The Finite Difference Time Domain Method For Electromagnetics With Matlab Simulations Aces Series On Computational Electromagnetics And Engineering

Photonic technology promises much faster computing, massive parallel processing, and an evolutionary step in the digital age. The search continues for devices that will enable this paradigm, and these devices will be based on photonic crystals. Modeling is a key process in developing crystals with the desired characteristics and performance, and Electromagnetic Theory and Applications for Photonic Crystals provides the electromagnetic-theoretical models that can be effectively applied to modeling photonic crystals and related optical devices. The book supplies eight self-contained chapters that detail various analytical, numerical, and computational approaches to the modeling of scattering and guiding problems. For each model, the chapter begins with a brief introduction, detailed formulations of periodic structures and photonic crystals, and practical applications to photonic crystal devices. Expert contributors discuss the scattering matrix method, multipole theory of scattering and propagation, model of layered periodic arrays for photonic crystals, the multiple multipole program, the mode-matching method for periodic metallic structures, the method of lines, the finite-difference frequency-domain technique, and the finite-difference time-domain technique. Based on original research and application efforts, Electromagnetic Theory and Applications for Photonic Crystals supplies a broad array of practical tools for analyzing and designing devices that will form the basis for a new age in computing.
This edited volume covers technological developments and current research trends in the field of photonics, plasmonics and optics, focusing on photonic crystals, semiconductor optical devices, optical communications and optical sensors, with an emphasis on practical sectors. It broadly contains the latest research domains contributed by experts and researchers in their respective fields with a major focus on the basic physics. Works in the area of electromagnetic bandgap structures (EBG) and metasurfaces are included for applications in different aspects of communications systems. Further, it covers research phenomena of microwave photonic devices to develop miniaturized high-frequency devices. FEATURES Reviews nonlinear optical phenomena related with materials and crystals and plasmonic effects on device fabrications Contains a detailed analysis on photonic crystals with their applications in making all-optical passive components Focusses on nonlinear optics, more precisely on crystals and materials, and computational aspects on evaluating their properties from Maxwell’s equations Presents an extensive study on the physics of EBG structures for application in antenna and high-frequency communications Includes metamaterials and metasurfaces for applications in photonics as well as in microwave engineering for high-frequency communication systems Photonics, Plasmonics and Information Optics: Research and Technological Advances is aimed at researchers, professionals and graduate students in optical communication, silicon photonics, photonic crystals, semiconductor optical devices, metamaterials and metasurfaces, and microwave photonics.
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
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

Photonics and Nanotechnology

Parallel Finite-difference Time-domain Method

CFDTD

Finite Difference Methods for Ordinary and Partial Differential Equations

The Finite-Difference Modelling of Earthquake Motions

New applications, research, and fundamental theories in nonlinear analysis are presented in this book. Each chapter provides a unique insight into a large domain of research focusing on functional equations, stability theory, approximation theory, inequalities, nonlinear functional analysis, and calculus of variations with applications to optimization theory. Topics include: Fixed point theory Fixed-circle theory Coupled fixed points Nonlinear duality in Banach spaces Jensen's integral inequality and applications Nonlinear differential equations Nonlinear integro-differential equations Quasiconvexity, Stability of a Cauchy-Jensen additive mapping Generalizations of metric spaces Hilbert-type integral inequality, Solitons Quadratic functional equations in fuzzy Banach spaces Asymptotic orbits in Hill'sproblem Time-domain electromagnetics Inertial Mann algorithms Mathematical modelling Robotics Graduate students and researchers will find this book helpful in comprehending current applications and developments in mathematical analysis. Research scientists and engineers studying essential modern methods and techniques to solve a variety of problems will find this book a valuable source filled with examples that illustrate concepts.

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.

This book introduces finite difference methods for both ordinary differential equations (ODEs) and partial differential equations (PDEs) and discusses the similarities and differences between algorithm design and stability analysis for different types of equations. A unified view of stability theory for ODEs and PDEs is presented, and the interplay between ODE and PDE analysis is stressed. The text emphasizes standard classical methods, but several newer approaches also are introduced and are described in the context of simple motivating examples.

This book is open access under a CC BY 4.0 license. This easy-to-read book introduces the basics of solving partial differential equations by means of finite difference methods. Unlike many of the traditional academic works on the topic, this book was written for practitioners. Accordingly, it especially addresses: the construction of finite difference schemes, formulation and implementation of algorithms, verification of implementations, analyses of physical behavior as implied by the numerical solutions, and how to apply the methods and software to solve problems in the fields of physics and biology.

A New Finite-difference Time-domain Method Applied to an Open Waveguide Structure

Steady-State and Time-Dependent Problems

DSP Analysis of the Finite Difference Time Domain (FDTD)method

Computational Electromagnetics

Finite Difference Computing with PDEs

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.

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

This work represents a university text and professional/research reference on the finite-difference time-domain computational solution method for Maxwell's equations. Sections cover numerical stability, numerical dispersion and dispersive, nonlinear and gain methods of FD-TD and antenna analysis.

Finite-Difference Time-Domain (FD-TD) modeling is arguably the most popular and powerful means available to perform detailed electromagnetic engineering analyses. Edited by the pioneer and foremost authority on the subject, here is the first book to assemble in one resource the latest techniques and results of the leading theoreticians and practitioners of FD-TD computational electromagnetics modeling.

Handbook of Antennas in Wireless Communications

Electromagnetic Theory and Applications for Photonic Crystals

Electromagnetic Simulation Using the FDTD Method

Computational Nanotechnology Using Finite Difference Time Domain

Higher Order Finite-difference Time-domain Method

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

The finite-difference time-domain (FTDT) method has revolutionized antenna design and electromagnetics engineering. This book raises the FDTD method to the next level by empowering it with the vast capabilities of parallel computing. It shows engineers how to exploit the natural parallel properties of FDTD to improve the existing FDTD method and to efficiently solve more complex and large problem sets. Professionals learn how to apply open source software to develop parallel software and hardware to run FDTD in parallel for their projects. The book features hands-on examples that illustrate th.

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.

The move toward worldwide wireless communications continues at a remarkable pace, and the antenna element of the technology is crucial to its success. With contributions from more than 30 international experts, the Handbook of Antennas in Wireless Communications brings together all of the latest research and results to provide engineering professionals and students with a one-stop reference on the theory, technologies, and applications for indoor, hand-held, mobile, and satellite systems. Beginning with an introduction to wireless communications systems, it offers an in-depth treatment of propagation prediction and fading channels. It then explores antenna technology with discussion of antenna design methods and the various antennas in current use or development for base stations, hand held devices, satellite communications, and shaping beams. The discussions then move to smart antennas and phased array technology, including details on array theory and beamforming techniques. Space diversity, direction-of-arrival estimation, source tracking, and blind source separation methods are addressed, as are the implementation of smart antennas and the results of field trials of systems using smart antennas implemented. Finally, the hot media topic of the safety of mobile phones receives due attention, including details of how the human body interacts with the electromagnetic fields of these devices. Its logical development and extensive range of diagrams, figures, and photographs make this handbook easy to follow and provide a clear understanding of design techniques and the performance of finished products. Its unique, comprehensive coverage written by top experts in their fields promises to make the Handbook of Antennas in Wireless Communications the standard reference for the field.

Computational Electrodynamics

The Finite-difference Time-domain Method

Improvement of the Accuracy of Finite-difference Time-domain (FDTD) Method for Electromagnetic Analysis

The Finite-Difference Time-Domain Method for Electromagnetics with MATLAB® Simulations

Handbook of Radar Signal Analysis

The finite-difference time-domain (FDTD) method has been shown in the last several years to be applicable to guided-wave photonics problems. The application of the method to diffraction gratings, intersecting and bending waveguides and Bragg mirrors has served to demonstrate that method can solve a set of problems not tractable for more traditional techniques such as the beam propagation method. Although these papers have served to demonstrate the applicability of the FDTD technique, few papers have described the use of the FDTD analysis in a design environment. This paper will describe the use of the FDTD method in two design problems and show how specific engineering questions can be answered with the simulation technique. The first problem, a distributed feedback reflector for a graded index wave-guide laser, will demonstrate the ability of FDTD to model complex structures whose analysis would otherwise be virtually intractable. The second example, a multi-layer Bragg wave guide design, will show how the FDTD technique can be used to complement and extend other analysis methods.

"Numerical simulation is an irreplaceable tool in earthquake ground motion research. Among all the numerical methods in seismology, the finite-difference (FD) technique is the most widely-used, providing the best balance of accuracy and computational efficiency. Now, for the first time, this book offers a comprehensive introduction to this method and its applications to earthquake motion"--

Master's Thesis from the year 2014 in the subject Computer Science - Applied, grade: First, University of Manchester (School of Computer Science), course: Advanced Computer Science: Computer Systems Engineering, language: English, abstract: Due to recent advancement in technology, one of the popular ways of achieving performance with respect to execution time of programs is by utilizing massive parallelism power of GPU-based accelerator computing along with CPU computing. In GPU- based accelerator computing, the data intensive or computationally intensive part is computed on the GPU whereas the simple yet complex instructions are computed on the CPU in order to achieve massive speedup in execution time of the computer program executed on the computer system. In physics, especially in electromagnetism, Finite-Difference Time-Domain (FDTD) is a popular numerical analysis method, which is used to solve the set of Maxwells partial differential equations to unify and relate electric field with magnetic field. Since FDTD method is computationally intensive and has high level of parallelism in the computational implementation, for this reason for past few years researchers are trying to compute the computationally intensive part of FDTD methods on the GPU instead of CPU. Although computing parallelized parts of FDTD algorithms on the GPU achieve very good performance, but fail to gain very good speedup in execution time because of the very high latency between the CPU and GPU. Calculation results at each FDTD time-step is supposed to be produced and saved on the hard disk of the system. This can be called as data output of the FDTD methods, and the overlapping of data output and computation of the field values at next time step cannot be performed simultaneously. Because of this and latency gap between the CPU and GPU, there is a bottleneck in the performance of the data output of the GPU. This problem can be regarded as the inefficient performance of data input/output (I/O) of FDTD methods on GPU. Hence, this project focuses on this aforementioned problem and addresses to find solutions to improve the efficiency of the data I/O of FDTD computation on GPGPU (General Purpose Graphics Processing Unit).

X-ray line profile analysis is an effective and non-destructive method for the characterization of the microstructure in crystalline materials. Supporting research in the area of x-ray line profile analysis is necessary in promoting further developments in this field. X-Ray Line Profile Analysis in Materials Science aims to synthesize the existing knowledge of the theory, methodology, and applications of x-ray line profile analysis in real-world settings. This publication presents both the theoretical background and practical implementation of x-ray line profile analysis and serves as a reference source for engineers in various disciplines as well as scholars and upper-level students.

Research and Technological Advances

Introduction to the Finite-Difference Time-Domain (FDTD) Method for Electromagnetics
Electromagnetic Pulse Simulations Using Finite-Difference Time-Domain Method
6th to 8th July, 2015, Singapore
7th WACBE World Congress on Bioengineering 2015

The application of computational electromagnetics to practical EMI/EMC engineering is an emerging technology. Because of the increased complexity in EMI/EMC issues resulting from advancements in electronics and telecommunications, it is no longer possible to rely exclusively on traditional techniques and tools to solve the growing list of electronic engineering design problems. EMI/EMC Computational Modeling Handbook introduces modeling and simulation of electromagnetics to real-world EMI/EMC engineering. It combines the essentials of electromagnetics, computational techniques, and actual EMI/EMC applications. Included are such popular full-wave computational modeling techniques as the Method of Moments, Finite-Difference Time Domain Technique, Finite Element Method, and several others. The authors have included a myriad of applications for computers, telecommunications, consumer electronics, medical electronics, and military uses. EMI/EMC Computational Modeling Handbook is an invaluable reference work for practicing EMI/EMC engineers, electronic design engineers, and any engineer involved in computational electromagnetics.

The Finite Difference Time Domain (FDTD) method is an essential tool in modeling inhomogeneous, anisotropic, and dispersive media with random, multilayered, and periodic fundamental (or device) nanostructures due to its features of extreme flexibility and easy implementation. It has led to many new discoveries concerning guided modes in nanoplasmonic waveguides and continues to attract attention from researchers across the globe. Written in a manner that is easily digestible to beginners and useful to seasoned professionals, Computational Nanotechnology Using Finite Difference Time Domain describes the key concepts of the computational FDTD method used in nanotechnology. The book discusses the newest and most popular computational nanotechnologies using the FDTD method, considering their primary benefits. It also predicts future applications of nanotechnology in technical industry by examining the results of interdisciplinary research conducted by world-renowned experts. Complete with case studies, examples, supportive appendices, and FDTD codes accessible via a companion website, Computational Nanotechnology Using Finite Difference Time Domain not only delivers a practical introduction to the use of FDTD in nanotechnology but also serves as a valuable reference for academia and professionals working in the fields of physics, chemistry, biology, medicine, material science, quantum science, electrical and electronic engineering, electromagnetics, photonics, optical science, computer science, mechanical engineering, chemical engineering, and aerospace engineering.

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.

Positioning itself at the common boundaries of several disciplines, this work provides new perspectives on modern nanoscale problems where fundamental science meets technology and computer modeling. In addition to well-known computational techniques such as finite-difference schemes and Ewald summation, the book presents a new finite-difference calculus of Flexible Local Approximation Methods (FLAME) that qualitatively improves the numerical accuracy in a variety of problems.

Applications of Nonlinear Analysis

Using the Finite Difference Time Domain Method as a Design Tool

Numerical Sound Synthesis

Proceedings of the GAMM Workshop on Computational Electromagnetics, Kiel, Germany, January 26–28, 2001

Scattering Analysis of Periodic Structures Using Finite-Difference Time-Domain Method

This book introduces the powerful Finite-Difference Time-Domain method to students and interested researchers and readers. An effective introduction is accomplished using a step-by-step process that builds competence and confidence in developing complete working codes for the design and analysis of various antennas and microwave devices. This book will serve graduate students, researchers, and those in industry and government who are using other electromagnetics tools and methods for the sake of performing independent numerical confirmation. No previous experience with finite-difference methods is assumed of readers.

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.

This new handbook on radar signal analysis adopts a deliberate and systematic approach. It uses a clear and consistent level of delivery while maintaining strong and easy-to-follow mathematical details. The emphasis of this book is on radar signal types and their relevant

signal processing and not on radar systems hardware or components. This handbook serves as a valuable reference to a wide range of audience. More specifically, college-level students, practicing radar engineers, as well as casual readers of the subject are the intended target audience of the first few chapters of this book. As the book chapters progress, these grow in complexity and specificity. Accordingly, later chapters are intended for practicing engineers, graduate college students, and advanced readers. Finally, the last few chapters contain several special topics on radar systems that are both educational and scientifically entertaining to all readers. The presentation of topics in this handbook takes the reader on a scientific journey whose major landmarks comprise the different radar subsystems and components. In this context, the chapters follow the radar signal along this journey from its birth to the end of its life. Along the way, the different relevant radar subsystems are analyzed and discussed in great detail. The chapter contributors of this new handbook comprise experienced academia members and practicing radar engineers. Their combined years of academic and real-world experiences are in excess of 175. Together, they bring a unique, easy-to-follow mix of mathematical and practical presentations of the topics discussed in this book. See the "Chapter Contributors" section to learn more about these individuals.

Abstract: Maxwell's equations represent govern the fundamental behavior of electromagnetic fields. Numerous efforts have been devoted to solve Maxwell's equations theoretically and numerically in complex media, such as anisotropic media and dispersive media. The Finite-Difference Time-Domain (FDTD) method is a powerful numerical technique for solving time-dependent Maxwell's curl equations in general media [1], [2). The basic FDTD technique has been extended over the years to solve increasingly more complicated media and geometries. In particular, in the past few years, FDTD has been extended to accommodate non-diagonal constitutive tensors, but the work done so far has been limited to second-order accurate schemes in both time and space. Our goal in this thesis is to derive and study extensions of FDTD to achieve a scheme with higher order of accuracy in space for the study of electromagnetic wave propagation in homogeneous and inhomogeneous anisotropic media. The objective of attaining high order FDTD method is to reduce the overall truncation error and dispersion error of the finite-difference approximations, and increase the overall accuracy of the numerical results.

Finite-Difference Time-Domain Analysis of Periodic Anisotropic Media
Advances in FDTD Computational Electrodynamics
Computational Methods for Nanoscale Applications
Introduction to the Finite-difference Time-domain (FDTD) Method for Electromagnetics
Gratings: Theory and Numeric Applications

The Finite-Difference Time-Domain (FDTD) method is a numerical technique for solving electromagnetic propagation and scattering problems. The FDTD method has been one of the most popular numerical tools in the computational electromagnetics since Kane Yee proposed his efficient and stable algorithm, often called the Yee algorithm. Recent rapid development in computer technologies in the last two decades allows us to have more power in computation and memory capacity, which overcomes the computationally intensive nature, the main hindrance of wide use of the FDTD method. Still, emerging new applications need modification to the original FDTD algorithm. For the applications of periodic structures such as gratings and photonic crystals, the FDTD method can be much more efficient and accurate by taking the advantage of the periodicity of structures. The simulation space can be dramatically reduced into only one unit cell by enforcing periodic boundary conditions (PBC). An efficient way of implementing PBCs is the split-field update method. The main advantage of the split-field FDTD method is its capability of wideband simulation at oblique incidence. However, the previous works were limited to materials that are either isotropic or that have diagonal tensors. Here we present a modified FDTD algorithm for periodic structures in more general anisotropic media, which incorporates the nondiagonal permittivity tensor. PBCs are implemented by using the split-field technique. Validation of the new FDTD method is done by applying it for problems of different structures and comparing the results from FDTD simulations with other analytical or numerical solutions. We report a rigorous numerical analysis of the Polarization Grating (PG) at the first time. Diffraction properties such as the diffraction efficiency and the polarization selectivity of each diffraction order are analyzed for all kinds of PGs. We discuss the effect of the grating regimes and the finite grating width on t.

The study makes use of a variation of the Finite-Difference Time-Domain (FDTD) method as first proposed by Yee to simulate electromagnetic field distribution and propagation in an open waveguide structure. In order to prove that this new method is valid, a reflection coefficient is calculated with simulation data and compared to measurements. The agreement between measurement and simulation data, while not exact, is enough to establish the veracity of the new method. This study contains a detailed discussion of the discrepancies which were observed. Also presented are colour images of the simulation which give the reader an idea as to the nature and level of detail of the information which can be obtained from the simulation.

The Finite Difference Time Domain Method for ElectromagneticsRoutledge

This volume publishes the proceedings of the WACBE World Congress on Bioengineering 2015 (WACBE 2015), which was be held in Singapore, from 6 to 8 July 2015. The World Association for Chinese Biomedical Engineers (WACBE)

organizes this World Congress biannually. Our past congresses have brought together many biomedical engineers from over the world to share their experiences and views on the future development of biomedical engineering. The 7th WACBE World Congress on Bioengineering 2015 in Singapore continued to offer such a networking platform for all biomedical engineers. Hosted by the Biomedical Engineering Society (Singapore) and the Department of Biomedical Engineering, National University of Singapore, the congress covered all related areas in bioengineering.
Advances in Computational Electrodynamics

EMI/EMC Computational Modeling Handbook
The Finite Difference Time Domain Method for Electromagnetics
Photonics, Plasmonics and Information Optics

The dimmed outlines of phenomenal things all into one another unless we put on the merge focusing-glass of theory, and screw it up some times to one pitch of definition and sometimes to another, so as to see down into different depths through the great millstone of the world James Clerk Maxwell (1831 - 1879) For a long time after the foundation of the modern theory of electromag netism by James Clerk Maxwell in the 19th century, the mathematical ap proach to electromagnetic field problems was for a long time dominated by the analytical investigation of Maxwell's equations. The rapid development of computing facilities during the last century has then necessitated appropriate numerical methods and algorithmic tools for the simulation of electromagnetic phenomena. During the last few decades, a new research area "Computational Electromagnetics" has emerged com prising the mathematical analysis, design, implementation, and application of numerical schemes to simulate all kinds of relevant electromagnetic pro cesses. This area is still rapidly evolving with a wide spectrum of challenging issues featuring, among others, such problems as the proper choice of spatial discretizations (finite differences, finite elements, finite volumes, boundary elements), fast solvers for the discretized equations (multilevel techniques, domain decomposition methods, multipole, panel clustering), and multiscale aspects in microelectronics and micromagnetics.

Here's a powerful, full three-dimensional Maxwell's equations solver that serves as a fast and accurate tool for modeling a wide variety of antenna and arrays, waveguides, cavities, microwave circuits, as well as a useful resource for Radar Cross Section analysis. This cutting-edge CFDTD software package combines visual languages and advanced techniques in computational electromagnetics to simulate the behaviors of complex microwave systems. Designed to handle 220 x 220 x 220 nodes, the software is well-equipped for large-size and high-frequency problems.

Efficient Data Input/Output (I/O) for Finite Difference Time Domain (FDTD). Computation on Graphics Processing Unit (GPU)
Conformal Finite-Difference Time-Domain Maxwells Equations Solver, Software and Users Guide
Scattering Analysis of Periodic Structures Using Finite-Difference Time-Domain
Essentials of Computational Electromagnetics
A Modern Software Approach