Numerical Computation
of
Electric and Magnetic Fields

C. W. Steele

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Numerical Computation Of Electric And Magnetic Fields

Leopold B. Felsen,Mauro Mongiardo,Peter Russer

Numerical Computation Of Electric And Magnetic Fields:

   Numerical Computation of Electric and Magnetic Fields Charles W. Steele,2012-12-06 Since the first edition of this book was published in 1987 there have been several important changes in the state of numerical field computation as discussed in the Introduction These changes have motivated the publication of this second edition As with the first edition the objective of this second edition is to give the newcomer to field computation the information needed to perform practical field computations Again clarity of presentation is given greater emphasis than a high degree of sophistication or the state of the art And again the basic concepts of field computation are presented as well as the commonly used algorithms Several persons have provided much valuable information for this second edition I wish to thank Professor Giorgio Molinari of the University of Genoa Italy for advice regarding adaptive mesh generation Dr C R E Emson of Vector Fields Ltd England and Dr John Brauer of McNeal Schwendler Corp for their advice on transient eddy current computation and Dr Zoltan Cendes of Ansoft Corp for information about their adaptive mesh generator Again I would like to acknowledge the support for this second edition by my wife Candace Again I could not have written this book without her support   **Analysis and Computation of Electric and Magnetic Field Problems** K. J. Binns,P. J. Lawrenson,2013-10-22 Analysis and Computation of Electric and Magnetic Field Problems Second Edition is a comprehensive treatment of both analytical and numerical methods for the derivation of two dimensional static and quasi static electric and magnetic fields The essence of each method of solution is emphasized and the scopes of the different methods are described with particular regard to the influence of digital computers This book is comprised of 12 chapters and begins with an introduction to the fundamental theory of electric and magnetic fields The derivation of quantities of physical interest such as force inductance and capacitance from the field solution is explained The next section deals with the methods of images and separation of variables and presents direct solutions of Laplace s equation and of Poisson s equation The basic solutions are developed rigorously from considerations of surface charges and are expressed in complex variable form Subsequent chapters discuss transformation methods as well as line and doublet sources the transformation of regions exterior to finite boundaries and the powerful numerical methods used to enlarge the scope of conformal transformation The last section is devoted to finite difference methods and the Monte Carlo method along with all classes of boundary shape and condition This monograph is intended primarily for engineers physicists and mathematicians as well as degree students towards the end of their courses   *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   Electromagnetic Modeling by Finite Element Methods João Pedro A. Bastos,Nelson Sadowski,2003-04-01 Unlike any other source in the field this valuable reference clearly examines key aspects of the finite element method FEM for electromagnetic analysis of low frequency electrical devices The authors examine phenomena such as nonlinearity mechanical force electrical circuit coupling vibration heat and movement for applications in the electrical mechanical nuclear aeronautics and transportation industries Electromagnetic Modeling by Finite Element Methods offers a wide range of examples including torque vibration and iron loss calculation coupling of the FEM with mechanical equations circuits converters and thermal effects material modeling and proven methods for hysteresis implementation into FEM codes Providing experimental results and comparisons from the authors personal research Electromagnetic Modeling by Finite Element Methods supplies techniques to implement FEM for solving Maxwell s equations analyze electrical and magnetic losses determine the behavior of electrical machines evaluate force distribution on a magnetic medium simulate movement in electrical machines and electromagnetic devices fed by external circuits or static converters and analyze the vibrational behavior of electrical machines   Numerical Methods in Electromagnetism Sheppard Salon,M. V.K. Chari,1999-11-10 Electromagnetics is the foundation of our electric technology It describes the fundamental principles upon which electricity is generated and used This includes electric machines high voltage transmission telecommunication radar and recording and digital computing Numerical Methods in Electromagnetism will serve both as an introductory text for graduate students and as a reference book for professional engineers and researchers This book leads the uninitiated into the realm of numerical methods for solving electromagnetic field problems by examples and illustrations Detailed descriptions of advanced techniques are also included for the benefit of working engineers and research students Comprehensive descriptions of numerical methods In depth introduction to finite differences finite elements and integral equations Illustrations and applications of linear and nonlinear solutions for multi dimensional analysis Numerical examples to facilitate understanding of the methods Appendices for quick reference of

mathematical and numerical methods employed   *Co-simulations of Microwave Circuits and High-Frequency Electromagnetic Fields* Mei Song Tong,Xiao Yu Li,2024-07-03 This book aims to provide many advanced application topics for microwave circuits and high frequency electromagnetic EM fields by using advanced design system ADS and high frequency structure simulator HFSS as simulation platforms In particular it contains the latest multidisciplinary co simulation guidance on the design of relevant components and devices Currently the circuit field design and performance analysis and optimization strongly rely on various kinds of robust electronic design automation EDA software RF microwave engineers must grasp two or more types of related simulation design software ADS by Keysight and HFSS by Ansys are the representative for circuit simulations and for field and structural simulations of microwave devices respectively At present these two types of software are widely used in enterprises universities and research institutions The main purpose of this book is to enable readers who are interested in microwave engineering and applied electromagnetics to master the applications of these two tools It also helps readers expand their knowledge boundaries behind those types of software and deepen their understanding of developing interdisciplinary technologies by co simulations The book is divided into three parts The first part introduces the two latest versions of ADS and HFSS and helps readers better understand the basic principles and latest functions better It also advises how to choose appropriate simulation tools for different problems The second part mainly describes co simulations for high frequency EM fields microwave circuits antenna designs EM compatibility EMC and thermal and structural analyses It provides guides and advices on performing co simulations by ADS and HFSS incorporated with other types of software respectively The last part narrates the automation interfaces and script programming methods for co simulations It primarily deals with the Advanced Extension Language AEL Python Data Link PDL and MATLAB interface in ADS For HFSS it discusses VBScript IronPython scripting and Application Programming Interface APIs based on MATLAB Each topic contains practical examples to help readers understand so that they can gain a solid knowledge and skills regarding automated interfaces and scripting methods based on these kinds of software Concisely written in combination with practical examples this book is very suitable as a textbook in introductory courses on microwave circuit and EM simulations and also as a supplementary textbook in many courses on electronics microwave engineering communication engineering and related fields As well it can serve as a reference book for microwave engineers and researchers   *Computational Electromagnetics—Retrospective and Outlook* Iftikhar Ahmed,Zhizhang (David) Chen,2014-08-27 The book will cover the past present and future developments of field theory and computational electromagnetics The first two chapters will give an overview of the historical developments and the present the state of the art in computational electromagnetics These two chapters will set the stage for discussing recent progress new developments challenges trends and major directions in computational electromagnetics with three main emphases a Modeling of ever larger structures with multi scale dimensions and multi level descriptions behavioral circuit network and

field levels and transient behaviours b Inclusions of physical effects other than electromagnetic quantum effects thermal effects mechanical effects and nano scale features c New developments in available computer hardware programming paradigms MPI Open MP CUDA and Open CL and the associated new modeling approaches These are the current emerging topics in the area of computational electromagnetics and may provide readers a comprehensive overview of future trends and directions in the area The book is written for students research scientists professors design engineers and consultants who engaged in the fields of design analysis and research of the emerging technologies related to computational electromagnetics RF microwave optimization new numerical methods as well as accelerator simulator dispersive materials nano antennas nano waveguide nano electronics terahertz applications bio medical and material sciences The book may also be used for those involved in commercializing electromagnetic and related emerging technologies sensors and the semiconductor industry The book can be used as a reference book for graduates and post graduates It can also be used as a text book for workshops and continuing education for researchers and design engineers *Electromagnetic Fields in Biological Systems* James C. Lin,2016-04-19 Spanning static fields to terahertz waves this volume explores the range of consequences electromagnetic fields have on the human body Topics discussed include essential interactions and field coupling phenomena electric field interactions in cells focusing on ultrashort pulsed high intensity fields dosimetry or coupling of ELF fields into biological systems and the historical developments and recent trends in numerical dosimetry It also discusses mobile communication devices and the dosimetry of RF radiation into the human body exposure and dosimetry associated with MRI and spectroscopy and available data on the interaction of terahertz radiation with biological tissues cells organelles and molecules **Computational Magnetics** J. Sykulski,2012-12-06 This book fills the gap between theory available computational techniques and engineering practice in the design of electrical and electromechanical machines The theory underlying all currently recommended computational and experimental methods is covered comprehensively including field analysis and synthesis magnetic fields coupled to stress and thermal fields The book is very practically oriented and includes many examples of actual solutions to real devices **Electric and Magnetic Fields** R. Belmans,A. Nicolet,2012-12-06 This book contains the edited versions of the papers presented at the Second International Workshop on Electric and Magnetic Fields held at the Katholieke Universiteit van Leuven Belgium in May 1994 This Workshop deals with numerical solutions of electromagnetic problems in real life applications The topics include coupled problems thermal mechanical electric circuits CAD CAM applications 3D eddy current and high frequency problems optimisation and application oriented numerical problems This workshop was organised jointly by the AIM Association of Engineers graduated from de Montefiore Electrical Institute together with the Departments of Electrical Engineering of the Katholieke Universiteit van Leuven Prof R Belmans the University of Gent Prof J Melkebbek and the University of Liege Prof W Legros These laboratories are working together in the framework of the Pole d Attraction Interuniversitaire Inter University Attractie Pole 51 on electromagnetic systems led

by the University of Liege and the research work they perform covers most of the topics of the Workshop One of the principal aims of this Workshop was to provide a bridge between the electromagnetic device designers mainly industrialists and the electromagnetic field computation developers Therefore this book contains a continuous spectrum of papers from application of electromagnetic models in industrial design to presentation of new theoretical developments **Electric Field Analysis** Sivaji Chakravorti,2017-12-19 Electric Field Analysis is both a student friendly textbook and a valuable tool for engineers and physicists engaged in the design work of high voltage insulation systems The text begins by introducing the physical and mathematical fundamentals of electric fields presenting problems from power and dielectric engineering to show how the theories are put into practice The book then describes various techniques for electric field analysis and their significance in the validation of numerically computed results as well as Discusses finite difference finite element charge simulation and surface charge simulation methods for the numerical computation of electric fields Provides case studies for electric field distribution in a cable termination around a post insulator in a condenser bushing and around a gas insulated substation GIS spacer Explores numerical field calculation for electric field optimization demonstrating contour correction and examining the application of artificial neural networks Explains how high voltage field optimization studies are carried out to meet the desired engineering needs Electric Field Analysis is accompanied by an easy to use yet comprehensive software for electric field computation The software along with a wealth of supporting content is available for download with qualifying course adoption **Introduction To Engineering Electromagnetic Fields** K Umashankar,1989-05-01 This is a textbook designed to provide analytical background material in the area of Engineering Electromagnetic Fields for the senior level undergraduate and preparatory level graduate electrical engineering students It is also an excellent reference book for researchers in the field of computational electromagnetic fields The textbook covers Static Electric and Magnetic Fields The basic laws governing the Electrostatics Magnetostatics with engineering examples are presented which are enough to understand the fields and the electric current and charge sources Dynamic Electromagnetic Fields The Maxwell s equations in Time Domain and solutions the Maxwell s equations in Frequency Domain and solutions Extensive approaches are presented to solve partial differential equations satisfying electromagnetic boundary value problems Foundation to electromagnetic field radiation guided wave propagation is discussed to expose at the undergraduate level application of the Maxwell s equations to practical engineering problems **Electromagnetic Field Computation by Network Methods** Leopold B. Felsen,Mauro Mongiardo,Peter Russer,2009-03-05 In this monograph the authors propose a systematic and rigorous treatment of electromagnetic field representations in complex structures The architecture suggested in this book accommodates use of different numerical methods as well as alternative Green s function representations in each of the subdomains resulting from a partitioning of the overall problem The subdomains are regions of space where electromagnetic energy is stored and are described in terms of equivalent circuit representations based either on lumped element circuits or

on transmission lines Connection networks connect the subcircuits representing the subdomains The connection networks are lossless don t store energy and represent the overall problem topology This is similar to what is done in circuit theory and permits a phrasing of the solution of EM field problems in complex structures by Network oriented methods **Numerical Analysis of Electromagnetic Fields** Pei-bai Zhou,2012-12-06 Numerical methods for solving boundary value problems have developed rapidly Knowledge of these methods is important both for engineers and scientists There are many books published that deal with various approximate methods such as the finite element method the boundary element method and so on However there is no textbook that includes all of these methods This book is intended to fill this gap The book is designed to be suitable for graduate students in engineering science for senior undergraduate students as well as for scientists and engineers who are interested in electromagnetic fields Objective Numerical calculation is the combination of mathematical methods and field theory A great number of mathematical concepts principles and techniques are discussed and many computational techniques are considered in dealing with practical problems The purpose of this book is to provide students with a solid background in numerical analysis of the field problems The book emphasizes the basic theories and universal principles of different numerical methods and describes why and how different methods work Readers will then understand any methods which have not been introduced and will be able to develop their own new methods Organization Many of the most important numerical methods are covered in this book All of these are discussed and compared with each other so that the reader has a clear picture of their particular advantage disadvantage and the relation between each of them The book is divided into four parts and twelve chapters *Calculation of Electromagnetic Fields in Multilayer Media* Vladimir Nikolaevich Ostreĭko,1989 Translated from the Russian original 1981 Leningrad U Press The purpose of this work is not only to derive rigorous and stable analytic algorithms for calculating the fields in linear multilayer media but to demonstrate the need for a very cautious approach to the monograph that any process in a layered media is unique due to the complexity of its dependence on the geometrical and material properties of the elements of the medium Book club price 59 Annotation copyrighted by Book News Inc Portland OR *Advances in Electromagnetic Fields in Living Systems* James C. Lin,1994 Volume 2 in this series offers research into two specific regions of the electromagnetic spectrum extremely low frequency fields and radiofrequency radiation with particular emphasis on the latter The investigations explore melatonin synthesis and exposure to extremely low frequency ELF fields ELF fields and cancer computational bioelectromagnetics health effects including the carcinogenic potential of radiofrequency radiation radiofrequency radiation as an energy source for arrhythmia and practical applications of the radiofrequency exposure standard *Analysis and Computation of Electric and Magnetic Field Problems* Kenneth John Binns,P. J. Lawrenson,1963 Index Electromagnetic Field, Health and Environment Andrzej Krawczyk,2008 Electromagnetic Field Health and Environment mirrors the image of the EHE 07 conference which attracted people investigating the phenomenon of interaction of electromagnetic field and biological

objects This book tries to enlighten the problem with the use of scientifically founded facts kept within methodological discipline The particular targets of the book can be briefly summarized as reviewing presenting and discussing innovations in computer modeling measurement and simulation of bioelectromagnetic phenomena analyzing physical and biological aspects of bioelectromagnetic phenomena and discussing environmental safety and policy issues as well as relevant international standards The book is divided into five chapters of which the first three chapters deal with the electromagnetic field in combination with environment health and biology respectively The fourth chapter focuses on computer simulation in bioelectromagnetics whereas the fifth chapter sees to the electromagnetic field in policy and standards An additional three contributions are included the first contribution shows the brief essay on Heinrich Rudolf Hertz in which the occasion of his birth 150 years ago is celebrated The second summarizes the long lasting research in magnetic stimulation and bioimaging and the third one considers some theoretical aspects of electromagnetic field **UHV Transmission Technology** China Electric Power Research Institute,2017-10-18 UHV Transmission Technology enables power system employees and the vast majority of those caring for UHV transmission technology to understand and master key technologies of UHV transmission This book can be used as a technical reference and guide for future UHV projects UHV transmission has many advantages for new power networks due to its capacity long distance potential high efficiency and low loss Development of UHV transmission technology is led by infrastructure development and renewal as well as smart grid developments which can use UHV power networks as the transmission backbone for hydropower coal nuclear power and large renewable energy bases UHV is a key enabling technology for optimal allocation of resources across large geographic areas and has a key role to play in reducing pressure on energy and land resources Provides a complete reference on the latest ultra high voltage transmission technologies Covers practical applications made possible by theoretical material extensive proofs applied systems examples and real world implementations including coverage of problem solving and design and manufacturing guidance Includes case studies of AC and DC demonstration projects Features input from a world leading UHV team
    Technical Abstract Bulletin Defense Documentation Center (U.S.),1961-10

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