Scattering of Electromagnetic Waves-Leung Tsang 2004-04-07 A timely and authoritative guide to the state of the art of wave scattering Scattering of Electromagnetic Waves offers 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 third volume, Advanced Topics, Leung Tsang (University of Washington) and Jin Au Kong (MIT) cover: * Two-dimensional random rough surface scattering * Kirchhoff and related methods for rough surface scattering * Analytic theory of volume scattering based on cascading raytracing * Analytic wave theory for medium with permittivity fluctuations * Multiple scattering theory for discrete scatterers * Quasicrystalline approximation in dense media scattering * Dense media scattering * Backscattering enhancement in radiation and scattering of waves-Leopold B. Felsen 1994-01-15 As relevant today as it was when it first was published 20 years ago, this book is a classic in the field. Nowhere else can you find more complete coverage of radiation and scattering of waves. The chapter: Asymptotic Evaluation of Integrals is considered the definitive source for asymptotic techniques. This book is essential reading for engineers, physicists and others involved in the fields of electromagnetics and acoustics. It is also an indispensable reference for advanced engineering courses. Wave Scattering Theory-Hyo J. Eom 2012-12-06 The Fourier transform technique has been widely used in electrical engineering, which covers signal processing, communication system, control, and optics. The Fourier transform technique is particularly useful in electromagnetics and optics since it provides a convenient mathematical representation for wave scattering, diffraction, and propagation. Thus the Fourier transform technique has been long applied to the wave scattering problems that are often encountered in microwave antenna, radiation, diffraction, and electromagnetic interference.
research or designing microwave and millimetre-wave devices, this study explores methods of calculating microwave absorption in waveguides, resonators and periodic layered dielectric systems. 2021 Radiation and Scattering of Electromagnetic Waves (RSEMW)-IEEE Staff 2021-06-28 The aim is to discuss the latest achievements in the spheres of electromagnetic wave propagation and scattering, antenna theory, theory of electromagnetism, electromagnetic analysis, and microwaves to present results of theoretical investigation and practical application covering these areas and to share ideas on the subsequent researches. Plane-Wave Theory of Time-Domain Fields-Thorkild B. Hansen 1999-06-10 "This invaluable book provides a comprehensive framework for the formulation and solution of numerous problems involving the radiation, reception, propagation and scattering of electromagnetic and acoustic waves. Filled with original derivations and theorems, it includes the first rigorous development of time-domain expansions for time-domain electromagnetic and acoustic fields. For the past 35 years, near-field measurement techniques have been confined to the frequency domain. Now, with the publication of this book, probe-corrected near-field measurement techniques have been extended to ultra-wide-band, short-pulse transmitting and receiving antennas and transducers. By combining unencumbered straightforward derivations with in-depth expositions of prerequisite material, the authors have created an invaluable resource for research scientists and engineers in electromagnetics and acoustics, and a definitive reference on wave-plate expansions and near-field measurements. Featured topics include: * An introduction to the basic electromagnetic field equations * A rigorous development of time-domain and frequency-domain plane-wave representations * The formulation of time-domain, frequency-domain, and static planar near-field measurement techniques * Analytic-signal formalism formulas that simplify the analysis and interpretation of the results * A Wave phenomena, such as electromagnetic missiles** encountered only in the time domain * Definitive force and power relations for electromagnetic and acoustic fields and sources. * Sponsored by: IEEE Antennas and Propagation Society. Theory of Wave Scattering From Random Rough Surfaces-J. A. Ogilvy 1991 A review of theories developed for the study of acoustic, elastic and electromagnetic wave scattering from randomly rough surfaces, and a comprehensive summary of the latest techniques. Different theories are illustrated by experimental data. With applications in radar, sonar, ultrasonics and optics this book will be invaluable to graduate students, researchers and engineers working in the area of wave scattering from random surfaces. Plasma Scattering of Electromagnetic Radiation-John Sheffield 2010-11-25 This work presents one of the most powerful methods of plasma diagnosis in exquisite detail, to guide researchers in the theory and measurement techniques of light scattering in plasmas. Light scattering in plasmas is essential in the research and development of fusion energy, environmental solutions, and electronics. Combined with the method of strong fluctuation random medium theory, this work encompasses fusion and industrial applications essential in plasma research. It is the only comprehensive resource specific to the plasma scattering technique. It provides a wide-range of experimental examples and discussion of their principles with worked examples to assist researchers in applying the theory. Computing techniques for solving basic equations helps researchers compare data to the actual experiment New material on advances on the experimental side, such as the application of high density plasmas of inertial fusion Worked out examples of the scattering technique for easier comprehension of theory. Research Studies in the Theory of Scattering of Electromagnetic Waves by Metallic Objects-Joseph B. Keller 1971 The object of the research was to extend existing knowledge of classical electromagnetic theory with emphasis on the problem of determining the phase and amplitude of the electromagnetic field scattered by a conducting body, and using knowledge of the scattered phase and amplitude to determine the size and shape of the body. The investigations pertaining to these problems are explained in the body of this report. Content: Coupling of Modes * Application of Strong Fluctuation Random Medium Theory to Scattering of Electromagnetic Waves from a Half Space of Dielectric Mixture-L. Tsang 1981 Theory of the Scattering of Electromagnetic Waves by Irregular Interfaces-Kenneth D. Martin Mitzner 1964 Two problems involving electromagnetic wave scattering from irregular interfaces are treated, both deterministic and statistical irregularities being considered. First, reflection of a partially polarized wave from a plane interface with large irregularities is studied using geometrical optics. Matrix transformations relating incident and reflected waves are obtained for reflection from a single specular point and from an extended area containing many independent reflectors. The properties of a wave reflected from a diffusely illuminated rough interface are found, and these results are used to study reflection noise reduction when a polarization-sensitive detector viewing near the Brewster angle is used in infrared temperature measurements. Second, the method of small perturbations is used to study scattering of an arbitrary completely
polarized wave from an irregular interface of general underlying shape. The irregularities are replaced by equivalent surface currents and then the field in space is found from the Green’s function of the problem. The results obtained are valid when the irregularity has small slope and amplitude small compared to the wavelength and local radii of curvature. (Author).

Modern Electromagnetic Scattering Theory with Applications-Andrej V. Uspenskii 2017-14-4 Romanov The 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 electromagnetic scattering. Scattering of Electromagnetic Waves, Numerical Simulations-Leung Tsang 2001-06-01 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 over 350 references of both traditional and recent 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 second volume, Numerical Simulations, Leung Tsang (University of Washington) Jin Au Kong (MIT), Kung-Hua Ding (Air Force Research Lab), and Chi On Au (NSRDC) describe methods and volume scattering simulations Dense media models and simulations Electromagnetic scattering by discrete scatterers and a buried object Scattering by vertical cylinders above a surface Electromagnetic waves scattering by vegetation Computational methods and programs used for performing various simulations Geometrical Theory of Diffraction for Electromagnetic Waves-Graeme L. James 1980 The continuous development of the geometrical theory of diffraction (GTD), from its conception in the 1950s, has now established it as a leading analytical technique in the prediction of high-frequency electromagnetic radiation and scattering phenomena. Consequently, there is an increasing demand for research workers in this field to be familiar with the geometrical theory of diffraction in order to be able to understand and interpret the results obtained using electromagnetic waves to be familiar with this technique. In this book they will find a thorough and clear exposition of the GTD formulation for vector fields. It begins by describing the foundations of the theory in canonical problems and then proceeds to develop the method to treat a variety of circumstances. Where applicable, the relationship between GTD and other high-frequency theories, such as the Wiener–Hopf method or small-angle approximations, is stressed throughout the text. The purpose of the book, apart from expounding the GTD method, is to present useful formulations that can be readily applied to solve practical engineering problems. To this end, the final chapter supplies some fully worked examples to demonstrate the practical application of the GTD techniques developed in the earlier chapters. Electromagnetic Wave Interactions-Ard[i]hur Guran 1996 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 affect. 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 used 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. The Theory and Application of the Scattering Matrix for Electromagnetic Waves-Raphael Tsu 1960 Scattering from Spherical Particles-Ferdinando Borghese 2007-07-11 This book provides the first coherent account of a well-known approach to the problem of light scattering by small anisotropic particles. In this extended second edition the authors have encompassed all the new topics arising from their recent studies of cosmic dust grains. Thus many chapters were deeply revised and new chapters were added. The book addresses a wide range of applications: Integral Equation Methods in Scattering Theory-David Colton 2013-11-15 This classic book provides a rigorous treatment of the Riesz-Fredholm theory of compact operators in dual systems, followed by a derivation of the jump relations and mapping properties of scalar and vector potentials in spaces of continuous and HÖlder continuous functions. These results are then used to study scattering problems for the Helmholtz and Maxwell equations. Readers will benefit from a full description of the mapping properties of scalar and vector potentials in the interplay between the general theories of HÖlder continuous functions, an in-depth treatment of the use of boundary integral equations to solve scattering problems for acoustic and electromagnetic waves, and an introduction to inverse scattering theory with an emphasis on the ill-posedness and nonlinearity of the inverse scattering problem. A More Exact Theory for the Scattering of Electromagnetic Waves from Statistically Rough Surfaces-Donald Edward Barrick 1965 Electromagnetic Radiation, Scattering, and Diffraction-Prabhakar H Pathak 2021-09-22 This book is designed to provide an understanding of the behavior of EM fields in radiation, scattering and guided wave environments, from fundamental electromagnetic principles and from heuristic and formal methods. Physical interpretations of the EM wave phenomena are stressed along with their underlying mathematics. Fundamental principles are stressed, and numerous examples are included to illustrate concepts. This book can facilitate students with a somewhat limited undergraduate EM background to rapidly and systematically advance their understanding of EM wave theory that is useful and important for doing graduate level research on wave EM problems. This book can therefore also be useful for gaining a better understanding of problems they are trying to simulate with commercial EM software and how to better interpret their results. The book can also be used for self-study as a refresher for EM industry professionals. Theory of Plasma Kinetics, Scattering of Electromagnetic Waves by Plasmas, and the Dynamics of Particles and Atoms-Kenneth M. Watson 1974 A summary is given of work performed during the last year. The chief topics were: Atomic Physics (scattering cross sections; multi-photon transition); Plasma Physics (nonlinear interaction; laser heating; interaction of strong electromagnetic waves); Elementary-Particles Physics (dual models; gauge models; current algebra).

Fundamentals of the Physical Theory of Diffraction-Pytro Ya. Ufnitshev 2007-02-09 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. An overview analytical method clearly explains 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. Modern Theory of Gratings-Yuriy K. Sirenko 2010-07-23 The advances in the theory of diffraction and in the applications of electromagnetic devices in the last two decades have contributed to a new understanding and design of electromagnetic devices and components. In this book the authors present the theory of diffraction gratings with many new problems which force us to search for new methods and tools for their resolution. Just in such way there appeared recently new fields, connected with the analysis, synthesis and definition of equivalent parameters of artificial materials – layers and coatings, having periodic structure and possessing features, which can be found in natural materials only in extraordinary or exceptional situations. In this book the authors present results of the electromagnetic theory of diffraction gratings that may constitute the base of further development of this theory which can meet the challenges provided by the most recent requirements of fundamental and applied science. The following issues will be considered in the book Authentic methods of diffraction grating analysis and approximate methods that allow the requirements of analysis of resonant scattering of electromagnetic waves by gratings; Spectral theory of gratings, providing a reliable foundation for the analysis of spatial – frequency transformations of electromagnetic fields occurring in open periodic resonators and waveguides; Parametric Fourier methods, and C-methods of analysis; Theory of periodic media; and analysis of transformation properties of fields in the case of arbitrary profile periodic boundary between dielectric media and multilayered conformal arrays; Rigorous methods for analysis of transient processes and time-spatial transformations of electromagnetic waves in resonant situations, based on development and incorporation in standard numerical routines of FDTD of so-called explicit absorbing boundary conditions. New approaches to the solution of homogeneization problems – the key problem arising in construction of metamaterials and meta surfaces; New physical results about the resonance scattering of pulse and monochromatic waves by periodic structures, including structures with chiral or left-handed materials; Methods and the results of the solutions of several actual applied problems…
problems of analysis and synthesis of pattern creating gratings, power compressors, resonance radiators of high capacity short radio pulses, open electromagnetic structures for the systems of resonant quasi optics and absorbing coatings.

Electromagnetic Waves-Vitaliy Zhurbenko 2011-06-21 This book is dedicated to various aspects of electromagnetic wave theory and its applications in science and technology. The covered topics include the fundamental physics of electromagnetic waves, theory of electromagnetic wave propagation and scattering, methods of computational analysis, material characterization, electromagnetic properties of plasma, analysis and applications of periodic structures and waveguide components, and finally, the biological effects and medical applications of electromagnetic fields.

Inverse Scattering Theory-David Colton 2013-04-17 It has now been almost ten years since our first book on scattering theory appeared [32]. At that time we claimed that “in recent years the development of integral equation methods for the direct scattering problem seems to be nearing completion, whereas the use of such an approach to study the inverse scattering problem has progressed to an extent that a “state of the art” survey appears highly desirable”. Since we wrote these words, the inverse scattering problem for acoustic and electromagnetic waves has grown from being a few theoretical considerations with limited numerical implementations to a well-developed mathematical theory with tested numerical algorithms. This maturing of the field of inverse scattering theory has been based on the realization that such problems are in general not only nonlinear but also improperly posed in the sense that the solution does not depend continuously on the measured data. This was emphasized in [32] and treated with the ideas and tools available at that time. Now, almost ten years later, these initial ideas have developed to the extent that a monograph summarizing the mathematical basis of the field seems appropriate. This book is our attempt to write such a monograph. The inverse scattering problem for acoustic and electromagnetic waves can broadly be divided into two classes, the inverse obstacle problem and the inverse medium problem.

Principles of Optics-Max Born 2000-02-28 Principles of Optics is one of the classic science books of the twentieth century, and probably the most influential book in optics published in the past 40 years. The new edition is the first ever thoroughly revised and expanded edition of this standard text. Among the new material, much of which is not available in any other optics text, is a section on the CAT scan (computerized axial tomography), which has revolutionized medical diagnostics. The book also includes a new chapter on scattering from inhomogeneous media which provides a comprehensive treatment of the theory of scattering of scalar as well as of electromagnetic waves, including the Born series and the Rytov series. The chapter also presents an account of the principles of diffraction tomography - a refinement of the CAT scan - to which Emil Wolf, one of the authors, has made a basic contribution by formulating in 1969 what is generally regarded to be the basic theorem in this field. The chapter also includes an account of scattering from periodic potentials and its connection to the classic subject of determining the structure of crystals from X-ray diffraction experiments, including accounts of von Laue equations, Bragg’s law, the Ewald sphere of reflection and the Ewald limiting sphere, both generalized to continuous media. These topics, although originally introduced in connection with the theory of X-ray diffraction by crystals, have since become of considerable relevance to optics, for example in connection with deep holograms. Other new topics covered in this new edition include interference with broad-band light, which introduces the reader to an important phenomenon discovered relatively recently by Emil Wolf, namely the generation of shifts of spectral lines and other modifications of spectra of radiated fields due to the state of coherence of a source. There is also a section on the so-called Rayleigh-Sommerfeld diffraction theory which, in recent times, has been finding increasing popularity among optical scientists. There are also several new appendices, including one on energy conservation in scalar wavefields, which is seldom discussed in books on optics. The new edition of this standard reference will continue to be invaluable to advanced undergraduates, graduate students and researchers working in most areas of optics.

Electromagnetic Waves-Vitaliy Zhurbenko 2011-06-21 This book is dedicated to various aspects of electromagnetic wave theory and its applications in science and technology. The covered topics include the fundamental physics of electromagnetic waves, theory of electromagnetic wave propagation and scattering, methods of computational analysis, material characterization, electromagnetic properties of plasma, analysis and applications of periodic structures and waveguide components, and finally, the biological effects and medical applications of electromagnetic fields.

Electromagnetic Wave Scattering on Nonspherical Particles-Tom Rother 2013-09-19 This book gives a detailed overview of the theory of electromagnetic wave scattering on single, homogeneous, but nonspherical particles. Beside the systematically developed Green’s function formalism of the first edition this second and enlarged edition contains additional material regarding group theoretical considerations for nonspherical particles with boundary symmetries, an iterative T-matrix scheme for approximate solutions, and two additional but basic applications. Moreover, to demonstrate the advantages of the group theoretical approach and the iterative solution technique, the restriction to axisymmetric scatterers of the first edition was abandoned.