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# Electromagnetics Problem Solver

S. A. Nasar,Syed A. Nasar

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WHAT THIS BOOK IS FOR Students have generally found electromagnetics a difficult subject to understand and learn Despite the publication of hundreds of textbooks in this field each one intended to provide an improvement over previous textbooks students of electromagnetics continue to remain perplexed as a result of numerous subject areas that must be remembered and correlated when solving problems Various interpretations of electromagnetics terms also contribute to the difficulties of mastering the subject In a study of electromagnetics REA found the following basic reasons underlying the inherent difficulties of electromagnetics No systematic rules of analysis were ever developed to follow in a step by step manner to solve typically encountered problems This results from numerous different conditions and principles involved in a problem which leads to many possible different solution methods To prescribe a set of rules for each of the possible variations would involve an enormous number of additional steps making this task more burdensome than solving the problem directly due to the expectation of much trial and error Current textbooks normally explain a given principle in a few pages written by an electromagnetics professional who has insight into the subject matter not shared by others These explanations are often written in an abstract manner that causes confusion as to the principle s use and application Explanations then are often not sufficiently detailed or extensive enough to make the reader aware of the wide range of applications and different aspects of the principle being studied The numerous possible variations of principles and their applications are usually not discussed and it is left to the reader to discover this while doing exercises Accordingly the average student is expected to rediscover that which has long been established and practiced but not always published or

adequately explained The examples typically following the explanation of a topic are too few in number and too simple to enable the student to obtain a thorough grasp of the involved principles The explanations do not provide sufficient basis to solve problems that may be assigned for homework or given on examinations Poorly solved examples such as these can be presented in abbreviated form which leaves out much explanatory material between steps and as a result requires the reader to figure out the missing information This leaves the reader with an impression that the problems and even the subject are hard to learn completely the opposite of what an example is supposed to do Poor examples are often worded in a confusing or obscure way They might not state the nature of the problem or they present a solution which appears to have no direct relation to the problem These problems usually offer an overly general discussion never revealing how or what is to be solved Many examples do not include accompanying diagrams or graphs denying the reader the exposure necessary for drawing good diagrams and graphs Such practice only strengthens understanding by simplifying and organizing electromagnetics processes Students can learn the subject only by doing the exercises themselves and reviewing them in class obtaining experience in applying the principles with their different ramifications In doing the exercises by themselves students find that they are required to devote considerable more time to electromagnetics than to other subjects because they are uncertain with regard to the selection and application of the theorems and principles involved It is also often necessary for students to discover those tricks not revealed in their texts or review books that make it possible to solve problems easily Students must usually resort to methods of trial and error to discover these tricks therefore finding out that they may sometimes spend several hours to solve a single problem When reviewing the exercises in classrooms instructors usually request students to take turns in writing solutions on the boards and explaining them to the class Students often find it difficult to explain in a manner that holds the interest of the class and enables the remaining students to follow the material written on the boards The remaining students in the class are thus too occupied with copying the material off the boards to follow the professor s explanations This book is intended to aid students in electromagnetics overcome the difficulties described by supplying detailed illustrations of the solution methods that are usually not apparent to students Solution methods are illustrated by problems that have been selected from those most often assigned for class work and given on examinations The problems are arranged in order of complexity to enable students to learn and understand a particular topic by reviewing the problems in sequence The problems are illustrated with detailed step by step explanations to save the students large amounts of time that is often needed to fill in the gaps that are usually found between steps of illustrations in textbooks or review outline books The staff of REA considers electromagnetics a subject that is best learned by allowing students to view the methods of analysis and solution techniques This learning approach is similar to that practiced in various scientific laboratories particularly in the medical fields In using this book students may review and study the illustrated problems at their own pace students are not limited to the time such problems receive in the classroom When

students want to look up a particular type of problem and solution they can readily locate it in the book by referring to the index that has been extensively prepared It is also possible to locate a particular type of problem by glancing at just the material within the boxed portions Each problem is numbered and surrounded by a heavy black border for speedy identification    *The Electromagnetics Problem Solver* Max Fogiel,1983    **Electromagnetic Field Theory** Markus Zahn,1979-05-31 Develops problem solving confidence through a series of increasingly complex worked examples emphasizing problems based on physical processes devices and models Covers charges as the source of the electric field coupled to polarizable and conducting media with negligible magnetic field currents as the source of the magnetic field coupled to magnetizable media with electromagnetic induction generating an electric field and electrodynamics where the electric and magnetic fields are of equal importance resulting in radiating waves Presents sample problems and solutions for each new concept using different problem solving methods to demonstrate advantages and limitations of each approach Clarifies the rigorous mathematical development by describing systems with linear constant co efficient differential and difference equations    **Electromagnetics and Calculation of Fields** Nathan Ida,Joao P.A. Bastos,2013-03-07 Intended for undergraduate students of electrical engineering this introduction to electromagnetic fields emphasizes the computation of fields as well as the development of theoretical relations The first part thus presents the electromagnetic field and Maxwell s equations with a view toward connecting the disparate applications to the underlying relations while the second part presents computational methods of solving the equations which for most practical calses cannot be solved analytically

**Problem Solving in Electromagnetics, Microwave Circuit, and Antenna Design for Communications Engineering** Karl F. Warnick,Peter Russer,2006 Presenting a wide range of real world electromagnetics problems this one of a kind resource offers professionals and students complete step by step solutions to the most critical challenges relating to antenna and microwave circuit design The book serves as a practical standalone reference or as a perfect complement to the text Electromagnetics Microwave Circuit and Antenna Design for Communications Engineering Second Edition by Peter Russer Artech House 2006 Readers find in depth coverage of the concepts methods and theorems they need to understand to effectively tackle critical problems in the field Including numerous graphical illustrations and simplifying mathematical computations the book offers a deep and intuitive understanding of the subject    **2008+ Solved Problems in Electromagnetics** S. A. Nasar,Syed A. Nasar,2008 This book covers the following areas vector analysis electrostatics magnetostatics Maxwell s equation plane waves transmission lines waveguides cavity resonator and antenna

**Electromagnetics through the Finite Element Method** José Roberto Cardoso,2016-10-03 Shelving Guide Electrical Engineering Since the 1980s more than 100 books on the finite element method have been published making this numerical method the most popular The features of the finite element method gained worldwide popularity due to its flexibility for simulating not only any kind of physical phenomenon described by a set of differential equations but also for the possibility of

simulating non linearity and time dependent studies Although a number of high quality books cover all subjects in engineering problems none of them seem to make this method simpler and easier to understand This book was written with the goal of simplifying the mathematics of the finite element method for electromagnetic students and professionals relying on the finite element method for solving design problems Filling a gap in existing literature that often uses complex mathematical formulas Electromagnetics through the Finite Element Method presents a new mathematical approach based on only direct integration of Maxwell s equation This book makes an original scholarly contribution to our current understanding of this important numerical method **Sophisticated Electromagnetic Forward Scattering Solver via Deep Learning** Qiang Ren,Yinpeng Wang,Yongzhong Li,Shutong Qi,2021-10-20 This book investigates in detail the deep learning DL techniques in electromagnetic EM near field scattering problems assessing its potential to replace traditional numerical solvers in real time forecast scenarios Studies on EM scattering problems have attracted researchers in various fields such as antenna design geophysical exploration and remote sensing Pursuing a holistic perspective the book introduces the whole workflow in utilizing the DL framework to solve the scattering problems To achieve precise approximation medium scale data sets are sufficient in training the proposed model As a result the fully trained framework can realize three orders of magnitude faster than the conventional FDFD solver It is worth noting that the 2D and 3D scatterers in the scheme can be either lossless medium or metal allowing the model to be more applicable This book is intended for graduate students who are interested in deep learning with computational electromagnetics professional practitioners working on EM scattering or other corresponding researchers Electromagnetics Editors of Rea,Research and Education Association Editors,1984-01-17 Each Problem Solver is an insightful and essential study and solution guide chock full of clear concise problem solving gems All your questions can be found in one convenient source from one of the most trusted names in reference solution guides More useful more practical and more informative these study aids are the best review books and textbook companions available Nothing remotely as comprehensive or as helpful exists in their subject anywhere Perfect for undergraduate and graduate studies Here in this highly useful reference is the finest overview of electromagnetics currently available with hundreds of electromagnetics problems that cover everything from dielectrics and magnetic fields to plane waves and transmission lines Each problem is clearly solved with step by step detailed solutions DETAILS The PROBLEM SOLVERS are unique the ultimate in study guides They are ideal for helping students cope with the toughest subjects They greatly simplify study and learning tasks They enable students to come to grips with difficult problems by showing them the way step by step toward solving problems As a result they save hours of frustration and time spent on groping for answers and understanding They cover material ranging from the elementary to the advanced in each subject They work exceptionally well with any text in its field PROBLEM SOLVERS are available in 41 subjects Each PROBLEM SOLVER is prepared by supremely knowledgeable experts Most are over 1000 pages PROBLEM SOLVERS are not meant to be read cover to cover

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review books that make it possible to solve problems easily Students must usually resort to methods of trial and error to discover these tricks therefore finding out that they may sometimes spend several hours to solve a single problem When reviewing the exercises in classrooms instructors usually request students to take turns in writing solutions on the boards and explaining them to the class Students often find it difficult to explain in a manner that holds the interest of the class and enables the remaining students to follow the material written on the boards The remaining students in the class are thus too occupied with copying the material off the boards to follow the professor s explanations This book is intended to aid students in electromagnetics overcome the difficulties described by supplying detailed illustrations of the solution methods that are usually not apparent to students Solution methods are illustrated by problems that have been selected from those most often assigned for class work and given on examinations The problems are arranged in order of complexity to enable students to learn and understand a particular topic by reviewing the problems in sequence The problems are illustrated with detailed step by step explanations to save the students large amounts of time that is often needed to fill in the gaps that are usually found between steps of illustrations in textbooks or review outline books The staff of REA considers electromagnetics a subject that is best learned by allowing students to view the methods of analysis and solution techniques This learning approach is similar to that practiced in various scientific laboratories particularly in the medical fields In using this book students may review and study the illustrated problems at their own pace students are not limited to the time such problems receive in the classroom When students want to look up a particular type of problem and solution they can readily locate it in the book by referring to the index that has been extensively prepared It is also possible to locate a particular type of problem by glancing at just the material within the boxed portions Each problem is numbered and surrounded by a heavy black border for speedy identification **Interdisciplinary Electromagnetic, Mechanic and Biomedical Problems** ,2007 The International Symposium on Applied Electromagnetics and Mechanics ISEM is an interdisciplinary international forum This title concerns 12th event and was organized by following three institutions Vienna Magnetics Group TU BioMed Society for Biomedical Engineering Bioelectricity and the Vienna University of Technology **A Concise Course In Electromagnetism For Electrical Engineering** Tapeng Tsao,1994-06-09 With increased pressure on the core syllabus from subjects relating to new technologies it is more important than ever that students receive exposure to the fundamental areas of electrical engineering science In this respect electromagnetism is pre eminent and this book has been written to provide all technologists with a concise introduction to the diversity and utility of this subject Because of its great advantage in conciseness of presentation vector calculus is introduced at an early stage and used throughout The emphasis however is not mathematical but is based upon an understanding of physical principle The book presents a broad topic in a concise form that is most appropriate to electrical engineers who may not specialise in this area Electromagnetic Modeling of Composite Metallic and Dielectric Structures Branko M. Kolundzija,Branko M. Kolundžija,A. R. Djordjević,2002 Annotation

This practical new book provides a much wider choice of analytical solutions to problems faced by antenna design engineers and researchers working in electromagnetic modeling Based on leading edge method of moments procedures the book presents new theories and techniques that help professionals optimize computer performance in numerical analysis of composite metallic and dielectric structures in the complex frequency domain For the first time comparisons and new combinations of techniques bring the elements of flexibility ease of implementation accuracy and efficiency into clear focus for all practitioners *Computational Methods for Electromagnetic Inverse Scattering* Xudong Chen,2018-03-20 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 **Monte Carlo Methods for Electromagnetics** Matthew N.O. Sadiku,2018-10-03 Until now novices had to painstakingly dig through the literature to discover how to use Monte Carlo techniques for solving electromagnetic problems Written by one of the foremost researchers in the field Monte Carlo Methods for Electromagnetics provides a solid understanding of these methods and their applications in electromagnetic computation Including much of his own work the author brings together essential information from several different publications Using a simple clear writing style the author begins with a historical background and review of electromagnetic theory After addressing probability and statistics he introduces the finite difference method as well as the fixed and floating random walk Monte Carlo methods The text then applies the Exodus method to Laplace s and Poisson s equations and presents Monte Carlo techniques for handing Neumann problems It also deals with whole field computation using the Markov chain applies Monte Carlo methods to time varying diffusion problems and explores wave scattering due to random rough surfaces The final chapter covers multidimensional integration Although numerical techniques have become the standard tools for solving practical complex electromagnetic problems there is no book currently available that focuses exclusively on Monte Carlo techniques for electromagnetics Alleviating this problem this book describes Monte Carlo methods as they are used in the field of electromagnetics **Harmonic Balance Finite Element Method** Junwei Lu,Xiaojun Zhao,Sotoshi Yamada,2016-08-01 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 **Proceedings of the Tenth International Symposium on Applied Electromagnetic and Mechanics** T. Takagi,2003 This publication covers topics in the area of applied electromagnetics and mechanics Since starting in Japan in 1988 the ISEM has become a well known international forum on applied electromagnetics *Teaching Electromagnetics* Krishnasamy T. Selvan,Karl F. Warnick,2021-06-18 Teaching Electromagnetics Innovative Approaches and Pedagogical Strategies is a guide for educators addressing course content and pedagogical methods primarily at the undergraduate level in electromagnetic theory and its applications Topics include teaching methods lab experiences and hands on learning and course structures that help teachers respond effectively to trends in learning styles and evolving engineering curricula The book grapples with issues related to the recent worldwide shift to remote teaching Each chapter begins with a high level consideration of the topic reviews previous work and publications and gives the reader a broad picture of the topic before delving into details Chapters include specific guidance for those who want to implement the methods and assessment results and evaluation of the effectiveness of the methods Respecting the limited time available to the average teacher to try new methods the chapters focus on why an instructor should adopt the methods proposed in it Topics include virtual laboratories computer assisted learning and MATLAB tools The authors also review flipped classrooms and online teaching methods that support remote teaching and learning The end result should be an impact on the reader represented by improvements to his or her practical teaching methods and curricular approach to electromagnetics education The book is intended for electrical engineering professors students lab instructors and practicing engineers with an interest in teaching and learning In summary this book Surveys methods and tools for teaching the foundations of wireless communications and electromagnetic theory Presents practical experience and best practices for topical coverage course sequencing and content Covers virtual laboratories computer assisted learning and MATLAB tools Reviews flipped classroom and online teaching methods that support remote teaching and learning Helps instructors in RF systems field theory and wireless communications bring their teaching practice up to date Dr Krishnasamy T Selvan is Professor in the Department of Electronics Communication Engineering SSN College of Engineering since June 2012 Dr Karl F Warnick is Professor in the Department of Electrical and Computer Engineering at BYU **Numerical Techniques in Electromagnetics, Second Edition** Matthew N.O. Sadiku,2000-07-12 As the availability of powerful computer resources has grown over the last three decades the art of computation of electromagnetic EM problems has also grown exponentially Despite this dramatic growth however the EM community lacked 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 The Second Edition of this 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 added a chapter on the method of lines Numerical Techniques in Electromagnetics continues to teach readers how to pose numerically analyze and solve EM problems give them the ability to expand their problem solving skills using a variety of methods and prepare them for research in electromagnetism Now the Second Edition goes even further toward providing a comprehensive resource that addresses all of the most useful computation methods for EM problems **Inverse Problems in Electric Circuits and Electromagnetics** N.V. Korovkin,V.L. Chechurin,M. Hayakawa,2007-04-14 The design and development of electrical devices involves choosing from many possible variants that which is the best or optimum according to one or several criteria These optimization criteria are usually already clear to the designer at the statement of the design problem The methods of optimization considered in this book allow us to sort out variants of the realization of a design on the basis of these criteria and to create the best device in the sense of the set criteria Optimization of devices is one of the major problems in electrical engi neering that is related to an extensive class of inverse problems including synthesis diagnostics fault detection identification and some others with common mathematical properties When designing a device the engineer ac tually solves inverse problems by defining the device structure and its pa rameters and then proceeds to deal with the technical specifications followed by the incorporation of his own notions of the best device Frequently the so lutions obtained are based on intuition and previous experience New meth ods and approaches discussed in this book will add mathematical rigor to these intuitive notions By virtue of their urgency inverse problems have been investigated for more than a century However general methods for their solution have been developed only recently An analysis of the scientific literature indicates a steadily growing interest among scientists and engineers in these problems Non-linear Electromagnetic Systems Paolo Di Barba,A. Savini,2000 This text is a collection of contributions covering a wide range of topics of interdisciplinary character from materials to systems from microdevices to large equipment with special emphasis on emerging subjects and particular attention to advanced computational methods in order to model both devices and systems The book provides the solution to challenging problems of research on non linear electromagnetic systems and is expected to help researchers working in this broad area

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