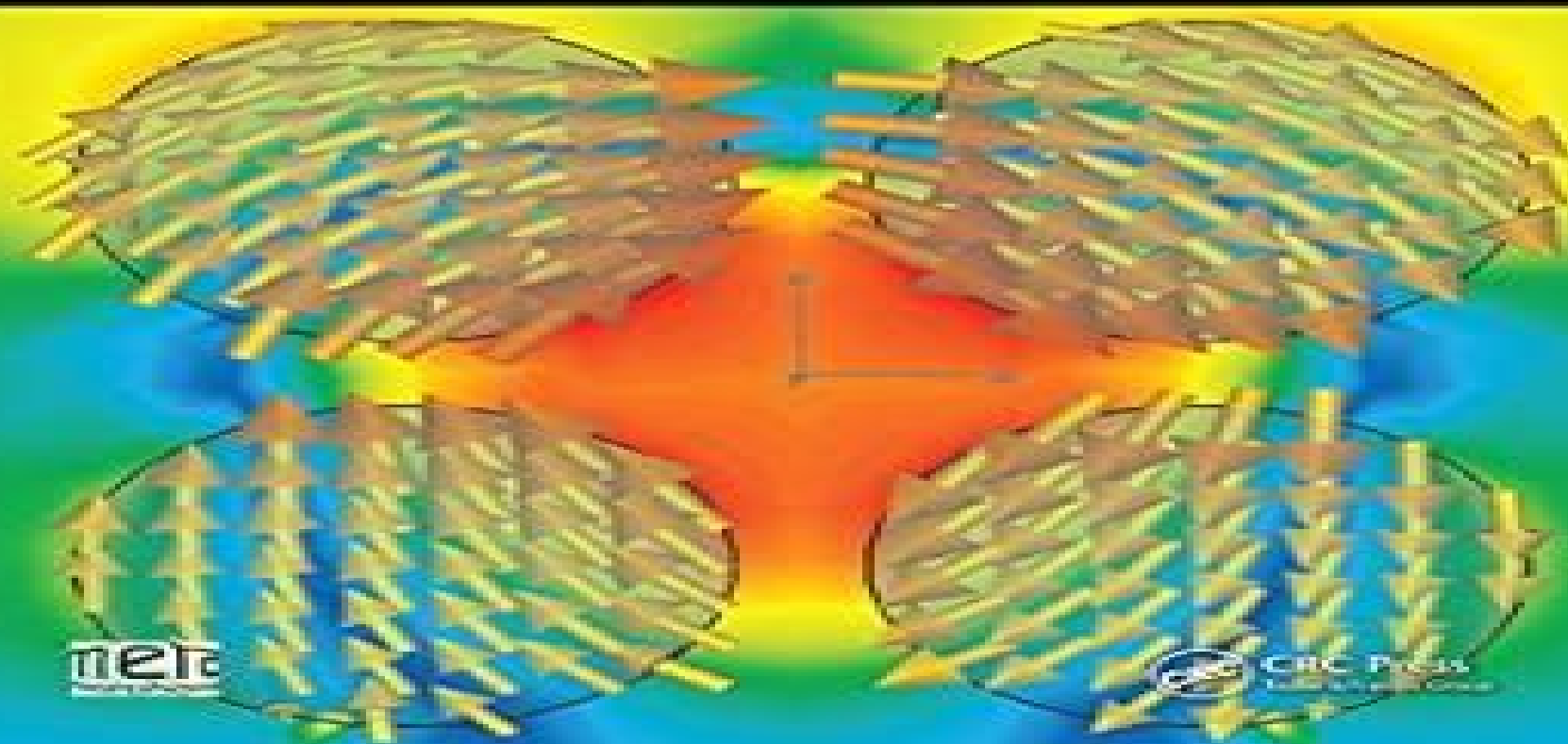


Metamaterials Handbook

Theory and Phenomena of Metamaterials

Edited by
Filippo Capolino

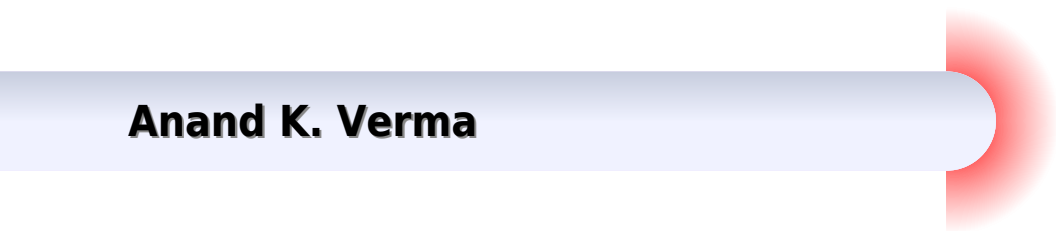


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Theory And Phenomena Of Metamaterials Theory And Phenomena Of Metamaterials

Anand K. Verma



Theory And Phenomena Of Metamaterials Theory And Phenomena Of Metamaterials:

Theory and Phenomena of Metamaterials Filippo Capolino, 2017-12-19 Theory and Phenomena of Metamaterials offers an in depth look at the theoretical background and basic properties of electromagnetic artificial materials often called metamaterials A volume in the Metamaterials Handbook this book provides a comprehensive guide to working with metamaterials using topics presented in a concise review format along with numerous references With contributions from leading researchers this text covers all areas where artificial materials have been developed Each chapter in the text features a concluding summary as well as various cross references to address a wide range of disciplines in a single volume

Theory and Phenomena of Metamaterials Filippo Capolino, 2009-10-05 Theory and Phenomena of Metamaterials offers an in depth look at the theoretical background and basic properties of electromagnetic artificial materials often called metamaterials A volume in the Metamaterials Handbook this book provides a comprehensive guide to working with metamaterials using topics presented in a concise review format along with numerous references With contributions from leading researchers this text covers all areas where artificial materials have been developed Each chapter in the text features a concluding summary as well as various cross references to address a wide range of disciplines in a single volume *Active Radar Cross Section Reduction* Hema Singh, Rakesh Mohan Jha, 2015-03-02 This book discusses the active and passive radar cross section RCS estimation and techniques to examine the low observable aerospace platforms It begins with the fundamentals of RCS followed by the dielectric magnetic and metamaterials parameters of the constituent materials and then explains various methods and the emerging trends followed in this area of study The RCS estimation of phased array including the mutual coupling effect is also presented in detail in the book The active RCS reduction is carefully touched upon through the performance of phased arrays sidelobe cancellers and mitigation of multipath effect Providing information on various adaptive algorithms like least mean square LMS recursive least square RLS and weighted least square algorithms the authors also mention the recent developments in the area of embedded antennas conformal load bearing antenna metamaterials and frequency selective surface FSS based RCS reduction *Introduction To Modern Planar Transmission Lines* Anand K. Verma, 2021-06-02 Provides a comprehensive discussion of planar transmission lines and their applications focusing on physical understanding analytical approach and circuit models Planar transmission lines form the core of the modern high frequency communication computer and other related technology This advanced text gives a complete overview of the technology and acts as a comprehensive tool for radio frequency RF engineers that reflects a linear discussion of the subject from fundamentals to more complex arguments Introduction to Modern Planar Transmission Lines Physical Analytical and Circuit Models Approach begins with a discussion of waves on transmission lines and waves in material medium including a large number of illustrative examples from published results After explaining the electrical properties of dielectric media the book moves on to the details of various transmission lines including waveguide microstrip line co planar

waveguide strip line slot line and coupled transmission lines A number of special and advanced topics are discussed in later chapters such as fabrication of planar transmission lines static variational methods for planar transmission lines multilayer planar transmission lines spectral domain analysis resonators periodic lines and surfaces and metamaterial realization and circuit models Emphasizes modeling using physical concepts circuit models closed form expressions and full derivation of a large number of expressions Explains advanced mathematical treatment such as the variation method conformal mapping method and SDA Connects each section of the text with forward and backward cross referencing to aid in personalized self study Introduction to Modern Planar Transmission Lines is an ideal book for senior undergraduate and graduate students of the subject It will also appeal to new researchers with the inter disciplinary background as well as to engineers and professionals in industries utilizing RF microwave technologies 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

Metamaterial-Based Electromagnetic Radiations and Applications Zhaoyun Duan, 2024-11-16 This book delves into the cutting edge research in the field of applied electromagnetism offering an expansive overview of the fundamental aspects of emerging metamaterials and a thorough exploration of two types of novel electromagnetic radiations observed in the metamaterials along with the corresponding devices Encompassing a wide array of topics this book balances the foundational theories with theoretical analyses and experimental validations Its rigorously structured contents are presented in an accessible manner enhanced with illustrative figures and detailed data making it an ideal reference for graduate students and professionals in electronic engineering physical electronics electromagnetic fields and microwave technology radio physics plasma physics accelerator physics optical engineering and so on Tunable Microwave Metamaterial Structures

Matthias Maasch,2016-01-23 This book presents original findings on tunable microwave metamaterial structures and describes the theoretical and practical issues involved in the design of metamaterial devices Special emphasis is given to tunable elements and their advantages in terms of feeding network simplification Different biasing schemes and feeding network topologies are presented together with extensive prototype measurements and simulations The book describes a novel unique solution for beam steering and beam forming applications and thus paves the way for the diffusion of new agile communication system components At the same time it provides readers with an outstanding and timely review of wave propagation in periodic structures tunability of metamaterials and the technological constraints that need to be considered in the design of reconfigurable microwave components *Fourier Modal Method and Its Applications in Computational Nanophotonics* Hwi Kim,Junghyun Park,Byoungcho Lee,2017-12-19 Most available books on computational electrodynamics are focused on FDTD FEM or other specific technique developed in microwave engineering In contrast Fourier Modal Method and Its Applications in Computational Nanophotonics is a complete guide to the principles and detailed mathematics of the up to date Fourier modal method of optical analysis It takes readers through the implementation of MATLAB codes for practical modeling of well known and promising nanophotonic structures The authors also address the limitations of the Fourier modal method Features Provides a comprehensive guide to the principles methods and mathematics of the Fourier modal method Explores the emerging field of computational nanophotonics Presents clear step by step practical explanations on how to use the Fourier modal method for photonics and nanophotonics applications Includes the necessary MATLAB codes enabling readers to construct their own code Using this book graduate students and researchers can learn about nanophotonics simulations through a comprehensive treatment of the mathematics underlying the Fourier modal method and examples of practical problems solved with MATLAB codes **Modern Small Antennas** Kyohei Fujimoto,Hisashi Morishita,2014-01-09 If you are involved in designing and developing small antennas this complete cutting edge guide covers everything you need to know From fundamentals and basic theory to design optimization evaluation measurements and simulation techniques all the essential information is included You will also get many practical examples from a range of wireless systems whilst a glossary is provided to bring you up to speed on the latest terminology A wide variety of small antennas is covered and design and practice steps are described for each type electrically small functionally small physically constrained small and physically small Whether you are a professional in industry a researcher or a graduate student this is your essential guide to small antennas Multidisciplinary Approaches to Neural Computing Anna Esposito,Marcos Faudez-Zanuy,Francesco Carlo Morabito,Eros Pasero,2017-08-28 This book presents a collection of contributions in the field of Artificial Neural Networks ANNs The themes addressed are multidisciplinary in nature and closely connected in their ultimate aim to identify features from dynamic realistic signal exchanges and invariant machine representations that can be exploited to improve the quality of life of their end users Mathematical tools like ANNs are currently exploited in many

scientific domains because of their solid theoretical background and effectiveness in providing solutions to many demanding tasks such as appropriately processing both for extracting features and recognizing mono and bi dimensional dynamic signals solving strong nonlinearities in the data and providing general solutions for deep and fully connected architectures Given the multidisciplinary nature of their use and the interdisciplinary characterization of the problems they are applied to which range from medicine to psychology industrial and social robotics computer vision and signal processing among many others ANNs may provide a basis for redefining the concept of information processing These reflections are supported by theoretical models and applications presented in the chapters of this book This book is of primary importance for a the academic research community b the ICT market c PhD students and early stage researchers d schools hospitals rehabilitation and assisted living centers and e representatives of multimedia industries and standardization bodies

Advances in Electrical and Computer Technologies Thangaparakash Sengodan, Sanjay Misra, Murugappan M, 2025-07-04 This book comprises a selection of papers presented at the Sixth International Conference on Advances in Electrical and Computer Technologies ICAECT 2024 It compiles groundbreaking research and advancements in the field of electrical engineering electronics engineering computer engineering and communication technologies The book touches upon a wide array of topics including smart grids soft computing techniques in power systems smart energy management systems and power electronics under the Electrical Engineering track and biomedical engineering antennas and waveguides image and signal processing and broad band and mobile communication under the Electronics Engineering track With special emphasis on Computer Engineering this book highlights emerging trends in computer vision pattern recognition cloud computing pervasive computing intelligent systems artificial intelligence neural network and fuzzy logic machine learning deep learning data science video processing and wireless communication This is a valuable resource for students researchers and engineers within the field of innovative research and practical applications of electrical and computer technologies

Convergence of Antenna Technologies, Electronics, and AI Hammouch, Zakia, Jamil, Ouazzani, 2024-09-17 In a rapidly evolving technological landscape the integration of antenna technologies electronics and artificial intelligence AI poses a significant challenge the complexity of these converging domains often surpasses the capacity of traditional educational resources and has been an area of research that is largely understudied This creates a challenge for researchers attempting to gain a full understanding of the issue as the lack of cohesive literature that bridges the gaps between these disciplines is significant Researchers engineers and enthusiasts are hampered in their efforts to grasp the full potential of this convergence Convergence of Antenna Technologies Electronics and AI offers a unique perspective to this problem by synthesizing the fundamental principles cutting edge advancements and practical applications of these interconnected domains This book serves as a comprehensive guide for navigating the complexities of this multidisciplinary frontier It provides a cohesive framework that not only elucidates the interconnections between antennas electronics and AI but also empowers readers to

leverage this knowledge in developing transformative innovations

Recent Technical Developments in

Energy-Efficient 5G Mobile Cells Raed A. Abd-Alhameed, Issa Elfergani, Jonathan Rodriguez, 2020-06-17 This book addresses the true innovation in engineering design that may be promoted by blending together models and methodologies from different disciplines and in this book the target was exactly to follow this approach to deliver a new disruptive architecture to deliver these next generation mobile small cell technologies According to this design philosophy the work within this book resides in the intersection of engineering paradigms that includes cooperation network coding and smart energy aware frontends These technologies will not only be considered as individual building blocks but re engineered according to an inter design approach resulting in the enabler for energy efficient femtocell like services on the move The book aims to narrow the gap between the current networking technologies and the foreseen requirements that are targeted at the future development of the 5G mobile and wireless communications networks in terms of the higher networking capacity the ability to support more users the lower cost per bit the enhanced energy efficiency and adaptability to new services and devices for example smart cities and the Internet of things IoT

From Complex Analysis to Operator

Theory: A Panorama Malcolm Brown, Fritz Gesztesy, Pavel Kurasov, Ari Laptev, Barry Simon, Gunter Stolz, Ian Wood, 2023-09-21 This volume is dedicated to the memory of Sergey Naboko 1950 2020 In addition to original research contributions covering the vast areas of interest of Sergey Naboko it includes personal reminiscences and comments on the works and legacy of Sergey Naboko s scientific achievements Areas from complex analysis to operator theory especially spectral theory are covered and the papers will inspire current and future researchers in these areas

FDTD Modeling of Metamaterials: Theory and Applications Yang Hao, Raj Mittra, 2008-10-01 Master powerful new modeling tools that let you quantify and represent metamaterial properties with never before accuracy This first of its kind book brings you up to speed on breakthrough finite difference time domain techniques for modeling metamaterial characteristics and behaviors in electromagnetic systems This practical resource comes complete with sample FDTD scripts to help you pave the way to new metamaterial applications and advances in antenna microwave and optics engineering You get in depth coverage of state of the art FDTD modeling techniques and applications for electromagnetic bandgap EBG structures left handed metamaterials LHMs wire medium metamaterials for optics and other practical metamaterials You find steps for computing dispersion diagrams dealing with material dispersion properties and verifying the left handedness Moreover this comprehensive volume offers guidance for handling the unique properties possessed by metamaterials including how to define material parameters characterize the interface of metamaterial slabs and quantify their spatial as well as frequency dispersion characteristics The book also presents conformal and dispersive FDTD modeling of electromagnetic cloaks perfect lens and plasmonic waveguides as well as other novel antenna microwave and optical applications Over 190 illustrations support key topics throughout the book

Electrodynamics of Metamaterials Andrey K. Sarychev, Vladimir M. Shalaev, 2007 Local

electromagnetic field fluctuations and related enhancement of nonlinear phenomena in metal dielectric composites near the percolation threshold percolation composites have recently become an area of active study because of the many fundamental problems involved and the high potential for various applications It has been recognized recently that local field fluctuations can be especially large in the optical and infrared spectral ranges due to the surface plasmon resonance in metallic granules and their clusters The strong fluctuations of the local electric and magnetic fields result in the enhancement of various optical effects anomalous absorption Rayleigh and Raman scattering generation of the higher harmonic Kerr nonlinearity etc Nonlinear percolation composites are potentially of great practical importance as media with intensity dependent dielectric functions and in particular as nonlinear filters and optical bistable elements The optical response of nonlinear composites can be tuned for example by controlling the volume fraction and morphology of constituents This book presents a new theory of electromagnetic field distribution and nonlinear optical processes in metal dielectric composites The new approach is based on a percolation theory and the fact that the problem of optical excitations in percolation composites mathematically maps the Anderson transition problem in quantum mechanics The theory predicts localization of the excitations surface plasmons in percolation composites and describes in detail the localization pattern that allows one to obtain relatively simple expressions for the enhancement of linear and nonlinear optical responses This theory is supported by recent near field experiments where the surface plasmon localization has been directly observed in the percolating composites in optical and microwave bands

Liquid Crystals Beyond Displays Quan Li, 2012-04-25 The chemistry physics and applications of liquid crystals beyond LCDs Liquid Crystals LCs combine order and mobility on a molecular and supramolecular level But while these remarkable states of matter are most commonly associated with visual display technologies they have important applications for a variety of other fields as well Liquid Crystals Beyond Displays Chemistry Physics and Applications considers these bringing together cutting edge research from some of the most promising areas of LC science Featuring contributions from respected researchers from around the globe this edited volume emphasizes the chemistry physics and applications of LCs in areas such as photovoltaics light emitting diodes field effect transistors lasers molecular motors nanophotonics and biosensors Specific chapters look at magnetic LCs lyotropic chromonic LCs LC based chemical sensors LCs in metamaterials and much more Introducing readers to the fundamentals of LC science through the use of illustrative examples Liquid Crystals Beyond Displays covers not only the most recent research in the myriad areas in which LCs are being utilized but also looks ahead addressing potential future developments Designed for physicists chemists engineers and biologists working in academia or industry as well as graduate students specializing in LC technology this is the first book to consider LC applications across a wide range of fields

Intelligent Reconfigurable Surfaces (IRS) for Prospective 6G Wireless Networks Muhammad Ali Imran, Lina Mohjazi, Lina Bariah, Sami Muhaidat, Tei Jun Cui, Qammer H.

Abbasi, 2023-01-19 Intelligent Reconfigurable Surfaces IRS for Prospective 6G Wireless Networks Authoritative resource

covering preliminary concepts and advanced concerns in the field of IRS and its role in 6G wireless systems Intelligent Reconfigurable Surfaces IRS for Prospective 6G Wireless Networks provides an in depth treatment of the fundamental physics behind reconfigurable metasurfaces also known as intelligent reflecting surfaces IRS and outlines the research roadmap towards their development as a low complexity and energy efficient solution aimed at turning the wireless environment into a software defined entity The text demonstrates IRS from different angles including the underlying physics hardware architecture operating principles and prototype designs It enables readers to grasp the knowledge of the interplay of IRS and state of the art technologies examining the advantages key principles challenges and potential use cases Practically it equips readers with the fundamental knowledge of the operational principles of reconfigurable metasurfaces resulting in its potential applications in various intelligent autonomous future wireless communication technologies To aid in reader comprehension around 50 figures tables illustrations and photographs to comprehensively present the material are also included Edited by a team of highly qualified professionals in the field sample topics covered are as follows Evolution of antenna arrays design introducing the fundamental principles of antenna theory and reviewing the stages of development of the field Beamforming design for IRS assisted communications discussing optimal IRS configuration in conjunction with overviewing novel beamforming designs Reconfigurable metasurfaces from physics to applications discussing the working principles of tunable reconfigurable metasurfaces and their capabilities and functionalities IRS hardware architectures detailing the general hardware architecture of IRS and features related to the IRS s main operational principle Wireless communication systems assisted by IRS discussing channel characterization system integration and aspects related to the performance analysis and network optimization of state of the art wireless applications For students and engineers in wireless communications microwave engineering and radio hardware and design Intelligent Reconfigurable Surfaces IRS for Prospective 6G Wireless Networks serves as an invaluable resource on the subject and is a useful course accompaniment for general Antenna Theory Microwave Engineering Electromagnetics courses

Coupled Structures for Microwave Sensing Ferran Martín, Enrique Bronchalo, 2024-04-26 This book offers a comprehensive and timely review of planar microwave sensors based on coupled structures Gathering chapters contributed by the most authoritative researchers on this topic it presents various strategies for sensor performance optimization using coupled lines directional couplers and coupled resonators either distributed or semi lumped focusing mainly on sensitivity optimization and covering chains of coupled resonators as well The book also reports on analytical methods design formulas sensor validation tests with both simulation and experimental methods describing some relevant practical applications Mainly reflecting the research activity carried out by the different contributors in the last years this book also includes two introductory chapters to help readers who are not very familiar with microwave sensing technologies and coupled structures All in all this book addresses advanced graduate students and researchers involved in microwave and sensor technologies and may be of interest for engineers and

professionals as well working in areas as diverse as wireless sensors and sensor networks biosensing chemical sensing motion control microfluidics Internet of Things IoT and smart systems **Plasmonics and Super-Resolution Imaging**

Zhaowei Liu, 2017-06-26 Plasmonics is an emerging field mainly developed within the past two decades Due to its unique capabilities to manipulate light at deep subwavelength scales plasmonics has been commonly treated as the most important part of nanophotonics Plasmonic assisted optical microscopy techniques especially super resolution microscopy have shown tremendous potential and attracted much attention This book aims to collect cutting edge studies in various optical imaging technologies with advanced performances that are enabled or enhanced by plasmonics The basic working principles development details and potential future direction and perspectives are discussed Edited by Zhaowei Liu a prominent researcher in the field of super resolution microscopy this book will be an excellent reference for anyone in the field of nanophotonics plasmonics and optical microscopy

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