

Electromagnetic Anisotropy and Bianisotropy

A Field Guide

Second Edition

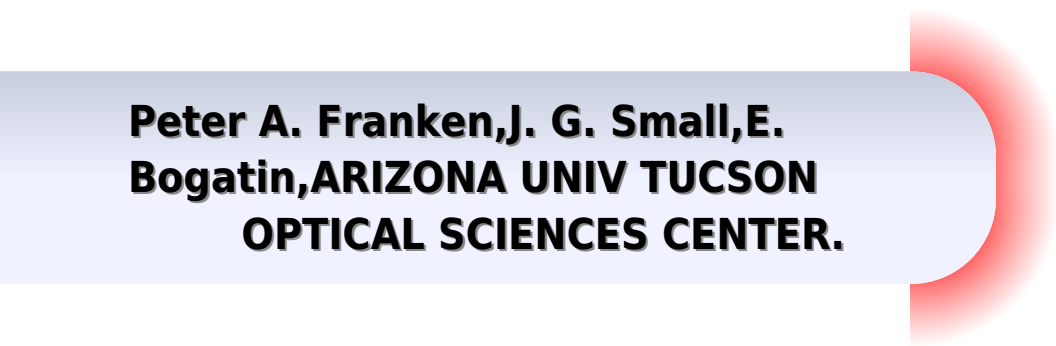
Tom G Mackay - Akhlesh Lakhtakia



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Electromagnetic Anisotropy And Bianisotropy A Field Guide

**Peter A. Franken, J. G. Small, E.
Bogatin, ARIZONA UNIV TUCSON
OPTICAL SCIENCES CENTER.**



Electromagnetic Anisotropy And Bianisotropy A Field Guide:

Electromagnetic Anisotropy and Bianisotropy Tom G. Mackay, Akhlesh Lakhtakia, 2010 The topics of anisotropy and bianisotropy are fundamental to electromagnetics from both theoretical and experimental perspectives These properties underpin a host of complex and exotic electromagnetic phenomena in naturally occurring materials and in relativistic scenarios as well as in artificially produced metamaterials As a unique guide to this rapidly developing field the book provides a unified presentation of key classic and recent results on the studies of constitutive relations spacetime symmetries planewave propagation dyadic Green functions and homogenization of composite materials This book also offers an up to date extension to standard treatments of crystal optics with coverage on both linear and weakly nonlinear regimes

Electromagnetic and Photonic Simulation for the Beginner: Finite-Difference Frequency-Domain in MATLAB® Raymond C. Rumpf, 2022-01-31 This book teaches the finite difference frequency domain FDFD method from the simplest concepts to advanced three dimensional simulations It uses plain language and high quality graphics to help the complete beginner grasp all the concepts quickly and visually This single resource includes everything needed to simulate a wide variety of different electromagnetic and photonic devices The book is filled with helpful guidance and computational wisdom that will help the reader easily simulate their own devices and more easily learn and implement other methods in computational electromagnetics Special techniques in MATLAB are presented that will allow the reader to write their own FDFD programs Key concepts in electromagnetics are reviewed so the reader can fully understand the calculations happening in FDFD A powerful method for implementing the finite difference method is taught that will enable the reader to solve entirely new differential equations and sets of differential equations in mere minutes Separate chapters are included that describe how Maxwell's equations are approximated using finite differences and how outgoing waves can be absorbed using a perfectly matched layer absorbing boundary With this background a chapter describes how to calculate guided modes in waveguides and transmission lines The effective index method is taught as way to model many three dimensional devices in just two dimensions Another chapter describes how to calculate photonic band diagrams and isofrequency contours to quickly estimate the properties of periodic structures like photonic crystals Next a chapter presents how to analyze diffraction gratings and calculate the power coupled into each diffraction order This book shows that many devices can be simulated in the context of a diffraction grating including guided mode resonance filters photonic crystals polarizers metamaterials frequency selective surfaces and metasurfaces Plane wave sources Gaussian beam sources and guided mode sources are all described in detail allowing devices to be simulated in multiple ways An optical integrated circuit is simulated using the effective index method to build a two dimensional model of the 3D device and then launch a guided mode source into the circuit A chapter is included to describe how the code can be modified to easily perform parameter sweeps such as plotting reflection and transmission as a function of frequency wavelength angle of incidence or a dimension of the device

The last chapter is advanced and teaches FDTD for three dimensional devices composed of anisotropic materials It includes simulations of a crossed grating a doubly periodic guided mode resonance filter a frequency selective surface and an invisibility cloak The chapter also includes a parameter retrieval from a left handed metamaterial The book includes all the MATLAB codes and detailed explanations of all programs This will allow the reader to easily modify the codes to simulate their own ideas and devices The author has created a website where the MATLAB codes can be downloaded errata can be seen and other learning resources can be accessed This is an ideal book for both an undergraduate elective course as well as a graduate course in computational electromagnetics because it covers the background material so well and includes examples of many different types of devices that will be of interest to a very wide audience Modern Analytical

Electromagnetic Homogenization Tom G Mackay,Akhlesh Lakhtakia,2015-07-01 Electromagnetic homogenization is the process of estimating the effective electromagnetic properties of composite materials in the long wavelength regime wherein the length scales of nonhomogeneities are much smaller than the wavelengths involved This is a bird s eye view of currently available homogenization formalisms for particulate composite materials It presents analytical methods only with focus on the general settings of anisotropy and bianisotropy The authors largely concentrate on effective materials as opposed to equivalent materials and emphasize the fundamental but sometimes overlooked differences between these two categories of homogenized composite materials The properties of an effective material represents those of its composite material regardless of the geometry and dimensions of the bulk materials and regardless of the orientations and polarization states of the illuminating electromagnetic fields In contrast the properties of equivalent materials only represent those of their corresponding composite materials under certain restrictive circumstances Photonics, Volume 1 David L.

Andrews,2015-01-16 Covers modern photonics accessibly and discusses the basic physical principles underlying all the applications and technology of photonics This volume covers the basic physical principles underlying the technology and all applications of photonics from statistical optics to quantum optics The topics discussed in this volume are Photons in perspective Coherence and Statistical Optics Complex Light and Singular Optics Electrodynamics of Dielectric Media Fast and slow Light Holography Multiphoton Processes Optical Angular Momentum Optical Forces Trapping and Manipulation Polarization States Quantum Electrodynamics Quantum Information and Computing Quantum Optics Resonance Energy Transfer Surface Optics Ultrafast Pulse Phenomena Comprehensive and accessible coverage of the whole of modern photonics Emphasizes processes and applications that specifically exploit photon attributes of light Deals with the rapidly advancing area of modern optics Chapters are written by top scientists in their field Written for the graduate level student in physical sciences Industrial and academic researchers in photonics graduate students in the area College lecturers educators policymakers consultants Scientific and technical libraries government laboratories NIH **Handbook of Nanoscience, Engineering, and Technology** William A. Goddard III,Donald Brenner,Sergey Edward Lyshevski,Gerald J

Iafrate,2018-09-03 In his 1959 address There is Plenty of Room at the Bottom Richard P Feynman speculated about manipulating materials atom by atom and challenged the technical community to find ways of manipulating and controlling things on a small scale This visionary challenge has now become a reality with recent advances enabling atomistic level tailoring and control of materials Exemplifying Feynman s vision Handbook of Nanoscience Engineering and Technology Third Edition continues to explore innovative nanoscience engineering and technology areas Along with updating all chapters this third edition extends the coverage of emerging nano areas even further Two entirely new sections on energy and biology cover nanomaterials for energy storage devices photovoltaics DNA devices and assembly digital microfluidic lab on a chip and much more This edition also includes new chapters on nanomagnet logic quantum transport at the nanoscale terahertz emission from Bloch oscillator systems molecular logic electronic optics in graphene and electromagnetic metamaterials With contributions from top scientists and researchers from around the globe this color handbook presents a unified up to date account of the most promising technologies and developments in the nano field It sets the stage for the next revolution of nanoscale manufacturing where scalable technologies are used to manufacture large numbers of devices with complex functionalities Nanostructure Integration Techniques for Manufacturable Devices, Circuits, and Systems Minoru M. Freund,M. Saif Islam,2005 Proceedings of SPIE present the original research papers presented at SPIE conferences and other high quality conferences in the broad ranging fields of optics and photonics These books provide prompt access to the latest innovations in research and technology in their respective fields Proceedings of SPIE are among the most cited references in patent literature **International Aerospace Abstracts** ,1999 **Anisotropy in Geoelectromagnetism** J. G. Negi,P. D. Saraf,1989 This comprehensive treatise is the first to be devoted solely to the study of the effect of electrical anisotropy in the propagation of electromagnetic waves in the earth The book handles a wide range of local regional and global geophysical problems It also provides analytical solutions to complex physical situations related numerical results and graphic displays for many fundamental and applied problems The following specific problems of solid earth relevance are discussed in detail direct current mapping of anisotropic sedimentary formations anisotropic effects in well logging measurements mutual impedance measurements frequency and time domain in induction prospecting on the anisotropic earth low frequency communication in anisotropic coal mines crustal mapping by magnetotellurics for a layered dipping anisotropic and inhomogeneous earth deep electromagnetic sounding in areas of geodynamic interest numerical modelling of laterally inhomogeneous anisotropic conductors data interpretation by inversion techniques for anisotropic media and laboratory and field results on anisotropic formations **Modern Analytical Electromagnetic Homogenization** Tom G. Mackay,Akhlesh Lakhtakia,2015 Electromagnetic homogenization is the process of estimating the effective electromagnetic properties of composite materials in the long wavelength regime wherein the length scales of nonhomogeneities are much smaller than the wavelengths involved This is a bird s eye view of currently available homogenization formalisms for

particulate composite materials It presents analytical methods only with focus on the general settings of anisotropy and bianisotropy *Electromagnetics of Bi-anisotropic Materials* Anatoly Serdyukov, Igor Semchenko, Sergi Tretyakov, 2001 This text focuses on fully bi anisotropic materials their microwave applications These are generally found in antennas scattering microwave optical technology solid state electronics plasma physics The book concentrates on recent challenging material from the world of electrical engineering **Electromagnetic Anisotropy** Peter A. Franken, J. G. Small, E. Bogatin, ARIZONA UNIV TUCSON OPTICAL SCIENCES CENTER., 1979 Two new precision laser interferometric tests of the postulates of special relativity are described Two independent frequency stabilized lasers situated on the circumference of a rotatable platform beat together at the center A variation in the beat frequency as the table rotates can be interpreted as a one way anisotropy in the speed of light A test for a round trip anisotropy is made by monitoring the cavity length change as the laser orientation change This can also be interpreted as a mass anisotropy in space Author **Electromagnetic Fields And Interactions** Richard Becker, 1969 *Fields and Electrodynamics* Pieter B. Visscher, 1988-10-11 The only text on this subject to detail numerical methods usually used in practice to calculate electromagnetic fields and to integrate these methods with computer simulation Thoroughly develops the basic mathematical methods which physicists use to describe fields e g density displacement and electrical demonstrating each with examples of applications to mechanical problems Describe Maxwell s equations governing electric and magnetic fields and shows how these lead to physical phenomena such as electromagnetic waves charged particle motion electromagnetic induction and other processes Maxwell s equations are introduced in a discrete form on a lattice and are discussed in terms of the original definition of the polarization field rather than the more abstract dipole moment approach Other topics covered include xerography EMP the magnetron oscillator and boundary value problems in the presence of superconductors none of which are included in other texts at this level

Introduction to Electromagnetic Fields Clayton R. Paul, S. A. Nasar, 1983 **Electromagnetic Fields, Energy, and Forces** Robert M. Fano, 1972 *Electromagnetic Fields and Waves* Magdy F. Iskander, 1992 Presents comprehensive coverage of the fundamentals of electromagnetic theory and applications Basic laws and physical phenomena are illustrated by numerous examples Methods for Electromagnetic Field Analysis Ismo V. Lindell, 1992 This monograph discusses mathematical and conceptual methods used in the analysis of electromagnetic fields and waves Dyadic algebra is reviewed and armed with new identities to be applied throughout the book The power of dyadic operations is seen when working with boundary sheet and interface conditions medium equations field transformations Green functions plane wave problems vector circuit theory multipole and image sources Dyadic algebra allows convenience in handling problems involving chiral and bianisotropic media of recent interest because of their wide range of potential applications The final chapter gives for the first time in book form a unified presentation of EIT the exact image theory introduced by this author and colleagues EIT is a general method for solving problems involving layered media by replacing them through image sources located in complex

space The main emphasis of the monograph is not on specific results but methods of analysis The work will interest research level electromagnetic physicists and engineers and applied mathematicians **Simulations of Slowly-varying**

Electromagnetic Fields in the Human Body Considering the Anisotropy of Muscles Catalin Victor Motrescu, 2010

Electromagnetic Fields Roald K. Wangsness, 1986-07-24 This revised edition provides patient guidance in its clear and organized presentation of problems It is rich in variety large in number and provides very careful treatment of relativity One outstanding feature is the inclusion of simple standard examples demonstrated in different methods that will allow students to enhance and understand their calculating abilities There are over 145 worked examples virtually all of the standard problems are included **Electromagnetic Fields** Alan M. Portis, 1978 Here is a textbook that develops the classical theory

of electromagnetic fields from a contemporary point of view with applications to the physics of condensed matter and plasmas It more thoroughly relates electricity and magnetism to media integrating solid state physics plasma physics and optics into the electromagnetic fields course Portis's balance of theory and application along with his effective use of relativity has produced a text that is constructive as well as complete He emphasizes the experimental investigations of Coulomb and Faraday together with the special theory of relativity including applications at each stage of development to topics in the physics of condensed matter and plasmas Each section is followed by exercises that are designed to reinforce the topics discussed Chapter problems emphasize the connection with the present material to previous chapters Besides his balance of theory and application reviewers have also praised Portis for the logical organization consistency in notation and presentation and the inclusion of condensed matter to topics Ideal for those with a background in mathematics and general physics Electromagnetic Fields can be used in courses that also recognize solid state physics optics plasma physics and modern physics Publisher

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