

# Engineering Electromagnetic Fields And Waves Solution Manual

This title can be used to either complement another electromagnetics text, or as an independent resource. Designed primarily for undergraduate electromagnetics, it can also be used in follow-up courses on antennas, propagation, microwaves, advanced electromagnetic theory, computational electromagnetics, electrical machines, signal integrity, etc. This title also provides practical content to current and aspiring industry professionals. MATLAB-Based Electromagnetics provides engineering and physics students and other users with an operational knowledge and firm grasp of electromagnetic fundamentals aimed toward practical engineering applications, by teaching them “hands on” electromagnetics through a unique and comprehensive collection of MATLAB computer exercises and projects. Essentially, the book unifies two themes: it presents and explains electromagnetics using MATLAB on one side, and develops and discusses MATLAB for electromagnetics on the other. MATLAB codes described (and listed) in TUTORIALS or proposed in other exercises provide prolonged benefits of learning. By running codes; generating results, figures, and diagrams; playing movies and animations; and solving a large variety of problems in MATLAB, in class, with peers in study groups, or individually, readers gain a deep understanding of electromagnetics.

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An electromagnetic field is a physical field produced by electrically charged objects. It affects the behavior of charged objects in the vicinity of the field. The electromagnetic field extends indefinitely throughout space and describes the electromagnetic interaction. The field can be viewed as the combination of an electric field and a magnetic field. Electric and magnetic fields (EMFs) are areas of energy that surround electrical devices. The electric field is produced by stationary charges, and the magnetic field by moving charges (currents); these two are often described as the sources of the field. Electromagnetic Theory covers the basic principles of electromagnetism: experimental basis, electrostatics, magnetic fields of steady currents, and electromagnetic induction, Maxwell's equations, propagation and radiation of electromagnetic waves, electric and magnetic properties of matter, and conservation laws. Electromagnetic Field Theories for Engineering gives a comprehensive fundamental knowledge of electric and magnetic fields, which is required to understand the working principles of generators, motors and transformers. This knowledge is also necessary to analyze transmission lines, substations, insulator flashover mechanism, transient phenomena, etc. Recently, academics and researches are working for sending electrical power to a remote area by designing a suitable antenna. In this case, the knowledge of electromagnetic fields is considered as important tool. This book provides fundamental knowledge of electromagnetic fields and waves in a structured manner.

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Electromagnetic fields, both static and dynamic, form the foundational basis of all electrical and electronic engineering devices and systems. Aimed at undergraduate students, university teachers, design and consultant engineers and researchers this book presents an in-depth, simple and comprehensive reference source on electromagnetics engineering. In much of electrical and electronics engineering (including: analogue and digital telecommunications engineering; biomedical monitoring and diagnostic equipment; power systems engineering and sensor technology) getting back to the fundamental principles that govern the technologies, namely electromagnetic fields and waves, has become crucial for future customer friendly technology and systems. Electromagnetics Engineering Handbook has been written to enable undergraduate students studying electromagnetics engineering for the first time to gain an understanding of the essentials of the largely invisible, but powerful, electromagnetic fields governed by the four elegant Maxwell's equations. Moreover, the book helps to apply that knowledge through analytical and computational solutions of these frequency and material dependent electric and magnetic fields. As electrical and electronic engineering grows and subdivides into many specialities this book aims to inform the reader of the basic principles that govern all of these specialised systems and on how to apply that knowledge to understand and design devices and systems that may operate at vastly different frequencies and in various media (e.g. semiconductor materials, magnetic materials, biological tissues, outer space and sea water).

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It also deals with a range of different functions dependant on the area of application. For example at very low power frequencies electromagnetic fields perform vastly different functions from device to device, such as in power transformers; current transformers; infrared sensors; synchronous generators; superconducting devices; electric motors and electric powered transport systems. This handbook will be of great help to students, engineers, innovators and researchers working in a wide variety of disciplines

The Electrical Engineer's Handbook is an invaluable reference source for all practicing electrical engineers and students. Encompassing 79 chapters, this book is intended to enlighten and refresh knowledge of the practicing engineer or to help educate engineering students. This text will most likely be the engineer's first choice in looking for a solution; extensive, complete references to other sources are provided throughout. No other book has the breadth and depth of coverage available here. This is a must-have for all practitioners and students! The Electrical Engineer's Handbook provides the most up-to-date information in: Circuits and Networks, Electric Power Systems, Electronics, Computer-Aided Design and Optimization, VLSI Systems, Signal Processing, Digital Systems and Computer Engineering, Digital Communication and Communication Networks, Electromagnetics and Control and Systems. About the Editor-in-Chief... Wai-Kai Chen is Professor and Head Emeritus of the Department of Electrical Engineering and Computer Science at the University of Illinois at Chicago. He has extensive

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experience in education and industry and is very active professionally in the fields of circuits and systems. He was Editor-in-Chief of the IEEE Transactions on Circuits and Systems, Series I and II, President of the IEEE Circuits and Systems Society and is the Founding Editor and Editor-in-Chief of the Journal of Circuits, Systems and Computers. He is the recipient of the Golden Jubilee Medal, the Education Award, and the Meritorious Service Award from the IEEE Circuits and Systems Society, and the Third Millennium Medal from the IEEE. Professor Chen is a fellow of the IEEE and the American Association for the Advancement of Science. \* 77 chapters encompass the entire field of electrical engineering. \* THOUSANDS of valuable figures, tables, formulas, and definitions. \* Extensive bibliographic references.

A four year Electrical and Electronic engineering curriculum normally contains two modules of electromagnetic field theories during the first two years. However, some curricula do not have enough slots to accommodate the two modules. This book, *Electromagnetic Field Theories*, is designed for Electrical and Electronic engineering undergraduate students to provide fundamental knowledge of electromagnetic fields and waves in a structured manner. A comprehensive fundamental knowledge of electric and magnetic fields is required to understand the working principles of generators, motors and transformers. This knowledge is also necessary to analyze transmission lines, substations, insulator flashover mechanism, transient phenomena, etc. Recently, academics and researches

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are working for sending electrical power to a remote area by designing a suitable antenna. In this case, the knowledge of electromagnetic fields is considered as important tool.

This book presents the concept of fractional dimensional space applied to the use of electromagnetic fields and waves. It provides demonstrates the advantages in studying the behavior of electromagnetic fields and waves in fractal media. The book presents novel fractional space generalization of the differential electromagnetic equations is provided as well as a new form of vector differential operators is formulated in fractional space. Using these modified vector differential operators, the classical Maxwell's electromagnetic equations are worked out. The Laplace's, Poisson's and Helmholtz's equations in fractional space are derived by using modified vector differential operators.

This book, with its versatile approach, includes thorough coverage of statics with an emphasis on the dynamics of engineering electromagnetics. It integrates practical applications, numerical details, and completely covers all relevant principles. Topics include vectors and fields, Maxwell's Equations, fields and waves, electromagnetic potentials, devices, circuits, and systems, and transmission-line essentials for digital electronics. The second part of the book covers communications, guided wave principles, electronics and photonics, and radiation and antennae. A valuable resource for computer engineering and electrical engineering professionals. In this book, a variety of topics related to electromagnetic fields and waves are extensively discussed. The topics

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encompass the physics of electromagnetic waves, their interactions with different kinds of media, and their applications and effects.

Behandelt wird die elektromagnetische Feldtheorie. Vermittelt werden die dafür erforderlichen mathematischen Methoden. Die Maxwell'schen Gleichungen werden vorgestellt und erläutert. Es folgen Ausführungen über Elektrostatik, Strömungsprobleme, Magnetostatik, quasistationäre Felder und elektromagnetische Wellen. Das Buch vereinigt Anschaulichkeit mit Strenge der Begriffsbildungen und Ableitungen. Ausblicke auf grundlegende, z.T. noch offene Fragen der Physik bis hin zur Quantenmechanik runden die Darstellung ab. Damit bietet das Werk den

Ingenieurstudenten eine solide Basis. Studenten der Physik oder anderer Fachrichtungen sind aber auch angesprochen.

Electrical Engineering/Electromagnetics The Plane Wave Spectrum Representation of Electromagnetic Fields A classic reissue in the IEEE/OUP Series on Electromagnetic Wave Theory Donald G. Dudley, Series Editor "I am pleased to see that the IEEE Press and OUP have secured the rights to republish this excellent monograph ... a long-cherished exposition on the angular spectrum concept."--James R.

Wait The purpose of this book is to explain how general electromagnetic fields can be represented by the superposition of plane waves traveling in diverse directions, and to illustrate the way in which this plane wave spectrum representation can be put to good use in treating various characteristic problems belonging to the classical theories of radiation, diffraction and propagation. The book offers a largely unified theory of a range of problems, solutions to all of which are obtained in forms at least patently capable of yielding numerical results by straightforward means. The reader is assumed to be competent at integration in the complex plane, but otherwise the discussion is virtually self-

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contained. The aim is to furnish the student of electromagnetic theory with a useful technical tool and a comparatively compact account of some interesting aspects of his discipline. The contents are presented in two parts. The first, under the heading of Theory, covers Preliminaries, Plane wave representations; and Supplementary theory. The second, with the heading Application, deals with Diffraction by a plane screen; Propagation over a uniform plane surface; Propagation over a two-part plane surface; The field of a moving point charge; and Sources of anisotropic media. Also in the series ... Field Computation by Moment Method An IEEE/OUP classic reissue R.F. Harrington, Syracuse University 1995, Hardcover, 240 pp. Waves and Fields in Inhomogeneous Media An IEEE/OUP classic reissue Weng Cho Chew, University of Illinois at Urbana-Champaign 1995, Hardcover, 632 pp. Methods in Electromagnetic Wave Propagation Second Edition D.S. Jones, University of Dundee 1994, Hardcover, 686 pp. About the series Formerly the IEEE Press Series on Electromagnetic Waves, this new joint series between IEEE Press and Oxford University Press offers even better coverage of the field with new titles as well as reprintings and revisions of recognized classics that maintain long-term archival significance in electromagnetic waves and applications. Designed specifically for graduate students, practicing engineers, and researchers, this series provides affordable volumes that explore electromagnetic waves and applications beyond the undergraduate level "Engineering Electromagnetics and Waves" is designed for upper-division college and university engineering students, for those who wish to learn the subject through self-study, and for practicing engineers who need an up-to-date reference text. The student using this text is assumed to have completed typical lower-division courses in physics and mathematics as well as a first course on electrical

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engineering circuits." "This book provides engineering students with a solid grasp of electromagnetic fundamentals and electromagnetic waves by emphasizing physical understanding and practical applications. The topical organization of the text starts with an initial exposure to transmission lines and transients on high-speed distributed circuits, naturally bridging electrical circuits and electromagnetics. Teaching and Learning Experience This program will provide a better teaching and learning experience-for you and your students. It provides: Modern Chapter Organization Emphasis on Physical Understanding Detailed Examples, Selected Application Examples, and Abundant Illustrations Numerous End-of-chapter Problems, Emphasizing Selected Practical Applications Historical Notes on the Great Scientific Pioneers Emphasis on Clarity without Sacrificing Rigor and Completeness Hundreds of Footnotes Providing Physical Insight, Leads for Further Reading, and Discussion of Subtle and Interesting Concepts and Applications"

After a brief introduction into the theory of electromagnetic fields and the definition of the field quantities the book teaches the analytical solution methods of Maxwell's equations by means of several characteristic examples. The focus is on static and stationary electric and magnetic fields, quasi stationary fields, and electromagnetic waves. For a deeper understanding, the many depicted field patterns are very helpful. The book offers a collection of problems and solutions which enable the reader to understand and to apply Maxwell's theory for a broad class of problems including classical static problems right up to waveguide eigenvalue problems.

The IEEE Press Series on Electromagnetic Wave Theory offers outstanding coverage of the field. It consists of new titles of contemporary interest as well as reissues and

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revisions of recognized classics by established authors and researchers. The series emphasizes works of long-term archival significance in electromagnetic waves and applications. Designed specifically for graduate students, researchers, and practicing engineers, the series provides affordable volumes that explore and explain electromagnetic waves beyond the undergraduate level.

Engineering Electromagnetic Fields and Waves John Wiley & Sons  
Electromagnetic Fields and Waves: Fundamentals of Engineering McGraw Hill Professional

Addresses the importance of EM wave absorbers and details pertinent theory, design, and applications Demands for various EM-wave absorbers are rapidly increasing along with recent trends toward complicated electromagnetic environments and development of higher-frequency communication equipment, including AI technology. This book provides a broad perspective on electromagnetic wave absorbers, as well as discussion of specific types of absorbers, their advantages and disadvantages, their applications, and performance verification. Electromagnetic Wave Absorbers: Detailed Theories and Applications presents the theory behind wave absorbers and their practical usage in design of EM-wave absorber necessary particularly for EMC environments, and similar applications. The first half of the book contains the foundations of electromagnetic wave engineering, specifically the transmission line theories necessary for EM-wave absorber analysis, the basic knowledge of reflection, transmission, and absorption of electromagnetic waves, derivation of Maxwell's equations and computer analysis. The second half describes special mediums, absorber application examples, simplified methods of absorber design, autonomously controllable EM-wave absorber, and more. This valuable text: Provides detailed explanations of basic theory and applied theory for

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understanding EM-wave absorbers Discusses the material constant measurement methods of EM-wave absorption characteristics that are necessary for designing EM-wave absorbers Includes examples of novel EM-wave absorber configurations Electromagnetic Wave Absorbers: Detailed Theories and Applications is an ideal read for researchers and students concerned with electromagnetic wave engineering. It will also appeal to computer software engineers and electromagnetic field theory researchers. Electromagnetism is the most pervasive force that exists in nature. Electromagnetic field theory is the study of characteristics of electric, magnetic and combined fields. The book is designed specifically to cater the needs of fourth semester students of B.Tech. in Electronics and Communications Engineering, JNTU. Simple, easy-to-understand and difficult-jargon-free text elucidates the fundamentals of the subject area and makes it a lasting resource for the students. Salient Features: ? Comprehensive coverage with lucid presentation style ? Rich exam-oriented pedagogy ? Unsolved review questions ? Objective-type questions

This book is designed to serve as a textbook for UG and PG students of Electronics and Communication, Electronics and Electrical, Electronics & Instrumentation and Telecommunication Engineering branches. It provides a thorough understanding of the electromagnetic theory and their properties, application and also the modern trends in Electromagnetism in detail. Book also describes transmission lines, wave guides, as well as the effects of EMI/EMC, including impedance matching and antennas. Written in an easy-to-understand manner, the book includes several illustrative examples, objective-type questions and exercise Questions to reinforce the theoretical understanding of subject. Appendices provide information and expressions as

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well as design data for references.

This is the eBook of the printed book and may not include any media, website access codes, or print supplements that may come packaged with the bound book. Engineering Electromagnetics and Waves is designed for upper-division college and university engineering students, for those who wish to learn the subject through self-study, and for practicing engineers who need an up-to-date reference text. The student using this text is assumed to have completed typical lower-division courses in physics and mathematics as well as a first course on electrical engineering circuits. This book provides engineering students with a solid grasp of electromagnetic fundamentals and electromagnetic waves by emphasizing physical understanding and practical applications. The topical organization of the text starts with an initial exposure to transmission lines and transients on high-speed distributed circuits, naturally bridging electrical circuits and electromagnetics. Teaching and Learning Experience This program will provide a better teaching and learning experience—for you and your students. It provides: Modern Chapter Organization Emphasis on Physical Understanding Detailed Examples, Selected Application Examples, and Abundant Illustrations Numerous End-of-chapter Problems, Emphasizing Selected Practical Applications Historical Notes on the Great Scientific Pioneers Emphasis on Clarity without Sacrificing Rigor and Completeness Hundreds of Footnotes Providing Physical Insight, Leads for Further Reading, and Discussion of Subtle and Interesting Concepts and Applications

This systematic and well-written book provides an in-depth analysis of all the major areas of the subject such as fields, waves and lines. It is written in a simple and an easy-to-understand language. Beginning with a discussion on vector calculus, the book elaborately explains electrostatics,

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including the concepts of electric force and field intensity, electric displacement, Gauss law, conductors, dielectrics and capacitors. This is followed by a detailed study of magnetostatics, covering Biot–Savart law, Lorentz’s force law and Ampere’s circuital law. Then, it discusses Maxwell’s equations that describe the time-varying fields and the wave theory which is the basis of radiation and wireless communications. Finally, the book gives a fair treatment to transmission line theory, which is a foundation course in mechanical engineering. The text is well-supported by a large number of solved and unsolved problems to enhance the analytical skill of the students. The problems are framed to test the conceptual understanding of the students. It also includes plenty of objective type questions with answers. It is intended as a textbook for the undergraduate students of Electrical and Electronics Engineering and Electronics and Communication Engineering for their course on Electromagnetic Waves and Transmission Lines.

"An IEEE reprinting of this classic 1968 edition, **FIELD COMPUTATION BY MOMENT METHODS** is the first book to explore the computation of electromagnetic fields by the most popular method for the numerical solution to electromagnetic field problems. It presents a unified approach to moment methods by employing the concepts of linear spaces and functional analysis. Written especially for those who have a minimal amount of experience in electromagnetic theory, this book illustrates theoretical and mathematical concepts to prepare all readers with the skills they need to apply the method of moments to new, engineering-related problems. Written especially for those who have a minimal amount of experience in electromagnetic theory, theoretical and mathematical concepts are illustrated by examples that prepare all readers with the skills they need to apply the method of moments to new, engineering-related problems."

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Publisher's Note: Products purchased from Third Party sellers are not guaranteed by the publisher for quality, authenticity, or access to any online entitlements included with the product. Understand electromagnetic field principles, engineering techniques, and applications This core introductory-level undergraduate textbook offers a solid coverage of the fundamentals of electromagnetic fields and waves. Written by two electrical engineering experts and experienced educators, the book is designed to accommodate both one and two semester curricula.

Electromagnetic Fields and Waves: Fundamentals of Engineering presents detailed explanations of the topic of EM fields in a holistic fashion that integrates the math and the physics of the material with students' realistic preparation in mind. You will learn about static and time-varying fields, wave propagation and polarization, transmission lines and waveguides, and more. Coverage includes:

- An introduction to electromagnetic fields and waves
- Transmission lines and wave equations
- Transition to electrostatics
- Electrostatic fields, electric flux, and Gauss' law
- Electric force, field, energy, and potential
- Materials: conductors and dielectrics
- Poisson's and Laplace's equations
- Uniqueness theorem and graphical and numerical solutions
- Magnetic fields and flux
- Magnetic materials, magnetic circuits, and inductance
- Time-varying fields and Faraday's law
- Wave propagation: plane waves
- Wave polarization and propagation in multiple layers
- Waveguides and cavity resonators
- Historical review of EM scientists

Discussed is the electromagnetic field theory and its mathematical methods. Maxwell's equations are presented and explained. It follows a detailed discussion of electrostatics, flux, magnetostatics, quasi stationary fields and electromagnetic fields.

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The author presents how to apply numerical methods like finite differences, finite elements, boundary elements, image charge methods, and Monte-Carlo methods to field theory problems. He offers an outlook on fundamental issues in physics including quantum mechanics. Some of these issues are still unanswered questions. A chapter dedicated to the theory of special relativity, which allows to simplify a number of field theory problems, complements this book. A book whose usefulness is not limited to engineering students, but can be very helpful for physicists and other branches of science. "Co-published with Oxford University Press Long considered the most comprehensive account of electromagnetic theory and analytical methods for solving waveguide and cavity problems, this new Second Edition has been completely revised and thoroughly updated -- approximately 40% new material! Packed with examples and applications FIELD THEORY OF GUIDED WAVES provides solutions to a large number of practical structures of current interest. The book includes an exceptionally complete discussion of scalar and Dyadic Green functions. Both a valuable review and source of basic information on applied mathematical topics and a hands-on source for solution methods and techniques, this book belongs on the desk of all engineers working in microwave and antenna systems!" Sponsored by: IEEE Antennas and

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## Propagation Society

The book *Electromagnetic Field Theory* caters to the students of BE/BTech Electronics and Communication Engineering, Electrical and Electronics Engineering, and Electronic Instrumentation Engineering, as electromagnetics is an integral part of their curricula. It covers a wide range of topics that deal with various physical and mathematical concepts, including vector functions, coordinate systems, integration and differentiation, complex numbers, and phasors. The book helps in understanding the electric and magnetic fields on different charge and current distributions, such as line, surface, and volume. It also explains the electromagnetic behaviour of waves, fields in transmission lines, and radiation in antennas. A number of electromagnetic applications are also included to develop the interest of students.

**SALIENT FEATURES**

- Simple and easy-to-follow text
- Complete coverage of the subject as per the syllabi of most universities
- Lucid, well-explained concepts with clear examples
- Relevant illustrations for better understanding and retention
- Some of the illustrations provide three-dimensional view for in-depth knowledge
- Numerous mathematical examples for full clarity of concepts
- Chapter objectives at the beginning of each chapter for its overview
- Chapter-end summary and exercises for quick review and to test your knowledge

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Balanis' second edition of *Advanced Engineering Electromagnetics* – a global best-seller for over 20 years – covers the advanced knowledge engineers involved in electromagnetic need to know, particularly as the topic relates to the fast-moving, continually evolving, and rapidly expanding field of wireless communications. The immense interest in wireless communications and the expected increase in wireless communications systems projects (antenna, microwave and wireless communication) points to an increase in the number of engineers needed to specialize in this field. In addition, the Instructor Book Companion Site contains a rich collection of multimedia resources for use with this text. Resources include: Ready-made lecture notes in Power Point format for all the chapters. Forty-nine MATLAB® programs to compute, plot and animate some of the wave phenomena Nearly 600 end-of-chapter problems, that's an average of 40 problems per chapter (200 new problems; 50% more than in the first edition) A thoroughly updated Solutions Manual 2500 slides for Instructors are included. This comprehensive revision begins with a review of static electric and magnetic fields, providing a wealth of results useful for static and time-dependent fields problems in which the size of the device is small compared with a wavelength. Some of the static results such as inductance of transmission lines calculations can be used for microwave frequencies.

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Familiarity with vector operations, including divergence and curl, are developed in context in the chapters on statics. Packed with useful derivations and applications.

Electrical Engineering/Electromagnetics Methods for Electromagnetic Field Analysis A volume in the IEEE Series on Electromagnetic Wave Theory Donald G. Dudley, Series Editor . a gigantic platter of formulae of the dyadic kind.'--Akhlesh Lakhtaki, Professor, The Pennsylvania State University This monograph discusses mathematical and conceptual methods applicable in the analysis of electromagnetic fields and waves. Dyadic algebra is reviewed and armed with new identities it is applied throughout the book. The power of dyadic operations is seen when working with boundary, sheet and interface conditions, medium equations, field transformations, Greens functions, plane wave problems, vector circuit theory, multipole and image sources. Dyadic algebra offers convenience in handling problems involving chiral and bianisotropic media, of recent interest because of their wide range of potential applications. The final chapter gives, for the first time in book form, a unified presentation of EIT, the exact image theory, introduced by this author and colleagues. EIT is a general method for solving problems involving layered media by replacing them through image sources located in complex space. The main emphasis of the monograph is not on

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specific results but methods of analysis. The contents should be of interest to scientists doing research work in various fields of electromagnetics, as well as to graduate students. The addition of problems and answers in this reprint will enhance the teaching value of this work. Also in the series. Mathematical Foundations for Electromagnetic Theory Donald D. Dudley, University of Arizona, Tucson 1994 Hardcover 256 pp Methods for Electromagnetic Wave Propagation D. S. Jones, University of Dundee 1995 Hardcover 672 pp The Transmission Line Modeling Method: TLM Christos Christopoulos, University of Nottingham 1995 Hardcover 232 pp

Das Buch behandelt die Grundgesetze des elektromagnetischen Feldes, deren Bedeutung für die verschiedensten ingenieurwissenschaftlichen und physikalischen Fachrichtungen sowie die aus heutiger Sicht wichtigen analytischen Verfahren zur Berechnung elektromagnetischer Felder. Anhand vieler Beispiele lernt der Leser, wie man durch sinnvolle Vernachlässigung zur Modellbildung gelangt. Für Studenten bietet das Buch die Möglichkeit, sich den Stoff auch autodidaktisch anzueignen. Außerdem kann es ideal zur Prüfungsvorbereitung verwendet werden. Der in der Praxis tätige Ingenieur oder Wissenschaftler frischt hier schnell sein Wissen auf.

Field and wave electromagnetics (World Student S.)

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This textbook is intended for a course in electromagnetism for upper undergraduate and graduate students. The main concepts and laws of classical macroscopic electrodynamics and initial information about generalized laws of modern electromagnetics are discussed, explaining some paradoxes of the modern theory. The reader then gets acquainted with electrodynamics methods of field analysis on the basis of wave equation solution. Emission physics are considered using an example of the Huygens-Fresnel-Kirchhoff canonic principle. The representation about strict electrodynamics task statement on the base of Maxwell equations, boundary conditions, emission conditions and the condition on the edge is given. Different classes of approximate boundary conditions are presented, which essentially simplify understanding of process physics. The canonic Fresnel functions are given and their generalization on the case of anisotropic impedance. The free waves in closed waveguides and in strip-slotted and edge-dielectric transmission lines are described. A large number of Mathcad programs for illustration of field patterns and its properties in different guiding structures are provided. The material is organized for self-study as well as classroom use.

One of the most methodical treatments of electromagnetic wave propagation, radiation, and scattering—including new applications and ideas Presented in two parts, this book takes an analytical approach on the subject and emphasizes new ideas and applications used today. Part one covers fundamentals of electromagnetic wave propagation, radiation, and

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scattering. It provides ample end-of-chapter problems and offers a 90-page solution manual to help readers check and comprehend their work. The second part of the book explores up-to-date applications of electromagnetic waves—including radiometry, geophysical remote sensing and imaging, and biomedical and signal processing applications. Written by a world renowned authority in the field of electromagnetic research, this new edition of *Electromagnetic Wave Propagation, Radiation, and Scattering: From Fundamentals to Applications* presents detailed applications with useful appendices, including mathematical formulas, Airy function, Abel's equation, Hilbert transform, and Riemann surfaces. The book also features newly revised material that focuses on the following topics: Statistical wave theories—which have been extensively applied to topics such as geophysical remote sensing, bio-electromagnetics, bio-optics, and bio-ultrasound imaging Integration of several distinct yet related disciplines, such as statistical wave theories, communications, signal processing, and time reversal imaging New phenomena of multiple scattering, such as coherent scattering and memory effects Multiphysics applications that combine theories for different physical phenomena, such as seismic coda waves, stochastic wave theory, heat diffusion, and temperature rise in biological and other media Metamaterials and solitons in optical fibers, nonlinear phenomena, and porous media Primarily a textbook for graduate courses in electrical engineering, *Electromagnetic Wave Propagation, Radiation, and Scattering* is also ideal for graduate

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students in bioengineering, geophysics, ocean engineering, and geophysical remote sensing. The book is also a useful reference for engineers and scientists working in fields such as geophysical remote sensing, bio–medical engineering in optics and ultrasound, and new materials and integration with signal processing. For courses in Electromagnetic Fields & Waves. Electromagnetic Waves continues the applied approach used in the authors' successful Engineering Electromagnetics. The second book is appropriate for a second course in Electromagnetics that covers the topic of waves and the application of Maxwell's equations to electromagnetic events.

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