

# Frequency Domain Hybrid Finite Element Methods In Electromagnetics Synthesis Lectures On Computational Electromagnetics

The book provides a survey of numerical methods for acoustics, namely the finite element method (FEM) and the boundary element method (BEM). It is the first book summarizing FEM and BEM (and optimization) for acoustics. The book shows that both methods can be effectively used for many other cases, FEM even for open domains and BEM for closed ones. Emphasis of the book is put on numerical aspects and on treatment of the exterior problem in acoustics, i.e. noise radiation.

This book presents the proceedings of the first vehicle engineering and vehicle industry conference. It captures the outcome of theoretical and practical studies as well as the future development trends in a wide field of automotive research. The themes of the conference include design, manufacturing, economic and educational topics.

The first book applying HBFEM to practical electronic nonlinear field and circuit problems • Examines and solves wide aspects of practical electrical and electronic nonlinear field and circuit problems presented by HBFEM • Combines the latest research work with essential background knowledge, providing an all-encompassing reference for researchers, power engineers and students of applied electromagnetics analysis • There are very few books dealing with the solution of nonlinear electric- power-related problems • The contents are based on the authors' many years' research and industry experience; they approach the subject in a well-designed and logical way • It is expected that HBFEM will become a more useful and practical technique over the next 5 years due to the HVDC power system, renewable energy system and Smart Grid, HF magnetic used in DC/DC converter, and Multi-pulse transformer for HVDC power supply • HBFEM can provide effective and economic solutions to R&D product development • Includes Matlab exercises

This publication contains a selection of 124 papers among the 165 full-length contributions which were submitted on-site at ISEM 2003. The objective of the symposia series is to vigorously promote the research in the field of electro-mechanical systems. The reader will, we hope, appreciate the variety of topics that were addressed. This is what makes ISEM so stimulating for whoever is interested in the applications of electromagnetics and its opening toward many technical fields. Yet, this publication does not intend to be a mosaic of sub-disciplines, but aims at their integration and synergy. This will be demonstrated by the present selection.

Due to progress in the development of communication systems, it is now possible to develop low-cost wearable communication systems. A wearable antenna is meant to be a part of the clothing or close to the body and used for communication purposes, which include tracking and navigation, mobile computing and public safety. Examples include smartwatches (with integrated Bluetooth antennas), glasses (such as Google Glass with Wi-Fi and GPS antennas), GoPro action cameras (with Wi-Fi and Bluetooth antennas), etc. They are increasingly common in consumer electronics and for healthcare and medical applications. However, the development of compact, efficient wearable antennas is one of the major challenges in the development of wearable communication and medical systems. Technologies such as printed compact antennas and miniaturization techniques have been developed to create efficient, small wearable antennas which are the main objective of this book. Each chapter covers enough mathematical detail and explanations to enable electrical, electromagnetic and biomedical engineers and students and scientists from all areas to follow and understand the topics presented. New topics and design methods are presented for the first time in the area of wearable antennas, metamaterial antennas and fractal antennas. The book covers wearable antennas, RF measurements techniques and measured results in the vicinity of the human body, setups and design considerations. The wearable antennas and devices presented in this book were analyzed by using HFSS and ADS 3D full-wave electromagnetics software. Explores wearable medical systems and antennas Explains the design and development of wearable communication systems Explores wearable reconfigurable antennas for communication and medical applications Discusses new types of metamaterial antennas and artificial magnetic conductors (AMC) Reviews textile antennas Dr. Albert Sabban holds a PhD in Electrical Engineering from the University of Colorado at Boulder, USA (1991), and an MBA from the Faculty of Management, Haifa University, Israel (2005). He is currently a Senior Lecturer and researcher at the Department of Electrical and Electronic Engineering at Kinneret and Ort Braude Engineering Colleges.

A comprehensive and updated overview of the theory, algorithms and applications of for electromagnetic inverse scattering problems Offers the recent and most important advances in inverse scattering grounded in fundamental theory, algorithms and practical engineering applications Covers the latest, most relevant inverse scattering techniques like signal subspace methods, time reversal, linear sampling, qualitative methods, compressive sensing, and noniterative methods Emphasizes theory, mathematical derivation and physical insights of various inverse scattering problems Written by a leading expert in the field

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

The Most Complete, Up-to-Date Coverage of the Finite Element Analysis and Modeling of Antennas and Arrays Aimed at researchers as well as practical engineers—and packed with over 200 illustrations including twenty-two color plates—Finite Element Analysis of Antennas and Arrays presents: Time- and frequency-domain formulations and mesh truncation techniques Antenna source modeling and parameter calculation Modeling of complex materials and fine geometrical details Analysis and modeling of narrowband and broadband antennas Analysis and modeling of infinite and finite phased-array antennas Analysis and modeling of antenna and platform interactions Recognizing the strengths of other numerical methods, this book goes beyond the finite element method and covers hybrid techniques that combine the finite element method with the finite difference time-domain method, the method of moments, and the high-frequency asymptotic methods to efficiently deal with a variety of complex antenna problems. Complemented with numerous examples, this cutting-edge resource fully demonstrates the power and capabilities of the finite element analysis and its many practical applications.

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

This book describes and illustrates the application of several asymptotic methods that have proved useful in the authors' research in electromagnetics and antennas. We first define asymptotic approximations and expansions and explain these concepts in detail. We then develop certain prerequisites from complex analysis such as power series, multivalued functions (including the concepts of branch points and branch cuts), and the all-important gamma function. Of particular importance is the idea of analytic continuation (of functions of a single complex variable); our discussions here include some recent, direct applications to antennas and computational electromagnetics. Then, specific methods are discussed. These include integration by parts and the Riemann-Lebesgue lemma, the use of contour integration in conjunction with other methods, techniques related to Laplace's method and Watson's lemma, the asymptotic behavior of certain Fourier sine and cosine transforms, and the Poisson summation formula (including its version for finite sums). Often underutilized in the literature are asymptotic techniques based on the Mellin transform; our treatment of this subject complements the techniques presented in our recent Synthesis Lecture on the exact (not asymptotic) evaluation of integrals.

The objective of this two-volume book is the systematic and comprehensive description of the most competitive time-domain computational methods for the efficient modeling and accurate solution of contemporary real-world EMC problems. Intended to be self-contained, it performs a detailed presentation of all well-known algorithms, elucidating on their merits or weaknesses, and accompanies the theoretical content with a variety of applications. Outlining the present volume, the analysis covers the theory of the finite-difference time-domain, the transmission-line matrix/modeling, and the finite integration technique. Moreover, alternative schemes, such as the finite-element, the finitevolume, the multiresolution time-domain methods and many others, are presented, while particular attention is drawn to hybrid approaches. To this aim, the general aspects for the correct implementation of the previous algorithms are also exemplified. At the end of every section, an elaborate reference on the prominent pros and possible cons, always in the light of EMC modeling, assists the reader to retrieve the gist of each formulation and decide on his/her best possible selection according to the problem under investigation. Table of Contents: Fundamental Time-Domain Methodologies for EMC Analysis / Alternative Time-Domain Techniques in EMC Modeling / Principal Implementation Issues of Time-Domain EMC Simulation

Stutzman's 3rd edition of Antenna Theory and Design provides a more pedagogical approach with a greater emphasis on computational methods. New features include additional modern material to make the text more exciting and relevant to practicing engineers; new chapters on systems, low-profile elements and base station antennas; organizational changes to improve understanding; more details to selected important topics such as microstrip antennas and arrays; and expanded measurements topic.

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.

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

Despite the dramatic growth in the availability of powerful computer resources, the EM community lacks a comprehensive text on the computational techniques used to solve EM problems. The first edition of Numerical Techniques in Electromagnetics filled that gap and became the reference of choice for thousands of engineers, researchers, and students. This third edition of the bestselling text reflects the continuing increase in awareness and use of numerical techniques and incorporates advances and refinements made in recent years. Most notable among these are the improvements made to the standard algorithm for the finite-difference time-domain (FDTD) method and treatment of absorbing boundary conditions in FDTD, finite element, and transmission-line-matrix methods. The author also has added a chapter on the method of lines. Numerical Techniques in Electromagnetics with MATLAB®, Third Edition continues to teach readers how to pose, numerically analyze, and solve EM problems, to give them the ability to expand their problem-solving skills using a variety of methods, and to prepare them for research in electromagnetism. Now the Third Edition goes even further toward providing a comprehensive resource that addresses all of the most useful computation methods for EM problems and includes MATLAB code instead of FORTRAN.

This book offers a broad panorama on recently achieved and potentially obtainable advances in electromagnetics with innovative IT technologies. Simple tutorial chapters introduce cutting edge technologies. These include parallel and distributed computing, object-oriented technologies, grid computing, semantic grids, agent based computing and service-oriented architectures. The book is a unique tool bridging the gap between IT and EM communities.

This reference explains hybrid-Trefftz finite element method (FEM). Readers are introduced to the basic concepts and general element formulations of the method. This is followed by topics on non-homogeneous parabolic problems, thermal analysis of composites, and heat conduction in nonlinear functionally graded materials. A brief summary of the fundamental solution based-FEM is also presented followed by a discussion on axisymmetric potential problems and the rotordynamic response of tapered composites. The book is rounded by chapters that cover the n-sided polygonal hybrid finite elements and analysis of piezoelectric materials. Key Features - Systematic presentation of 9 topics - Covers FEMs in two sections: 1) hybrid-Trefftz method and 2) fundamental FEM solutions - Bibliographic references - Includes solutions to problems in the numerical analysis of different material types - Includes solutions to some problems encountered in civil engineering (seepage, heat transfer, etc). This reference is suitable for scholars involved in advanced courses in mathematics and engineering (civil engineering/materials engineering). Professionals involved in developing analytical tools for materials and construction testing can also benefit from the methods presented in the book.

Magnetic resonance imaging (MRI) is a technique used in biomedical imaging and radiology to visualize internal structures of the body. Because MRI provides excellent contrast between different soft tissues, the technique is especially useful for diagnostic imaging of the brain, muscles, and heart. In the past 20 years, MRI technology has improved significantly with the introduction of systems up to 7 Tesla (7 T) and with the development of numerous post-processing algorithms such as diffusion tensor imaging (DTI), functional MRI (fMRI), and spectroscopic imaging. From these developments, the diagnostic potentialities of MRI have improved impressively with an exceptional spatial resolution and the possibility of analyzing the morphology and function of several kinds of pathology. Given these exciting developments, the Magnetic Resonance Imaging Handbook: Image Principles, Neck, and the Brain is a timely addition to the growing body of literature in the field. Covering MRI from fundamentals to practice, this comprehensive book: Discusses the clinical benefits of diagnosing human pathologies using MRI Explains the physical principles of MRI and how to use the technique correctly Highlights each organ's anatomy and pathological processes with high-quality images Examines the protocols and potentialities of advanced MRI scanners such as 7 T systems Includes extensive references at the end of each chapter to enhance further study Thus, the Magnetic Resonance Imaging Handbook: Image Principles, Neck, and the Brain provides radiologists and imaging specialists with a valuable, state-of-the-art reference on MRI.

Advances in Machine Learning Research and Application: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Machine Learning. The editors have built Advances in Machine Learning Research and Application: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Machine Learning in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Advances in Machine Learning Research and Application: 2011 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>.

The proceedings of the International Congress (c) include about 120 papers selected out of 160 papers submitted for presentations at APCF/SIF-2014, to be held in Sydney, Australia, December 9-12, 2014, and uniting the Asian-Pacific Conference on Fracture and Strength 2014 (APCFS-2014) with the International Conference on Structural Integrity and Failure (SIF-2014). The congress will be hosted by The University of Sydney and co-organized by Australia Fracture Group (AFG), the Chinese Mechanical Engineering Society, Materials Institution (CMES-MI), the Korean Society of Mechanical Engineers, Materials and Fracture Division (KSME-MFD) and The Japanese Society of Mechanical Engineers, Materials and Mechanics Division (JSME-MMD). The congress follows the series of the previous very successful APCF and SIF international forums, in particular, APCFS 2012, Busan and the 8th SIF, Melbourne, 2013. Characterisations of complex mechanisms of damage accumulation and failure Application of new multi-scale modelling approaches in problems associated with structural integrity Development of more accurate technologies for structural damage assessment

This volume consists of the papers presented at the 6th International Workshop on Scattering Theory and Biomedical Engineering. Organized every two years, this workshop provides an overview of the hot topics in scattering theory and biomedical technology, and brings together young researchers and senior scientists, creating a forum for the exchange of new scientific ideas. At the sixth meeting, all the invited speakers, who are recognized as being eminent in their field and, more important, as being stimulating speakers, presented their latest achievements. The proceedings have been selected for coverage in: . OCo Index to Scientific & Technical Proceedings- (ISTP- / ISI Proceedings). OCo Index to Scientific & Technical Proceedings (ISTP CDROM version / ISI Proceedings). OCo CC Proceedings

OCO Biomedical, Biological & Agricultural Sciences. Contents: Scattering Theory: On the Elastic Scattering Problem from Cubic Anisotropic Inclusions (K A Anagnostopoulos & A Charalambopoulos); On the Scattering of Spherical Electromagnetic Waves by a Penetrable Chiral Obstacle (C Athanasiadis et al.); A Factorization Methods for Maxwell's Equations (A Kirsch); Acoustic Scattering by an Impenetrable Spheroid (J A Roumeliotis et al.); Applied Mathematics: Wave Dispersion Phenomena in Concrete (D G Aggelis & D Polyzos); Homogenization of Maxwell's Equations in Dissipative Bianisotropic Media (G Barbatis & I G Stratis); Moment's Method for Inverse Boundary Value Problems (Y Kurylev); Cleaning Astronomical Databases Using Hough Transforms and Renewal Strings (C K I Williams et al.); Mesh Modeling and its Applications in Image Processing (Y Yang); Biomedical Engineering: Autoregressive Spectral Analysis of Phrenic Neurogram Before and After Vagotomy in the Piglet (S Agner & M Akay); Classifying Patterns Relating to the Early Development of Posttraumatic Stress Disorder Using Principal Components Analysis (B Knorr et al.); Fingerprint Verification Based on Image Processing Segmentation Using an Onion Algorithm of Computational Geometry (M Poulos et al.); and other papers. Readership: Graduate students, academics and researchers in biomedical engineering, bioinformatics and mathematical biology."

The nature of dark matter remains one of the preeminent mysteries in physics and cosmology. It appears to require the existence of new particles whose interactions with ordinary matter are extraordinarily feeble. One well-motivated candidate is the axion, an extraordinarily light neutral particle that may possibly be detected by looking for their conversion to detectable microwaves in the presence of a strong magnetic field. This has led to a number of experimental searches that are beginning to probe plausible axion model space and may reveal the axion in the near future. These proceedings discuss the challenges of designing and operating tunable resonant cavities and detectors at ultralow temperatures. The topics discussed here have potential application far beyond the field of dark matter detection and may be applied to resonant cavities for accelerators as well as designing superconducting detectors for quantum information and computing applications. This work is intended for graduate students and researchers interested in learning the unique requirements for designing and operating microwave cavities and detectors for direct axion searches and to introduce several proposed experimental concepts that are still in the prototype stage.

Substrate integrated waveguide (SIW) is a new type of transmission line. It implements a waveguide on a piece of printed circuit board by emulating the side walls of the waveguide using two rows of metal posts. It inherits the merits both from the microstrip for compact size and easy integration, and from the waveguide for low radiation loss, and thus opens another door to design efficient microwave circuits and antennas at a low cost. This book presents a two-dimensional fullwave analysis method to investigate an SIW circuit composed of metal and dielectric posts. It combines the cylindrical eigenfunction expansion and the method of moments to avoid geometrical discretization of the posts. The method is presented step-by-step, with all the necessary formulations provided for a practitioner who wants to implement this method by himself. This book covers the SIW circuit printed on either homogeneous or inhomogeneous substrate, the microstrip-to-SIW transition and the speed-up technique for the simulation of symmetrical SIW circuits. Different types of SIW circuits are shown and simulated using the proposed method. In addition, several slot antennas and horn antennas fabricated using the SIW technology are also given. Table of Contents: Introduction / SIW Circuits Composed of Metallic Posts / SIW Circuits with Dielectric Posts / Even-Odd Mode Analysis of a Symmetrical Circuit / Microstrip to SIW Transition and Half Mode SIW / SIW Antennas

This volume consists of the papers presented at the 6th International Workshop on Scattering Theory and Biomedical Engineering. Organized every two years, this workshop provides an overview of the hot topics in scattering theory and biomedical technology, and brings together young researchers and senior scientists, creating a forum for the exchange of new scientific ideas. At the sixth meeting, all the invited speakers, who are recognized as being eminent in their field and, more important, as being stimulating speakers, presented their latest achievements. The proceedings have been selected for coverage in: • Index to Scientific & Technical Proceedings® (ISTP® / ISI Proceedings) • Index to Scientific & Technical Proceedings (ISTP CDROM version / ISI Proceedings) • CC Proceedings — Biomedical, Biological & Agricultural Sciences Contents: Scattering Theory: On the Elastic Scattering Problem from Cubic Anisotropic Inclusions (K A Anagnostopoulos & A Charalambopoulos) On the Scattering of Spherical Electromagnetic Waves by a Penetrable Chiral Obstacle (C Athanasiadis et al.) A Factorization Methods for Maxwell's Equations (A Kirsch) Acoustic Scattering by an Impenetrable Spheroid (J A Roumeliotis et al.) Applied Mathematics: Wave Dispersion Phenomena in Concrete (D G Aggelis & D Polyzos) Homogenization of Maxwell's Equations in Dissipative Bianisotropic Media (G Barbatis & I G Stratis) Moment's Method for Inverse Boundary Value Problems (Y Kurylev) Cleaning Astronomical Databases Using Hough Transforms and Renewal Strings (C K I Williams et al.) Mesh Modeling and its Applications in Image Processing (Y Yang) Biomedical Engineering: Autoregressive Spectral Analysis of Phrenic Neurogram Before and After Vagotomy in the Piglet (S Agner & M Akay) Classifying Patterns Relating to the Early Development of Posttraumatic Stress Disorder Using Principal Components Analysis (B Knorr et al.) Fingerprint Verification Based on Image Processing Segmentation Using an Onion Algorithm of Computational Geometry (M Poulos et al.) and other papers Readership: Graduate students, academics and researchers in biomedical engineering, bioinformatics and mathematical biology. Keywords: Applied Mathematics; Scattering Theory; Biomedical Engineering

This volume presents and discusses recent advances in boundary element methods and their solid mechanics applications. It illustrates these methods in their latest forms, developed during the last five to ten years, and demonstrates their advantages in solving a wide range of solid mechanics problems.

Mutual Coupling Between Antennas A guide to mutual coupling between various types of antennas in arrays such as wires, apertures and microstrip patches or antennas co-sited on platforms Mutual Coupling Between Antennas explores the theoretical underpinnings of mutual coupling, offers an up-to-date description of the physical effects of mutual coupling for a variety of antennas, and contains techniques for analysing and assessing its effects. The book puts the topic in historical context, presents an integral equation approach, includes the current techniques, measurement methods, and discusses the most recent advances in the field. With contributions from noted experts on the topic, the book reviews practical aspects of mutual coupling and examines applications that clearly demonstrate where the performance is impacted both positively and negatively. Mutual Coupling Between Antennas contains information on how mutual coupling can be analysed with a wide range of methods from direct computer software using discrete methods, to integral equations and Greens function methods as well as approximate asymptotic methods. This important text: Provides a theoretical background for understanding mutual coupling between various types of antennas Describes the interaction that occurs between antennas, both planned and unplanned Explores a key aspect of arrays in any wireless, radar or sensing system operating at radio frequencies Offers a groundbreaking book on antenna mutual coupling Written for antenna engineers, technical specialists, researchers and students, Mutual Coupling Between Antennas is the first book to examine mutual coupling between various types of antennas including wires, horns, microstrip patches, MIMO antennas, co-sited antennas and arrays in planar or conformal configurations.

This book presents ultrawideband antennas and their applications on microwave imaging. The chapters focus on recent techniques, analysis, and applications along with the future vision of this emerging field of applied electromagnetics. Several emerging topics are essayed, including dielectric resonator antennas and planar ultrawideband antennas for microwave imaging. This resource incorporates modern design concepts, analysis, and optimization techniques based on recent developments. Readers are also provided with an extensive overview of current regulations, including those related to microwave effects in biological tissues.

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.

Frequency Domain Hybrid Finite Element Methods for Electromagnetics Morgan & Claypool Publishers

The objective of this two-volume book is the systematic and comprehensive description of the most competitive time-domain computational methods for the efficient modeling and accurate solution of contemporary real-world EMC problems. Intended to be self-contained, it performs a detailed presentation of all well-known algorithms, elucidating on their merits or weaknesses, and accompanies the theoretical content with a variety of applications. Outlining the present volume, the analysis covers the theory of the finite-difference time-domain, the transmission-line matrix/modeling, and the finite integration technique. Moreover, alternative schemes, such as the finite-element, the finite-volume, the multiresolution time-domain methods and many others, are presented, while particular attention is drawn to hybrid approaches. To this aim, the general aspects for the correct implementation of the previous algorithms are also exemplified. At the end of every section, an elaborate reference on the prominent pros and possible cons, always in the light of EMC modeling, assists the reader to retrieve the gist of each formulation and decide on his/her best possible selection according to the problem under investigation. This book is a self-contained, programming-oriented and learner-centered book on finite element method (FEM), with special emphasis given to developing MATLAB® programs for numerical modeling of electromagnetic boundary value problems. It provides a deep understanding and intuition of FEM programming by means of step-by-step MATLAB® programs with detailed descriptions, and eventually enabling the readers to modify, adapt and apply the provided programs and formulations to develop FEM codes for similar problems through various exercises. It starts with simple one-dimensional static and time-harmonic problems and extends the developed theory to more complex two- or three-dimensional problems. It supplies sufficient theoretical background on the topic, and it thoroughly covers all phases (pre-processing, main body and post-processing) in FEM. FEM formulations are obtained for boundary value problems governed by a partial differential equation that is expressed in terms of a generic unknown function, and then, these formulations are specialized to various electromagnetic applications together with a post-processing phase. Since the method is mostly described in a general context, readers from other disciplines can also use this book and easily adapt the provided codes to their engineering problems. After forming a solid background on the fundamentals of FEM by means of canonical problems, readers are guided to more advanced applications of FEM in electromagnetics through a survey chapter at the end of the book. Offers a self-contained and easy-to-understand introduction to the theory and programming of finite element method. Covers various applications in the field of static and time-harmonic electromagnetics. Includes one-, two- and three-dimensional finite element codes in MATLAB®. Enables readers to develop finite element programming skills through various MATLAB® codes and exercises. Promotes self-directed learning skills and provides an effective instruction tool.

TEM waves -- Waveguides -- Potentials, concepts, and theorems -- Canonical problems -- Method of moments -- Finite element method -- Uniform theory of diffraction -- Physical theory of diffraction -- Scalar and dyadic Green's functions -- Green's functions construction I -- Green's functions construction II

This lecture provides a tutorial introduction to the Nyström and locally-corrected Nyström methods when used for the numerical solutions of the common integral equations of two-dimensional electromagnetic fields. These equations exhibit kernel singularities that complicate their numerical solution. Classical and generalized Gaussian quadrature rules are reviewed. The traditional Nyström method is summarized, and applied to the magnetic field equation for illustration. To obtain high order accuracy in the numerical results, the locally-corrected Nyström method is developed and applied to both the electric field and magnetic field equations. In the presence of target edges, where current or charge density singularities occur, the method must be extended through the use of appropriate singular basis functions and special quadrature rules. This extension is also described.

Table of Contents: Introduction / Classical Quadrature Rules / The Classical Nyström Method / The Locally-Corrected Nyström Method / Generalized Gaussian Quadrature / LCN

### Treatment of Edge Singularities

This series of volumes constitutes an outstanding collection of contributions by the most active research workers in the area of acoustics and mechanics. It brings the reader up to date on the status of the various aspects of research in this field. The volumes should preserve their value for a long time, as they represent a monument to the achievements of human research capabilities in the underwater-acoustics aspects of the environment. Contents: Scattering from Elliptical Shells — A Unified Approach Applicable to Both Elastic and Fluid Media (R P Radlinski & M M Simon) On the Systematic Use of Spherical, Cylindrical and Plane Vector Wave Functions in Elastodynamic Scattering Problems (A Boström) Computational Modeling of Transient Acoustic Wavefields — A Structured Approach Based on Reciprocity (A T de Hoop) Linear Viscoelasticity (F Mainardi) Transient Waves in Linear Viscoelastic Media (F Mainardi) Computational Ocean-Seismoacoustic Modeling Using Finite Elements (J E Murphy & S A Chin-Bing) Nonorthogonality of Measured Normal Modes in a Shallow Water Waveguide (G H Rayborn et al.) Nearfield Acoustical Holography (A Sarkissian) Elimination of Internal Resonance Effects in Acoustic Scattering from Cylinders Using Method of Moments (S P Sun & P K Raju) Pulsed Asymmetric Point Force Loading of a Layered Half-Space (P Borejko & F Ziegler) Nonlinear Stability Analysis of Pre-Stressed Elastic Bodies (Y B Fu & R W Ogden) Readership: Nonlinear scientists. Keywords: Reviews: "... Überall's work in acoustic and electromagnetic scattering has evoked much interest, in the US as well as abroad, because of its possible practical applications, as well as the theoretical understanding. Many collaborators have been inspired by it, and have now contributed to this volume. The book is an excellent contribution to the literature of Acoustics and Wave Propagation. Professor Guran is to be congratulated for organizing and editing this volume." Prof. Hans A Bethe, Nobel Laureate Cornell University "... This is an impressive collection of 45 research and review chapters involving 78 authors. Taking into account the high educational quality and research value of this set of books, it is recommended for purchase by libraries that serves research programs involved with acoustic scattering related to underwater and ultrasonics." Professor Philip Marston Journal of the Acoustical Society of America

III European Conference on Computational Mechanics: Solids, Structures and Coupled Problem in Engineering Computational Mechanics in Solid, Structures and Coupled Problems in Engineering is today a mature science with applications to major industrial projects. This book contains the edited version of the Abstracts of Plenary and Keynote Lectures and Papers, and a companion CD-ROM with the full-length papers, presented at the III European Conference on Computational Mechanics: Solids, Structures and Coupled Problems in Engineering (ECCM-2006), held in the National Laboratory of Civil Engineering, Lisbon, Portugal 5th - 8th June 2006. The book reflects the state-of-art of Computation Mechanics in Solids, Structures and Coupled Problems in Engineering and it includes contributions by the world most active researchers in this field.

This book presents the application of the overlapping grids approach to solve chiral material problems using the FDFD method. Due to the two grids being used in the technique, we will name this method as Double-Grid Finite Difference Frequency-Domain (DG-FDFD) method. As a result of this new approach the electric and magnetic field components are defined at every node in the computation space. Thus, there is no need to perform averaging during the calculations as in the aforementioned FDFD technique [16]. We formulate general 3D frequency-domain numerical methods based on double-grid (DG-FDFD) approach for general bianisotropic materials. The validity of the derived formulations for different scattering problems has been shown by comparing the obtained results to exact and other solutions obtained using different numerical methods.

We are concerned with the numerical solution linear systems that arise from a hybridization of the Finite Element Method (FEM) and the Boundary Element Method (BEM). Our present focus is hybrid FEM-BEM discretization of the frequency-domain vector Helmholtz equation of electromagnetics, but similar hybrid techniques are used in electrostatics, acoustics, elasticity, etc. The hybrid FEM-BEM technique is used to solve "open" or "infinite" problems, where the FEM is used to discretize the interior of the problem and the BEM is used to simulate the effect of the infinite domain. This is illustrated generically in two dimensions in Figure 1 below. The FEM is applied to the interior  $V$ , the BEM is applied to the fictitious surface  $S$ , and the two methods are appropriately coupled to form a well-posed problem.

This is the first truly comprehensive and most up-to-date handbook available on modern reflector antennas and feed sources for diversified space and ground applications. There has never been such an all-encompassing reflector handbook in print, and no currently available title offers coverage of such recent research developments. The Handbook consists of three volumes. Volume II focuses on feed sources. Reflector antennas are extraordinary devices that combine high gain with geometrical simplicity, and can operate in broad frequency bands. Their performance, however, depends on the electrical characteristics of the feed system with which they operate. This comprehensive volume provides you with a solid understanding of feed system theory, design, and analysis. Featuring chapters authored by experts in each aspect of feed systems, this book takes you from fundamental mathematical techniques, electrically small and large dual reflectors, feed geometry and telemetry, tracking and command antennas, and more. Throughout the book numerous examples are provided to guide you in the practical aspects of feed design.

Here are the printed proceedings of EPMESC X, held on August 21-23, 2006 in Sanya, Hainan Island of China. It includes 14 full papers of plenary and semi-plenary lectures and approximately 166 one-page summaries. The accompanying CD-ROM includes all 180 full papers presented at the conference.

This volume contains the proceedings of the first ICASE/LaRC Work shop on Computational Electromagnetics and Its Applications conducted by the Institute for Computer Applications in Science and Engineering and NASA Langley Research Center. We had several goals in mind when we decided, jointly with the Electromagnetics Research Branch, to organize this workshop on Computational Electromagnetics (CEM). Among our goals were a desire to obtain an overview of the current state of CEM, covering both algorithms and applications and their effect on NASA's activities in this area. In addition, we wanted to provide an attractive setting for computational scientists with expertise in

other fields, especially computational fluid dynamics (CFD), to observe the algorithms and tools of CEM at work. Our expectation was that scientists from both fields would discover mutually beneficial inter connections and relationships. Another goal was to learn of progress in solution algorithms for electromagnetic optimization and design problems; such problems make extensive use of field solvers and computational efficiency is at a premium. To achieve these goals we assembled the renowned group of speakers from academia and industry whose talks are contained in this volume. The papers are printed in the same order in which the talks were presented at the meeting. The first paper is an overview of work currently being performed in the Electromagnetic Research Branch at the Langley Research Center.

[Copyright: f5e31f17c5832a4d4587e12871fbda83](#)