

Kasra Barkeshli

Advanced Electromagnetics and Scattering Theory

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SB Merriam



Advanced Electromagnetics And Scattering Theory:

Advanced Electromagnetics and Scattering Theory Kasra Barkeshli, 2014-10-25 This book presents 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

Modern Electromagnetic Scattering Theory with Applications Andrey V. Osipov, Sergei A. Tretyakov, 2017-01-31 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

Advanced Electromagnetic Waves Saad Bashir, 2015-11-18 This book endeavors to give the reader a strong base in the advanced theory of electromagnetic waves and its applications while keeping pace with research in various other disciplines that apply electrostatics electrodynamics theory The treatment is highly mathematical which tends to obscure the principles involved

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scattering and curious to know how engineering concepts and techniques relate to the foundations of electromagnetics

Boundary Integral Equations George C. Hsiao, Wolfgang L. Wendland, 2021-03-26 This is the second edition of the book which has two additional new chapters on Maxwell's equations as well as a section on properties of solution spaces of Maxwell's equations and their trace spaces These two new chapters which summarize the most up to date results in the literature for the Maxwell's equations are sufficient enough to serve as a self contained introductory book on the modern mathematical theory of boundary integral equations in electromagnetics The book now contains 12 chapters and is divided into two parts The first six chapters present modern mathematical theory of boundary integral equations that arise in fundamental problems in continuum mechanics and electromagnetics based on the approach of variational formulations of the equations The second six chapters present an introduction to basic classical theory of the pseudo differential operators The aforementioned corresponding boundary integral operators can now be recast as pseudo differential operators These serve as concrete examples that illustrate the basic ideas of how one may apply the theory of pseudo differential operators and their calculus to obtain additional properties for the corresponding boundary integral operators These two different approaches are complementary to each other Both serve as the mathematical foundation of the boundary element methods which have become extremely popular and efficient computational tools for boundary problems in applications This book contains a wide spectrum of boundary integral equations arising in fundamental problems in continuum mechanics and electromagnetics The book is a major scholarly contribution to the modern approaches of boundary integral equations and should be accessible and useful to a large community of advanced graduate students and researchers in mathematics physics and engineering

The Design of Chiral Metamaterials and Metasurfaces Yaoliang Song, Igor Semchenko, Sergei Khakhomov, Lei Wang, 2025-01-27 The Design of Chiral Metamaterials and Metasurfaces covers the theoretical and experimental study of the properties of chiral metamaterials composite media that can be engineered to exhibit unique electromagnetic properties metasurfaces and helix structured systems This book also focuses on the practical applications of the physical properties and the phenomena that are characteristic of chiral metamaterials including electromagnetic signal polarization conversion selection and electromagnetic wave absorption Given that chiral materials and metasurfaces offer solutions for manipulating electromagnetic waves by incorporating an additional degree of freedom namely the ability to control the polarization of the wave this book provides a welcome update for researchers and engineers working in the fields of optics radio physics biophysics and condensed matter physics Covers recent research work on the design of new metamaterials and metasurfaces Introduces chiral metamaterials and their manufacturing methods Discusses the optical rotation mechanism of chiral materials based on the chiral characteristics of natural DNA double helix structural fragments Presents a theory for the design of new metamaterials and metasurfaces and their applications Provides the simulation and experimentation of artificial spiral structures planar asymmetric SRR nested multilayer stacking and interconnection

structural metamaterials and metasurfaces Theory and Computation of Electromagnetic Fields Jian-Ming Jin, 2015-08-26 Reviews the fundamental concepts behind the theory and computation of electromagnetic fields The book is divided in two parts The first part covers both fundamental theories such as vector analysis Maxwell's equations boundary condition and transmission line theory and advanced topics such as wave transformation addition theorems and fields in layered media in order to benefit students at all levels The second part of the book covers the major computational methods for numerical analysis of electromagnetic fields for engineering applications These methods include the three fundamental approaches for numerical analysis of electromagnetic fields the finite difference method the finite difference time domain method in particular the finite element method and the integral equation based moment method The second part also examines fast algorithms for solving integral equations and hybrid techniques that combine different numerical methods to seek more efficient solutions of complicated electromagnetic problems Theory and Computation of Electromagnetic Fields Second Edition Provides the foundation necessary for graduate students to learn and understand more advanced topics Discusses electromagnetic analysis in rectangular cylindrical and spherical coordinates Covers computational electromagnetics in both frequency and time domains Includes new and updated homework problems and examples Theory and Computation of Electromagnetic Fields Second Edition is written for advanced undergraduate and graduate level electrical engineering students This book can also be used as a reference for professional engineers interested in learning about analysis and computation skills *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 **An Introduction to Classical Electromagnetic Radiation** Glenn S. Smith, 1997-08-13 This book provides a thorough description of classical electromagnetic radiation starting from Maxwell's equations and moving on to show how fundamental concepts are applied in a wide variety of examples from areas such as classical optics antenna analysis and electromagnetic scattering Throughout the author interweaves theoretical and experimental results to help give insight into the physical and historical foundations of the subject A key feature of the book is that pulsed and time harmonic signals are presented on an equal footing Mathematical and physical explanations are enhanced by a wealth of illustrations over 300 and the book includes more than 140 problems It can be used as a textbook for advanced undergraduate and graduate courses in electrical engineering and physics and will also be of interest to scientists and engineers working in applied electromagnetics A solutions manual is available on request for lecturers adopting the text **Electromagnetic Materials - Proceedings Of The International Conference On Materials For Advanced Technologies (Symposium P)** Hock Lim, Serguei

Matitsine, Yeow Beng Gan, Ling Bing Kong, 2007-06-20 The contributions to this volume deliberate the electrical and magnetic properties of materials relevant to the design of unconventional antennas microwave circuits components anti reflection media and coatings EMI shielding structures radomes etc Though a classical research topic some recent advancements in technology have led to new capabilities to create and control fine scale structures This has inspired scientists to develop new materials with exceptionally high permittivity or permeability as well as metamaterials or negative index materials with unusual electromagnetic properties Novel materials based on the use of active devices to control their electromagnetic performance have also been proposed The multi disciplinary nature of these new materials has brought together researchers from materials science physics and electrical engineering to explore and deepen our current understanding of electromagnetic wave propagation A wide range of new commercial defence applications of these materials is expected to emerge in the near future

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