Spectral Domain Method for Microwave Integrated Circuits (Computer methods in electromagnetics series)

Mirshekar-syahk, D

Note: This is not the actual book cover

Spectral Domain Method In Electromagnetics

Peter Russer

Spectral Domain Method In Electromagnetics:

The Spectral Domain Method in Electromagnetics Craig Scott,1989 Presents an introduction to spectral domain techniques and illustrates their application to a variety of electromagnetic boundary value problems An integrated approach to the solution of seemingly diverse problems is presented in order to show the underlying unity of solution Complex problems can **The Spectral Domain Method in Electromagnetics** Craig Scott,1989-01-01 **Electromagnetics, Microwave Circuit and Antenna Design for Communications Engineering** Peter Russer,2003 If you re looking for a clear comprehensive overview of basic electromagnetics principles and applications to antenna and microwave circuit design for communications this authoritative book is your best choice Including concise explanations of all required mathematical concepts needed to fully comprehend the material the book is your complete resource for understanding electromagnetics in current emerging and future broadband communication systems as well as high speed analogue and digital electronic circuits and systems **Spectral Domain Method for Microwave Integrated Circuits** Dariush Mirshekar-Syahkal,1990 **Frequency Domain Hybrid Finite Element Methods in Electromagnetics** John. L Volakis,Kubilay Sertel,Brian C Usner,2022-06-01 This book provides a brief overview of the popular Finite Element Method FEM and its hybrid versions for electromagnetics with applications to radar scattering antennas and arrays guided structures microwave components frequency selective surfaces periodic media and RF materials characterizations and related topics It starts by presenting concepts based on Hilbert and Sobolev spaces as well as Curl and Divergence spaces for generating matrices useful in all engineering simulation methods It then proceeds to present applications of the finite element and finite element boundary integral methods for scattering and radiation Applications to periodic media metamaterials and bandgap structures are also included The hybrid volume integral equation method for high contrast dielectrics and is presented for the first time Another unique feature of the book is the inclusion of design optimization techniques and their integration within commercial numerical analysis packages for shape and material design To aid the reader with the method s utility an entire chapter is devoted to two dimensional problems The book can be considered as an update on the latest developments since the publication of our earlier book Finite Element Method for Electromagnetics IEEE Press 1998 The latter is certainly complementary companion to this one *Multiresolution Frequency Domain Technique for Electromagnetics* Mesut Gökten,Atef Elsherbeni,Ercument Arvas,2022-06-01 In this book a general frequency domain numerical method similar to the finite difference frequency domain FDFD technique is presented The proposed method called the multiresolution frequency domain MRFD technique is based on orthogonal Battle Lemarie and biorthogonal Cohen Daubechies Feauveau CDF wavelets The objective of developing this new technique is to achieve a frequency domain scheme which exhibits improved computational efficiency figures compared to the traditional FDFD method reduced memory and simulation time requirements while retaining numerical accuracy The newly introduced MRFD scheme is successfully applied to the analysis

of a number of electromagnetic problems such as computation of resonance frequencies of one and three dimensional resonators analysis of propagation characteristics of general guided wave structures and electromagnetic scattering from two dimensional dielectric objects The efficiency characteristics of MRFD techniques based on different wavelets are compared to each other and that of the FDFD method Results indicate that the MRFD techniques provide substantial savings in terms of execution time and memory requirements compared to the traditional FDFD method Table of Contents Introduction Basics of the Finite Difference Method and Multiresolution Analysis Formulation of the Multiresolution Frequency Domain Schemes Application of MRFD Formulation to Closed Space Structures Application of MRFD Formulation to Open Space Structures A Multiresolution Frequency Domain Formulation for Inhomogeneous Media Conclusion *The Finite Element Method in Electromagnetics* Jian-Ming Jin,2015-02-18 A new edition of the leading textbook on the finite element method incorporating major advancements and further applications in the field of electromagnetics The finite element method FEM is a powerful simulation technique used to solve boundary value problems in a variety of engineering circumstances It has been widely used for analysis of electromagnetic fields in antennas radar scattering RF and microwave engineering high speed high frequency circuits wireless communication electromagnetic compatibility photonics remote sensing biomedical engineering and space exploration The Finite Element Method in Electromagnetics Third Edition explains the method s processes and techniques in careful meticulous prose and covers not only essential finite element method theory but also its latest developments and applications giving engineers a methodical way to quickly master this very powerful numerical technique for solving practical often complicated electromagnetic problems Featuring over thirty percent new material the third edition of this essential and comprehensive text now includes A wider range of applications including antennas phased arrays electric machines high frequency circuits and crystal photonics The finite element analysis of wave propagation scattering and radiation in periodic structures The time domain finite element method for analysis of wideband antennas and transient electromagnetic phenomena Novel domain decomposition techniques for parallel computation and efficient simulation of large scale problems such as phased array antennas and photonic crystals Along with a great many examples The Finite Element Method in Electromagnetics is an ideal book for engineering students as well as for professionals in the field Applied Frequency-Domain Electromagnetics Robert Paknys,2016-09-19 Understanding electromagnetic wave theory is pivotal in the design of antennas microwave circuits radars and imaging systems Researchers behind technology advances in these and other areas need to understand both the classical theory of electromagnetics as well as modern and emerging techniques of solving Maxwell s equations To this end the book provides a graduate level treatment of selected analytical and computational methods The analytical methods include the separation of variables perturbation theory Green s functions geometrical optics the geometrical theory of diffraction physical optics and the physical theory of diffraction The numerical techniques include mode matching the method of moments and the finite

element method The analytical methods provide physical insights that are valuable in the design process and the invention of new devices The numerical methods are more capable of treating general and complex structures Together they form a basis for modern electromagnetic design The level of presentation allows the reader to immediately begin applying the methods to some problems of moderate complexity It also provides explanations of the underlying theories so that their capabilities and limitations can be understood   *Modern Antenna Design* Thomas A. Milligan,2005-06-24 A practical book written for engineers who design and use antennas The author has many years of hands on experience designing antennas that were used in such applications as the Venus and Mars missions of NASA The book covers all important topics of modern antenna design for communications Numerical methods will be included but only as much as are needed for practical applications

   The Nystrom Method in Electromagnetics Mei Song Tong,Weng Cho Chew,2020-06-29 A comprehensive step by step reference to the Nystr m 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 Nystr m 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 Nystr m 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 Nystr m 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 Nystr m method for solving electromagnetic problems Features the unique benefits of using the Nystr m 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   **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 **Surface Electromagnetics** Fan Yang,Yahya Rahmat-Samii,2019-06-20 Provides systematic coverage of the theory physics functional designs and engineering applications of advanced electromagnetic surfaces *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   Ultra-Wideband, Short-Pulse Electromagnetics 10 Frank Sabath,Eric L. Mokole,2014-02-07 This book presents contributions of deep technical content and high scientific quality in the areas of electromagnetic theory scattering UWB antennas UWB systems ground penetrating radar GPR UWB communications pulsed power generation time domain computational electromagnetics UWB compatibility target detection and discrimination propagation through dispersive media and wavelet and multi resolution techniques Ultra wideband UWB short pulse SP electromagnetics are now being used for an increasingly wide variety of applications including collision avoidance radar concealed object detection and communications Notable progress in UWB and SP technologies has been achieved by investigations of their theoretical bases and improvements in solid state manufacturing computers and digitizers UWB radar systems are also being used for mine clearing oil pipeline inspections archeology geology and electronic effects testing Like previous books in this series Ultra Wideband Short Pulse Electromagnetics 10 serves as an essential reference for scientists and engineers working in these applications areas   **Finite Element Method Electromagnetics** John L. Volakis,Arindam Chatterjee,Leo C. Kempel,1998-06-15 Employed in a large number of commercial electromagnetic simulation packages the finite element method is one of the most popular and well established numerical techniques in engineering This book covers the theory development implementation and application of the finite element method and its hybrid versions to electromagnetics FINITE ELEMENT METHOD FOR ELECTROMAGNETICS begins with a step by step textbook presentation of the finite method and its variations then goes on to provide up to date coverage of three dimensional formulations and modern applications to open and closed domain problems Worked out examples are included to aid the

reader with the fine features of the method and the implementation of its hybridization with other techniques for a robust simulation of large scale radiation and scattering The crucial treatment of local boundary conditions is carefully worked out in several stages in the book Sponsored by IEEE Antennas and Propagation Society **Integral Equation Methods for Electromagnetic and Elastic Waves** Weng Chew,Mei-Song Tong,Bin HU,2022-05-31 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 Integral equation methods have been around for several decades and their introduction to electromagnetics has been due to the seminal works of Richmond and Harrington in the 1960s There was a surge in the interest in this topic in the 1980s notably the work of Wilton and his coworkers due to increased computing power The interest in this area was on the wane when it was demonstrated that differential equation methods with their sparse matrices can solve many problems more efficiently than integral equation methods Recently due to the advent of fast algorithms there has been a revival in integral equation methods in electromagnetics Much of our work in recent years has been in fast algorithms for integral equations which prompted our interest in integral equation methods While previously only tens of thousands of unknowns could be solved by integral equation methods now tens of millions of unknowns can be solved with fast algorithms This has prompted new enthusiasm in integral equation methods Table of Contents Introduction to Computational Electromagnetics Linear Vector Space Reciprocity and Energy Conservation Introduction to Integral Equations Integral Equations for Penetrable Objects Low Frequency Problems in Integral Equations Dyadic Green s Function for Layered Media and Integral Equations Fast Inhomogeneous Plane Wave Algorithm for Layered Media Electromagnetic Wave versus Elastic Wave Glossary of Acronyms

Electromagnetic Pulse Simulations Using Finite-Difference Time-Domain Method Shahid Ahmed,2021-04-20 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 **Electromagnetic and Optical Pulse Propagation** Kurt E. Oughstun,2019-07-17 In two volumes this book presents a detailed systematic treatment of electromagnetics with application to the propagation of transient electromagnetic fields including ultrawideband signals and ultrashort pulses in dispersive absorptive media This expanded updated and reorganized new edition presents a rigorous development of both time and frequency domain electromagnetics from classical theory to current topics in applied research on temporally pulsed wave fields in dielectric conducting and semiconducting materials With meaningful exercises throughout it is suitable as a graduate textbook in electromagnetic wave theory and will be of use to researchers as a resource on electromagnetic radiation and wave propagation theory with applications to radar imaging communications and safety issues Volume 1 develops the fundamental Maxwell Lorentz theory of microscopic electromagnetics and its relationship to macroscopic electromagnetics in complex media with particularemphasis given to temporally dispersive materials supplemented with several appendices on mathematical methods The second edition includes new material on conjugate electromagnetic fields time reversal invariance the four potential and Lorentz invariance anisotropic and spatially dispersive media double negative metamaterials and generalized Fresnel reflection and refraction coefficients for complex media The relationship between both the mathematical and physical interpretation of classical electromagnetic field theory with the special theory of relativity is emphasized throughout the volume Volume 2 covers temporal pulse dynamics in dispersive attenuative media with asymptotic analysis at the forefront *Numerical and Analytical Methods in Electromagnetics* Hristos T. Anastassiu,2021-03-19 Like all branches of physics and engineering electromagnetics relies on mathematical methods for modeling simulation and design procedures in all of its aspects radiation propagation scattering imaging etc Originally

rigorous analytical techniques were the only machinery available to produce any useful results In the 1960s and 1970s emphasis was placed on asymptotic techniques which produced approximations of the fields for very high frequencies when closed form solutions were not feasible Later when computers demonstrated explosive progress numerical techniques were utilized to develop approximate results of controllable accuracy for arbitrary geometries In this Special Issue the most recent advances in the aforementioned approaches are presented to illustrate the state of the art mathematical techniques in electromagnetics   The Method of Moments in Electromagnetics Walton C. Gibson,2007-11-28 Responding to the need for a clear up to date introduction to the field The Method of Moments in Electromagnetics explores surface integral equations in electromagnetics and presents their numerical solution using the method of moments MOM technique It provides the numerical implementation aspects at a nuts and bolts level while discuss

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