[DOC] Acoustic Metamaterials Tunable Gradient Index Phononic Crystals For Acoustic Wave Manipulation

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State-of-the-Art Materials Science in Belgium 2017-Dirk Poelman 2018-10-17 This book is a printed edition of the Special Issue "State-of-the-Art Materials Science in Belgium 2017" that was published in Materials

Topics On The Nonlinear Dynamics And Acoustics Of Ordered Granular Media-Vakakis Alexander F 2017-03-17 This research monograph provides a brief overview of the authors' research in the area of ordered granular media over the last decade. The exposition covers one-dimensional homogeneous and dimer chains in great detail incorporating novel analytical tools and experimental results supporting the analytical and numerical studies. The proposed analytical tools have since been successfully implemented in studying two-dimensional dimers, granular dimers on on-site perturbations, solitary waves in Toda lattices to name a few. The second part of the monograph dwells on weakly coupled homogeneous granular chains from analytical, numerical and experimental perspective exploring the interesting phenomenon of Landau–Zener tunneling in granular media. The final part of the monograph provides a brief introduction to locally resonant acoustic metamaterials incorporating internal rotators and the resulting energy channeling mechanism in unit-cells and in one- and two-dimensional lattices. The monograph provides a comprehensive overview of the research in this interesting domain. However, this exposition is not all exhaustive with regard to equally exciting research by other researchers across the globe, but we provide an exhaustive list of references for the interested readers to further explore in this direction.

Design Optimisation and Validation of Phononic Crystal Plates for Manipulation of Elastodynamic Guided Waves-Saeid Hedayatrasa 2018-01-09 This thesis proposes novel designs of phononic crystal plates (PhPs) allowing ultra-wide controllability frequency ranges of guided waves at low frequencies, with promising structural and tunability characteristics. It reports on topology optimization of bi-material-layered (1D) PhPs allowing maximized relative bandgap width (RBW) at target filling fractions and

demonstrates multiscale functionality of gradient PhPs. It also introduces a multi-objective topology optimization method for 2D porous PhPs allowing both maximized RBW and in-plane stiffness and addresses the critical role of considering stiffness in designing porous PhPs. The multi-objective topology optimization method is then expanded for designing 2D porous PhPs with deformation induced tunability. A variety of innovative designs are introduced which their maximized broadband RBW is enhanced by, is degraded by or is insensitive to external finite deformation. Not only does this book address the challenges of new topology optimization methods for computational design of phononic crystals; yet, it demonstrated the suitability and applicability of the topological designs by experimental validation. Furthermore, it offers a comprehensive review of the existing optimization-based approaches for the design of finite non-periodic acoustic metamaterial structures, acoustic metamaterial lattice structures and acoustic metamaterials under perfect periodicity.

Zero Index Metamaterials-Nishant Shankhwar 2021-04-20 This book presents the emerging regime of zero refractive index photonics, involving metamaterials that exhibit effectively zero refractive index. Metamaterials are artificial structures whose optical properties can be tailored at will. With metamaterials, intriguing and spellbinding phenomena like negative refraction and electromagnetic cloaking could be realized, which otherwise seem unnatural or straight out of science fiction. Zero index metamaterials are also seen as a means of boosting nonlinear properties and are believed to have strong prospects for being useful in nonlinear optical applications. In summary, this book highlights almost everything currently available on zero index metamaterials and is useful for professionally interested and motivated readers.

Graded Elastic Metamaterials for Energy

Harvesting-Jacopo Maria De Ponti

Magnonics-Abdellatif Akjouj 2019-01-09 Magnonics: Interface Transmission Tutorial Book Series provides up-to-date and concise summaries of the present knowledge of interface transmission science. The series' volumes foster the exchange of ideas among scientists interested in different aspects of interface transmission, with each release designed as a text, a reference, and a source. The series serves as an introduction to advanced graduate students, researchers and scientists with little acquaintance with the subject, and is also useful in keeping specialists informed about general progress in the field. A detailed description of mathematical languages is provided in an appendix, enabling readers to find composite system linear transmission properties. All scientists who contribute to these volume have worked in interface transmission in composite systems over many years, providing a thorough and comprehensive understanding of magnonics. Offers a unique approach to magnonics from an interfacial transmission point-of-view Teaches the modern physics of interface transmission, and in particular, magnonics through composite systems Authored and edited by world-leading experts on Interface Transmission

Phononic Crystals-Abdelkrim Khelif 2015-07-28 This book provides an in-depth analysis as well as an overview of phononic crystals. This book discusses numerous techniques for the analysis of phononic crystals and covers, among other material, sonic and ultrasonic structures, hypersonic planar structures and their characterization, and novel applications of phononic crystals. This is an ideal book for those working with micro and nanotechnology, MEMS (microelectromechanical systems), and acoustic devices. This book also: Presents an introduction to the fundamentals and properties of phononic crystals Covers simulation techniques for the analysis of phononic crystals Discusses sonic and ultrasonic, hypersonic and planar, and three-

dimensional phononic crystal structures Illustrates how phononic crystal structures are being deployed in communication systems and sensing systems

Acoustic Metamaterials and Phononic Crystals-Pierre A. Deymier 2013-01-13 This comprehensive book presents all aspects of acoustic metamaterials and phononic crystals. The emphasis is on acoustic wave propagation phenomena at interfaces such as refraction, especially unusual refractive properties and negative refraction. A thorough discussion of the mechanisms leading to such refractive phenomena includes local resonances in metamaterials and scattering in phononic crystals.

Metamaterials-Tie Jun Cui 2009-10-30 Metamaterials:Theory, Design, and Applications goes beyond left-handed materials (LHM) or negative index materials (NIM) and focuses on recent research activity. Included here is an introduction to optical transformation theory, revealing invisible cloaks, EM concentrators, beam splitters, and new-type antennas, a presentation of general theory on artificial metamaterials composed of periodic structures, coverage of a new rapid design method for inhomogeneous metamaterials, which makes it easier to design a cloak, and new developments including but not limited to experimental verification of invisible cloaks, FDTD simulations of invisible cloaks, the microwave and RF applications of metamaterials, sub-wavelength imaging using anisotropic metamaterials, dynamical metamaterial systems, photonic metamaterials, and magnetic plasmon effects of metamaterials.

Metasurfaces: Physics and Applications-Sergey I. Bozhevolnyi 2018-11-16 This book is a printed edition of the Special Issue "Metasurfaces: Physics and Applications" that was published in Applied Sciences

Gradient-Index Optics-C. Gomez-Reino 2012-12-06 This book provides a comprehensive and thorough treatment on fundamentals and applications of light propagation through inhomogeneous media. The authors present a description of the phenomena, components and technology used in GRIN Optics, and analyze various applications.

Finite Element Investigation of Tunable and Non-reciprocal Elastic Wave Metamaterials-Benjamin Michael Goldsberry 2019 This dissertation studies elastic wave propagation in metamaterials subjected to an externally-applied static or spatiotemporally-varying pre-strain. Elastic metamaterials are media with subwavelength structure that behave as effective materials displaying atypical effective dynamic properties that are used to directly control the propagation of macroscopic waves. One major design limitation of most metamaterial structures is that the dynamic response cannot be altered once the microstructure is manufactured. However, the ability to modify, or tune, wave propagation in the metamaterial with an external pre-strain that induces geometric nonlinearity is highly desirable for numerous applications. Acoustic and elastic metamaterials with time- and space-dependent effective material properties have also recently received significant attention as a means to induce non-reciprocal wave propagation. However, the modulation of effective material properties in space and time using mechanical deformation has been unexplored. Tunable elastic metamaterials that exhibit large effective material property changes under a varying external pre-strain are therefore strong candidates for a non-reciprocal medium. The complex geometry present in unit cells that exhibit large geometric nonlinearity necessitates the development of a numerical technique. In this dissertation, a finite element approach is derived and implemented to study elastic wave propagation in a static pre-strained metamaterial, then generalized to include the

effects of a spatiotemporally-varying pre-strain. A honeycomb structure composed of a doubly-periodic array of curved beams, known as a negative stiffness honeycomb (NSH), is analyzed as a tunable and non-reciprocal elastic metamaterial. It is shown that NSH exhibits significant tunability and a high degree of anisotropic wave behavior when a static pre-strain is imposed. This behavior can be used to guide wave energy in different directions depending on static pre-strain levels. In addition, it is shown that partial band gaps exist where only longitudinal waves propagate. The NSH therefore behaves as a meta-fluid, or pentamode metamaterial, which may be of use for applications of transformation elastodynamics such as cloaking and gradient index lens devices. A negative stiffness chain, a quasi-one-dimensional representation of NSH, is also shown as a case example of a non-reciprocal medium. It is shown in this work that this structure displays a high degree of non-reciprocity for a small amount of modulation pre-strain. The utility of the finite element approach is further demonstrated by investigating the effects of chiral geometric asymmetry to enhance the non-reciprocal behavior of elastic wave propagation in NSH

Photon Processing in Microelectronics and Photonics IV- 2005

Acoustic Metamaterials-Richard V. Craster 2012-12-06 About the book: This book is the first comprehensive review on acoustic metamaterials; novel materials which can manipulate sound waves in surprising ways, which include collimation, focusing, cloaking, sonic screening and extraordinary transmission. It covers both experimental and theoretical aspects of acoustic and elastic waves propagating in structured composites, with a focus on effective properties associated with negative refraction, lensing and cloaking. Most related books in the field address electromagnetic metamaterials and focus on

numerical methods, and little (or no) experimental section. Each chapter will be authored by an acknowledged expert, amongst the topics covered will be experimental results on non-destructive imaging, cloaking by surface water waves, flexural waves in thin plates. Applications in medical ultrasound imaging and modeling of metamaterials will be emphasized too. The book can serve as a reference for researchers who wish to build a solid foundation of wave propagation in this class of novel materials.

Electromagnetic Metamaterials-Christophe Caloz 2005-11-22 Electromagnetic metamaterials-from fundamental physics to advanced engineering applications This book presents an original generalized transmission line approach associated with non-resonant structures that exhibit larger bandwidths, lower loss, and higher design flexibility. It is based on the novel concept of composite right/left-handed (CRLH) transmission line metamaterials (MMs), which has led to the development of novel guided-wave, radiated-wave, and refracted-wave devices and structures. The authors introduced this powerful new concept and are therefore able to offer readers deep insight into the fundamental physics needed to fully grasp the technology. Moreover, they provide a host of practical engineering applications. The book begins with an introductory chapter that places resonant type and transmission line metamaterials in historical perspective. The next six chapters give readers a solid foundation in the fundamentals and practical applications: Fundamentals of LH MMs describes the fundamental physics and exotic properties of left-handed metamaterials TL Theory of MMs establishes the foundations of CRLH structures in three progressive steps: ideal transmission line, LC network, and real distributed structure Two-Dimensional MMs develops both a transmission matrix method and a transmission line method to address the problem of finite-size 2D metamaterials excited by arbitrary sources Guided-Wave Applications and Radiated-Wave

Applications present a number of groundbreaking applications developed by the authors The Future of MMs sets forth an expert view on future challenges and prospects This engineering approach to metamaterials paves the way for a new generation of microwave and photonic devices and structures. It is recommended for electrical engineers, as well as physicists and optical engineers, with an interest in practical negative refractive index structures and materials.

Propagation of Sound in Porous Media-J.F. Allard 2012-12-06 This book has grown out of the research activities of the author in the fields of sound propagation in porous media and modelling of acoustic materials. It is assumed that the reader has a background of advanced calculus, including an introduction to differential equations, complex variables and matrix algebra. A prior exposure to theory of elasticity would be advantageous. Chapters 1-3 deal with sound propagation of plane waves in solids and fluids, and the topics of acoustic impedance and reflection coefficient are given a large emphasis. The topic of flow resistivity is presented in Chapter 2. Chapter 4 deals with sound propagation in porous materials having cylindrical pores. The topics of effective density, and of tortuosity, are presented. The thermal exchanges between the frame and the fluid, and the behaviour of the bulk modulus of the fluid, are described in this simple context. Chapter 5 is concerned with sound propagation in other porous materials, and the recent notions of characteristic dimensions, which describe thermal exchanges and the viscous forces at high frequencies, are introduced. In Chapter 6, the case of porous media having an elastic frame is considered in the context of Biot theory, where new topics described in Chapter 5 have been included.

Waves in Metamaterials-Laszlo Solymar 2009 Metamaterials is a young subject born in the 21st century. It is concerned with artificial materials

which can have electrical and magnetic properties difficult or impossible to find in nature. The building blocks in most cases are resonant elements much smaller than the wavelength of the electromagnetic wave. The book offers a comprehensive treatment of all aspects of research in this field at a level that should appeal to final year undergraduates in physics or in electrical and electronic engineering. The mathematics is kept at a minimum; the aim is to explain the physics in simple terms and enumerate the major advances. It can be profitably read by graduate and post-graduate students in order to find out what has been done in the field outside their speciality, and by experts who may gain new insight about the inter-relationship of the physical phenomena involved.

The Applied Dynamics Of Ocean Surface Waves-Mei Chiang C 1989-07-01 The aim of this book is to present selected theoretical topics on ocean wave dynamics, including basic principles and applications in coastal and offshore engineering, all from the deterministic point of view. The bulk of the material deals with the linearized theory.

Metamaterials with Negative Parameters-Ricardo Marqués 2011-09-20 The first general textbook to offer a complete overview ofmetamaterial theory and its microwave applications Metamaterials with Negative Parameters represents theonly unified treatment of metamaterials available in one convenientbook. Devoted mainly to metamaterials that can be characterized bya negative effective permittivity and/or permeability, the bookincludes a wide overview of the most important topics, scientificfundamentals, and technical applications of metamaterials. Chapter coverage includes: the electrodynamics of left-handedmedia, synthesis of bulk metamaterials, synthesis of metamaterialsin planar technology, microwave applications of metamaterialconcepts,

and advanced and related topics, including SRR-andCSRR-based admittance surfaces, magneto- and electro-inductivewaves, and sub-diffraction imaging devices. A list of problems andreferences is included at the end of each chapter, and abibliography offers a complete, up-to-daterepresentation of thecurrent state of the art in metamaterials. Geared toward students and professionals alike, Metamaterialswith Negative Parameters is an ideal textbook for postgraduatecourses and also serves as a valuable introductory reference forscientists and RF/microwave engineers.

Physics of Negative Refraction and Negative Index Materials-Clifford M. Krowne 2007-08-14 This book deals with the subject of optical and electronic negative refraction (NR) and negative index materials NIM). Diverse approaches for achieving NR and NIM are covered, such as using photonic crystals, phononic crystals, split-ring resonators (SRRs) and continuous media, focusing of waves, guided-wave behavior, and nonlinear effects. It is perhaps the most comprehensive book on the new class of negative refraction materials, covering all aspects of negative refraction and negative index materials.

Elastic Waves in Solids I-DANIEL ROYER 1999-11-29 Elastic waves possess some remarkable properties and have become ever more important to applications in fields such as telecommunications (signal processing), medicine (echography), and metallurgy (non-destructive testing). These volumes serve as a bridge between basic books on wave phenomena and more technically oriented books on specific applications of wave phenomena. The first volume studies the different mechanisms of propagation in isotropic and anisotropic media. The second volume describes the generation and applications of free and guided waves.

Theoretical Acoustics-Philip McCord Morse 1986 This volume, available for the first time in

paperback, is a standard work on the physical aspects of acoustics. Starting from first principles, the authors have successfully produced a unified and thorough treatment of the subjects of generation, propagation, absorption, reflection, and scattering of compressional waves in fluids, progressing to such topics as moving sound sources, turbulence, and wave-induced vibration of structures. Material is included on viscous and thermal effects, on the acoustics of moving media, on plasma acoustics, on nonlinear effects, and on the interaction between light and sound. Problems, with answers in many cases, are given at the end of each chapter. They contain extensions to further applications, thus enhancing the reference value of the book. Many of the examples worked out in the text and in the problem solutions were not previously published. Anyone familiar with calculus and vector analysis should be able to understand the mathematical techniques used here.

Hyperbolic Metamaterials-Igor I Smolyaninov 2018-03-23 Hyperbolic metamaterials were originally introduced to overcome the diffraction limit of optical imaging. Soon thereafter it was realized that hyperbolic metamaterials demonstrate a number of novel phenomena resulting from the broadband singular behavior of their density of photonic states. These novel phenomena and applications include super resolution imaging, new stealth technologies, enhanced quantum-electrodynamic effects, thermal hyperconductivity, superconductivity, and interesting gravitation theory analogs. Here I review typical material systems, which exhibit hyperbolic behavior and outline important new applications of hyperbolic metamaterials, such as imaging experiments with plasmonic hyperbolic metamaterials and novel VCSEL geometries, in which the Bragg mirrors may be engineered in such a way that they exhibit hyperbolic properties in the long wavelength infrared range, so that they may be used to efficiently remove excess heat from the laser cavity. I will also discuss potential applications of self-assembled

photonic hypercrystals. This system bypasses 3D nanofabrication issues, which typically limit hyperbolic metamaterial applications. Photonic hypercrystals combine the most interesting features of hyperbolic metamaterials and photonic crystals.

Functional Metamaterials and Metadevices-Xingcun Colin Tong 2017-09-14 To meet the demands of students, scientists and engineers for a systematic reference source, this book introduces, comprehensively and in a single voice, research and development progress in emerging metamaterials and derived functional metadevices. Coverage includes electromagnetic, optical, acoustic, thermal, and mechanical metamaterials and related metadevices. Metamaterials are artificially engineered composites with designed properties beyond those attainable in nature and with applications in all aspects of materials science. From spatially tailored dielectrics to tunable, dynamic materials properties and unique nonlinear behavior, metamaterial systems have demonstrated tremendous flexibility and functionality in electromagnetic, optical, acoustic, thermal, and mechanical engineering. Furthermore, the field of metamaterials has been extended from the mere pursuit of various exotic properties towards the realization of practical devices, leading to the concepts of dynamically-reconfigurable metadevices and functional metasurfaces. The book explores the fundamental physics, design, and engineering aspects, as well as the full array of state-of-the-art applications to electronics, telecommunications, antennas, and energy harvesting. Future challenges and potential in regard to design, modeling and fabrication are also addressed.

Dynamics of Heterogeneous Materials-Vitali Nesterenko 2013-03-09 This monograph deals with the behavior of essentially nonlinear heterogeneous materials in processes occurring under intense dynamic loading, where microstructural effects play the main role. This

book is not an introduction to the dynamic behavior of materials, and general information available in other books is not included. The material herein is presented in a form I hope will make it useful not only for researchers working in related areas, but also for graduate students. I used it successfully to teach a course on the dynamic behavior of materials at the University of California, San Diego. Another course well suited to the topic may be nonlinear wave dynamics in solids, especially the part on strongly nonlinear waves. About 100 problems presented in the book at the end of each chapter will help the reader to develop a deeper understanding of the subject. I tried to follow a few rules in writing this book: (1) To focus on strongly nonlinear phenomena where there is no small parameter with respect to the amplitude of disturbance, including solitons, shock waves, and localized shear. (2) To take into account phenomena sensitive to materials structure, where typical space scale of material parameters (particle size, cell size) are presented in the models or are variable in experimental research.

Transformation Electromagnetics and Metamaterials-Douglas H. Werner 2013-07-19
Transformation electromagnetics is a systematic design technique for optical and electromagnetic devices that enables novel wave-material interaction properties. The associated metamaterials technology for designing and realizing optical and electromagnetic devices can control the behavior of light and electromagnetic waves in ways that have not been conventionally possible. The technique is credited with numerous novel device designs, most notably the invisibility cloaks, perfect lenses and a host of other remarkable devices. Transformation Electromagnetics and Metamaterials: Fundamental Principles and Applications presents a comprehensive treatment of the rapidly growing area of transformation electromagnetics and related metamaterial technology with contributions on the subject provided by a collection of leading experts from around the world. On the theoretical side, the

following questions will be addressed: “Where does transformation electromagnetics come from?,” “What are the general material properties for different classes of coordinate transformations?,” “What are the limitations and challenges of device realizations?,” and “What theoretical tools are available to make the coordinate transformation-based designs more amenable to fabrication using currently available techniques?” The comprehensive theoretical treatment will be complemented by device designs and/or realizations in various frequency regimes and applications including acoustic, radio frequency, terahertz, infrared, and the visible spectrum. The applications encompass invisibility cloaks, gradient-index lenses in the microwave and optical regimes, negative-index superlenses for sub-wavelength resolution focusing, flat lenses that produce highly collimated beams from an embedded antenna or optical source, beam concentrators, polarization rotators and splitters, perfect electromagnetic absorbers, and many others. This book will serve as the authoritative reference for students and researchers alike to the fast-evolving and exciting research area of transformation electromagnetics/optics, its application to the design of revolutionary new devices, and their associated metamaterial realizations.

Acoustic Absorbers and Diffusers-Trevor J. Cox 2009-01-26 Absorbers and diffusers are two of the main design tools for altering the acoustic conditions of rooms, semi-enclosed spaces and the outdoor environment. Their correct use is important for delivering high quality acoustics. Unique and authoritative, this book decribes how to effectively measure, model, design and apply diffusers and absorbers. It is a resource for new and experienced acousticians, seeking an understanding of the evolution, characteristics and application of modern diffusers. Absorption is a more established technology and so the book blends traditional designs with modern developments. The book covers practical and theoretical aspects of absorbers and diffusers and is well illustrated with examples of

installations and case studies. This new edition brings Acoustic Absorbers and Diffusers up-to-date with current research, practice and standards. New developments in measurement, materials, theory and practice since the first edition (published in 2004) are included. The sections on absorbers are extended to include more about noise control.

Acoustics of Ducts and Mufflers With Application to Exhaust and Ventilation System Design-M. L. Munjal 1987-05-08 An analysis of the major topics in sound suppression and noise control for the analysis and design of acoustical mufflers, air conditioning and ventilation duct work. Both fundamentals and the latest technology are discussed, with an emphasis on applications.

Applications of Metamaterials-Filippo Capolino 2017-12-19 This book uses the first volume's exploration of theory, basic properties, and modeling topics to develop readers' understanding of applications and devices that are based on artificial materials. It explores a wide range of applications in fields including electronics, telecommunications, sensing, medical instrumentation, and data storage. The text also includes a practical user's guide and explores key areas in which artificial materials have developed. It includes experts' perspectives on current and future applications of metamaterials, to present a well-rounded view on state-of-the-art technologies.

Acoustics of Ducts and Mufflers-M. L. Munjal 2014-02-04 Fully updated second edition of the premier reference book onmuffler and lined duct acoustical performance Engine exhaust noise pollutes the street environment andventilation fan noise enters dwellings along with fresh air. Peoplehave become conscious of their working environment. Governments ofmost countries have responded to popular demand with mandatoryrestrictions on sound emitted by

automotive engines, and a thoroughknowledge of acoustics of ducts and mufflers is needed for thedesign of efficient muffler configurations. This fully updatedSecond Edition of Acoustics of Ducts and Mufflers deals withpropagation, reflection and dissipation/absorption of sound alongducts/pipes/tubes, area discontinuities, perforated elements andabsorptive linings that constitute the present-day mufflers andsilencers designed to control noise of exhaust and intake systemsof automotive engines, diesel-generator sets, compressors and HVACsystems. It includes equations, figures, tables, references, and solvedexamples and unsolved exercises with answers, so it can be used asa text book as well as a reference book. It also offers acomplete presentation and analysis of the major topics in soundsuppression and noise control for the analysis and design ofacoustical mufflers, air conditioning and ventilation duct work.Both the fundamentals and the latest technology are discussed, withan emphasis on applications. Deals with reactive mufflers,dissipative silencers, the frequency-domain approach, and thetime-domain approach. Fully updated second edition of the premier reference book onmuffler and lined duct acoustical performance, in one completevolume Presents original new research on topics including bafflesilencers and louvers, 3D analytical techniques, and flow-acousticanalysis of multiply-connected perforated-element mufflers Includes a general design procedure to help muffler designersin the automotive industry, exhaust noise being a major componentof automobile and traffic noise pollution Written by an expert with four decades' experience inteaching to graduate students, publishing extensively in reputedinternational journals, and consulting with industry for noisecontrol as well as designing for quietness

Active Sound Absorption-Claude J. Mazzola 1993-01-01 This NEW BOOK by Claude J. Mazzola introduces a novel approach to the theory of active sound absorption. The result of more than five years' work, it is now available to the general public. PARTIAL CONTENTS: *

General Theory and Control Law * Spherical Black Hole * Cylindrical Black Hole * General Feedback Strategy * Feedback Strategy on a Vibrating Active Plate * Reflection Coefficient of an Active Plate * Reflection Coefficient of an Active Resonant Plate * Absorption of an Oblique Incident Wave on an Active Plate * Duality of the Max Absorption Control Law and the Radiation Admittance Law * Absorption Cross Section of an Active Sphere * Active Infinite Cylinder * Absorption Cross Section of an Active Circular Piston.

Theory and Design of Acoustic Metamaterials-Perngjin Frank Pai 2015-08-01 This book presents the most recent theoretical developments and numerical/experimental validations of new metamaterials and phononic crystals for the broadband absorption of elastic waves and vibrations in structures. These nine chapters explore many aspects of phononic crystals and acoustic/elastic metamaterials, including sound attenuation/absorption, extraordinary transmission, wave broadband mitigation, wave steering, cloaking via the transformation method, optimization of phononic crystals, and active acoustic metamaterials.

Metamaterials-Nader Engheta 2006-06-23 Leading experts explore the exotic properties and excitingapplications of electromagnetic metamaterials Metamaterials: Physics and Engineering Explorations givesreaders a clearly written, richly illustrated introduction to themost recent research developments in the area of electromagneticmetamaterials. It explores the fundamental physics, the designs,and the engineering aspects, and points to a myriad of excitingpotential applications. The editors, acknowledged leaders in thefield of metamaterials, have invited a group of leading researchersto present both their own findings and the full array ofstate-of-the-art applications for antennas, waveguides, devices,and components. Following a brief overview of the history of artificialmaterials, the publication

divides its coverage into two majorclasses of metamaterials. The first half of the publicationexamines effective media with single (SNG) and double negative(DNG) properties; the second half examines electromagnetic band gap(EBG) structures. The book further divides each of these classesinto their three-dimensional (3D volumetric) and two-dimensional(2D planar or surface) realizations. Examples of each type ofmetamaterial are presented, and their known and anticipatedproperties are reviewed. Collectively, Metamaterials: Physics and EngineeringExplorations presents a review of recent research advancesassociated with a highly diverse set of electromagneticmetamaterials. Its multifaceted approach offers readers acombination of theoretical, numerical, and experimentalperspectives for a better understanding of their behaviors andtheir potentialapplications in components, devices, and systems.Extensive reference lists provide opportunities to exploreindividual topics and classes of metamaterials in greaterdepth. With full-color illustrations throughout to clarify concepts andhelp visualize actual results, this book provides a dynamic,user-friendly resource for students, engineers, physicists, andother researchers in the areas of electromagnetic materials,microwaves, millimeter waves, and optics. It equips newcomers witha basic understanding of metamaterials and their potentialapplications. Advanced researchers will benefit fromthought-provoking perspectives that will deepen their knowledge andlead them to new areas of investigation.

Wave Propagation in Elastic Solids-J. D. Achenbach 2016-01-21 Wave Propagation in Elastic Solids focuses on linearized theory and perfectly elastic media. This book discusses the one-dimensional motion of an elastic continuum; linearized theory of elasticity; elastodynamic theory; and elastic waves in an unbounded medium. The plane harmonic waves in elastic half-spaces; harmonic waves in waveguides; and forced motions of a half-space are also elaborated. This text likewise covers the

transient waves in layers and rods; diffraction of waves by a slit; and thermal and viscoelastic effects, and effects of anisotropy and nonlinearity. Other topics include the summary of equations in rectangular coordinates, time-harmonic plane waves, approximate theories for rods, and transient in-plane motion of a layer. This publication is a good source for students and researchers conducting work on the wave propagation in elastic solids.

Tutorials in Metamaterials-Mikhail A. Noginov 2016-04-19 From science fiction to science laboratories Discover the State of the Art in Photonic Metamaterials Metamaterials—composite media with unusual optical properties—have revolutionized the landscape of optical science and engineering over the past decades. Metamaterials have transformed science-fiction-like concepts of superresolution imaging and optical cloaking to the realm of science laboratories, and further promise to transform these into the realm of our everyday life. This new era of optical metamaterials calls for the development of experimental and theoretical methods capable of analyzing optical behavior on the multitude of scales—from the nanometer scale of individual inhomogeneity, to the micrometer level and the larger scale of metamaterials-based devices. Tutorials in Metamaterials offers a collection of chapters that were designed as self-contained tutorials describing photonic metamaterials and the state of the art in metamaterials research. Chapters cover: Linear and nonlinear properties of photonic metamaterials and their potential applications Fabrication techniques for optical metamaterials, ranging from electron-beam lithography, focused ion beam milling, and nanoimprint lithography to direct laser writing Recent achievements in metatamerial research at visible, IR, and microwave frequencies Novel applications of metamaterials for light guiding, steering, and refraction Efforts to compensate and eliminate optical loss by introducing optical gain into the metamaterial matrix A comprehensive overview of metamaterial

photonics, this reference is suitable for graduate students as well as physicists and engineers interested in entering this dynamic new field.

Mathematical Theory of Optics-Rudolf Karl Luneburg 1966

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.

Imaging Phonons-James P. Wolfe 2005-11-10 A highly illustrated introduction to the physics of acoustic phonons - for researchers.

Diffractive Optics and Nanophotonics-Igor Minin 2015-10-29 In this book the authors present several examples of techniques used to overcome the Abby diffraction limit using flat and 3D diffractive optical elements, photonic crystal lenses, photonic jets, and surface plasmon diffractive optics. The structures discussed can be used in the microwave and THz range and also as scaled models for optical frequencies. Such nano-optical microlenses can be integrated, for example, into existing semiconductor heterostructure platforms for next-generation optoelectronic applications. Chapter 1 considers flat diffractive lenses and innovative 3D radiating structures including a conical millimeter-wave

Fresnel zone plate (FZP) lens proposed for subwavelength focusing. In chapter 2 the subwavelength focusing properties of diffractive photonic crystal lenses are considered and it is shown that at least three different types of photonic crystal lens are possible. With the aim of achieving subwavelength focusing, in chapter 3 an alternative mechanism to produce photonic jets at Terahertz frequencies (terajets) using 3D dielectric particles of arbitrary size (cuboids) is considered. A scheme to create a 2D “teraknife” using dielectric rods is also discussed. In the final chapter the successful adaptation of free-space 3D binary phase-reversal conical FZPs for operation on surface plasmon-polariton (SPP) waves demonstrates that analogues of Fourier diffractive components can be developed for in-plane SPP 3D optics. Review ing theory, modelling and experiment, this book will be a valuable resource for students and researchers working on nanophotonics and sub-wavelength focusing and imaging.

Numerical Methods in Photonics-Andrei V. Lavrinenko 2018-09-03 Simulation and modeling using numerical methods is one of the key instruments in any scientific work. In the field of photonics, a wide range of numerical methods are used for studying both fundamental optics and applications such as design, development, and optimization of photonic components. Modeling is key for developing improved photonic devices and reducing development time and cost. Choosing the appropriate computational method for a photonics modeling problem requires a clear understanding of the pros and cons of the available numerical methods. Numerical Methods in Photonics presents six of the most frequently used methods: FDTD, FDFD, 1+1D nonlinear propagation, modal method, Green’s function, and FEM. After an introductory chapter outlining the basics of Maxwell’s equations, the book includes self-contained chapters that focus on each of the methods. Each method is accompanied by a review of the mathematical principles in which it is based, along with sample

scripts, illustrative examples of characteristic problem solving, and exercises. MATLAB® is used throughout the text. This book provides a solid basis to practice writing your own codes. The theoretical formulation is complemented by sets of exercises, which allow you to grasp the essence of the modeling tools.