<<光学中的数学模型>>

图书基本信息

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作者：（美）包刚　等著

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内容概要

this volume addresses recent developments in mathematical modeling in three areas of optical science: diffractive optics, photonic band gap structures, and waveguides. particular emphasis is on the formulation of mathematical models and the design and analysis of new computational approaches. the book contains cutting-edge discourses on areas motivated by emerging technology in optics that provide significant challenges and opportunities for applied mathematicians, researchers, and engineers.

each of the three topics is presented through a series of survey papers to provide a broad overview focusing on the mathematical models. chapters are organized to present model problems, physical principles, mathematical and computational approaches, and engineering applications corresponding to each of the three areas. while some of the subject matter is classical, the topics presented are new and represent the latest developments in their respective fields.

this book is intended to help researchers and especially graduate students gain broad exposure to model problems in the areas of optical science:diffractive optics, photonic band gap structures, and waveguides. it includes up-to-date results and references for more experienced researchers while providing introductory material for those less familiar with these areas.

书籍目录

章节摘录

Periodic structures (gratings) have received increasing attention through the years because of important applications in integrated optics, optical lenses, antire-flective structures, holography, lasers, communication, and computing. Significant mathematical results on periodic achiral structures may be found in Bao and Dob-son, tBao, Dobson, and Cox , Chen and Friedman , Ned61ec and Starling , Dofoson and Friedman, Dobson , Abboud , Bruno and R,eitich ,and Bao. Chiral gratings provide an exciting combination of the medium and structure.The combination gives rise to new features and applications. For instance, chiral gratings are capable of converting a linearly polarized incident field into two nearly circularly polarized diffracted modes in different directions. For various physical and computational aspects of the electromagnetic wave propagation inside periodic chiral media, we refer to Jaggar et al. , Lakhtakia,Varadan, and Varadan , and Yueh and Kong . Jaggar et al. have inves- tigated the electromagnetic properties of a structure with sinusoidally periodic per- mittivity, permeability, and chirality admittance by using coupled-mode equations linking forward and backward propagating waves of opposite circular polarizations. Lakhtakia, Varadan, and Varadan have investigated a similar problem with a different approach. They have obtained coupled first-order differential equations for reduced fields and analyzed a piecewise constant case and a constant impedance case. Lakhtakia, Varadan, and Varadan have solved wave scattering at an in-terface with a singly periodic geometry separating a chiral medium from an achiral one by a fully vectorial treatment and have studied the reflection and transmission characteristics of these gratings. Yueh and Kong have analyzed the diffraction of waves by chiral gratings placed over a dielectric substrate, for arbitrary angles of incidence and polarizations, by a generalization of the coupled wave theory. Numer-ical examples have been given to illustrate the effects of chirality on the polarization states of waves diffracted by gratings with rectangular grooves. It has been found that the chiral grating is able to more evenly distribute the power between Floquet modes and also to make modes nearly circularly. In this chapter, we consider a time-harmonic electromagnetic plane wave in-cident on a very general biperiodic structure in R3. By biperiodic structure or doubly periodic structure, we mean that the structure is periodic in two orthog- onal directions. The periodic structure separates two chiral homogeneous regions. The medium inside the structure is chiral and non,homogen,eous. The study of the propagation of the refiected and transmitted waves away from the structure is the diffraction problem. The purpose of this chapter is to introduce a variational formulation of the dif-fraction problem by chiral gratings. The main result is concerned with the well-pos-edness of the model problem. It is shown that for all but possibly a discrete set of fre-quencies, there is a uruque quasi-periodic weak solution to the diffraction problem.The approach is based on a Hodge decomposition, and a compact imbeddin,g result. ……

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