

# FREE DOWNLOAD GEOMETRICAL THEORY OF DIFFRACTION FOR ELECTROMAGNETIC WAVES IEE ELECTROMAGNETIC WAVES SERIES

## **Geometrical Theory of Diffraction for Electromagnetic Waves**

The purpose of the book, apart from expounding the Geometrical Theory of Diffraction (GTD) method, is to present useful formulations that can be readily applied to solve practical engineering problems.

## **Geometrical Theory of Diffraction**

This book details the ideas underlying geometrical theory of diffraction (GTD) along with its relationships with other EM theories.

## **Electromagnetic Radiation, Scattering, and Diffraction**

Electromagnetic Radiation, Scattering, and Diffraction Discover a graduate-level text for students specializing in electromagnetic wave radiation, scattering, and diffraction for engineering applications In Electromagnetic Radiation, Scattering and Diffraction, distinguished authors Drs. Prabhakar H. Pathak and Robert J. Burkholder deliver a thorough exploration of the behavior of electromagnetic fields in radiation, scattering, and guided wave environments. The book tackles its subject from first principles and includes coverage of low and high frequencies. It stresses physical interpretations of the electromagnetic wave phenomena along with their underlying mathematics. The authors emphasize fundamental principles and provide numerous examples to illustrate the concepts contained within. Students with a limited undergraduate electromagnetic background will rapidly and systematically advance their understanding of electromagnetic wave theory until they can complete useful and important graduate-level work on electromagnetic wave problems. Electromagnetic Radiation, Scattering and Diffraction also serves as a practical companion for students trying to simulate problems with commercial EM software and trying to better interpret their results. Readers will also benefit from the breadth and depth of topics, such as: Basic equations governing all electromagnetic (EM) phenomena at macroscopic scales are presented systematically. Stationary and relativistic moving boundary conditions are developed. Waves in planar multilayered isotropic and anisotropic media are analyzed. EM theorems are introduced and applied to a variety of useful antenna problems. Modal techniques are presented for analyzing guided wave and periodic structures. Potential theory and Green's function methods are developed to treat interior and exterior EM problems. Asymptotic High Frequency methods are developed for evaluating radiation Integrals to extract ray fields. Edge and surface diffracted ray fields, as well as surface, leaky and lateral wave fields are obtained. A collective ray analysis for finite conformal antenna phased arrays is developed. EM beams are introduced and provide useful basis functions. Integral equations and their numerical solutions via the method of moments are developed. The fast multipole method is presented. Low frequency breakdown is studied. Characteristic modes are discussed. Perfect for graduate students studying electromagnetic theory, Electromagnetic Radiation, Scattering, and Diffraction is an invaluable resource for professional electromagnetic engineers and researchers working in this area.

## **Electromagnetic Wave Propagation, Radiation, and Scattering**

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.

## **Modern Electromagnetic Scattering Theory with Applications**

This self-contained book gives fundamental knowledge about scattering and diffraction of electromagnetic waves and fills the gap between general electromagnetic theory courses and collections of engineering formulas. The book is a tutorial for advanced students learning the mathematics and physics of electromagnetic scattering and curious to know how engineering concepts and techniques relate to the foundations of electromagnetics

## **Parabolic Equation Methods for Electromagnetic Wave Propagation**

Provides scientists and engineers with a tool for accurate assessment of diffraction and ducting on radio and radar systems. The author gives the mathematical background to parabolic equations modeling and describes simple parabolic equation algorithms before progressing to more advanced topics such as domain truncation, the treatment of impedance boundaries, and the implementation of very fast hybrid methods combining ray-tracing and parabolic equation techniques. The last three chapters are devoted to scattering problems, with application to propagation in urban environments and to radar-cross-section computation. Annotation copyrighted by Book News, Inc., Portland, OR

## **Aperture Antennas and Diffraction Theory**

Two alternative methods of aperture antenna analysis are described in this book.

## **Asymptotic and Hybrid Methods in Electromagnetics**

Asymptotic methods provide considerable physical insight and understanding of diffraction mechanisms and are very useful in the design of electromagnetic devices such as radar targets and antennas. However, difficulties can arise when trying to solve problems using multipole and asymptotic methods together, such

as in radar crosssection objects. This new book offers a solution to this problem by combining these approaches into hybrid methods, therefore creating high demand for both understanding and learning how to apply asymptotic and hybrid methods to solve diffraction problems.

## **Scattering, Two-Volume Set**

Scattering is the collision of two objects that results in a change of trajectory and energy. For example, in particle physics, such as electrons, photons, or neutrons are "scattered off" of a target specimen, resulting in a different energy and direction. In the field of electromagnetism, scattering is the random diffusion of electromagnetic radiation from air masses is an aid in the long-range sending of radio signals over geographic obstacles such as mountains. This type of scattering, applied to the field of acoustics, is the spreading of sound in many directions due to irregularities in the transmission medium. Volume I of Scattering will be devoted to basic theoretical ideas, approximation methods, numerical techniques and mathematical modeling. Volume II will be concerned with basic experimental techniques, technological practices, and comparisons with relevant theoretical work including seismology, medical applications, meteorological phenomena and astronomy. This reference will be used by researchers and graduate students in physics, applied physics, biophysics, chemical physics, medical physics, acoustics, geosciences, optics, mathematics, and engineering. This is the first encyclopedic-range work on the topic of scattering theory in quantum mechanics, elastodynamics, acoustics, and electromagnetics. It serves as a comprehensive interdisciplinary presentation of scattering and inverse scattering theory and applications in a wide range of scientific fields, with an emphasis, and details, up-to-date developments. Scattering also places an emphasis on the problems that are still in active current research. The first interdisciplinary reference source on scattering to gather all world expertise in this technique Covers the major aspects of scattering in a common language, helping to widening the knowledge of researchers across disciplines The list of editors, associate editors and contributors reads like an international Who's Who in the interdisciplinary field of scattering

## **Handbook of Optical Systems, Volume 2**

The state-of-the-art full-colored handbook gives a comprehensive introduction to the principles and the practice of calculation, layout, and understanding of optical systems and lens design. Written by reputed industrial experts in the field, this text introduces the user to the basic properties of optical systems, aberration theory, classification and characterization of systems, advanced simulation models, measuring of system quality and manufacturing issues. In this Volume Volume 2 continues the introduction given in volume 1 with the more advanced texts about the foundations of image formation. Emphasis is placed on an intuitive while theoretically exact presentation. More than 400 color graphs and selected references on the end of each chapter support this undertaking. From the contents: 17 Wave equation 18 Diffraction 19 Interference and coherence 20 Imaging 21 Imaging with partial coherence 22 Three dimensional imaging 23 Polarization 24 Polarization and optical imaging A1 Mathematical appendix Other Volumes Volume 1: Fundamentals of Technical Optics Volume 3: Aberration Theory and Correction of Optical Systems Volume 4: Survey of Optical Instruments Volume 5: Advanced Physical Optics

## **Electromagnetic Wave Scattering by Aerial and Ground Radar Objects**

Electromagnetic Wave Scattering by Aerial and Ground Radar Objects presents the theory, original calculation methods, and computational results of the scattering characteristics of different aerial and ground radar objects. This must-have book provides essential background for computing electromagnetic wave scattering in the presence of different kinds of irregularities, as well as Summarizes fundamental electromagnetic statements such as the Lorentz reciprocity theorem and the image principle Contains integral field representations enabling the study of scattering from various layered structures Describes scattering computation techniques for objects with surface fractures and radar-absorbent coatings Covers elimination of "terminator discontinuities" appearing in the method of physical optics in general bistatic cases Includes radar cross-section (RCS) statistics and high-range resolution profiles of assorted aircrafts, cruise missiles,

and tanks Complete with radar backscattering diagrams, echo signal amplitude probability distributions, and other valuable reference material, *Electromagnetic Wave Scattering by Aerial and Ground Radar Objects* is ideal for scientists, engineers, and researchers of electromagnetic wave scattering, computational electrodynamics, and radar detection and recognition algorithms.

## **Analyzing the Physics of Radio Telescopes and Radio Astronomy**

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.

## **Balanis' Advanced Engineering Electromagnetics**

*Balanis' Advanced Engineering Electromagnetics* The latest edition of the foundational guide to advanced electromagnetics Balanis' third edition of *Advanced Engineering Electromagnetics* - a global best-seller for over 30 years - covers the advanced knowledge engineers involved in electromagnetics need to know, particularly as the topic relates to the fast-moving, continuously evolving, and rapidly expanding field of wireless communications. The immense interest in wireless communications and the expected increase in wireless communications systems projects (antennas, microwaves and wireless communications) points to an increase in the number of engineers needed to specialize in this field. Highlights of the 3rd Edition include: A new chapter, on Artificial Impedance Surfaces (AIS), contains material on current and advanced EM technologies, including the exciting and fascinating topic of metasurfaces for: Control and broadband RCS reduction using checkerboard designs. Optimization of antenna fundamental parameters, such as: input impedance, directivity, realized gain, amplitude radiation pattern. Leaky-wave antennas using 1-D and 2-D polarization diverse-holographic high impedance metasurfaces for antenna radiation control and optimization. Associated MATLAB programs for the design of checkerboard metasurfaces for RCS reduction, and metasurface printed antennas and holographic LWA for radiation control and optimization. Throughout the book, there are: Additional examples, numerous end-of-chapter problems, and PPT notes. Fifty three MATLAB computer programs for computations, graphical visualizations and animations. Nearly 4,500 multicolor PowerPoint slides are available for self-study or lecture use.

## **Handbook of Antennas in Wireless Communications**

The move toward worldwide wireless communications continues at a remarkable pace, and the antenna element of the technology is crucial to its success. With contributions from more than 30 international experts, the *Handbook of Antennas in Wireless Communications* brings together all of the latest research and results to provide engineering professionals and students with a one-stop reference on the theory, technologies, and applications for indoor, hand-held, mobile, and satellite systems. Beginning with an introduction to wireless communications systems, it offers an in-depth treatment of propagation prediction and fading channels. It then explores antenna technology with discussion of antenna design methods and the various antennas in current use or development for base stations, hand held devices, satellite communications, and shaping beams. The discussions then move to smart antennas and phased array technology, including details on array theory and beamforming techniques. Space diversity, direction-of-arrival estimation, source tracking, and blind source separation methods are addressed, as are the

implementation of smart antennas and the results of field trials of systems using smart antennas implemented. Finally, the hot media topic of the safety of mobile phones receives due attention, including details of how the human body interacts with the electromagnetic fields of these devices. Its logical development and extensive range of diagrams, figures, and photographs make this handbook easy to follow and provide a clear understanding of design techniques and the performance of finished products. Its unique, comprehensive coverage written by top experts in their fields promises to make the Handbook of Antennas in Wireless Communications the standard reference for the field.

## **Antenna Handbook**

Techniques based on the method of modal expansions, the Rayleigh-Stevenson expansion in inverse powers of the wavelength, and also the method of moments solution of integral equations are essentially restricted to the analysis of electromagnetic radiating structures which are small in terms of the wavelength. It therefore becomes necessary to employ approximations based on "high-frequency techniques" for performing an efficient analysis of electromagnetic radiating systems that are large in terms of the wavelength. One of the most versatile and useful high-frequency techniques is the geometrical theory of diffraction (GTD), which was developed around 1951 by J. B. Keller [1,2,3]. A class of diffracted rays are introduced systematically in the GTD via a generalization of the concepts of classical geometrical optics (GO). According to the GTD these diffracted rays exist in addition to the usual incident, reflected, and transmitted rays of GO. The diffracted rays in the GTD originate from certain "localized" regions on the surface of a radiating structure, such as at discontinuities in the geometrical and electrical properties of a surface, and at points of grazing incidence on a smooth convex surface as illustrated in Fig. 1. In particular, the diffracted rays can enter into the GO shadow as well as the lit regions. Consequently, the diffracted rays entirely account for the fields in the shadow region where the GO rays cannot exist.

## **Electromagnetic Wave Interactions**

This book is a collection of papers on electromagnetic wave mechanics and its applications written by experts in this field. It offers the reader a sampling of exciting research areas in this field. The topics include polarimetric imaging, radar spectroscopy, surface or creeping waves, bistatic radar scattering, the Seebeck effect. Mathematical methods include inverse scattering theory, singularity expansion method, mixed potential integral equation, method of moments, and diffraction theory. Applications include Cellular Mobile Radios (CMR), radar target identification, and Personal Communication Services (PCS). This book shows how electromagnetic wave theory is currently being utilized and investigated. It involves a modicum of mathematical physics and will be of interest to researchers and graduate students in electrical engineering, physics and applied mathematics.

## **Electromagnetic Diffraction Modeling and Simulation with MATLAB**

This exciting new resource presents a comprehensive introduction to the fundamentals of diffraction of two-dimensional canonical structures, including wedge, strip, and triangular cylinder with different boundary conditions. Maxwell equations are discussed, along with wave equation and scattered, diffracted and fringe fields. Geometric optics, as well as the geometric theory of diffraction are explained. With MATLAB scripts included for several well-known electromagnetic diffraction problems, this book discusses diffraction fundamentals of two-dimensional structures with different boundary conditions and analytical numerical methods that are used to show diffraction. The book introduces fundamental concepts of electromagnetic problems, identities, and definitions for diffraction modeling. Basic coordinate systems, boundary conditions, wave equation, and Green's function problem are given. The scattered fields, diffracted fields, and fringe fields, radar cross section for diffraction modeling are presented. Behaviors of electromagnetic waves around the two-dimensional canonical wedge and canonical strip are also explored. Diffraction of trilateral cylinders and wedges with rounded edges is investigated as well as double tip diffraction using Finite Difference Time Domain and Method of Moments. A MATLAB based virtual tool, developed with graphical user interface

(GUI), for the visualization of both fringe currents and fringe waves is included, using numerical FDTD and MoM algorithm and High-Frequency Asymptotics approaches.

## **Radio Propagation and Adaptive Antennas for Wireless Communication Links**

Antennas and Propagation for Wireless Communication covers the basics of wireless communication system design with emphasis on antennas and propagation. It contains information on antenna fundamentals and the latest developments in smart antennas, as well as the radiation effects of hand-held devices. Antennas and Propagation for Wireless Communication provides a complete discussion of all the topics important to the design of wireless communication systems. Written by acknowledged authorities in their respective fields, the book deals with practical applications and presents real world examples. A solutions manual for college adopters accompanies the text. Ideal for engineers working in communication, antennas, and propagation for telecomm, military, and aerospace applications, as well as students of electrical engineering, this book covers all topics needed for a complete system design.

## **Fundamentals of the Physical Theory of Diffraction**

The book is a complete, comprehensive description of the modern Physical Theory of Diffraction (PTD) based upon the concept of elementary edge waves. The theory is demonstrated with examples of the diffraction of acoustic and electromagnetic waves at perfectly reflecting objects. Readers develop the skills to apply PTD to solve various scattering problems. The derived analytic expressions clearly illustrate the physical structure of the scattered field. They additionally describe all of the reflected and diffracted rays and beams, as well as the fields in the vicinity of caustics and foci. Shadow radiation, a fundamental component of PTD, is introduced and proven to contain half the total scattered power. The equivalence relationships between acoustic and electromagnetic diffracted waves are established and emphasized. Throughout the book, the author enables readers to master both the theory and its practical applications. Plotted numeric results supplement the theory and facilitate the visualization of individual contributions of distinct parts of the scattering objects to the total diffracted field. Detailed comments help readers understand and implement all the critical steps of the analytic and numeric calculations. Problem sets in each chapter give readers an opportunity to analyse and investigate the diffraction phenomena.

## **Geometrical Optics in Engineering Physics**

This monograph provides concise and clear coverage of modern ray theory without the need of complicated mathematics. Comprehensive coverage is given to wave problems in engineering physics, considering rays and caustics as physical objects.

## **Antenna Theory**

The discipline of antenna theory has experienced vast technological changes. In response, Constantine Balanis has updated his classic text, *Antenna Theory*, offering the most recent look at all the necessary topics. New material includes smart antennas and fractal antennas, along with the latest applications in wireless communications. Multimedia material on an accompanying CD presents PowerPoint viewgraphs of lecture notes, interactive review questions, Java animations and applets, and MATLAB features. Like the previous editions, *Antenna Theory*, Third Edition meets the needs of electrical engineering and physics students at the senior undergraduate and beginning graduate levels, and those of practicing engineers as well. It is a benchmark text for mastering the latest theory in the subject, and for better understanding the technological applications. An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department.

## **Proceedings of International conference on Antenna Technologies**

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.

## **Advanced Engineering Electromagnetics**

Volume 2 of TERB 3ed covers the convergence of telephony and data transport, including wireless networks. Now that data is becoming the predominant source of traffic more efficient multiplexing schemes and more flexible control methods are needed in the transport network, such as giving the customer the ability to call for bandwidth on demand. With the development of control methods for switched data services it is now recognised that improved ways to control the transport network are possible and standards initiatives are taking place to establish and improve the network control layer. Detailed explanation of propagation in wireless and optical fibre systems requires a substantial amount of mathematics, also covered in this volume. For each of the math chapters there is an explanation of why the mathematics is important, where it is applied and references to other chapters.

## **The Cable and Telecommunications Professionals' Reference**

This is the first comprehensive treatment of conformal antenna arrays from an engineering perspective. While providing a thorough foundation in theory, the authors of this publication provide a wealth of hands-on instruction for practical analysis and design of conformal antenna arrays. Thus, you get the knowledge you need, alongside the practical know-how to design antennas that are integrated into such structures aircrafts or skyscrapers.

## **Atti Della Fondazione Giorgio Ronchi Anno LVII N,4**

Understanding electromagnetic wave theory is pivotal in the design of antennas, microwave circuits, radars, and imaging systems. Researchers behind technology advances in these and other areas need to understand both the classical theory of electromagnetics as well as modern and emerging techniques of solving Maxwell's equations. To this end, the book provides a graduate-level treatment of selected analytical and computational methods. The analytical methods include the separation of variables, perturbation theory, Green's functions, geometrical optics, the geometrical theory of diffraction, physical optics, and the physical theory of diffraction. The numerical techniques include mode matching, the method of moments, and the finite element method. The analytical methods provide physical insights that are valuable in the design process and the invention of new devices. The numerical methods are more capable of treating general and complex structures. Together, they form a basis for modern electromagnetic design. The level of presentation allows the reader to immediately begin applying the methods to some problems of moderate complexity. It also provides explanations of the underlying theories so that their capabilities and limitations can be understood.

## **Conformal Array Antenna Theory and Design**

Professor Jean Van Bladel, an eminent researcher and educator in fundamental electromagnetic theory and its application in electrical engineering, has updated and expanded his definitive text and reference on electromagnetic fields to twice its original content. This new edition incorporates the latest methods, theory, formulations, and applications that relate to today's technologies. With an emphasis on basic principles and a focus on electromagnetic formulation and analysis, *Electromagnetic Fields, Second Edition* includes detailed discussions of electrostatic fields, potential theory, propagation in waveguides and unbounded space, scattering by obstacles, penetration through apertures, and field behavior at high and low frequencies.

## **Applied Frequency-Domain Electromagnetics**

This book is the first complete and comprehensive description of the modern Physical Theory of Diffraction (PTD) based on the concept of elementary edge waves (EEWs). The theory is demonstrated with the example of the diffraction of acoustic and electromagnetic waves at perfectly reflecting objects. The derived analytic expressions clearly explain the physical structure of the scattered field and describe in detail all of the reflected and diffracted rays and beams, as well as the fields in the vicinity of caustics and foci. Shadow radiation, a new fundamental component of the field, is introduced and proven to contain half of the total scattered power.

## **Electromagnetic Fields**

This book is devoted to describing the theory, design, performance and application of microwave horns and feeds for reflector. The first general treatment of feeds for reflector antennas, it describes design principles and methods of analysis.

## **Fundamentals of the Physical Theory of Diffraction**

This book constitutes the first single-volume, English-language treatise on electromagnetic wave propagation across the frequency spectrum.

## **Microwave Horns and Feeds**

This is an extensively revised and updated new edition of the best-selling *Mobile Antenna Systems Handbook*. Comprehensive, authoritative and practical, it provides the information you need to understand the relationship between the elements involved in antenna systems design for mobile communications. You get sound advice in choosing the appropriate antenna for any given requirement - including antennas for ITS, access to the latest modeling formulas for macro, micro and pico cell propagation, and guidance on the latest RF safety standards and measurement techniques.

## **Introduction to Electromagnetic Wave Propagation**

This unique book presents simple, easy-to-use, but effective short codes as well as virtual tools that can be used by electrical, electronic, communication, and computer engineers in a broad range of electrical engineering problems. Electromagnetic modeling is essential to the design and modeling of antenna, radar, satellite, medical imaging, and other applications. In this book, author Levent Sevgi explains techniques for solving real-time complex physical problems using MATLAB-based short scripts and comprehensive virtual tools. Unique in coverage and tutorial approach, *Electromagnetic Modeling and Simulation* covers fundamental analytical and numerical models that are widely used in teaching, research, and engineering designs—including mode and ray summation approaches with the canonical 2D nonpenetrable parallel plate waveguide as well as FDTD, MoM, and SSPE scripts. The book also establishes an intelligent balance among the essentials of EM MODSIM: The Problem (the physics), The Theory and Models (mathematical background and analytical solutions), and The Simulations (code developing plus validation, verification, and



calibration). Classroom tested in graduate-level and short courses, *Electromagnetic Modeling and Simulation*: Clarifies concepts through numerous worked problems and quizzes provided throughout the book Features valuable MATLAB-based, user-friendly, effective engineering and research virtual design tools Includes sample scenarios and video clips recorded during characteristic simulations that visually impact learning—available on wiley.com Provides readers with their first steps in EM MODSIM as well as tools for medium and high-level code developers and users *Electromagnetic Modeling and Simulation* thoroughly covers the physics, mathematical background, analytical solutions, and code development of electromagnetic modeling, making it an ideal resource for electrical engineers and researchers.

## **Mobile Antenna Systems Handbook**

*Radio Propagation and Adaptive Antennas for Wireless Communication Networks*, 2nd Edition, presents a comprehensive overview of wireless communication system design, including the latest updates to considerations of over-the-terrain, atmospheric, and ionospheric communication channels. New features include the latest experimentally-verified stochastic approach, based on several multi-parametric models; all-new chapters on wireless network fundamentals, advanced technologies, and current and modern multiple access networks; and helpful problem sets at the conclusion of each chapter to enhance clarity. The volume's emphasis remains on a thorough examination of the role of obstructions on the corresponding propagation phenomena that influence the transmission of radio signals through line-of-sight (LOS) and non-line-of-sight (NLOS) propagation conditions along the radio path between the transmitter and the receiver antennas—and how adaptive antennas, used at the link terminals, can be used to minimize the deleterious effects of such obstructions. With its focus on 3G, 4G, MIMO, and the latest wireless technologies, *Radio Propagation and Adaptive Antennas for Wireless Communication Networks* represents an invaluable resource to topics critical to the design of contemporary wireless communication systems. Explores novel wireless networks beyond 3G, and advanced 4G technologies, such as MIMO, via propagation phenomena and the fundamentals of adapted antenna usage. Explains how adaptive antennas can improve GoS and QoS for any wireless channel, with specific examples and applications in land, aircraft and satellite communications. Introduces new stochastic approach based on several multi-parametric models describing various terrestrial scenarios, which have been experimentally verified in different environmental conditions New chapters on fundamentals of wireless networks, cellular and non-cellular, multiple access networks, new applications of adaptive antennas for positioning, and localization of subscribers Includes the addition of problem sets at the end of chapters describing fundamental aspects of wireless communication and antennas.

## **Electromagnetic Modeling and Simulation**

Numerically rigorous techniques for the computation of electromagnetic fields diffracted by an object become computationally intensive, if not impractical to handle, at high frequencies and one must resort to asymptotic methods to solve the scattering problem at short wavelengths. The asymptotic methods provide closed form expansions for the diffracted fields and are also useful for eliciting physical interpretations of the various diffraction phenomena. One of the principal objectives of this book is to discuss the different asymptotic methods in a unified manner. Although the book contains explicit formulas for computing the field diffracted by conducting or dielectric-coated objects, it also provides the mathematical foundations of the different methods and explains how they are interrelated.

## **Radio Propagation and Adaptive Antennas for Wireless Communication Networks**

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.

## **Subject Catalog**

This volume focuses on asymptotic methods in the low and high frequency limits for the solution of scattering and propagation problems. Each chapter is pedagogical in nature, starting with the basic foundations and ending with practical applications. For example, using the Geometrical Theory of Diffraction, the canonical problem of edge diffraction is first solved and then used in solving the problem of diffraction by a finite crack. In recent times, the crack problem has been of much interest for its applications to Non-Destructive Evaluation (NDE) of flaws in structural materials.

## **Asymptotic Methods in Electromagnetics**

An important contribution to the literature that introduces powerful new methods for modeling and simulating radio wave propagation A thorough understanding of electromagnetic wave propagation is fundamental to the development of sophisticated communication and detection technologies. The powerful numerical methods described in this book represent a major step forward in our ability to accurately model electromagnetic wave propagation in order to establish and maintain reliable communication links, to detect targets in radar systems, and to maintain robust mobile phone and broadcasting networks. The first new book on guided wave propagation modeling and simulation to appear in nearly two decades, *Radio Wave Propagation and Parabolic Equation Modeling* addresses the fundamentals of electromagnetic wave propagation generally, with a specific focus on radio wave propagation through various media. The authors explore an array of new applications, and detail various virtual electromagnetic tools for solving several frequent electromagnetic propagation problems. All of the methods described are presented within the context of real-world scenarios typifying the differing effects of various environments on radio-wave propagation. This valuable text: Addresses groundwave and surface wave propagation Explains radar applications in terms of parabolic equation modeling and simulation approaches Introduces several simple and sophisticated MATLAB scripts Teaches applications that work with a wide range of electromagnetic, acoustic and optical wave propagation modeling Presents the material in a quick-reference format ideal for busy researchers and engineers *Radio Wave Propagation and Parabolic Equation Modeling* is a critical resource forelectrical, electronics, communication, and computer engineers working on industrial and military applications that rely on the directed propagation of radio waves. It is also a useful reference for advanced engineering students and academic researchers.

## **Electromagnetic Wave Propagation, Radiation, and Scattering**

Low and High Frequency Asymptotics

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