnetizing a steel-hulled ship is presented, along with the operation of shaft-grounding systems, paints, and alternate configurations for power distribution cables. In addition, active signature reduction technologies are described, such as degaussing and deamping, which attempt to cancel the fields surrounding a surface ship or submarine rather than eliminate its source. Table of Contents: Introduction / Passive Magnetic Silencing Techniques / Active Signature Compensation / Summary

An Introduction Using MATLAB and Computational Electromagnetics Examples

Electromagnetic Pulse Simulations Using Finite-Difference Time-Domain Method

Variational Formulations, Complementarity, Edge Elements

Nanoplasmonics

Theory and Computation of Electromagnetic Fields

Presenting topics that have not previously been contained in a single volume, this book offers an up-to-date review of computational methods in electromagnetism, with a focus on recent results in the numerical simulation of real-life electromagnetic problems and on theoretical results that are useful in devising and analyzing approximation algorithms. Based on four courses delivered in Cetraro in June 2014, the material covered includes the spatial discretization of Maxwell’s equations in a bounded domain, the numerical approximation of the eddy current model in harmonic regime, the time domain integral equation method (with an emphasis on the electric-field integral equation) and an overview of qualitative methods for inverse electromagnetic scattering problems. Assuming some knowledge of the variational formulation of PDEs and of finite element/boundary element methods, the book is suitable for PhD students and researchers interested in numerical approximation of partial differential equations and scientific computing.
The application of computational electromagnetics to real-world EMI/EMC engineering is an emerging technology. With the advancement in electronics, EMI/EMC issues have greatly increased in complexity. As a result, it is no longer possible to rely exclusively on traditional techniques and expect cost-effective solutions. The first edition of this book

introduced computational electromagnetics to EMI/EMC engineering. This second edition continues the introduction of computational electromagnetics to EMI/EMC engineering, but also adds new modeling techniques, namely the Partial Element Equivalent Circuit method and the Transmission Line Matrix method, and updates to the science of EMI/EMC modeling that have occurred since the first edition was published. This book combines the essential elements of electromagnetic theory, computational techniques, and EMI/EMC engineering as they apply to computational modeling for EMI/EMC applications. It is intended to provide an understanding for those interested in incorporating modeling techniques in their work. A variety of modeling techniques are needed for anyone interested in using computational modeling in the real world. This book includes an introduction of all the popular modeling techniques, such as the Finite-Difference Time-Domain method, the Method of Moments, the Finite Element Method, the Partial Element Equivalent Circuit method and the Transmission Line Matrix method. EMI/EMC Computational Modeling Handbook, Second Edition will serve many different levels of readers. It will serve as a basic introduction to modeling as applied to EMI/EMC problems for the engineer interested in getting started, and it will help the person already using modeling as a tool to become more effective in using different modeling techniques. It will also be useful for the engineer who is familiar with computational techniques and wishes to apply them to EMI/EMC applications. This book can also be used as a text to help students of electromagnetic theory and application better understand real-world challenges facing engineers.
This comprehensive revision begins with a review of static electric and magnetic fields, providing a wealth of results useful for static and time-dependent fields problems in which the size of the device is small compared with a wavelength. Some of the static results such as inductance of transmission lines calculations can be used for microwave frequencies. Familiarity with vector operations, including divergence and curl, are developed in context in the chapters on statics. Packed with useful derivations and applications.

This is the first monograph on the subject, providing a comprehensive introduction to the LSFEM method for numerical solution of PDEs. LSFEM is simple, efficient and robust, and can solve a wide range of problems in fluid dynamics and electromagnetics.

Computational Electromagnetics

Fields and Waves in Communication Electronics

Analytical and Computational Methods in Electromagnetics

The Nystrom Method in Electromagnetics

Fast and Efficient Algorithms in Computational Electromagnetics

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.

This lecture is written primarily for the non-expert engineer or the undergraduate or graduate student who wants to learn, for the first time, the finite element method with applications to electromagnetics. It is also designed for research engineers who have knowledge of other numerical techniques and want to familiarize themselves with the finite element method.Finite element method is a numerical method used to solve boundary-value problems characterized by a partial differential equation and a set of boundary conditions. Author Anastasis Polycarpou provides the reader with all information necessary to successfully apply the finite element method to one- and two-dimensional boundary-value problems in electromagnetics.The book is accompanied by a number of codes written by the author in Matlab. These are the finite element codes that were used to generate most of the graphs presented in this book. Specifically, there are three Matlab codes for the one-dimensional case (Chapter 1) and two Matlab codes for the two-dimensional case (Chapter 2). The reader may execute these codes, modify certain parameters such as mesh size or object dimensions, and visualize the results. The codes are available on the Morgan & Claypool Web site at http://www.morganclaypool.com.

The revised and updated second edition of this textbook teaches students to create computer codes used to engineer antennas, microwave circuits, and other critical technologies for wireless communications and other applications of electromagnetic fields and waves. Worked code examples are provided for MATLAB technical computing software.

Introduces CEM methods, applying the codes that implement them to real-world engineering problems.

The Multilevel Fast Multipole Algorithm (MLFMA) for Solving Large-Scale Computational Electromagnetics Problems

Higher-Order Techniques in Computational Electromagnetics

Computational Methods for Electromagnetic Phenomena

Introduction to the Finite-Difference Time-Domain (FDTD) Method for Electromagnetics

EMI/EMC Computational Modeling Handbook

This is a textbook on the theory and calculation of molecular electromagnetic and spectroscopic properties designed for a one-semester course with lectures and exercise classes. The idea of the book is to provide thorough background knowledge for the calculation of electromagnetic and spectroscopic properties of molecules with modern quantum chemical software packages. The book covers the derivation of the molecular Hamiltonian in the presence of electromagnetic fields, and of time-independent and time-dependent perturbation theory in the form of response theory. It defines many molecular properties and spectral parameters and gives an introduction to modern computational chemistry methods.

The Method of Moments in Electromagnetics, Third Edition details the numerical solution of electromagnetic integral equations via the Method of Moments (MoM). Previous editions focused on the solution of radiation and scattering problems involving conducting, dielectric, and composite objects. This new edition adds a significant amount of material on new, state-of-the art compressive techniques. Included are new chapters on the Adaptive Cross Approximation (ACA) and Multi-Level Adaptive Cross Approximation

(MLACA), advanced algorithms that permit a direct solution of the MoM linear system via LU decomposition in compressed form. Significant attention is paid to parallel software implementation of these methods on traditional central processing units (CPUs) as well as new, high performance graphics processing units (GPUs). Existing material on the Fast Multipole Method (FMM) and Multi-Level Fast Multipole Algorithm (MLFMA) is also updated, blending in elements of the ACA algorithm to further reduce their memory demands. The Method of Moments in Electromagnetics is intended for students, researchers, and industry experts working in the area of computational electromagnetics (CEM) and the MoM. Providing a bridge between theory and software implementation, the book incorporates significant background material, while presenting practical, nuts-and-bolts implementation details. It first derives a generalized set of surface integral equations used to treat electromagnetic radiation and scattering problems, for objects comprising conducting and dielectric regions. Subsequent chapters apply these integral equations for progressively more difficult problems such as thin wires, bodies of revolution, and two- and three-dimensional bodies. Radiation and scattering problems of many different types are considered, with numerical results compared against analytical theory as well as measurements.

Computational Electromagnetics with MATLAB, Fourth Edition

Advances in FDTD Computational Electrodynamics