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Special Volume
Numerical Methods
in Electromagnetics

W.H.A. SCHILDERS
E.J.W. TER MATEN
Guest Editors

Numerical Methods In Electromagnetics Special Volume

E. Jan W. ter Maten,Hans-Georg Brachtendorf,Roland Pulch,Wim Schoenmaker,Herbert De Gersem

Numerical Methods In Electromagnetics Special Volume:

Numerical Methods in Electromagnetics W.H.A. SCHILDERS,E.J.W. TER MATEN,2005-04-04 This special volume provides a broad overview and insight in the way numerical methods are being used to solve the wide variety of problems in the electronics industry Furthermore its aim is to give researchers from other fields of application the opportunity to benefit from the results wich have been obtained in the electronics industry Complete survey of numerical methods used in the electronic industry Each chapter is selfcontained Presents state of the art applications and methods Internationally recognised authors   *Handbook of Numerical Analysis: Numerical methods in electromagnetics* Philippe G. Ciarlet,Jacques-Louis Lions,1990   Mathematical Models and Numerical Methods for Full Wave Analysis of Prolate and Oblate Spheroidal Conformal Microwave Components Saif Al-Hasson,2014-08-29 Conformal components are used nowadays at higher rate than ever before They can be found in curved mobile phones communication navigation and imaging systems in land water air and space vehicles The integration of those components within the external structure became of significant importance for aerodynamic electromagnetic aesthetic or physical reasons As a result many mathematical models were previously developed to analyze and optimize such conformed devices In this thesis we contributed to this field by developing various models for full wave analysis of spheroidal components As a starting point mathematical formulas for conforming antennas on oblate and prolate spheroids were obtained Those conformation methods were validated by conforming many antennas on spheroidal surfaces They were then used to formulate Method of Moments equations with spheroidally curved current functions for analyzing wire antennas of random shape conformed to spheroids in the frequency domain The complete model was applied to a conformal Archimedean spiral antenna on an oblate spheroid and showed that the conformed spiral has similar current distribution as its planar counterpart but produces an unsymmetrical radiation pattern The obtained model was then extended to spheroidal multi layer structures by integrating the spheroidal dyadic Green s Function within its mathematical derivation However due to a detected divergence in that function the model couldn t be implemented On the side of time based analysis methods a Finite Difference Time Domain method was developed for closed oblate and prolate spheroidal structures Alternative formulas for the structure s singularities and the condition of numerical stability were derived as well The obtained model was then validated and used to characterize spheroidal cavities in the time and frequency domains The method was extended later to unbounded spheroidal domain by deriving the Absorbing Boundary Conditions using the One Way Wave method The whole model was then applied to characterize a patch antenna conformed to a prolate spheroid Finally an analytical solution for the transient fields in spherical multilayer media energized by spherical harmonics source and an algorithm for tracing back the path of all the reflected waves were obtained The model was applied to different multilayer structures where the transient response was obtained and validated against a numerical solution

Numerical Techniques in Electromagnetics with MATLAB Matthew N.O. Sadiku,2018-10-08 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

Model Reduction for Circuit Simulation Peter Benner,Michael Hinze,E. Jan W. ter Maten,2011-03-25 Simulation based on mathematical models plays a major role in computer aided design of integrated circuits ICs Decreasing structure sizes increasing packing densities and driving frequencies require the use of refined mathematical models and to take into account secondary parasitic effects This leads to very high dimensional problems which nowadays require simulation times too large for the short time to market demands in industry Modern Model Order Reduction MOR techniques present a way out of this dilemma in providing surrogate models which keep the main characteristics of the device while requiring a significantly lower simulation time than the full model With Model Reduction for Circuit Simulation we survey the state of the art in the challenging research field of MOR for ICs and also address its future research directions Special emphasis is taken on aspects stemming from miniturisations to the nano scale Contributions cover complexity reduction using e g balanced truncation Krylov techniques or POD approaches For semiconductor applications a focus is on generalising current techniques to differential algebraic equations on including design parameters on preserving stability and on including nonlinearity by means of piecewise linearisations along solution trajectories TPWL and interpolation techniques for nonlinear parts Furthermore the influence of interconnects and power grids on the physical properties of the device is considered and also top down system design approaches in which detailed block descriptions are combined with behavioral models Further topics consider MOR and the combination of approaches from optimisation and statistics and the inclusion of PDE models with emphasis on MOR for the resulting partial differential algebraic systems The methods which currently are being developed have also relevance in other application areas such as mechanical multibody systems and systems arising in chemistry and to biology The current number of books in the area of MOR for ICs is very limited so that this volume helps to fill a gap in providing the state of the art material and to stimulate further research in this area of MOR Model Reduction for

Circuit Simulation also reflects and documents the vivid interaction between three active research projects in this area namely the EU Marie Curie Action ToK project O MOORE NICE members in Belgium The Netherlands and Germany the EU Marie Curie Action RTN project COMSON members in The Netherlands Italy Germany and Romania and the German federal project System reduction in nano electronics SyreNe *Ultrawideband Phased Array Antenna Technology for Sensing and Communications Systems* Alan J. Fenn,Peter T. Hurst,2015-04-10 Practical ultrawideband phased array technology used in airborne and ground based systems applications *The Cell Method* Elena Ferretti,2014-02-02 The Cell Method CM is a computational tool that maintains critical multidimensional attributes of physical phenomena in analysis This information is neglected in the differential formulations of the classical approaches of finite element boundary element finite volume and finite difference analysis often leading to numerical instabilities and spurious results This book highlights the central theoretical concepts of the CM that preserve a more accurate and precise representation of the geometric and topological features of variables for practical problem solving Important applications occur in fields such as electromagnetics electrodynamics solid mechanics and fluids CM addresses non locality in continuum mechanics an especially important circumstance in modeling heterogeneous materials Professional engineers and scientists as well as graduate students are offered A general overview of physics and its mathematical descriptions Guidance on how to build direct discrete formulations Coverage of the governing equations of the CM including nonlocality Explanations of the use of Tonti diagrams and References for further reading *Analytical and Computational Methods in Electromagnetics* Ramesh Garg,2008 This authoritative resource offers you clear and complete explanation of this essential electromagnetics knowledge providing you with the analytical background you need to understand such key approaches as MoM method of moments FDTD Finite Difference Time Domain and FEM Finite Element Method and Green s functions This comprehensive book includes all math necessary to master the material **Scientific Computing in Electrical Engineering** Angelo Marcello Anile,Giuseppe Alì,G. Mascali,2007-01-10 This book is a collection of papers presented at the last Scientific Computing in Electrical Engineering SCEE Conference held in Sicily in 2004 The series of SCEE conferences aims at addressing mathematical problems which have a relevancy to industry The areas covered at SCEE 2004 were Electromagnetism Circuit Simulation Coupled Problems and General mathematical and computational methods **Nonsmooth Modeling and Simulation for Switched Circuits** Vincent Acary,Olivier Bonnefon,Bernard Brogliato,2010-10-19 Nonsmooth Modeling and Simulation for Switched Circuits concerns the modeling and the numerical simulation of switched circuits with the nonsmooth dynamical systems NSDS approach using piecewise linear and multivalued models of electronic devices like diodes transistors switches Numerous examples ranging from introductory academic circuits to various types of power converters are analyzed and many simulation results obtained with the INRIA open source SICONOS software package are presented Comparisons with SPICE and hybrid methods demonstrate the power of the NSDS approach Nonsmooth Modeling and Simulation for Switched

Circuits is intended to researchers and engineers in the field of circuits simulation and design but may also attract applied mathematicians interested by the numerical analysis for nonsmooth dynamical systems as well as researchers from Systems and Control   Time Domain Electromagnetics Sadasiva M. Rao,1999-07-26 Time Domain Electromagnetics deals with a specific technique in electromagnetics within the general area of electrical engineering This mathematical method has become a standard for a wide variety of applications for design and problem solving This method of analysis in electromagnetics is directly related to advances in cellular and mobile communications technology as well as traditional EM areas such as radar antennas and wave propagation Most of the material is available in the research journals which is difficult for a non specialist to locate read understand and effectively use for the problem at hand Only book currently available to practicing engineers and research scientists exclusively devoted to this subject Includes contributions by the world s leading experts in electromagnetics Presents the most popular methods used in time domain analysis are included at one place with thorough discussion of the methods in an easily understandable style In each chapter many simple and practical examples are discussed thoroughly to illustrate the salient points of the material presented All chapters are written in a consistent style that allows the book to be of use for self study by professionals as well as for use in a graduate level course in electrical engineering   **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   *The RF and Microwave Handbook - 3 Volume Set* Mike Golio,2018-10-08 By 1990 the wireless revolution had begun In late 2000 Mike Golio gave the world a significant tool to

use in this revolution The RF and Microwave Handbook Since then wireless technology spread across the globe with unprecedented speed fueled by 3G and 4G mobile technology and the proliferation of wireless LANs Updated to reflect this tremendous growth the second edition of this widely embraced bestselling handbook divides its coverage conveniently into a set of three books each focused on a particular aspect of the technology Six new chapters cover WiMAX broadband cable bit error ratio BER testing high power PAs power amplifiers heterojunction bipolar transistors HBTs as well as an overview of microwave engineering Over 100 contributors with diverse backgrounds in academic industrial government manufacturing design and research reflect the breadth and depth of the field This eclectic mix of contributors ensures that the coverage balances fundamental technical issues with the important business and marketing constraints that define commercial RF and microwave engineering Focused chapters filled with formulas charts graphs diagrams and tables make the information easy to locate and apply to practical cases The new format three tightly focused volumes provides not only increased information but also ease of use You can find the information you need quickly without wading through material you don t immediately need giving you access to the caliber of data you have come to expect in a much more user friendly format

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 **Ultra-Wideband, Short Pulse Electromagnetics 9** Frank Sabath,D.V. Giri,Farhad Rachidi,Armin Kaelin,2010-06-17 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 Ultra wideband Short Pulse Electromagnetics 9 presents selected papers of deep technical content and high scientific quality from the UWB SP9 Conference which was held from July 21 25 2008 in Lausanne Switzerland The wide ranging coverage includes contributions on electromagnetic theory time domain computational techniques modeling techniques antennas pulsed power UWB interactions radar systems UWB communications broadband systems and components This book serves as a state of the art reference for scientists and engineers working in these applications areas **Nanoelectronic Coupled Problems Solutions** E. Jan W. ter Maten,Hans-Georg Brachtendorf,Roland Pulch,Wim Schoenmaker,Herbert De Gersem,2019-11-06 Designs in nanoelectronics often lead to challenging simulation problems and include strong feedback couplings Industry

demands provisions for variability in order to guarantee quality and yield It also requires the incorporation of higher abstraction levels to allow for system simulation in order to shorten the design cycles while at the same time preserving accuracy The methods developed here promote a methodology for circuit and system level modelling and simulation based on best practice rules which are used to deal with coupled electromagnetic field circuit heat problems as well as coupled electro thermal stress problems that emerge in nanoelectronic designs This book covers 1 advanced monolithic multirate co simulation techniques which are combined with envelope wavelet approaches to create efficient and robust simulation techniques for strongly coupled systems that exploit the different dynamics of sub systems within multiphysics problems and which allow designers to predict reliability and ageing 2 new generalized techniques in Uncertainty Quantification UQ for coupled problems to include a variability capability such that robust design and optimization worst case analysis and yield estimation with tiny failure probabilities are possible including large deviations like 6 sigma 3 enhanced sparse parametric Model Order Reduction techniques with a posteriori error estimation for coupled problems and for UQ to reduce the complexity of the sub systems while ensuring that the operational and coupling parameters can still be varied and that the reduced models offer higher abstraction levels that can be efficiently simulated All the new algorithms produced were implemented transferred and tested by the EDA vendor MAGWEL Validation was conducted on industrial designs provided by end users from the semiconductor industry who shared their feedback contributed to the measurements and supplied both material data and process data In closing a thorough comparison to measurements on real devices was made in order to demonstrate the algorithms industrial applicability *Innovative Computing Vol 1 - Emerging Topics in Artificial Intelligence* Jason C. Hung,Jia-Wei Chang,Yan Pei,2023-04-30 This book comprises select peer reviewed proceedings of the 6th International Conference on Innovative Computing IC 2023 The contents focus on communication networks business intelligence and knowledge management web intelligence and fields related to the development of information technology The chapters include contributions on various topics such as databases and data mining networking and communications web and Internet of Things embedded systems soft computing social network analysis security and privacy optical communication and ubiquitous pervasive computing This volume will serve as a comprehensive overview of the latest advances in information technology for those working as researchers in both academia and industry *Modern EMC Analysis Techniques Volume I* Nikolaos V. Kantartzis,Theodoros D. Tsiboukis,2022-05-31 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   *Handbook of Reflector Antennas and Feed Systems Volume II: Feed Systems* Lotfollah Shafai,Satish K. Sharma,Sudhakar Rao,2013-07-01 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   **Scientific Computing in Electrical Engineering SCEE 2008** Luis R.J. Costa,Janne Roos,2010-06-14 This book is a collection of 65 selected papers presented at the 7th International Conference on Scientific Computing in Electrical Engineering SCEE held in Espoo Finland in 2008 The aim of the SCEE 2008 conference was to bring together scientists from academia and industry e g mathematicians electrical engineers computer scientists and physicists with the goal of intensive discussions on industrially relevant mathematical problems with an emphasis on modeling and numerical simulation of electronic circuits and devices electromagnetic fields and coupled problems This extensive reference work is divided into five parts 1 Computational electromagnetics 2 Circuit simulation 3 Coupled problems 4 Mathematical and computational methods and 5 Model order reduction Each part starts with an general introduction followed by the actual papers

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