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Electromagnetic Field Theory Jul 29 2020
Solutions Manual to Accompany Engineering Electrom Agnetic Fields and Waves Jan 15 2022
Resonant Scattering and Generation of Waves Oct 20 2019 This monograph deals with theoretical aspects and numerical simulations of the interaction of electromagnetic fields with nonlinear materials. It focuses in particular on media with nonlinear polarization properties. It addresses the direct problem of nonlinear Electrodynamics, that is to understand the nonlinear behavior in the induced polarization and to analyze or even to control its impact on the propagation of electromagnetic fields in the matter. The book gives a comprehensive presentation of the results obtained by the authors during the last decade and put those findings in a broader, unified context and extends them in several directions.It is divided into eight chapters and three appendices. Chapter 1 starts from the Maxwell's equations and develops a wave propagation theory in plate-like media with nonlinear polarizability. In chapter 2 a theoretical framework in terms of weak solutions is given in order to prove the existence and uniqueness of a solution of the semilinear boundary-value problem derived in the first chapter. Chapter 3 presents a different approach to the solvability theory of the reduced frequency-domain model. Here the boundary-value problem is reduced to finding solutions of a system of one-dimensional nonlinear Hammerstein integral equations. Chapter 4 describes an approach to the spectral analysis of the linearized system of integral equations. Chapters 5 and 6 are devoted to the numerical approximation of the solutions of the corresponding mathematical models. Chapter 7 contains detailed descriptions, discussions and evaluations of the numerical experiments. Finally, chapter 8 gives a summary of the results and an outlook for future work.
Numerical Solution of Full-wave Equation with Mode-coupling Dec 02 2020 A new method for the numerical solution of the wave equation governing the propagation of electromagnetic waves in a horizontally stratified, inhomogeneous, anisotropic layer is described. The wave equation is a homogeneous set of four linear differential equations of the first order. In the computer calculation, all singularities of the wave equation are removed in practical cases and a proper step-size based on the gradients of the medium properties is programmed automatically. The multiplicative nature of the solutions facilitates the procedure. Modification of solutions from one height to another is

expressed in explicit form on the assumption that the propagation tensor varies linearly with height in each step of integration. In the mathematical development, matrix operations are extensively used in order to achieve a general representation. Four independent solutions of the wave equation are derived. During an ordinary integration for an inhomogeneous medium, a degradation occurs inevitably in the degree of linear independence among special solutions. This cause is analyzed. To obtain a complete set of special solutions with good linear independence, a particular device is developed for general applications. This method has been programmed for computer calculation by an IBM 7090. The resultant wave fields and wave polarizations for the independent modes are shown for a model ionosphere. The resultant wave is described as a 'scrambling' of four characteristic waves. The 'scrambling' state is visualized at each height. (Author).

Waves And Distributions Sep 30 2020 This book begins with an introduction on continuum mechanics and a derivation of the linear partial differential equations for sound waves in fluids and elastic waves in solids. There is a brief chapter on the wave equations of electrodynamics. This is followed by a description of plane wave solutions and a discussion of concepts like reflection, refraction, polarization and the role of boundary conditions.The second part of the book deals with the theory and applications of distributions and Fourier transforms. Furthermore, dispersion, the method of stationary phase, Kramers-Kronig relations and various examples including surface waves on liquids are discussed.This text is unique because it emphasizes the use of distributions to analyze the solutions of the wave equation. The treatment of continuum mechanics is self-contained, as well as the discussion on distributions and Fourier transforms. In addition, many classical methods of theoretical physics are thoroughly discussed, e.g. the use of Green functions and multipole expansions.

Electromagnetic Fields and Waves Nov 25 2022 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.

Solutions to Problems of Controlling Long Waves with the Help of Micro-structure

Tools Mar 05 2021 "In recent times the idea of cloaking has become very popular. After radar and sonar were discovered, problems of ""visibility"" reduction for physical bodies in air (by electromagnetic waves) or in water (by acoustical waves) have immediately become serious"

Solutions and Applications of Scattering, Propagation, Radiation and Emission of Electromagnetic Waves Jul 09 2021 In this book, a wide range of different topics related to analytical as well as numerical solutions of problems related to scattering, propagation, radiation, and emission in different medium are discussed. Design of several devices and their measurements aspects are introduced. Topics related to microwave region as well as Terahertz and quasi-optical region are considered. Bi-isotropic metamaterial in optical region is investigated. Interesting numerical methods in frequency domain and time domain for scattering, radiation, forward as well as reverse problems and microwave imaging are summarized. Therefore, the book will satisfy different tastes for engineers interested for example in microwave engineering, antennas, and numerical methods.

Electromagnetic Fields and Waves in Fractional Dimensional Space Oct 24 2022 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.

Electromagnetic Fields, Energy, and Waves Feb 04 2021

Advanced Electromagnetics and Scattering Theory Sep 11 2021 This book present the lecture notes used in two courses that the late Professor Kasra Barkeshli had offered at Sharif University of Technology, namely, Advanced Electromagnetics and Scattering Theory. The prerequisite for the sequence is vector calculus and electromagnetic fields and waves. Some familiarity with Green's functions and integral equations is desirable but not necessary. The book provides a brief but concise introduction to classical topics in the field. It is divided into three parts including annexes. Part I covers principle of electromagnetic theory. The discussion starts with a review of the Maxwell's equations in differential and integral forms and basic boundary conditions. The solution of inhomogeneous wave equation and various field representations including Lorentz's potential functions and the Green's function method are discussed next. The solution of Helmholtz equation and wave harmonics follow. Next, the book presents plane wave propagation in dielectric and lossy media and various wave velocities. This part concludes with a general discussion of planar and circular waveguides. Part II presents basic concepts of electromagnetic scattering theory. After a brief discussion of radar equation and scattering cross section, the author reviews the canonical problems in

scattering. These include the cylinder, the wedge and the sphere. The edge condition for the electromagnetic fields in the vicinity of geometric discontinuities are discussed. The author also presents the low frequency Rayleigh and Born approximations. The integral equation method for the formulation of scattering problems is presented next, followed by an introduction to scattering from periodic structures. Part III is devoted to numerical methods. It begins with finite-difference methods to solve elliptic equations, and introduces the finite-difference time-domain method for the solution of hyperbolic and parabolic equations. Next, the part turns to the method of moments for the solution of integral equations. This part ends with a short introduction to the finite-element method.

Solutions Manual for Electromagnetic Fields and Waves Dec 26 2022

Electromagnetism and the Structure of Matter Mar 25 2020 The classical theory of electromagnetism is entirely revised in this book by proposing a variant of Maxwell equations that allows solitonic solutions (photons). The Lagrangian is the standard one, but it is minimized on a constrained space that enforces the wave packets to follow the rules of geometrical optics. Exact solutions are explicitly shown; this opens a completely new perspective for the study of light wave phenomena. In the framework of general relativity, the equations are written in covariant form. A coupling with the metric is obtained through the Einstein equation, whose solutions are computed exactly in a lot of original situations. Finally, the explicit construction of elementary particles, consisting of rotating photons, is indicated. The results agree qualitatively and quantitatively with what it is actually observed. This opens the path to an understanding of the structure of matter and its properties, also aimed to provide a causal explanation to quantum phenomena.

Solutions Manual to Electromagnetic Fields, Energy and Waves Feb 28 2023

Problems and Solutions on Electromagnetism Jan 27 2023 The material for these volumes has been selected from the past twenty years' examination questions for graduate students at University of California at Berkeley, Columbia University, the University of Chicago, MIT, State University of New York at Buffalo, Princeton University and University of Wisconsin. This volume comprises 440 problems and is divided into five parts: (I) Electrostatics; (II) Magnetostatic Field and Quasi-Stationary Electromagnetic Field; (III) Circuit Analysis; (IV) Electromagnetic Waves; (V) Relativistic Particle-Field Interactions.

Non-diffracting Waves Feb 22 2020 This continuation and extension of the successful book "Localized Waves" by the same editors brings together leading researchers in non-diffractive waves to cover the most important results in their field and as such is the first to present the current state. The well-balanced presentation of theory and experiments guides readers through the background of different types of non-diffractive waves, their generation, propagation, and possible applications. The authors include a historical account of the development of the field, and cover different types of non-diffractive waves, including Airy waves and realistic, finite-energy solutions suitable for experimental realization. Apart from basic research, the concepts explained

here have promising applications in a wide range of technologies, from wireless communication to acoustics and bio-medical imaging.

The Plane Wave Spectrum Representation of Electromagnetic Fields Apr 18 2022 The Plane Wave Spectrum Representation of Electromagnetic Fields presents the theory of the electromagnetic field with emphasis to the plane wave. This book explains how fundamental electromagnetic fields can be represented by the superstition of plane waves traveling in different directions. Organized into two parts encompassing eight chapters, this book starts with an overview of the methods whereby plane wave spectrum representation can be used in attacking different characteristic problems belonging to the theories of radiation, diffraction, and propagation. This book then discusses the concept of relative simplicity of plane wave solutions of Maxwell's equations whereby their use enables some of the significant elementary physical and engineering characteristics of the electromagnetic field to be clarified. Other chapters consider the concept of an infinitely thin screen that is absolutely absorbing. The final chapter deals with the complicated problems that occur when anisotropic media are involved. Mathematicians and physicists will find this book useful.

Field Theory of Guided Waves Aug 22 2022 "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 Propagation Society

Fields, Waves and Transmission Lines Jul 21 2022 One of us (FAB) published a book Problems in Electronics with Solutions in 1957 which became well established and ran to five editions, the last revised and enlarged edition appearing in 1976. When the first edition was written it covered almost the complete undergraduate electronics courses in engin eering at universities. One book, at a price students can afford, can no longer cover an undergraduate course in electronics. It has therefore been decided to produce a book covering one important section of such a course using the experience gained and a few problems from previous editions of Problems in Electronics with Solutions. The book is based largely on problems collected by us over many years and given to undergraduate electronic and electrical engineers. Its purpose is to present the problems, together with a large number of their solutions, in the hope that it will prove valuable to undergraduates and other teachers. It should also be useful for Master's degree students in electronic and electrical engineering and physics, research workers, engineers and scientists in industry and as a reference source.

Waves in Focal Regions May 27 2020 Using numerous mathematical and numerical

techniques of diffraction theory, Waves in Focal Regions: Propagation, Diffraction and Focusing of Light, Sound and Water Waves provides a full and richly illustrated description of waves in focal regions. Unlike most books, the author treats electromagnetic, acoustic, and water waves in one comprehensive volume. After an introductory section, the book describes approximate diffraction theories and efficient numerical methods to study the focusing of various kinds of waves. It then covers the physical interpretation of the theories, their accuracy, and the computational savings obtained, emphasizing uniform asymptotic results that remain valid in the vicinity of shadow boundaries and caustics. The next part deals with the focusing of scalar waves, including thorough theoretical analyses and detailed contour maps of diffraction patterns in focal regions for a variety of different system parameters, such as f-number, Frensel number, aperture shape, amplitude distribution, and wavefront aberration. The author proceeds to explore the diffraction and focusing of electromagnetic waves. First solutions are derived for fields radiated by sources, reflected and refracted at plane interfaces, or diffracted by apertures in plane screens, and then these solutions are applied to study the focusing in homogeneous media and through a plane dielectric interface. In both cases, the author includes many computed results of the electromagnetic field distribution near focus. Presenting both theoretical and experimental results, the following part examines the focusing of sound and water waves by means of zone-plate lenses. The book concludes with a detailed study of the diffraction and focusing of water waves and a comparison of the results of both linear and nonlinear theories with those of experiments.

Plane-Wave Theory of Time-Domain Fields Oct 12 2021 "This invaluable book provides a comprehensive framework for the formulation and solution ofnumerous 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 plane-wave 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 plane-wave expansions and near-field measurements. Featured topics include: * An introduction to the basic electromagnetic and acoustic 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 with and without probe-correction * Sampling theorems and computation schemes for time-domain and frequency-domain fields * Analytic-signal formulas that simplify the formulation and analysis of transient fields * 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.

Waves in Neural Media Feb 16 2022 ?Waves in Neural Media: From Single Neurons to Neural Fields surveys mathematical models of traveling waves in the brain, ranging from intracellular waves in single neurons to waves of activity in large-scale brain networks. The work provides a pedagogical account of analytical methods for finding traveling wave solutions of the variety of nonlinear differential equations that arise in such models. These include regular and singular perturbation methods, weakly nonlinear analysis, Evans functions and wave stability, homogenization theory and averaging, and stochastic processes. Also covered in the text are exact methods of solution where applicable. Historically speaking, the propagation of action potentials has inspired new mathematics, particularly with regard to the PDE theory of waves in excitable media. More recently, continuum neural field models of large-scale brain networks have generated a new set of interesting mathematical questions with regard to the solution of nonlocal integro-differential equations. Advanced graduates, postdoctoral researchers and faculty working in mathematical biology, theoretical neuroscience, or applied nonlinear dynamics will find this book to be a valuable resource. The main prerequisites are an introductory graduate course on ordinary differential equations or partial differential equations, making this an accessible and unique contribution to the field of mathematical biology.

Fields and Waves in Communication Electronics May 19 2022 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. Familiarity with vector operations, including divergence and curl, are developed in context in the chapters on statics. Packed with useful derivations and applications.

A Solution for the Wave Velocity Field Existing on an Underwater Portion of an Impervious Sloping Breakwater May 07 2021

Water Waves and Ship Hydrodynamics Apr 25 2020 In this book an introduction is given to aspects of water waves that play a role in ship hydrodynamics and offshore engineering. At first the equations and linearized boundary conditions are derived describing the non-viscous free surface water waves, with special attention to the combination of steady and non-steady flow fields. Then some simple kinds of free wave solutions are derived, such as plane waves and cylindrical waves. For several situations, steady and unsteady, the source singularity function is derived. These functions play a role in numerical codes used to describe the motion of ships and offshore structures. These codes are mostly based on a boundary integral formulation; therefore we give an introduction to these methods. It is shown how first order ship motions can be determined. In offshore engineering the second order wave drift motions play an important role. An introduction to this phenomenon is given and the effects which have to be taken into account are explained by means of a simple

example where we can determine nearly all the aspects analytically. An interesting example that is worked out is the motion of very large floating flexible platforms with finite draft. Finally an introduction to the theory of shallow water non-linear dispersive waves is presented, and shallow water ship hydrodynamics, that plays a role in coastal areas and channels is treated. Here attention is paid to the interaction between passing ships in restricted water. In the appendix a short introduction to some of the mathematical tools is given.

Problems And Solutions In Special Relativity And Electromagnetism Dec 14 2021 Field theory is an important topic in theoretical physics, which is studied in the physical and physico-mathematical departments of universities. Therefore, lecturers are faced with the urgent task of not only providing students with information about the subject, but also to help them master the material at a deep qualitative level, by presenting the specific features of general approaches to the statement and the solution of problems in theoretical physics. One of the ways to study field theory is the practical one, where the students can deepen their knowledge of the theoretical material and develop problem-solving skills. This book includes a concise theoretical summary of the main branches of field theory and electrodynamics, worked examples, and some problems for the student to solve.The book is written for students of theoretical and applied physics, and corresponds to the curricula of the theoretical courses 'Field theory' and 'Electrodynamics' for physics undergraduates. It can also be useful for students of other disciplines, in particular, those in which physics is one of the base subjects.

Analysis of Electromagnetic Fields and Waves Aug 10 2021 The Method of Lines (MOL) is a versatile approach to obtaining numerical solutions to partial differential equations (PDEs) as they appear in dynamic and static problems. This method, popular in science and engineering, essentially reduces PDEs to a set of ordinary differential equations that can be integrated using standard numerical integration methods. Its significant advantage is that the analysis algorithms follow the physical wave propagation and are therefore efficient. This is because the fields on the discretisation lines are described by generalised transmission line (GTL) equations. With this formulation we have a connection to the well known transmission line theory and resulting in an easy understanding. The method of lines is a very accurate and powerful way to analyze electromagnetic waves, enabling a full-wave solution without the computational burden of pure finite element or finite difference methods. With Analysis of Electromagnetic Fields and Waves, Reinhold Pregla describes an important and powerful method for analyzing electromagnetic waves. This book: Describes the general analysis principles for electromagnetic fields. Includes applications in microwave, millimetre wave and optical frequency regions. Unifies the analysis by introducing generalised transmission line (GTL) equations for all orthogonal coordinate systems and with materials of arbitrary anisotropy as a common start point. Demonstrates a unique analysis principle with the numerical stable impedance/admittance transformation and a physical adapted field transformation concept that is also useful for other modelling algorithms. Includes chapters on

Eigenmode calculations for various waveguides, concatenations and junctions of arbitrary number of different waveguide sections in complex devices, periodic structures (e.g. Bragg gratings, meander lines, clystron resonators, photonic crystals), antennas (e.g. circular and conformal). Enables the reader to solve partial differential equations in other physical areas by using the described principles. Features an accompanying website with program codes in Matlab© for special problems. Analysis of Electromagnetic Fields and Waves will appeal to electromagnetic field practitioners in primary and applied research as well as postgraduate students in the areas of photonics, micro- and millimetre waves, general electromagnetics, e.g. microwave integrated circuits, antennas, integrated and fibre optics, optoelectronics, nanophotonics, microstructures, artificial materials.

Exact Solutions of Einstein's Field Equations Jan 03 2021 A paperback edition of a classic text, this book gives a unique survey of the known solutions of Einstein's field equations for vacuum, Einstein-Maxwell, pure radiation and perfect fluid sources. It introduces the foundations of differential geometry and Riemannian geometry and the methods used to characterize, find or construct solutions. The solutions are then considered, ordered by their symmetry group, their algebraic structure (Petrov type) or other invariant properties such as special subspaces or tensor fields and embedding properties. Includes all the developments in the field since the first edition and contains six completely new chapters, covering topics including generation methods and their application, colliding waves, classification of metrics by invariants and treatments of homothetic motions. This book is an important resource for graduates and researchers in relativity, theoretical physics, astrophysics and mathematics. It can also be used as an introductory text on some mathematical aspects of general relativity.

Solutions Manual to Accompany Fields and Waves in Communication Electronics Sep 23 2022

Iterative Solutions of Maxwell's Equations Nov 01 2020 The problem of scattering of electromagnetic waves by a closed, bounded, smooth, perfectly conducting surface immersed in vacuum is considered and a method for determining the scattered electric and magnetic field vectors (solutions of the homogeneous Maxwell equations satisfying the well known boundary conditions on the surface and the Silver-Muller radiation condition at infinity) everywhere exterior to the surface is presented. Specifically, two integral equations are derived, one for each scattered field vector. These equations are coupled. The kernels of the equations are dyadic functions of position and can be derived from the solutions of standard interior and exterior potential problems. Once these dyadic kernels are determined for a particular surface geometry the integral equations can be solved by iteration for the wave number k being sufficiently small. Alternatively, the scattered fields in the integral equations may be expanded in a power series of the wave number k and recursion formulas be found for the unknown coefficients in the expansions by equating equal power of k. As a check, the method is applied to the problem of scattering of a plane electromagnetic wave by a perfectly conducting sphere. The first two terms in the low frequency expansions of the

electric and magnetic scattered fields are found and are shown to be in complete agreement with known results. (Author).

Electromagnetic Waves Jun 08 2021 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.

Electromagnetic Fields and Waves Aug 30 2020 In this book, a variety of topics related to electromagnetic fields and waves are extensively discussed. The topics encompass the physics of electromagnetic waves, their interactions with different kinds of media, and their applications and effects.

Numerical Solution of Wave Equations for Long Wavelength Radio Waves Mar 17 2022 The long wavelength reflection coefficients for a day and night horizontally stratified model ionosphere are calculated by integrating the governing differential equations. The wave fields inside the ionosphere and the group height are also illustrated. This is useful when the measured reflection or conversion coefficients show unexpected features and a detailed examination of these wave fields may lead to a physical insight of the origin of such features. The compute time is 200 horizontally stratified slabs per second on a CDC 6600. (Author).

Nonlinear Wave Equations Jun 27 2020 The theory of nonlinear wave equations in the absence of shocks began in the 1960s. Despite a great deal of recent activity in this area, some major issues remain unsolved, such as sharp conditions for the global existence of solutions with arbitrary initial data, and the global phase portrait in the presence of periodic solutions and traveling waves. This book, based on lectures presented by the author at George Mason University in January 1989, seeks to present the sharpest results to date in this area. The author surveys the fundamental qualitative properties of the solutions of nonlinear wave equations in the absence of boundaries and shocks. These properties include the existence and regularity of global solutions, strong and weak singularities, asymptotic properties, scattering theory and stability of solitary waves. Wave equations of hyperbolic, Schrodinger, and KdV type are discussed, as well as the Yang-Mills and the Vlasov-Maxwell equations. The book offers readers a broad overview of the field and an understanding of the most recent developments, as well as the status of some important unsolved problems. Intended for mathematicians and physicists interested in nonlinear waves, this book would be suitable as the basis for an advanced graduate-level course.

Acoustic Fields and Waves in Solids Nov 20 2019

Localized Waves Jan 23 2020 The first book on Localized Waves—a subject of phenomenal worldwide research with important applications from secure communications to medicine Localized waves—also known as non-diffractive waves—are beams and pulses capable of resisting diffraction and dispersion over long distances even in non-guiding media. Predicted to exist in the early 1970s and obtained theoretically and experimentally as solutions to the wave equations starting in 1992,

localized waves now garner intense worldwide research with applications in all fields where a role is played by a wave equation, from electromagnetism to acoustics and quantum physics. In the electromagnetics areas, they are paving the way, for instance, to ubiquitous secure communications in the range of millimeter waves, terahertz frequencies, and optics. At last, the localized waves with an envelope at rest are expected to have important applications especially in medicine. Localized Waves brings together the world's most productive researchers in the field to offer a well-balanced presentation of theory and experiments in this new and exciting subject. Composed of thirteen chapters, this dynamic volume: Presents a thorough review of the theoretical foundation and historical aspects of localized waves Explores the interconnections of the subject with other technologies and scientific areas Analyzes the effect of arbitrary anisotropies on both continuous-wave and pulsed non-diffracting fields Describes the physical nature and experimental implementation of localized waves Provides a general overview of wave localization, for example in photonic crystals, which have received increasing attention in recent years Localized Waves is the first book to cover this emerging topic, making it an indispensable resource in particular for researchers in electromagnetics, acoustics, fundamental physics, and free-space communications, while also serving as a requisite text for graduate students.
Terrestrial Propagation of Long Electromagnetic Waves Dec 22 2019 Terrestrial Propagation of Long Electromagnetic Waves deals with the propagation of long electromagnetic waves confined principally to the shell between the earth and the ionosphere, known as the terrestrial waveguide. The discussion is limited to steady-state solutions in a waveguide that is uniform in the direction of propagation. Wave propagation is characterized almost exclusively by mode theory. The mathematics are developed only for sources at the ground surface or within the waveguide, including artificial sources as well as lightning discharges. This volume is comprised of nine chapters and begins with an introduction to the fundamental concepts of wave propagation in a planar and curved isotropic waveguide. A number of examples are presented to illustrate the effects of an anisotropic ionosphere. The basic equations are summarized and plane-wave reflection from a dielectric interface is considered, along with the superposition of two obliquely incident plane waves. The properties of waveguide boundaries are implicitly represented by Fresnel reflection coefficients. Subsequent chapters focus on boundaries of the terrestrial guide; lightning discharges as a natural source of extremely-low-frequency and very-low-frequency radiation; and the mode theory for waves in an isotropic spherical shell. This book will be a useful resource for students and practitioners of physics.
Phase Conjugation in a Layer of Nonlinear Material Apr 06 2021 Optical phase conjugation, or time reversal, of an optical wave front is an important technique to correct distortions in electromagnetic waves which are built up during propagation through a medium. The authors have studied theoretically optical phase conjugation through four-wave mixing in a slab of non-linear material. When two strong counter-propagating laser beams irradiate a non-linear crystal, the third-order susceptibility is

activated, and can couple to an external weak probe field. A four-wave mixing process then generates a phase-conjugated or time-reversed replica of this incident probe field. They investigated the mechanism of the production of phase-conjugated radiation in such a configuration by solving the non-linear Maxwell equations for the electric field. The electric field in the material satisfies a set of two coupled wave equations, which couple positive and negative frequency components of the electric field. It is shown that the polarisation of the pumps and the tensorial nature of the interaction can be accounted for by a simple polarisation operator in the wave equations. Maxwell's equations for the field in the layer admit plane-wave solutions, although the dispersion relations are very different from the usual linear relation between the frequency and the wave number. The coupling between the two waves exhibits a strong resonance near the frequency of the pump beams. These plane-wave modes can be matched across the boundaries of the layer to the probe field. The response of the material can then be expressed in terms of Fresnel reflection and transmission coefficients for both s- and p-polarisation. We have derived simple matrix equations for the set of Fresnel coefficients, which can be solved numerically, and the have also obtained closed-form analytical solutions for the various Fresnel coefficients. It is indicated that our solutions reduce to earlier results in the appropriate limits.

University Physics Jun 20 2022 University Physics is a three-volume collection that meets the scope and sequence requirements for two- and three-semester calculus-based physics courses. Volume 1 covers mechanics, sound, oscillations, and waves. Volume 2 covers thermodynamics, electricity and magnetism, and Volume 3 covers optics and modern physics. This textbook emphasizes connections between between theory and application, making physics concepts interesting and accessible to students while maintaining the mathematical rigor inherent in the subject. Frequent, strong examples focus on how to approach a problem, how to work with the equations, and how to check and generalize the result. The text and images in this textbook are grayscale.

Acoustic fields and waves in solids Nov 13 2021 Volume One begins with a systematic development of basic concepts (strain, stress, stiffness and compliance, viscous clamping) and coordinate transformations in both tensor and matrix notation. The basic elastic field equations are then written in a form analogous to Maxwell's equations. This analogy is then pursued when analyzing wave propagation in both isotropic and anisotropic solids. Piezoelectricity and bulk wave transducers are treated in the final chapter. Appendixes list slowness diagrams and material properties for various crystalline solids.

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- Electromagnetic Fields And Waves
- Electromagnetic Fields And Waves In Fractional Dimensional Space

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