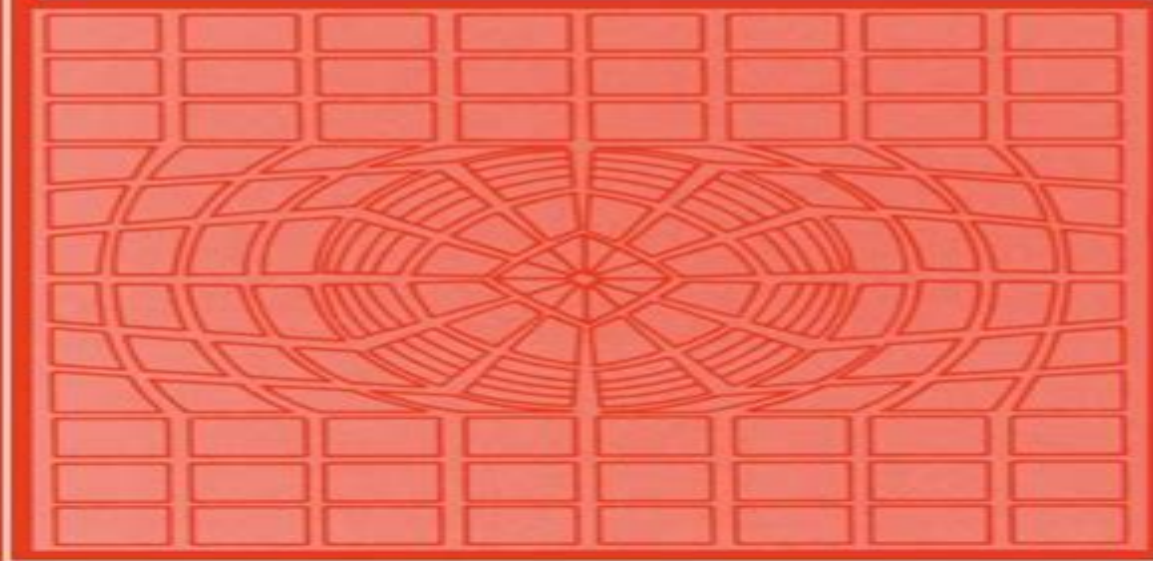


Jean-Claude Sabonnadière
and Jean-Louis Coulomb

Finite Element Methods in CAD:

Electrical and Magnetic Fields



Springer-Verlag New York Inc.

Finite Element Methods In Cad Electrical

Stanley Humphries, Jr.



Finite Element Methods In Cad Electrical:

Finite Element Methods in CAD Jean Claude Sabonnadiere, Jean Louis Coulomb, 2012-12-06 The finite element method FEM has been understood at least in principle for more than 50 years The integral formulation on which it is based has been known for a longer time thanks to the work of Galerkin Ritz Courant and Hilbert 1 4 to mention the most important However the method could not be applied in a practical way since it involved the solution of a large number of linear or non linear algebraic equations Today it is quite common with the aid of computers to solve non linear algebraic problems of several thousand equations The necessary numerical methods and programming techniques are now an integral part of the teaching curriculum in most engineering schools Mechanical engineers confronted with very complicated structural problems were the first to take advantage of advanced computational methods and high level languages FORTRAN to transform the mechanical models into algebraic equations 1956 In recent times 1960 the FEM has been studied by applied mathematicians and having received rigorous treatment has become a part of the more general study of partial differential equations gradually replacing the finite difference method which had been considered the universal tool to solve these types of problems *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 *Finite Elements for Electrical Engineers* Peter Peet Silvester, Ronald L. Ferrari, 1996-09-05 Like the earlier editions this text begins by deriving finite elements for the simplest familiar potential fields then advances to formulate finite elements for a wide range of applied electromagnetics problems A wide selection of demonstration programs allows the reader to follow the practical use of the methods **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

Quick Finite Elements for Electromagnetic Waves Giuseppe Pelosi, Roberto Coccioli, Stefano Selleri, 2009 The classic 1998 Artech House book Quick Finite Elements for Electromagnetic Waves has now been revised and expanded to bring you up to date with the latest developments in the Field You find brand new discussions on finite elements in 3D 3D resonant cavities and 3D waveguide devices Moreover the second edition supplies you with MATLAB code making this resource easier to comprehend and use for your projects in the field This practical book and accompanying software enables you to quickly and easily work out challenging microwave engineering and high frequency electromagnetic problems using the finite element method FEM Using clear concise text and dozens of real world application examples the book provides a detailed description of FEM implementation while the software provides the code and tools needed to solve the three major types of EM problems guided propagation scattering and radiation With this unique book and software set in hand you can compute the dispersion diagram of arbitrarily shaped inhomogeneous isotropic lossless or lossy guiding structures analyze E and H plane waveguide discontinuities and devices and understand the reflection from and transmission through simple 2D and 3D inhomogeneous periodic structures CD ROM Included Easy to use finite element software contains ready made MATLAB and FORTRAN source code that you can use immediately to solve a wide range of microwave and EM problems The package is fully compatible with Internet freeware so you can perform advanced engineering functions without having to purchase expensive pre and post processing tools

Finite Elements, Electromagnetics and Design S.R.H. Hoole, 1995-05-19 Advanced topics of research in field computation are explored in this publication Contributions have been sourced from international experts ensuring a comprehensive specialist perspective A unity of style has been achieved by the editor who has specifically inserted appropriate cross references throughout the volume plus a single collected set of references at the

end The book provides a multi faceted overview of the power and effectiveness of computation techniques in engineering electromagnetics In addition to examining recent and current developments it is hoped that it will stimulate further research in the field

Finite Element Method with Applications in Engineering Y. M. Desai,2011 The book explains the finite element method with various engineering applications to help students teachers engineers and researchers It explains mathematical modeling of engineering problems and approximate methods of analysis and different approaches

Integral Methods in Low-Frequency Electromagnetics Pavel Solin,Ivo Dolezel,Pavel Karban,Bohus Ulrych,2009-08-11 A modern presentation of integral methods in low frequency electromagnetics This book provides state of the art knowledge on integral methods in low frequency electromagnetics Blending theory with numerous examples it introduces key aspects of the integral methods used in engineering as a powerful alternative to PDE based models Readers will get complete coverage of The electromagnetic field and its basic characteristics An overview of solution methods Solutions of electromagnetic fields by integral expressions Integral and integrodifferential methods Indirect solutions of electromagnetic fields by the boundary element method Integral equations in the solution of selected coupled problems Numerical methods for integral equations All computations presented in the book are done by means of the authors own codes and a significant amount of their own results is included At the book s end they also discuss novel integral techniques of a higher order of accuracy which are representative of the future of this rapidly advancing field

Integral Methods in Low Frequency Electromagnetics is of immense interest to members of the electrical engineering and applied mathematics communities ranging from graduate students and PhD candidates to researchers in academia and practitioners in industry

Scientific Computing in Electrical Engineering Martijn van Beurden,Neil Budko,Wil Schilders,2022-03-11 The conference has an interdisciplinary focus and aims to bring together scientists mathematicians electrical engineers computer scientists and physicists from universities and industry to have in depth discussions of the latest scientific results in Computational Science and Engineering relevant to Electrical Engineering and to stimulate and inspire active participation of young researchers

Computer-Aided Design in Magnetics D.A. Lowther,P.P. Silvester,2012-12-06 Computer aided design has come of age in the magnetic devices industry From its early beginnings in the 1960s when the precision needs of the experimental physics community first created a need for computational aids to magnet design CAD software has grown to occupy an important spot in the industrial designer s tool kit Numerous commercial CAD systems are now available for magnetics work and many more software packages are used in house by large industrial firms While their capabilities vary all these software systems share a very substantial common core of both methodology and objectives The present need particularly in medium sized and nonspecialist firms is for an understanding of how to make effective use of these new and immensely powerful tools what approximations are inherent in the methods what quantities can be calculated and how to relate the computed results to the needs of the designer These new analysis techniques profoundly affect the designer s approach to problems since the

analytic tools available exert a strong influence on the conceptual models people build and these in turn dictate the manner in which they formulate problems The impact of CAD is just beginning to be felt industrially and the authors believe this is an early but not too early time to collect together some of the experience which has now accumulated among industrial and research users of magnetics analysis systems The Finite Element Method in Engineering Singiresu S. Rao,1989

Multigrid Finite Element Methods for Electromagnetic Field Modeling Yu Zhu,Andreas C. Cangellaris,2006-03-10 This is the first comprehensive monograph that features state of the art multigrid methods for enhancing the modeling versatility numerical robustness and computational efficiency of one of the most popular classes of numerical electromagnetic field modeling methods the method of finite elements The focus of the publication is the development of robust preconditioners for the iterative solution of electromagnetic field boundary value problems BVPs discretized by means of finite methods Specifically the authors set forth their own successful attempts to utilize concepts from multigrid and multilevel methods for the effective preconditioning of matrices resulting from the approximation of electromagnetic BVPs using finite methods Following the authors careful explanations and step by step instruction readers can duplicate the authors results and take advantage of today's state of the art multigrid multilevel preconditioners for finite element based iterative electromagnetic field solvers Among the highlights of coverage are Application of multigrid multilevel and hybrid multigrid multilevel preconditioners to electromagnetic scattering and radiation problems Broadband robust numerical modeling of passive microwave components and circuits Robust finite element based modal analysis of electromagnetic waveguides and cavities Application of Krylov subspace based methodologies for reduced order macromodeling of electromagnetic devices and systems Finite element modeling of electromagnetic waves in periodic structures The authors provide more than thirty detailed algorithms alongside pseudo codes to assist readers with practical computer implementation In addition each chapter includes an applications section with helpful numerical examples that validate the authors methodologies and demonstrate their computational efficiency and robustness This groundbreaking book with its coverage of an exciting new enabling computer aided design technology is an essential reference for computer programmers designers and engineers as well as graduate students in engineering and applied physics **Control and Dynamic Systems V59: Computer-Aided**

Design/Engineering (Cad/Cae) Techniques And Their Applications Part 2 of 2 C.T. Leonides,2012-12-02 Control and Dynamic Systems Volume 59 Computer Aided Design Engineering CAD CAE Techniques and Their Applications Part 2 of 2 is the second of a two volume sequence that manifests the significance and the power of CAD CAE techniques that are available and their further development for the essential role they play in the design of modern engineering systems The volume contains 10 chapters and begins with an in depth treatment of the essential integration that must exist between design and manufacturing systems This is followed by separate chapters on object oriented programming OOP and graphical user interface GUI technologies that support the CAD CAE design process in particular by means of the PC and the workstation

and the role of a geometrically associative analysis modeler in the design optimization process Subsequent chapters deal with finite analysis modeling for the integration of CAD CAE technology and finite element method the mechanical analysis of two large structures the world s largest telescope the 8m ESO VLT and a 3 D nuclear power plant heat exchanger and techniques for CAD for electromagnetic systems and components The final chapters cover aircraft structural design techniques for determining the adequacy of the number of grids i e grid quality control in computational fluid dynamics CFD and techniques or the optimum design of control systems using system model variables and parameters The contributions to this volume will provide a significant and perhaps unique reference source for students research workers practicing engineers and others on the international scene for many years

Field Solutions on Computers Stanley Humphries,

Jr.,2020-09-23 Field Solutions on Computers covers a broad range of practical applications involving electric and magnetic fields The text emphasizes finite element techniques to solve real world problems in research and industry After introducing numerical methods with a thorough treatment of electrostatics the book moves in a structured sequence to advanced topics These include magnetostatics with non linear materials permanent magnet devices RF heating eddy current analysis electromagnetic pulses microwave structures and wave scattering The mathematical derivations are supplemented with chapter exercises and comprehensive reviews of the underlying physics The book also covers essential supporting techniques such as mesh generation interpolation sparse matrix inversions and advanced plotting routines

A class of hybris finite element methods for electromagnetics: a review John L. Volakis, A. Chatterjee and J. Gong,

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

The RF and Microwave Handbook Mike Golio,2000-12-20 The recent shift in focus from defense and

government work to commercial wireless efforts has caused the job of the typical microwave engineer to change dramatically. The modern microwave and RF engineer is expected to know customer expectations, market trends, manufacturing technologies, and factory models to a degree that is unprecedented in the field.

Permanent Magnet and Electromechanical Devices Edward P. Furlani, 2001-09-05. The book provides both the theoretical and the applied background needed to predict magnetic fields. The theoretical presentation is reinforced with over 60 solved examples of practical engineering applications such as the design of magnetic components like solenoids which are electromagnetic coils that are moved by electric currents and activate other devices such as circuit breakers. Other design applications would be for permanent magnet structures such as bearings and couplings which are hardware mechanisms used to fashion a temporary connection between two wires. This book is written for use as a text or reference by researchers, engineers, professors, and students engaged in the research, development, study, and manufacture of permanent magnets and electromechanical devices. It can serve as a primary or supplemental text for upper level courses in electrical engineering on electromagnetic theory, electronic and magnetic materials, and electromagnetic engineering.

Electrical Machine Fundamentals with Numerical Simulation using MATLAB / SIMULINK Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, 2021-04-12. A comprehensive text combining all important concepts and topics of Electrical Machines and featuring exhaustive simulation models based on MATLAB Simulink. Electrical Machine Fundamentals with Numerical Simulation using MATLAB Simulink provides readers with a basic understanding of all key concepts related to electrical machines including working principles, equivalent circuit, and analysis. It elaborates the fundamentals and offers numerical problems for students to work through. Uniquely, this text includes simulation models of every type of machine described in the book, enabling students to design and analyse machines on their own. Unlike other books on the subject, this book meets all the needs of students in electrical machine courses. It balances analytical treatment, physical explanation, and hands-on examples and models with a range of difficulty levels. The authors present complex ideas in simple, easy-to-understand language, allowing students in all engineering disciplines to build a solid foundation in the principles of electrical machines. This book includes clear elaboration of fundamental concepts in the area of electrical machines using simple language for optimal and enhanced learning. Provides wide coverage of topics aligning with the electrical machines syllabi of most international universities. Contains extensive numerical problems and offers MATLAB Simulink simulation models for the covered machine types. Describes MATLAB Simulink modelling procedure and introduces the modelling environment to novices. Covers magnetic circuits, transformers, rotating machines, DC machines, electric vehicle motors, multiphase machine concept, winding design, and details finite element analysis and more. Electrical Machine Fundamentals with Numerical Simulation using MATLAB Simulink is a well-balanced textbook perfect for undergraduate students in all engineering majors. Additionally, its comprehensive treatment of electrical machines makes it suitable as a reference for researchers in the field.

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