

Finite Element Methods for Nonlinear Optical Waveguides



Christina Wang

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Finite Element Methods For Nonlinear Optical Waveguides

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Zhong, Hooshang Ghafouri-shiraz**



Finite Element Methods For Nonlinear Optical Waveguides:

Finite Element Methods for Nonlinear Optical Waveguides Xin-Hua Wang, 2019-06-14 This book provides researchers at the forefront of nonlinear optical technologies with robust procedures and software for the systematic investigation of the fundamental phenomena in nonlinear optical waveguide structures A full vectorial electromagnetic formulation is adopted and the conditions under which simplification to a scalar formulation is possible are clearly indicated The need to model the dielectric saturation properly is identified and improved algorithms are presented for obtaining the complete power dispersion curve of structures exhibiting bistability As the stability analysis of nonlinear modes is crucial to the development of nonlinear model methods an effective procedure to investigate the propagation of the scalar nonlinear waves in 3D is another important feature of the book All of the procedures described as well as an automatic mesh generator for the finite element method are incorporated into a software package which is included with this book

Finite Element Methods for Nonlinear Optical Waveguides Xin-Hua Wang, 2019-12-02 This book provides researchers at the forefront of nonlinear optical technologies with robust procedures and software for the systematic investigation of the fundamental phenomena in nonlinear optical waveguide structures A full vectorial electromagnetic formulation is adopted and the conditions under which simplification to a scalar formulation is possible are clearly indicated The need to model the dielectric saturation properly is identified and improved algorithms are presented for obtaining the complete power dispersion curve of structures exhibiting bistability As the stability analysis of nonlinear modes is crucial to the development of nonlinear model methods an effective procedure to investigate the propagation of the scalar nonlinear waves in 3D is another important feature of the book All of the procedures described as well as an automatic mesh generator for the finite element method are incorporated into a software package which is included with this book

Finite Element Methods for Nonlinear Optical Waveguides Xinhua Wang, 1992

Optical Waveguide Theory by the Finite Element Method Masanori Koshiba, 2014-01-14 Recent advances in the field of guided wave optics such as fiber optics and integrated optics have included the introduction of arbitrarily shaped optical waveguides which in many cases also happened to be arbitrarily inhomogeneous dissipative anisotropic and or nonlinear Most of such cases of waveguide arbitrariness do not lend themselves to analytical solutions hence computational tools for modeling and simulation are essential for successful design optimization and realization of the optical waveguides For this purpose various numerical techniques have been developed In particular the finite element method FEM is a powerful and efficient tool for the most general i e arbitrarily shaped inhomogeneous dissipative anisotropic and nonlinear optical waveguide problem Its use in industry and research is extensive and indeed it could be said that without it many optical waveguide problems would be incapable of solution This book is intended for students engineers designers and technical managers interested in a detailed description of the FEM for optical waveguide analysis Starting from a brief review of electromagnetic theory the first chapter provides the concepts of the FEM and its fundamentals In

addition to conventional elements i.e line elements triangular elements tetrahedral elements ring elements and triangular ring elements which are utilized for one dimensional two dimensional three dimensional axisymmetric two dimensional and axisymmetric three dimensional problems respectively special purpose elements such as isoparametric elements edge elements infinite elements and boundary elements are also introduced Optical Waveguide Theory by the Finite Element Method Masanori Koshihara,1993 Recent advances in the field of guided wave optics such as fibre optics and integrated optics have included the introduction of various optical waveguides Computational tools for modelling and simulation are essential for a successful design optimization and realization of the optical waveguides Despite its relatively brief existence the finite element method has grown into a powerful and efficient tool for solving the most general optical waveguide problems In this book starting with a brief review of electromagnetic theory for optical waveguide analysis the concepts of the finite element method and its fundamentals are discussed in detail Current topics of the application of the finite element method to various optical waveguide problems such as planar optical waveguides optical channel waveguides optical fibres polarization maintaining optical fibres optical gratings optical waveguide discontinuities nonlinear optical waveguides optical solitons and quantum well structures are described including many illustrations **Optical Communications And Networks (With**

Cd-rom): Proceedings Of The First International Conference On Iocn 2002 Cambyse Guy Omidyar,W D Zhong,Hooshang Ghafouri-shiraz,2002-10-23 Optical communications networks are becoming increasingly important as there is demand for high capacity links Dense wavelength division multiplexing DWDM is widely deployed at the core networks to accommodate high capacity transport systems Optical components such as optical amplifiers tunable filters transceivers termination devices and add drop multiplexers are becoming more reliable and affordable Access and metropolitan area networks are increasingly built with optical technologies to overcome the electronic bottleneck at network edges New components and subsystems for very high speed optical networks offer new design options The proceedings of the First International Conference on Optical Communications and Networks present high quality recent research results in the areas of optical communications network components architectures protocols planning design management and operation

From Classical to Quantum Plasmonics in Three and Two Dimensions Thomas Christensen,2017-01-11 This thesis provides a comprehensive introduction to two active research directions within the field of plasmonics i nonclassical or quantum aspects of the plasmonic response and ii two dimensional plasmonics a recent innovation in the field stimulated by the advent of two dimensional materials It discusses the fundamentals of this field in detail and explores several current research directions Nonclassical plasmonics has been spurred on in recent years by the tremendous technological progress in nanofabrication and optical characterization today it is possible to investigate the plasmonic features of nanostructures with characteristic features in the few nanometer range The book describes and analyzes the breakdown of the classical theory under these conditions and explores several alternatives and extensions The unique electronic and dimensional

features of novel two dimensional materials such as graphene lie at the core of plasmonics most rapidly developing subfield two dimensional plasmonics This thesis provides a clear and comprehensive exposition of the central features for interested researchers looking for an entry point to this riveting area

Fundamentals of Optical Waveguides Katsunari

Okamoto,2010-08-04 Fundamentals of Optical Waveguides is an essential resource for any researcher professional or student involved in optics and communications engineering Any reader interested in designing or actively working with optical devices must have a firm grasp of the principles of lightwave propagation Katsunari Okamoto has presented this difficult technology clearly and concisely with several illustrations and equations Optical theory encompassed in this reference includes coupled mode theory nonlinear optical effects finite element method beam propagation method staircase concatenation method along with several central theorems and formulas Since the publication of the well received first edition of this book planar lightwave circuits and photonic crystal fibers have fully matured With this second edition the advances of these fibers along with other improvements on existing optical technologies are completely detailed This comprehensive volume enables readers to fully analyze design and simulate optical atmospheres Exceptional new chapter on Arrayed Waveguide Grating AWG In depth discussion of Photonic Crystal Fibers PCFs Thorough explanation of Multimode Interference Devices MMI Full coverage of polarization Mode Dispersion PMD

Poled Polymers and Their Applications to

SHG and EO Devices Seizo Miyata,Hiroyuki Sasabe,2020-12-18 Poled polymers doped with nonlinear optically active chromophores combine the large second order nonlinearity of the dopant dye molecules with the optical quality of the polymer The material design flexibility afforded to doped polymers makes them attractive in a large variety of devices and applications This book addresses the critical science and technology issues in the development and application of poled polymers with an emphasis on the stabilization of poled polymers and their special applications to second harmonic generation SHG and electro optic EO devices

Anisotropic and Nonlinear Optical Waveguides C.G. Someda,G.I.

Stegeman,2012-12-02 Dielectric optical waveguides have been investigated for more than two decades In the last ten years they have had the unique position of being simultaneously the backbone of a very practical and fully developed technology as well as an extremely exciting area of basic forefront research Existing waveguides can be divided into two sets one consisting of waveguides which are already in practical use and the second of those which are still at the laboratory stage of their evolution This book is divided into two separate parts the first dealing with anisotropic waveguides and the second with nonlinear behaviour Nonlinear behaviour in optical waveguides is a topic of current research interest an effect eagerly being sought in waveguides The relative importance of nonlinearity versus anisotropy in theoretical papers changes enormously from problem to problem Many theories can be quite useful and enlightening even though they neglect entirely one of the two aspects Scientists may find their research work leading them in the near future to deal simultaneously with anisotropy and nonlinearity in order to pursue their own investigations This book will be of interest to researchers who first need to

understand the individual topics suitably chosen from the two parts of this work thus providing them with the necessary ingredients to pursue their explorations **Physics of Photorefraction in Polymers** Dave West,D.J. Binks,2004-11-29 Photorefractive polymer composites are an unusually sensitive class of photopolymers Physics of Photorefraction in Polymers describes our current understanding of the physical processes that produce a photorefractive effect in key composite materials Topics as diverse as charge generation dispersive charge transport charge compensation and trapping molecular diffusion organic composite structure and nonlinear optical wave coupling are all developed from a physical perspective Emphasis is placed on explaining how these physical processes lead to observable properties of the polymers and the authors discuss various applications including holographic archiving **Computational Liquid Crystal Photonics** Salah Obayya,Mohamed Farhat O. Hameed,Nihal F. F. Areed,2016-05-31 Optical computers and photonic integrated circuits in high capacity optical networks are hot topics attracting the attention of expert researchers and commercial technology companies Optical packet switching and routing technologies promise to provide a more efficient source of power and footprint scaling with increased router capacity integrating more optical processing elements into the same chip to increase on chip processing capability and system intelligence has become a priority This book is an in depth look at modelling techniques and the simulation of a wide range of liquid crystal based modern photonic devices with enhanced high levels of flexible integration and enhanced power processing It covers the physics of liquid crystal materials techniques required for modelling liquid crystal based devices the state of the art liquid crystal photonic based applications for telecommunications such as couplers polarization rotators polarization splitters and multiplexer demultiplexers liquid core photonic crystal fiber LC PCF sensors including biomedical and temperature sensors and liquid crystal photonic crystal based encryption systems for security applications Key features Offers a unique source of in depth learning on the fundamental principles of computational liquid crystal photonics Explains complex concepts such as photonic crystals liquid crystals waveguides and modes and frequency and time domain techniques used in the design of liquid crystal photonic crystal photonic devices in terms that are easy to understand Demonstrates the useful properties of liquid crystals in a diverse and ever growing list of technological applications Requires only a foundational knowledge of mathematics and physics **Frontiers in Planar Lightwave Circuit Technology** Siegfried Janz,Jiri Ctyroky,Stoyan Tanev,2006-01-12 The contributions to this book constitute an excellent record of many key issues and scientific problems in planar lightwave circuit research There are detailed overviews of experimental and theoretical work in high index contrast waveguide systems micro optical resonators nonlinear optics and advanced optical simulation methods as well as articles describing emerging applications of integrated optics for medical and biological applications **Finite Element Modeling Methods for Photonics** B. M. Azizur Rahman ,Arti Agrawal ,2013-08-01 The term photonics can be used loosely to refer to a vast array of components devices and technologies that in some way involve manipulation of light One of the most powerful numerical approaches available to

engineers developing photonic components and devices is the Finite Element Method FEM which can be used to model and simulate such components devices and analyze how they will behave in response to various outside influences This resource provides a comprehensive description of the formulation and applications of FEM in photonics applications ranging from telecommunications astronomy and sensing to chemistry imaging and biomedical R D This book emphasizes practical problem solving applications and includes real world examples to assist readers in understanding how mathematical concepts translate to computer code for finite element based methods applicable to a range of photonic structures In addition this is the perfect support to anyone using the COMSOL Multiphysics RF Module

Guided Wave Photonics Le Nguyen Binh, 2016-04-19 A comprehensive presentation of the theory and simulation of optical waveguides and wave propagations in a guided environment Guided Wave Photonics Fundamentals and Applications with MATLAB supplies fundamental and advanced understanding of integrated optical devices that are currently employed in modern optical fiber communications systems and p

Proceedings of the International Conference on Atomic, Molecular, Optical & Nano Physics with Applications Vinod Singh, Rinku Sharma, Man Mohan, Mohan Singh Mehata, A. K. Razdan, 2022-03-14 This book highlights the proceedings of the International Conference on Atomic Molecular Optical and Nano Physics with Applications CAMNP 2019 organized by the Department of Applied Physics Delhi Technological University New Delhi India It presents experimental and theoretical studies of atoms ions molecules and nanostructures both at the fundamental level and on the application side using advanced technology It highlights how modern tools of high field and ultra fast physics are no longer merely used to observe nature but can be used to reshape and redirect atoms molecules particles or radiation It brings together leading researchers and professionals on the field to present and discuss the latest finding in the following areas but not limited to Atomic and Molecular Structure Collision Processes Data Production and Applications Spectroscopy of Solar and Stellar Plasma Intense Field Short Pulse Laser and Atto Second Physics Laser Technology Quantum Optics and applications Bose Einstein condensation Nanomaterials and Nanoscience Nanobiotechnology and Nanophotonics Nano and Micro Electronics Computational Condensed Matter Physics

Finite Element Software for Microwave Engineering Tatsuo Itoh, Giuseppe Pelosi, Peter P. Silvester, 1996-08-23 Finite element methods have become essential design tools for managing the complex structures and devices needed in modern microwave technology Long the preferred techniques of both researchers and engineers their migration from research lab to routine industrial use has been accelerated by hardware and software improvements The last decade has seen the widespread availability of good commercial finite element programs for an extensive range of applications Finite Element Software for Microwave Engineering provides the first comprehensive overview of this burgeoning field With its unique focus on current and future industrial applications rather than on mathematical methodology this book is an invaluable complement to the existing literature on finite element methods Directed to practicing engineers and researchers the book describes user experience with current software shows how

existing programs can be used to solve problems not foreseen by their designers and attempts to predict which methods may appear in the commercial products of tomorrow *Microwave Photonics* Anne Vilcot, Béatrice Cabon, Jean Chazelas, 2010-06-07 This cross disciplinary title features contributions by key note specialists from Europe Israel and the United States It deals with the rapidly growing area of microwave photonics and includes an extended study of the interactions between optical signals and microwave and millimetre wave electrical signals for broadband applications

Integrated Photonics Research , 2003 Photonics Modelling and Design Slawomir Sujecki, 2018-09-03 Photonics Modeling and Design delivers a concise introduction to the modeling and design of photonic devices Assuming a general knowledge of photonics and the operating principles of fibre and semiconductor lasers this book Describes the analysis of the light propagation in dielectric media Discusses heat diffusion and carrier transport Applies the presented theory to develop fibre and semiconductor laser models Addresses the propagation of short optical pulses in optical fibres Puts all modeling into practical context with examples of devices currently in development or on the market Providing hands on guidance in the form of MATLAB scripts tips and other downloadable content Photonics Modeling and Design is written for students and professionals interested in modeling photonic devices either for gaining a deeper understanding of the operation or to optimize the design

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