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 Theory of Electromagnetic Waves

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Electromagnetic Wave Theory

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 This book provides a new, more accurate and efficient way for design engineers to understand electromagnetic theory and practice as it relates to the shielding of electrical and electronic equipment. The author starts by defining an electromagnetic wave, and goes on to explain the shielding of electromagnetic waves using the basic laws of physics. This is a new approach for the understanding of EMI shielding of barriers, apertures and seams. It provides a reliable, systematic approach that is easily understood by design engineers for the purpose of packaging the electrical and electronic systems of the future. This book covers

both theory and practical application, emphasizing the use of transfer impedance to explain fully the penetration of an electromagnetic wave through an EMI gasketed seam. Accurate methods of testing shielding components such as EMI gaskets, shielded cables and connectors, shielded air vent materials, conductive glass and conductive paint are also covered. Describes in detail why the currently accepted theory of shielding needs improvement. Discusses the penetration of an electromagnetic wave through shielding barrier materials and electromagnetic interference (EMI) gasketed seams. Emphasizes the use of transfer impedance to explain the penetration of an electromagnetic wave through an EMI gasketed seam. The definition of an electromagnetic wave and how it is generated is included. Chapter in the book are included that reinforce the

presented theory.

Lateral Electromagnetic Waves John Wiley & Sons

International Series of Monographs in Electromagnetic Waves, Volume 3: Electromagnetic Waves in Stratified Media provides information pertinent to the electromagnetic waves in media whose properties differ in one particular direction. This book discusses the important feature of the waves that enables communications at global distances. Organized into 13 chapters, this volume begins with an overview of the general analysis for the electromagnetic response of a plane stratified medium comprising of any number of parallel homogeneous layers. This text then explains the reflection of electromagnetic waves from planar stratified media. Other chapters consider the oblique reflection of plane electromagnetic waves from a

continuously stratified medium. This book discusses as well the fundamental theory of wave propagation around a sphere. The final chapter deals with the theory of propagation in a spherically stratified medium. This book is a valuable resource for electrical engineers, scientists, and research workers.

Electromagnetic Wave Absorbers John Wiley & Sons

An expert guide to the relationship between information theory and the physics of wave propagation, covering stochastic and deterministic approaches, engineering applications, and the universal physical limits of radiation. It is an ideal reference for researchers and graduate students in electrical engineering, physics, and applied mathematics.

Electromagnetic Wave Theory for Boundary-Value Problems Jones & Bartlett Learning

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 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 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.

Foundations of the Mathematical Theory of Electromagnetic Waves

MDPI

This book reviews basic electromagnetic (EM) wave theory and applies it specifically to lasers in order to give the reader not only tangible examples of how the theory is manifested in real life, but also practical knowledge about lasers, and their operation and usage. The latter can be useful for those involved with using lasers. As a short treatise on this subject matter, this book is not intended to dwell deeply into the details of EM waves nor lasers. A bibliography is provided for those who wish to explore in more depth the topics covered in this book. Rather the aim of this book is to offer a quick overview, which will allow the reader to gain a competent general understanding of EM waves and lasers.

Discontinuities in the Electromagnetic Field

Springer Science & Business Media

This book is a first-year graduate text on electromagnetic fields and waves. It is the translated and revised edition of the Chinese version with the same title published by the Publishing House of Electronic Industry (PHEI) of China in 1994. The text is based on the graduate course lectures on "Advanced Electrodynamics" given by the authors at Tsinghua University. More than 300 students from the Department of Electronic Engineering and the Department of Applied Physics have taken this course during the last decade. Their particular fields are microwave and millimeterwave theory and technology, physical electronics, optoelectronics and engineering physics. As the title of the book shows, the texts and examples in the book concentrate mainly on electromagnetic theory related to microwaves and optoelectronics, or light wave technology. However, the book can also be used as an intermediate-level

text or reference book on electromagnetic fields and waves for students and scientists engaged in research in neighboring fields.

Tour of the Electromagnetic Spectrum

Morgan & Claypool Publishers

Electromagnetic wave theory is based on Maxwell's equations, and electromagnetic boundary-value problems must be solved to understand electromagnetic scattering, propagation, and radiation.

Electromagnetic theory finds practical applications in wireless telecommunications and microwave engineering. This book is written as a text for a two-semester graduate course on electromagnetic wave theory. As such, *Electromagnetic Wave Theory for Boundary-Value Problems* is intended to help students enhance analytic skills by solving pertinent boundary-value problems. In particular, the techniques of Fourier transform, mode matching, and residue calculus are utilized to solve some canonical scattering and radiation problems.

Research Topics in Electromagnetic Wave Theory

Wiley-Interscience

In the field of astrophysics, modern developments of practice are emerging in order to further understand the spectral information derived from cosmic sources. Radio telescopes are a current mode of practice used to observe these occurrences. Despite the various accommodations that this technology offers, physicists around the globe need a better understanding of the underlying physics and operational components of radio telescopes as well as an explanation of the cosmic objects that are being detected. *Analyzing the Physics of Radio Telescopes and Radio Astronomy* is an essential reference source that discusses the principles of the astronomical instruments involved in the construction of radio telescopes and the analysis of cosmic sources and celestial objects detected by this machinery. Featuring research on topics such as electromagnetic theory, antenna design, and geometrical optics, this book is ideally designed for astrophysicists, engineers, researchers, astronomers, students, and educators seeking coverage on the operational methods of radio telescopes and understanding the physical processes of radio astronomy.

Electromagnetic Theory and Applications in Beam-wave Electronics

Elsevier

A timely and authoritative guide to the state of the art of wave scattering *Scattering of Electromagnetic Waves* offers in three volumes a complete and up-to-date treatment of wave scattering by

random discrete scatterers and rough surfaces. Written by leading scientists who have made important contributions to wave scattering over three decades, this new work explains the principles, methods, and applications of this rapidly expanding, interdisciplinary field. It covers both introductory and advanced material and provides students and researchers in remote sensing as well as imaging, optics, and electromagnetic theory with a one-stop reference to a wealth of current research results. Plus, *Scattering of Electromagnetic Waves* contains detailed discussions of both analytical and numerical methods, including cutting-edge techniques for the recovery of earth/land parametric information. The three volumes are entitled respectively *Theories and Applications*, *Numerical Simulation*, and *Advanced Topics*. In the first volume, *Theories and Applications*, Leung Tsang (University of Washington) Jin Au Kong (MIT), and Kung-Hau Ding (Air Force Research Lab) cover: * Basic theory of electromagnetic scattering * Fundamentals of random scattering * Characteristics of discrete scatterers and rough surfaces * Scattering and emission by layered media * Single scattering and applications * Radiative transfer theory and solution techniques * One-dimensional random rough surface scattering

Electromagnetic Radiation, Scattering, and Diffraction John Wiley & Sons

Self-contained treatment examines operational definition of charge and current; specification of arbitrary distributions of charge and current; definition of electromagnetic field and effect on general charge distributions; electric field produced by static charges; magnetic induction field produced by steady currents; Maxwell's equations in vacuum; much more. 1981 edition.

Electromagnetic Wave Theory for Boundary-Value Problems IGI Global

Perfect for the upper-level undergraduate physics student, *Introduction to Electromagnetic Theory* presents a complete account of classical electromagnetism with a modern perspective. Its focused approach delivers numerous problems of varying degrees of difficulty for continued study. The text gives special attention to concepts that are important for the development of modern physics, and discusses applications to other areas of physics wherever possible. A generous amount of detail has been given in mathematical manipulations, and vectors are employed right from the start.

Electromagnetic Wave Theory John Wiley & Sons

This book is divided into two parts. The first part deals with basic electromagnetic and the second part with beam-wave electronics related to growing-wave devices including 'slow-wave' travelling-wave tubes and 'fast-wave' gyro-travelling-wave tubes. The first part is a prerequisite for the second part, while the second part covers the applications of the topics discussed in the first part. These two parts put together make the volume a self-contained treatise. In the specific applications considered, time-independent field concepts are exemplified in the problems related to the formation of an electron beam by an electron gun, the confinement of an electron beam by a magnetic focusing structure, etc. Similarly, time-dependent field concepts are exemplified in problems related to propagation through a slow-wave structure and amplification in growing-wave electron beam devices, such as travelling-wave tubes, double-stream amplifiers, beam-plasma amplifiers and gyro-travelling-wave tubes. All throughout the text, stress is given to provide complete analytical deductions with full mathematical details and present the state-of-the-art concepts.

Analyzing the Physics of Radio Telescopes and Radio Astronomy Springer Science & Business Media

Electromagnetic (EM) waves carry energy through propagation in space. This radiation associates with entangled electric and magnetic fields which must exist simultaneously. Although all EM waves travel at the speed of light in vacuum, they cover a wide range of frequencies called the EM spectrum. The various portions of the EM spectrum are referred to by various names based on their different attributes in the emission, transmission, and absorption of the corresponding waves and also based on their different practical applications. There are no certain boundaries separating these various portions, and the ranges tend to overlap. Overall, the EM spectrum, from the lowest to the highest frequency (longest to shortest wavelength) contains the following waves: radio frequency (RF), microwaves, millimeter waves, terahertz, infrared, visible light, ultraviolet, X-rays, and gamma rays. This Special Issue consists of sixteen papers covering a broad range of topics related to the applications of EM waves, from the design of filters and antennas for wireless communications to biomedical imaging and sensing and beyond.

Electromagnetic Theory for Microwaves and Optoelectronics Springer Science & Business Media

Reviews diverse current applications of electromagnetic wave theory, particularly those of interest in aerospace and defense research. Uses the topic of random media to model the ionosphere and the earth terrain with applications to pulse distortion and microwave remote sensing. Studies inhomogeneous plasmas and magnetized ferrites for the propagation, reflection, and transmission of electromagnetic waves with a variational formalism and a coordinate invariant method, and from the point of view of linear mode conversion. Treats result sensing based on microwave radiometer for earth terrain and line-of-sight method for atmosphere parameters. Examines the interaction of electromagnetic fields with biological bodies. In the antenna field, coverage encompasses the topics of broadband antenna arrays, dipole radiation in stratified media, insulated linear antennas, and offset feed reflector antennas.

Wave Theory of Information Springer Science & Business Media

This book aims to disseminate geometric algebra as a straightforward mathematical tool set for working with and understanding classical electromagnetic theory. It's target readership is anyone who has some knowledge of electromagnetic theory, predominantly ordinary scientists and engineers who use it in the course of their work, or postgraduate students and senior undergraduates who are seeking to broaden their knowledge and increase their understanding of the subject. It is assumed that the reader is not a mathematical specialist and is neither familiar with geometric algebra or its application to electromagnetic theory. The modern approach, geometric algebra, is the mathematical tool set we should all have started out with and once the reader has a grasp of the subject, he or she cannot fail to realize that traditional vector analysis is really awkward and even misleading by comparison. Professors can request a solutions manual by email: pressbooks@ieee.org

Theory of Electromagnetic Waves Springer Science & Business Media

Fundamentals of Optical Waveguides is an essential resource for any researcher, professional or student involved in optics and communications engineering. Any reader interested in designing or actively working with optical devices must have a firm grasp of the principles of lightwave propagation. Katsunari Okamoto has presented this difficult technology clearly and concisely with several illustrations and equations. Optical theory encompassed in this reference includes coupled mode

theory, nonlinear optical effects, finite element method, beam propagation method, staircase concatenation method, along with several central theorems and formulas. Since the publication of the well-received first edition of this book, planar lightwave circuits and photonic crystal fibers have fully matured. With this second edition the advances of these fibers along with other improvements on existing optical technologies are completely detailed. This comprehensive volume enables readers to fully analyze, design and simulate optical atmospheres. - Exceptional new chapter on Arrayed-Waveguide Grating (AWG) - In-depth discussion of Photonic Crystal Fibers (PCFs) - Thorough explanation of Multimode Interference Devices (MMI) - Full coverage of polarization Mode Dispersion (PMD)

Understanding Geometric Algebra for Electromagnetic Theory Institute of Electrical & Electronics Engineers(IEEE) This book is written for scientists and engineers whose work involves wave reflection or transmission. Most of the book is written in the language of electromagnetic theory, but, as the title suggests, many of the results can be applied to particle waves, specifically to those satisfying the Schrödinger equation. The mathematical connection between electromagnetic s (or TE) waves and quantum particle waves is established in Chapter 1. The main results for s waves are translated into quantum mechanical language in the Appendix. There is also a close analogy between acoustic waves and electromagnetic p (or TM) waves, as shown in Section 1-4. Thus the book, though primarily intended for those working in optics, microwaves and radio, will be of use to physicists, chemists and electrical engineers studying reflection and transmission of particles at potential barriers. The techniques developed here can also be used by those working in acoustics, oceanography and seismology. Chapter 1 is recommended for all readers: it introduces reflection phenomena, defines the notation, and previews (in

Section 1-6) the contents of the rest of the book. This preview will not be duplicated here. We note only that applied topics do appear: two examples are the important phenomenon of attenuated total reflection in Chapter 8, and the reflectivity of multilayer dielectric mirrors in Chapter 12. The subject matter is restricted to linear classical electrodynamics in non-magnetic media, and the corresponding particle analogues.

Shielding of Electromagnetic Waves

Courier Corporation

Electromagnetic wave theory is based on Maxwell's equations, and electromagnetic boundary-value problems must be solved to understand electromagnetic scattering, propagation, and radiation.

Electromagnetic theory finds practical applications in wireless telecommunications and microwave engineering. This book is written as a text for a two-semester graduate course on electromagnetic wave theory. As such, Electromagnetic Wave Theory for Boundary-Value Problems is intended to help students enhance analytic skills by solving pertinent boundary-value problems. In particular, the techniques of Fourier transform, mode matching, and residue calculus are utilized to solve some canonical scattering and radiation problems.

Electromagnetic Wave Theory Wiley-Interscience

University Physics is designed for the two- or three-semester calculus-based physics course. The text has been developed to meet the scope and sequence of most university physics courses and provides a foundation for a career in mathematics, science, or engineering. The book provides an important opportunity for students to learn the core concepts of physics and understand how those concepts apply to their lives and to the world around them. Due to the comprehensive nature of the material, we are offering the book in three volumes for flexibility and efficiency. Coverage and Scope Our University Physics textbook adheres to the scope and sequence of most two- and three-semester

physics courses nationwide. We have worked to make physics interesting and accessible to students while maintaining the mathematical rigor inherent in the subject. With this objective in mind, the content of this textbook has been developed and arranged to provide a logical progression from fundamental to more advanced concepts, building upon what students have already learned and emphasizing connections between topics and between theory and applications. The goal of each section is to enable students not just to recognize concepts, but to work with them in ways that will be useful in later courses and future careers. The organization and pedagogical features were developed and vetted with feedback from science educators dedicated to the project. VOLUME II Unit 1:

Thermodynamics Chapter 1: Temperature and Heat Chapter 2: The Kinetic Theory of Gases Chapter 3: The First Law of Thermodynamics Chapter 4: The Second Law of Thermodynamics Unit 2: Electricity and Magnetism Chapter 5: Electric Charges and Fields Chapter 6: Gauss's Law Chapter 7: Electric Potential Chapter 8: Capacitance Chapter 9: Current and Resistance Chapter 10: Direct-Current Circuits Chapter 11: Magnetic Forces and Fields Chapter 12: Sources of Magnetic Fields Chapter 13: Electromagnetic Induction Chapter 14: Inductance Chapter 15: Alternating-Current Circuits Chapter 16: Electromagnetic Waves

Electromagnetic Wave Propagation, Radiation, and Scattering Springer

This is a first year graduate text on electromagnetic field theory emphasizing mathematical approaches, problem solving and physical interpretation. Examples deal with guidance, propagation, radiation and scattering of electromagnetic waves, metallic and dielectric wave guides, resonators, antennas and radiating structures, Cerenkov radiation, moving media, plasmas, crystals, integrated optics, lasers and fibers, remote sensing, geophysical probing, dipole antennas and stratified media.

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