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# Electromagnetic Analysis And Design In Magnetic Resonance Imaging Biomedical Engineering

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Analytical and Computational Methods in Electromagnetics  
Design Sensitivity Analysis and Optimization of Electromagnetic Systems  
Antenna Theory  
Electromagnetic Simulation, Analysis and Design with Application to Antennas and Radar Absorbers  
Advanced FDTD Methods  
Anechoic Range Design for Electromagnetic Measurements  
Electromagnetic Radiation in Analysis and Design of Organic Materials  
Electromagnetic Compatibility (EMC) Design and Test Case Analysis  
Electromagnetic Analysis of Printed Structures in Planary Layered Media, Software and User's Manual  
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The Finite Element Method in Electromagnetics  
Methods, Analysis, Circuits, and Measurement, Third Edition  
Electronic and Biotechnology Applications  
Finite Elements-based Optimization  
Electromagnetic Product Design and Nondestructive Evaluation  
Analysis and Design  
Advanced Electromagnetic Wave Propagation Methods  
Electromagnetic Radiation in Analysis and Design of Organic Materials  
Computer-aided Analysis and Design of Electromagnetic Devices  
Analysis and Design of a Controller for a Three Dimensional Electromagnetic Wind Tunnel Support System  
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Modeling and Design of Electromagnetic Compatibility for High-Speed Printed Circuit Boards and Packaging  
Oscillator Design/Compu Si  
Field Computation for Accelerator Magnets  
Electromagnetic Compatibility  
2-D Electromagnetic Simulation of Passive Microstrip Circuits  
Finite Element Analysis of Antennas and Arrays  
Electromagnetic Analysis and Design Considerations of Linear Synchronous Motors for Drives  
Electromagnetic Compatibility (EMC) Design and Test Case Analysis  
Antenna Analysis and Design Using FEKO Electromagnetic Simulation Software  
Numerical Analysis for Electromagnetic Integral Equations  
Parallelization, Acceleration, and Engineering Applications  
Electromagnetic Compatibility for Device Design and System Integration  
ANTENNA THEORY AND DESIGN, REVISED ED

Microwave Circuit Modeling Using Electromagnetic Field Simulation  
Electronic and Biotechnology Applications  
Low Frequency Electromagnetic Design  
Analysis and Design of Transmitarray Antennas

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## MARISA COMPTON

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*Analytical and Computational Methods in Electromagnetics* Artech House Publishers  
Global Demand for Streamlined Design and Computation The explosion of wireless communications has generated a tidal wave of interest and development in computational techniques for electromagnetic simulation as well as the design and analysis of RF and microwave circuits. Learn About Emerging Disciplines, State-of-the-Art Methods 2-D Electromagnetic Simulation of Passive Microstrip Circuits describes this simple procedure in order to provide basic knowledge and practical insight into quotidian problems of microstrip passive circuits applied to microwave systems and digital technologies. The text dissects the latest emerging disciplines and methods of microwave circuit analysis, carefully balancing theory and state-of-the-art experimental concepts to elucidate the process of analyzing high-speed circuits. The author covers the newer techniques – such as the study of signal integrity within circuits, and the use of field map interpretations – employed in powerful electromagnetic simulation analysis methods. But why and how does the intrinsic two-dimensional simulation model used here reduce numerical error? Step-by-Step Simulation Provides Insight and Understanding The author presents the FDTD electromagnetic simulation method, used to reproduce different microstrip test circuits, as well as an explanation of the complementary electrostatic method of moments (MoM). Each reproduces different microstrip test circuits that are physically constructed and then studied, using a natural methodological progression to facilitate understanding. This approach gives readers a solid comprehension and insight into the theory and practical applications of the microstrip scenario, with emphasis on high-speed interconnection elements.

[Design Sensitivity Analysis and Optimization of Electromagnetic Systems](#) Wiley  
[Electromagnetic Analysis and Design in Magnetic Resonance Imaging](#)Routledge

**Antenna Theory** SciTech Publishing

This book presents a comprehensive introduction to design sensitivity analysis theory as applied to electromagnetic systems. It treats the subject in a unified manner, providing numerical methods and design examples. The specific focus is on continuum design sensitivity analysis, which offers significant advantages over discrete design sensitivity methods. Continuum design sensitivity formulas are derived from the material derivative in continuum mechanics and the variational form of the governing equation. Continuum sensitivity analysis is applied to Maxwell equations of electrostatic, magnetostatic and eddy-current systems, and then the sensitivity formulas for each system are derived in a closed form; an integration along the design interface. The book also introduces the recent breakthrough of the topology optimization method, which is accomplished by

coupling the level set method and continuum design sensitivity. This topology optimization method enhances the possibility of the global minimum with minimised computational time, and in addition the evolving shapes during the iterative design process are easily captured in the level set equation. Moreover, since the optimization algorithm is transformed into a well-known transient analysis algorithm for differential equations, its numerical implementation becomes very simple and convenient. Despite the complex derivation processes and mathematical expressions, the obtained sensitivity formulas are very straightforward for numerical implementation. This book provides detailed explanation of the background theory and the derivation process, which will help readers understand the design method and will set the foundation for advanced research in the future.

**Electromagnetic Simulation, Analysis and Design with Application to Antennas and Radar Absorbers** Artech House

Modeling and Design of Electromagnetic Compatibility for High-Speed Printed Circuit Boards and Packaging presents the electromagnetic modelling and design of three major electromagnetic compatibility (EMC) issues related to the high-speed printed circuit board (PCB) and electronic packages: signal integrity (SI), power integrity (PI), and electromagnetic interference (EMI). The emphasis is put on two essential passive components of PCBs and packages: the power distribution network and the signal distribution network. This book includes two parts. Part one talks about the field-circuit hybrid methods used for the EMC modeling, including the modal method, the integral equation method, the cylindrical wave expansion method and the de-embedding method. Part two illustrates EMC design methods and explores the applications of novel metamaterials and two-dimensional materials on traditional EMC problems. This book is designed to enhance worthwhile electromagnetic theory and mathematical methods for practical engineers and to train students with advanced EMC applications.

[Advanced FDTD Methods](#) Artech House

A practical introduction to techniques for the design of electronic products from the Electromagnetic compatibility (EMC) perspective Introduces techniques for the design of electronic products from the EMC aspects Covers normalized EMC requirements and design principles to assure product compatibility Describes the main topics for the control of electromagnetic interferences and recommends design improvements to meet international standards requirements (FCC, EU EMC directive, Radio acts, etc.) Well organized in a logical sequence which starts from basic knowledge and continues through the various aspects required for compliance with EMC requirements Includes practical examples and case studies to illustrate design features and troubleshooting Author is the founder of the EMC design risk evaluation approach and this book presents many years' experience in teaching and researching the topic

[Anechoic Range Design for Electromagnetic Measurements](#) Routledge

In an historical context, the development of electromagnetic theory and analysis has undergone

many evolutionary changes since the 19th century. Faraday's 1831 discovery of the magnetic induction principle was at first a scientific curiosity, then a subject of intense intellectual activity resulting in the infication of the macroscopic electromagnetic principles through Maxwell's equations. One of the subdisciplines created by the discovery of electromagnetic induction and its theoretical foundation was the analysis of specific arrangements of ponderable bodies, including conductors which interact with electromagnetic fields to produce the measurable physical effects which we call heat and mechanical force. This book is intended neither as a supplement or replacement for previous texts, however, a number of conductor arrangements are covered here which are not done elsewhere. It is primarily for industrial use; where insight into the physical processes may be of practical value.

**Electromagnetic Radiation in Analysis and Design of Organic Materials** Morgan & Claypool Publishers

The Electromagnetic Compatibility has become an increasingly essential factor for placing a product on the global, world wide market. Fulfilling emission limits and immunity requirements as well as handling apparently complex cases of incompatibility demands a deeper understanding of the physical interrelations and of Maxwell's theory. Based on the authors' experiences, the textbook provides some help in solving such interferential cases. It contains many illustrative examples and more than 80 exercises with solutions.

Electromagnetic Compatibility (EMC) Design and Test Case Analysis Artech House

The five-volume set may serve as a comprehensive reference on electromagnetic analysis and its applications at all frequencies, from static fields to optics and photonics. The material includes micro- and nanomagnetism, the new generation of electric machines, renewable energy, hybrid vehicles, low-noise motors; antennas and microwave devices, plasmonics, metamaterials, lasers, and more. Written at a level accessible to both graduate students and engineers, *Electromagnetic Analysis* is a comprehensive reference, covering methods and applications at all frequencies (from statics to optical). Each volume contains pedagogical/tutorial material of high archival value as well as chapters on state-of-the-art developments.

Electromagnetic Analysis of Printed Structures in Planary Layered Media, Software and User's Manual Artech House Publishers

The Most Complete, Up-to-Date Coverage of the Finite Element Analysis and Modeling of Antennas and Arrays Aimed at researchers as well as practical engineers—and packed with over 200 illustrations including twenty-two color plates—*Finite Element Analysis of Antennas and Arrays* presents: Time- and frequency-domain formulations and mesh truncation techniques Antenna source modeling and parameter calculation Modeling of complex materials and fine geometrical details Analysis and modeling of narrowband and broadband antennas Analysis and modeling of infinite and finite phased-array antennas Analysis and modeling of antenna and platform interactions Recognizing the strengths of other numerical methods, this book goes beyond the finite element method and covers hybrid techniques that combine the finite element method with the finite difference time-domain method, the method of moments, and the high-frequency asymptotic methods to efficiently deal with a variety of complex antenna problems. Complemented with numerous examples, this cutting-edge resource fully demonstrates the power and capabilities of the

finite element analysis and its many practical applications.

*Analytical and Numerical Methods for Electromagnetic Design and Optimization* CRC Press

Annotation This practical "how to" book is an ideal introduction to electromagnetic field-solvers.

Where most books in this area are strictly theoretical, this unique resource provides engineers with helpful advice on selecting the right tools for their RF (radio frequency) and high-speed digital circuit design work

Developments in Antenna Analysis and Design CRC Press

Bridging condensed matter physics, photochemistry, photophysics, and materials science, *Electromagnetic Radiation in Analysis and Design of Organic Materials: Electronic and Biotechnology Applications* covers physical properties of materials in the presence of radiation from across the electromagnetic spectrum. It describes the optical, spectral, thermal, and morphological properties of a wide range of materials and their practical implications in electronic and biotechnologies. It discusses recent advances in the use of radiation in analysis of materials and design for advanced applications. The book contains experimental and theoretical issues that reflect the impact of radiation on materials characteristics highlighting their ease of analysis or adaptation for applications as optical filters, drug delivery systems, antimicrobial layers, amphetamine detectors, or liquid crystal displays.

**The Finite Element Method in Electromagnetics** John Wiley & Sons

Written by a leading expert on the electromagnetic design and engineering of superconducting accelerator magnets, this book offers the most comprehensive treatment of the subject to date. In concise and easy-to-read style, the author lays out both the mathematical basis for analytical and numerical field computation and their application to magnet design and manufacture. Of special interest is the presentation of a software-based design process that has been applied to the entire production cycle of accelerator magnets from the concept phase to field optimization, production follow-up, and hardware commissioning. Included topics: Technological challenges for the Large Hadron Collider at CERN Algebraic structures and vector fields Classical vector analysis Foundations of analytical field computation Fields and Potentials of line currents Harmonic fields The conceptual design of iron- and coil-dominated magnets Solenoids Complex analysis methods for magnet design Elementary beam optics and magnet polarities Numerical field calculation using finite- and boundary-elements Mesh generation Time transient effects in superconducting magnets, including superconductor magnetization and cable eddy-currents Quench simulation and magnet protection Mathematical optimization techniques using genetic and deterministic algorithms Practical experience from the electromagnetic design of the LHC magnets illustrates the analytical and numerical concepts, emphasizing the relevance of the presented methods to a great many applications in electrical engineering. The result is an indispensable guide for high-energy physicists, electrical engineers, materials scientists, applied mathematicians, and systems engineers.

**Methods, Analysis, Circuits, and Measurement, Third Edition** Routledge

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.

**Electronic and Biotechnology Applications** John Wiley & Sons

This book is intended to be a cookbook for students and researchers to understand the finite element method and optimization methods and couple them to effect shape optimization. The optimization part of the book will survey optimization methods and focus on the genetic algorithm and Powell's method for implementation in the codes. It will contain pseudo-code for the relevant algorithms and homework problems to reinforce the theory to compile finite element programs capable of shape optimization. Features Enables readers to understand the finite element method and optimization methods and couple them to effect shape optimization Presents simple approach with algorithms for synthesis Focuses on automated computer aided design (CAD) of electromagnetic devices Provides a unitary framework involving optimization and numerical modelling Discusses how to integrate open-source mesh generators into your code Indicates how parallelization of algorithms, especially matrix solution and optimization, may be approached cheaply using the graphics processing unit (GPU) that is available on most PCs today Includes coupled problem optimization using hyperthermia as an example

**Finite Elements-based Optimization** Springer Science & Business Media

This textbook provides a solid foundation into many approaches that are used in the analysis of advanced electromagnetic wave propagation problems. The techniques discussed are essential to obtain closed-form solutions or asymptotic solutions and meet an existing need for instructors and students in electromagnetic theory. The book covers various advanced mathematical methods used in the evaluation of the electromagnetic fields in rectangular, cylindrical and spherical geometries. The mathematics of special functions (i.e., Bessel, Hankel, Airy, Legendre, Error, etc.) are covered in depth, including appropriate Appendices. The author takes particular care to provide detailed explanations of auxiliary potentials, Hertz's vectors, Debye potentials, as well as the use of Green functions, the Watson transformation and the method of steepest descent in the solution of electromagnetic problems. Overall, Advanced Electromagnetic Wave Propagation Methods is a good source for the many skills required in obtaining closed form and asymptotic solution, which in many instances cannot be obtained using computer codes of Maxwell's equations. Thus, it provides an

excellent training for preparing graduate students in their research work. This book is intended for a graduate course in electromagnetic theory for students in electrical engineering. Students in physics and professionals will also find it appropriate and useful.

**Electromagnetic Product Design and Nondestructive Evaluation** John Wiley & Sons

A practical introduction to techniques for the design of electronic products from the Electromagnetic compatibility (EMC) perspective Introduces techniques for the design of electronic products from the EMC aspects Covers normalized EMC requirements and design principles to assure product compatibility Describes the main topics for the control of electromagnetic interferences and recommends design improvements to meet international standards requirements (FCC, EU EMC directive, Radio acts, etc.) Well organized in a logical sequence which starts from basic knowledge and continues through the various aspects required for compliance with EMC requirements Includes practical examples and case studies to illustrate design features and troubleshooting Author is the founder of the EMC design risk evaluation approach and this book presents many years' experience in teaching and researching the topic

**Analysis and Design** John Wiley & Sons

Shelving Guide: Electrical Engineering Revised, updated, and expanded, Electromagnetic Compatibility: Methods, Analysis, Circuits, and Measurement, Third Edition provides comprehensive practical coverage of the design, problem solving, and testing of electromagnetic compatibility (EMC) in electrical and electronic equipment and systems. This new edition provides novel information on theory, applications, evaluations, electromagnetic computational programs, and prediction techniques available. With sixty-nine schematics providing examples for circuit level electromagnetic interference (EMI) hardening and cost effective EMI problem solving, this book also includes 1130 illustrations and tables. Including extensive data on components and their correct implementation, the myths, misapplication, misconceptions, and fallacies that are common when discussing EMC/EMI will also be addressed and corrected.

**Advanced Electromagnetic Wave Propagation Methods** CRC Press

This book presents a comprehensive treatment of electromagnetic analysis and design of three critical devices for an MRI system - the magnet, gradient coils, and radiofrequency (RF) coils. Electromagnetic Analysis and Design in Magnetic Resonance Imaging is unique in its detailed examination of the analysis and design of the hardware for an MRI system. It takes an engineering perspective to serve the many scientists and engineers in this rapidly expanding field. Chapters present: an introduction to MRI basic concepts of electromagnetics, including Helmholtz and Maxwell coils, inductance calculation, and magnetic fields produced by special cylindrical and spherical surface currents principles for the analysis and design of gradient coils, including discrete wires and the target field method analysis of RF coils based on the equivalent lumped-circuit model as well as an analysis based on the integral equation formulation survey of special purpose RF coils analytical and numerical methods for the analysis of electromagnetic fields in biological objects With the continued, active development of MRI instrumentation, Electromagnetic Analysis and Design in Magnetic Resonance Imaging presents an excellent, logically organized text - an indispensable resource for engineers, physicists, and graduate students working in the field of MRI.

**Electromagnetic Radiation in Analysis and Design of Organic Materials** Springer

The finite-difference time-domain (FDTD) method has revolutionized antenna design and electromagnetics engineering. Here we offer a cutting-edge book that focuses on the performance optimization and engineering applications of FDTD simulation systems. Covering the latest developments in this area, this unique resource offers you expert advice on the FDTD method, hardware platforms, and network systems. Moreover, the book offers guidance in distinguishing between the many different electromagnetics software packages on the market today. You also find a complete chapter dedicated to large multi-scale problem solving. This practical reference is supported with 250 illustrations, 128 equations, and 11 appendixes filled with helpful data processing techniques related to the FDTD method.

**Computer-aided Analysis and Design of Electromagnetic Devices** Artech House

Bridging condensed matter physics, photochemistry, photophysics, and materials science, *Electromagnetic Radiation in Analysis and Design of Organic Materials: Electronic and Biotechnology Applications* covers physical properties of materials in the presence of radiation from across the electromagnetic spectrum. It describes the optical, spectral, thermal, and morphological properties of a wide range of materials and their practical implications in electronic and biotechnologies. It discusses recent advances in the use of radiation in analysis of materials and design for advanced applications. The book contains experimental and theoretical issues that reflect the impact of radiation on materials characteristics highlighting their ease of analysis or adaptation for applications as optical filters, drug delivery systems, antimicrobial layers, amphetamine detectors, or liquid crystal displays.