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# Finite Elements For Electrical Engineering

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Higher Order Hexahedral Finite Elements for Electromagnetic Modeling  
Practical Guide to Finite Elements  
Finite Elements, Electromagnetics and Design  
Finite Element Method Electromagnetics  
Finite Element Programs in Structural Engineering and Continuum Mechanics  
Electrical Machine Analysis Using Finite Elements  
Finite Elements in Electrical and Magnetic Field Problems  
Electromagnetic Product Design and Nondestructive Evaluation  
Electromagnetics through the Finite Element Method  
Boundary Element Methods for Electrical Engineers  
The Finite Element Method for Electromagnetic Modeling  
Electric Machines  
Finite Elements for Electrical Engineers  
Finite Element Methods in Electrical Power Engineering  
Fundamentals and Applications in Chemical Engineering  
Finite Elements for Analysis and Design  
Applications in Solids, Structures, and Heat Transfer  
Antennas, Microwave Circuits, and Scattering Applications  
Moving Finite Element Method  
A Solid Mechanics Approach  
from 1992 to Present & Proceedings of the 13th Workshop  
The Finite Element Method in Electromagnetics  
Transients, Control Principles, Finite Element Analysis, and Optimal Design with MATLAB®  
A Primer  
A Simplified Approach Using Maxwell's Equations  
Magnetic Materials and 3D Finite Element Modeling  
Notes for IEEE Pittsburgh Magnetics Chapter Short Course, March 14-17, 1982, Pittsburgh, Pennsylvania  
Introduction to Finite Element Vibration Analysis  
The Finite Element Method in Heat Transfer Analysis  
Finite Element Method  
Computational Mathematics and Applications Series  
A Dissertation in Electrical Engineering  
A Mathematical Introduction  
Finite Elements in Electrical Engineering  
International Workshop on Finite Elements for Microwave Engineering  
Finite Elements-based Optimization  
Finite Element Analysis of Electrical Machines  
Some Applications of the Finite Element Method in Electrical Engineering Design

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## **SHEPPARD ALBERT**

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### Higher Order Hexahedral Finite Elements for Electromagnetic Modeling Springer Science & Business Media

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 elect

**Practical Guide to Finite Elements** John Wiley & Sons  
Bridging the gap between theoretical texts and the massive and expensive software packages, this handbook covers finite element programming in a wide range of problems in mechanical, civil, aeronautical and electrical engineering. Comprehensive, it ranges from the static analysis of two- and three-dimensional structures to stress analysis of thick slabs on elastic foundations, and from two- and three- dimensional vibration analysis problems to two-dimensional field problems including heat transfer and acoustic vibrations. The 24 printouts of powerful and valuable engineering computer programs, written in QUICK BASIC, are introduced by a preliminary chapter giving useful hints and formulae intended for structural design. The programs are capable of analysing problems in engineering design and manufacture, with text fully describing how to use the computer programs for their particular problems or tasks. The finite element method is used in all the programs, and the problems for analysis can be of quite complex design and shape and with complex boundary conditions. Covers finite element programming in a wide range of problems in mechanical, civil, aeronautical and electrical engineering Ranges from the static analysis of two- and three-dimensional structures to stress analysis of thick slabs on elastic foundations

*Finite Elements, Electromagnetics and Design* Finite Elements for Electrical Engineers

This second edition of The Finite Element Method in Engineering reflects the new and current developments in this area, whilst

maintaining the format of the first edition. It provides an introduction and exploration into the various aspects of the finite element method (FEM) as applied to the solution of problems in engineering. The first chapter provides a general overview of FEM, giving the historical background, a description of FEM and a comparison of FEM with other problem solving methods. The following chapters provide details on the procedure for deriving and solving FEM equations and the application of FEM to various areas of engineering, including solid and structural mechanics, heat transfer and fluid mechanics. By commencing each chapter with an introduction and finishing with a set of problems, the author provides an invaluable aid to explaining and understanding FEM, for both the student and the practising engineer.

*Finite Element Method Electromagnetics* CRC Press

In Finite Element Analysis of Electrical Machines the author covers two-dimensional analysis, emphasizing the use of finite elements to perform the most common calculations required of machine designers and analysts. The book explains what is inside a finite element program, and how the finite element method can be used to determine the behavior of electrical machines. The material is tutorial and includes several completely worked out examples. The main illustrative examples are synchronous and induction machines. The methods described have been used successfully in the design and analysis of most types of rotating and linear machines. Audience: A valuable reference source for academic researchers, practitioners and designers of electrical machinery.

Finite Element Programs in Structural Engineering and Continuum Mechanics CRC Press

Designed for a one-semester course in Finite Element Method, this compact and well-organized text presents FEM as a tool to find approximate solutions to differential equations. This provides the student a better perspective on the technique and its wide range of applications. This approach reflects the current trend as the present-day applications range from structures to biomechanics to electromagnetics, unlike in conventional texts that view FEM primarily as an extension of matrix methods of structural analysis. After an introduction and a review of

mathematical preliminaries, the book gives a detailed discussion on FEM as a technique for solving differential equations and variational formulation of FEM. This is followed by a lucid presentation of one-dimensional and two-dimensional finite elements and finite element formulation for dynamics. The book concludes with some case studies that focus on industrial problems and Appendices that include mini-project topics based on near-real-life problems. Postgraduate/Senior undergraduate students of civil, mechanical and aeronautical engineering will find this text extremely useful; it will also appeal to the practising engineers and the teaching community.

*Electrical Machine Analysis Using Finite Elements* CRC Press

Presents Boundary Element Method (BEM) in a simple fashion in order to help the beginner to understand the very basic principles of the method. This book initially derives BEM for the simplest potential problems, and subsequently builds on these to formulate BEM for a wide range of applications in electromagnetics.

**Finite Elements in Electrical and Magnetic Field Problems** Elsevier

This book focuses on process simulation in chemical engineering with a numerical algorithm based on the moving finite element method (MFEM). It offers new tools and approaches for modeling and simulating time-dependent problems with moving fronts and with moving boundaries described by time-dependent convection-reaction-diffusion partial differential equations in one or two-dimensional space domains. It provides a comprehensive account of the development of the moving finite element method, describing and analyzing the theoretical and practical aspects of the MFEM for models in 1D, 1D+1d, and 2D space domains. Mathematical models are universal, and the book reviews successful applications of MFEM to solve engineering problems. It covers a broad range of application algorithm to engineering problems, namely on separation and reaction processes presenting and discussing relevant numerical applications of the moving finite element method derived from real-world process simulations.

Electromagnetic Product Design and Nondestructive Evaluation

John Wiley & Sons

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.

*Electromagnetics through the Finite Element Method* CRC Press  
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.

**Boundary Element Methods for Electrical Engineers** CRC Press

This Second Edition extensively covers advanced issues/subjects in electric machines, starting from principles, to applications and

case studies with ample graphical (numerical) results. This textbook is intended for second (and third) semester courses covering topics such as modeling of transients, control principles, electromagnetic and thermal finite element analysis, and optimal design (dimensioning). Notable recent knowledge with strong industrialization potential has been added to this edition, such as: Orthogonal models of multiphase a.c. machines. Thermal Finite Element Analysis of (FEA) electric machines. FEA-based-only optimal design of a PM motor case study. Line start synchronizing premium efficiency PM induction machines. Induction machines (three and single phase), synchronous machines with DC excitation, with PM-excitation, and with magnetically salient rotor and a linear Pm oscillatory motor are all investigated in terms of transients, electromagnetic FEM analysis and control principles. Case studies, numerical examples, and lots of discussion of FEM results for PMSM and IM are included throughout the book. The optimal design is treated in detail using Hooke-Jeeves and GA algorithms with case comparison studies in dedicated chapters for IM and PMSM. Numerous computer simulation programs in MATLAB® and Simulink® are available online that illustrate performance characteristics present in the chapters, and the FEM and optimal design case studies (and codes) may be used as homework to facilitate a deeper understanding of fundamental issues.

*The Finite Element Method for Electromagnetic Modeling* Springer Science & Business Media

This book is designed to give the theoretical foundation needed by the new user of finite elements in electrical power engineering, and shows how the equipment designer can benefit from finite element analysis. It is divided into three parts; theory, modelling, and application of the finite element method. The first part outlines relevant electromagnetics, including treatment of boundaries, saturation and permanent magnets. It also shows how the finite element equations can be formulated. The presentation throughout is aimed at giving the reader a physical understanding of the process. The second part deals with special aspects of finite element modelling of engineering problems, including problem formulation, data generation and post processing and emphasises the importance of engineering judgement. The final part is an assembly of 'real' magnetic and electric field problems solved by finite elements, including

application to turbine generators, permanent magnet machines, switched reluctance drives, induction motors, transformers and bushings.

**Electric Machines** IOS Press

An introduction to the practice of the Finite Element Method and a comparison of solutions via its various methods including software used in industry.

*Finite Elements for Electrical Engineers* Pergamon

Employed in a large number of commercial electromagnetic simulation packages, the finite element method is one of the most popular and well-established numerical techniques in engineering. This book covers the theory, development, implementation, and application of the finite element method and its hybrid versions to electromagnetics. FINITE ELEMENT METHOD FOR ELECTROMAGNETICS begins with a step-by-step textbook presentation of the finite method and its variations then goes on to provide up-to-date coverage of three dimensional formulations and modern applications to open and closed domain problems. Worked out examples are included to aid the reader with the fine features of the method and the implementation of its hybridization with other techniques for a robust simulation of large scale radiation and scattering. The crucial treatment of local boundary conditions is carefully worked out in several stages in the book. Sponsored by: IEEE Antennas and Propagation Society.

**Finite Element Methods in Electrical Power Engineering** Elsevier

In Finite Element Analysis of Electrical Machines the author covers two-dimensional analysis, emphasizing the use of finite elements to perform the most common calculations required of machine designers and analysts. The book explains what is inside a finite element program, and how the finite element method can be used to determine the behavior of electrical machines. The material is tutorial and includes several completely worked out examples. The main illustrative examples are synchronous and induction machines. The methods described have been used successfully in the design and analysis of most types of rotating and linear machines. Audience: A valuable reference source for academic researchers, practitioners and designers of electrical machinery.

*Fundamentals and Applications in Chemical Engineering* PHI Learning Pvt. Ltd.

This volume includes contributions on: field theory and advanced computational electromagnetics; electrical machines and transformers; optimization and interactive design; electromagnetics in materials; coupled field and electromagnetic components in mechatronics; induction heating systems; bioelectromagnetics; and electromagnetics in education. Finite Elements for Analysis and Design Firenze University Press

Magnetic Materials and 3D Finite Element Modeling explores material characterization and finite element modeling (FEM) applications. This book relates to electromagnetic analysis based on Maxwell's equations and application of the finite element (FE) method to low frequency devices. A great source for senior undergraduate and graduate students in electromagnetics, it also supports industry professionals working in magnetics, electromagnetics, ferromagnetic materials science and electrical engineering. The authors present current concepts on ferromagnetic material characterizations and losses. They provide introductory material; highlight basic electromagnetics, present experimental and numerical modeling related to losses and focus on FEM applied to 3D applications. They also explain various formulations, and discuss numerical codes. • Furnishes algorithms in computational language • Summarizes concepts related to the FE method • Uses classical algebra to present the method, making it easily accessible to engineers

Written in an easy-to-understand tutorial format, the text begins with a short presentation of Maxwell's equations, discusses the generation mechanism of iron losses, and introduces their static and dynamic components. It then demonstrates simplified models for the hysteresis phenomena under alternating magnetic fields. The book also focuses on the Preisach and Jiles-Atherton models, discusses vector hysteresis modeling, introduces the FE technique, and presents nodal and edge elements applied to 3D FE formulation connected to the hysteretic phenomena. The book discusses the concept of source-field for magnetostatic cases, magnetodynamic fields, eddy currents, and anisotropy. It also

explores the need for more sophisticated coding, and presents techniques for solving linear systems generated by the FE cases while considering advantages and drawbacks.

**Applications in Solids, Structures, and Heat Transfer** WIT Press

This volume on some recent aspects of finite element methods and their applications is dedicated to Ulrich Langer and Arnd Meyer on the occasion of their 60th birthdays in 2012. Their work combines the numerical analysis of finite element algorithms, their efficient implementation on state of the art hardware architectures, and the collaboration with engineers and practitioners. In this spirit, this volume contains contributions of former students and collaborators indicating the broad range of their interests in the theory and application of finite element methods. Topics cover the analysis of domain decomposition and multilevel methods, including hp finite elements, hybrid discontinuous Galerkin methods, and the coupling of finite and boundary element methods; the efficient solution of eigenvalue problems related to partial differential equations with applications in electrical engineering and optics; and the solution of direct and inverse field problems in solid mechanics.

*Antennas, Microwave Circuits, and Scattering Applications* Cambridge University Press

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.

Moving Finite Element Method Elsevier

*Finite Element Analysis for Engineers* introduces FEA as a technique for solving differential equations, and for application to problems in Civil, Mechanical, Aerospace and Biomedical Engineering and Engineering Science & Mechanics. Intended primarily for senior and first-year graduate students, the text is mathematically rigorous, but in line with students' math courses. Organized around classes of differential equations, the text includes MATLAB code for selected examples and problems. Both solid mechanics and thermal/fluid problems are considered. Based on the first author's class-tested notes, the text builds a solid understanding of FEA concepts and modern engineering applications.

*A Solid Mechanics Approach* CRC Press

Assuming only basic knowledge of mathematics and engineering mechanics, this lucid reference introduces the fundamentals of finite element theory using easy-to-understand terms and simple problems-systematically grounding the practitioner in the basic principles then suggesting applications to more general cases. Furnishes a wealth of practical insights drawn from the extensive experience of a specialist in the field! Generously illustrated with over 200 detailed drawings to clarify discussions and containing key literature citations for more in-depth study of particular topics, this clearly written resource is an exceptional guide for mechanical, civil, aeronautic, automotive, electrical and electronics, and design engineers; engineering managers; and upper-level undergraduate, graduate, and continuing-education students in these disciplines.