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Modern Theory of Gratings

Resonant Scattering: Analysis Techniques
and Phenomena

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quantum and solid state oscillators open quasi optical dispersive resonators and power compressors slow wave structures and patter forming systems accelerators and spectrometer that is still far from being a complete list of devices exploiting the amazing ability of periodic structures to perform controlled frequency spatial and polarization selection of signals Diffraction gratings used to be and still are one of the most popular objects of analysis in electromagnetic theory The further development of the theory of diffraction gratings in spite of considerable achievements is still very important presently The requirements of applied optics and microwave engineering present the theory of diffraction gratings with many new problems which force us to search for new methods and tools for their resolution Just in such way there appeared recently new fields connected with the analysis synthesis and definition of equivalent parameters of artificial materials layers and coatings having periodic structure and possessing features which can be found in natural materials only in extraordinary or exceptional situations In this book the authors present results of the electromagnetic theory of diffraction gratings that may constitute the base of further development of this theory which can meet the challenges provided by the most recent requirements of fundamental and applied science The following issues will be considered in the book Authentic methods of analytical regularization that perfectly match the requirements of analysis of resonant scattering of electromagnetic waves by gratings Spectral theory of gratings providing a reliable foundation for the analysis of spatial frequency transformations of electromagnetic fields occurring in open periodic resonators and waveguides Parametric Fourier method and C method that are oriented towards the efficient numerical analysis of transformation properties of fields in the case of arbitrary profile periodic boundary between dielectric media and multilayered conformal arrays Rigorous methods for analysis of transient processes and time spatial transformations of electromagnetic waves in resonant situations based on development and incorporation in standard numerical routines of FDTD of so called explicit absorbing boundary conditions New approaches to the solution of homogenization problems the key problem arising in construction of metamaterials and meta surfaces New physical results about the resonance scattering of pulse and monochromatic waves by periodic structures including structures with chiral or left handed materials Methods and the results of the solutions of several actual applied problems of analysis and synthesis of pattern creating gratings power compressors resonance radiators of high capacity short radio pulses open electromagnetic structures for the systems of resonant quasi optics and absorbing coatings   Gratings: Theory and Numeric Applications ,   Adventures in Contemporary Electromagnetic Theory Tom G. Mackay,Akhlesh Lakhtakia,2023-07-31 This book describes the most recent advances in electromagnetic theory motivated and partly informed by developments in engineering science and nanotechnology The collection of chapters provided in this edited book authored by leading experts in the field offers a bird s eye view of recent progress in electromagnetic theory spanning a wide range of topics of current interest ranging from fundamental issues to applications   Solutions and Applications of Scattering, Propagation, Radiation and Emission of Electromagnetic Waves Ahmed Kishk,2012-11-14 In this book a wide range of

different topics related to analytical as well as numerical solutions of problems related to scattering propagation radiation and emission in different medium are discussed Design of several devices and their measurements aspects are introduced Topics related to microwave region as well as Terahertz and quasi optical region are considered Bi isotropic metamaterial in optical region is investigated Interesting numerical methods in frequency domain and time domain for scattering radiation forward as well as reverse problems and microwave imaging are summarized Therefore the book will satisfy different tastes for engineers interested for example in microwave engineering antennas and numerical methods   Plasmonics Stefan Enoch,Nicolas Bonod,2012-06-30 This book deals with all aspects of plasmonics basics applications and advanced developments Plasmonics is an emerging field of research dedicated to the resonant interaction of light with metals The light matter interaction is strongly enhanced at a nanometer scale which sparks a keen interest of a wide scientific community and offers promising applications in pharmacology solar energy nanocircuitry or also light sources The major breakthroughs of this field of research originate from the recent advances in nanotechnology imaging and numerical modelling The book is divided into three main parts extended surface plasmons polaritons propagating on metallic surfaces surface plasmons localized on metallic particles imaging and nanofabrication techniques The reader will find in the book Principles and recent advances of plasmonics a complete description of the physics of surface plasmons a historical survey with emphasize on the emblematic topic of Wood s anomaly an overview of modern applications of molecular plasmonics and an extensive description of imaging and fabrications techniques   Electromagnetic Waves in Complex Systems Yuriy Sirenko,Lyudmyla Velychko,2016-05-24 This book gives guidance to solve problems in electromagnetics providing both examples of solving serious research problems as well as the original results to encourage further investigations The book contains seven chapters on various aspects of resonant wave scattering each solving one original problem All of them are unified by the authors desire to show advantages of rigorous approaches at all stages from the formulation of a problem and the selection of a method to the interpretation of results The book reveals a range of problems associated with wave propagation and scattering in natural and artificial environments or with the design of antennas elements The authors invoke both theoretical analytical and numerical and experimental techniques for handling the problems Attention is given to mathematical simulations computational efficiency and physical interpretation of the experimental results The book is written for students graduate students and young researchers   *More Adventures in Contemporary Electromagnetic Theory* Francesco Chiadini,Vincenzo Fiumara,2025-05-10 This book describes some recent advances in electromagnetic theory motivated and partly informed by developments in engineering science and nanotechnology The collection of chapters provided in this edited book authored by leading experts in the field offers a bird s eye view of recent progress in electromagnetic theory spanning a wide range of topics of current interest ranging from fundamental issues to applications   **Resonant Scattering and Generation of Waves** Lutz Angermann,Vasyl V. Yatsyk,2018-07-26 This monograph deals with theoretical

aspects and numerical simulations of the interaction of electromagnetic fields with nonlinear materials It focuses in particular on media with nonlinear polarization properties It addresses the direct problem of nonlinear Electrodynamics that is to understand the nonlinear behavior in the induced polarization and to analyze or even to control its impact on the propagation of electromagnetic fields in the matter The book gives a comprehensive presentation of the results obtained by the authors during the last decade and put those findings in a broader unified context and extends them in several directions It is divided into eight chapters and three appendices Chapter 1 starts from the Maxwell s equations and develops a wave propagation theory in plate like media with nonlinear polarizability In chapter 2 a theoretical framework in terms of weak solutions is given in order to prove the existence and uniqueness of a solution of the semilinear boundary value problem derived in the first chapter Chapter 3 presents a different approach to the solvability theory of the reduced frequency domain model Here the boundary value problem is reduced to finding solutions of a system of one dimensional nonlinear Hammerstein integral equations Chapter 4 describes an approach to the spectral analysis of the linearized system of integral equations Chapters 5 and 6 are devoted to the numerical approximation of the solutions of the corresponding mathematical models Chapter 7 contains detailed descriptions discussions and evaluations of the numerical experiments Finally chapter 8 gives a summary of the results and an outlook for future work   **Scattering Theory for Diffraction Gratings** Calvin H. Wilcox,2012-12-06 The scattering of acoustic and electromagnetic waves by periodic sur faces plays a role in many areas of applied physics and engineering Opti cal diffraction gratings date from the nineteenth century and are still widely used by spectroscopists More recently diffraction gratings have been used as coupling devices for optical waveguides Trains of surface waves on the oceans are natural diffraction gratings which influence the scattering of electromagnetic waves and underwater sound Similarly the surface of a crystal acts as a diffraction grating for the scattering of atomic beams This list of natural and artificial diffraction gratings could easily be extended The purpose of this monograph is to develop from first principles a theory of the scattering of acoustic and electromagnetic waves by periodic surfaces In physical terms the scattering of both time harmonic and transient fields is analyzed The corresponding mathematical model leads to the study of boundary value problems for the Helmholtz and d Alembert wave equations in plane domains bounded by periodic curves In the formal ism adopted here these problems are intimately related to the spectral analysis of the Laplace operator acting in a Hilbert space of functions defined in the domain adjacent to the grating   Lasers Hans Joachim Eichler,Jürgen Eichler,Oliver Lux,2018-11-19 This book provides a comprehensive overview of laser sources and their applications in various fields of science industry and technology After an introduction to the basics of laser physics different laser types and materials for lasers are summarized in the context of a historical survey outlining the evolution of the laser over the past five decades This includes amongst other aspects gas lasers excimer lasers the wide range of solid state and semiconductor lasers and femtosecond and other pulsed lasers where particular attention is paid to high power sources Subsequent

chapters address related topics such as laser modulation and nonlinear frequency conversion In closing the enormous importance of the laser is demonstrated by highlighting its current applications in everyday life and its potential for future developments Typical applications in advanced material processing medicine and biophotonics as well as plasma and X ray generation for nanoscale lithography are discussed The book provides broad and topical coverage of laser photonics and opto electronics focusing on significant findings and recent advances rather than in depth theoretical studies Thus it is intended not only for university students and engineers but also for scientists and professionals applying lasers in biomedicine material processing and everyday consumer products Further it represents essential reading for engineers using or developing high power lasers for scientific or industrial applications *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 *Graphene Optics* Ricardo A Depine,2017-01-01 This book is a rigorous but concise macroscopic description of the interaction between electromagnetic radiation and structures containing graphene sheets two dimensional structures It presents canonical problems with translational invariant geometries in which the solution of the original vectorial problem can be reduced to the treatment of two scalar problems corresponding to two basic polarization modes The book includes computational problems and makes use of the Python programming language to make numerical calculations accessible to any science student Many figures within are accompanied by Python scripts **Photonic Crystals** Jean-Michel Lourtioz,Henri Benisty,Vincent Berger,Jean-Michel Gerard,Daniel Maystre,Alexei Tchelnokov,2008-03-19 Just like the periodical crystalline potential in solid state crystals determines their properties for the conduction of electrons the periodical structuring of photonic crystals leads to envisioning the possibility of achieving a control of the photon flux in dielectric and metallic materials The use of photonic crystals as a cage for storing filtering or guiding light at the wavelength scale thus paves the way to the realisation of optical and optoelectronic devices with ultimate properties and dimensions This should contribute toward meeting the demands for a greater miniaturisation that the processing of an ever increasing number of data requires Photonic Crystals intends to provide students and researchers from different fields with the theoretical background needed for modelling photonic crystals and their optical properties while at the same time presenting the large variety of devices from optics to microwaves where photonic crystals have found applications As such it aims at building bridges between optics electromagnetism and solid state physics This book was written by six specialists of nanophotonics and was coordinated by Jean Michel Lourtioz head of the Institut d lectronique Fondamentale in Orsay and coordinator of the French Research Network in Nanophotonics

Spectral Theory and Excitation of Open Structures V. P. Shestopalov,1996 Open resonators open waveguides and open diffraction gratings are used extensively in modern millimetre and submillemetre technology spectroscopy and radio engineering In this book the physical processes in these open electromagnetic structures are analysed using a specially constructed spectral theory   Some Contemporary Advances in Physics Karl Kelchner Darrow,1923   *An Introduction to the Theory of Optics* Sir Arthur Schuster,1909   **Proceedings of the Eleventh National Conference on Communications** ,2005   **Advances in Photochemistry, Volume 27** Douglas C. Neckers,William S. Jenks,Thomas Wolff,2002-10-09 More than a simple survey of the current literature Advances in Photochemistry offers critical evaluations written by internationally recognized experts These pioneering scientists offer unique and varied points of view of the existing data Their articles are challenging as well as provocative and are intended to stimulate discussion promote further research and encourage new developments in the field

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