Dielectric Waveguide Model Matlab Code

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MCCS 2020 John Wiley & Sons
Modelling and computations in electromagnetics is a quite fast-growing research area. The recent interest in this field is caused by the increased demand for designing complex microwave components, modeling electromagnetic materials, and rapid increase in computational power for calculation of complex electromagnetic problems. The first part of this book is devoted to the advances in the analysis techniques such as method of moments, finite-difference time- domain method, boundary perturbation theory, Fourier analysis, mode-matching method, and analysis based on circuit theory. These techniques are considered with regard to several challenging technological applications such as those related to electrically large devices, scattering in layered structures, photonic crystals, and artificial materials. The second part of the book deals with waveguides, transmission lines and transitions. This includes microstrip lines (MSL), slot waveguides, substrate integrated waveguides (SIW), vertical transmission lines in multilayer media as well as MSL to SIW and MSL to slot line transitions.
Passive Microwave Components and Antennas CRC Press
Carefully structured to provide practical knowledge on

fundamental issues, Optical Fiber Communications Systems: Theory and Practice with MATLAB® and Simulink® Models explores advanced modulation and transmission techniques of lightwave communication systems. With coverage ranging from fundamental to modern aspects, the text presents optical communication techniques and applications, employing single mode optical fibers as the transmission medium. With MATLAB and Simulink models that illustrate methods, it supplies a deeper understanding of future development of optical systems and networks. The book begins with an overview of the development of optical fiber communications technology over the last three decades of the 20th century. It describes the optical transmitters for direct and external modulation technique and discusses the detection of optical signals under direct coherent and incoherent reception. The author also covers lumped Er.doped and distributed Roman optical amplifiers with extensive models for the amplification of signals and structuring the amplifiers on the Simulink platform. He outlines a design strategy for optically amplified transmission systems coupled with MATLAB Simulink models, including dispersion and attenuation budget methodology and simulation techniques. The book concludes with coverage of advanced modulation formats for long haul optical fiber transmission systems with accompanied Simulink models. Although many books have been written on this topic over the last two decades, most of them present only the theory and practice of devices and subsystems of the optical fiber communications systems in the fields, but do not illustrate any computer models to represent the true practical aspects of engineering practice. This book fills the need for a text that emphasizes practical computing models that shed light on the behavior and dynamics of the devices.

Distributed Feedback Semiconductor Lasers Springer
This book teaches the finite-difference frequency-domain (FDFD) method from the simplest concepts to advanced three-dimensional simulations. It uses plain language and high-quality graphics to help the complete beginner grasp all the concepts quickly and visually. This single resource includes everything needed to simulate a wide variety of different electromagnetic and photonic devices. The book is filled with helpful guidance and computational wisdom that will help the reader easily simulate their own devices and more easily learn and implement other methods in computational electromagnetics. Special techniques in MATLAB® are presented that will allow the reader to write their own FDFD programs. Key concepts in electromagnetics are reviewed so the reader can fully understand the calculations happening in FDFD. A powerful method for implementing the finite-difference method is taught that will enable the reader to solve entirely new differential equations and sets of differential equations in mere minutes. Separate chapters are included that describe how Maxwell's equations are approximated using finite-differences and how outgoing waves can be absorbed using a perfectly matched layer absorbing boundary. With this background, a chapter describes how to calculate guided modes in waveguides and transmission lines. The effective index method is taught as way to model many three-dimensional devices in just two-dimensions. Another chapter describes how to calculate photonic band diagrams and isofrequency contours to quickly estimate the properties of periodic structures like photonic crystals. Next, a chapter presents how to analyze diffraction gratings and calculate the power coupled into each diffraction order. This book shows that many devices can be simulated in the context of a diffraction grating including guided-mode resonance filters, photonic crystals, polarizers, metamaterials, frequency selective surfaces, and metasurfaces. Plane wave sources, Gaussian beam sources, and

guided-mode sources are all described in detail, allowing devices to be simulated in multiple ways. An optical integrated circuit is simulated using the effective index method to build a two-dimensional model of the 3D device and then launch a guided-mode source into the circuit. A chapter is included to describe how the code can be modified to easily perform parameter sweeps, such as plotting reflection and transmission as a function of frequency, wavelength, angle of incidence, or a dimension of the device. The last chapter is advanced and teaches FDFD for three-dimensional devices composed of anisotropic materials. It includes simulations of a crossed grating, a doubly-periodic guided-mode resonance filter, a frequency selective surface, and an invisibility cloak. The chapter also includes a parameter retrieval from a left-handed metamaterial. The book includes all the MATLAB codes and detailed explanations of all programs. This will allow the reader to easily modify the codes to simulate their own ideas and devices. The author has created a website where the MATLAB codes can be downloaded, errata can be seen, and other learning resources can be accessed. This is an ideal book for both an undergraduate elective course as well as a graduate course in computational electromagnetics because it covers the background material so well and includes examples of many different types of devices that will be of interest to a very wide audience.

`Physics and Practical Modeling` CRC Press
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This books aims to present fundamental aspects of
optical communication techniques and advanced
modulation techniques and extensive applications
of optical communications systems and networks
employing single-mode optical fibers as the
transmission system. New digital techqniues such
as chromatic dispersion, polarization mode
dispersion, nonlinear phase distortion effects,
etc. will be discussed. Practical models for
practice and understanding the behavior and
dynamics of the devices and systems will be
included.
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Advanced Electromagnetic Computation CRC Press
This book is a self-contained, programming-oriented and learner-centered book on finite element method (FEM), with special emphasis given to developing MATLAB® programs for numerical modeling of electromagnetic boundary value problems. It provides a deep understanding and intuition of FEM programming by means of step-by-step MATLAB® programs with detailed descriptions, and eventually enabling the readers to modify, adapt and apply the provided programs and formulations to develop FEM codes for similar problems through various exercises. It starts with simple one-dimensional static and time-harmonic problems and extends the developed theory to more complex two- or three-dimensional problems. It supplies sufficient theoretical background on the topic, and it thoroughly covers all phases (pre-processing, main body and post-processing) in FEM. FEM formulations are obtained for boundary value problems governed by a partial differential equation that is expressed in terms of a generic unknown function, and then, these formulations are specialized to various electromagnetic applications together with a post-processing phase. Since the method is mostly described in a general context, readers from other disciplines can also use this book and easily adapt the provided codes to their engineering problems. After forming a solid background on the fundamentals of FEM by means of canonical problems, readers are guided to more advanced applications of FEM in electromagnetics through a survey chapter at the end of the book. Offers a self-contained and easy-to-understand introduction to the theory and programming of finite element method. Covers various applications in the field of static and time-harmonic electromagnetics. Includes one-, two- and three-dimensional finite element codes in MATLAB® . Enables readers to develop finite element programming skills through various MATLAB® codes and exercises. Promotes self-directed learning skills and provides an effective instruction tool.

Full Matlab Code for Synthesis and Optimization of Bragg Gratings Cambridge University Press
This practical book and accompanying software enables you to quickly and easily work out challenging microwave engineering and high-frequency electromagnetic problems using the finite element method (FEM) Using clear, concise text and dozens of real-world application examples, the book provides a detailed description of FEM implementation, while the software provides the code and tools needed to solve the three major types of EM problems: guided propagation, scattering, and radiation.

Theory, Design, and Applications Taylor & Francis
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

Analog Filters using MATLAB BoD – Books on Demand
This substantially updated and augmented second edition adds over 200 pages of text covering and an array of newer developments in nanoscale thermal transport. In Nano/Microscale Heat Transfer, 2nd edition, Dr. Zhang expands his classroom-proven text to incorporate thermal conductivity spectroscopy, time-domain and frequency-domain thermoreflectance techniques, quantum size effect on specific heat, coherent phonon, minimum thermal conductivity, interface thermal conductance, thermal interface materials, 2D sheet materials and their unique thermal properties, soft materials, first-principles simulation, hyperbolic metamaterials, magnetic polaritons, and new near-field radiation experiments and numerical simulations. Informed by over 12 years use, the author's research experience, and feedback from teaching faculty, the book has been reorganized in many sections and enriched with more examples and homework problems. Solutions for selected problems are also available to qualified faculty via a password-protected website. • Substantially updates and augments the widely adopted original edition, adding over 200 pages and many new illustrations; • Incorporates student and faculty feedback from a decade of classroom use; • Elucidates concepts explained with many examples and illustrations; • Supports student application of theory with 300 homework problems; • Maximizes reader understanding of micro/nanoscale thermophysical properties and processes and how to apply them to thermal science and engineering; • Features MATLAB codes for working with size and temperature effects on thermal conductivity, specific heat of nanostructures, thin-film optics, RCWA, and near-field radiation.

Optical Fiber Communication Systems with MATLAB® and Simulink® Models DIANE Publishing
Despite the dramatic growth in the availability of powerful computer resources, the EM community lacks a comprehensive text on the computational techniques used to solve EM problems. The first edition of Numerical Techniques in Electromagnetics filled that gap and became the reference of choice for thousands of engineers, researchers, and students. This third edition of the bestselling text reflects the continuing increase in awareness and use of numerical techniques and incorporates advances and refinements made in recent years. Most notable among these are the improvements made to the standard algorithm for the finite-difference time-domain (FDTD) method and treatment of absorbing boundary conditions in FDTD, finite element, and transmission-line-matrix methods. The author also has added a chapter on the method of lines. Numerical Techniques in Electromagnetics with MATLAB® , Third Edition continues to teach readers how to pose, numerically analyze, and solve EM problems, to

give them the ability to expand their problem-solving skills using a variety of methods, and to prepare them for research in electromagnetism. Now the Third Edition goes even further toward providing a comprehensive resource that addresses all of the most useful computation methods for EM problems and includes MATLAB code instead of FORTRAN.

Photonic Crystals Springer
This book presents a theoretical description of fiber Bragg gratings, focusing on channels' densification and the tunability of Bragg filters. It also includes a full Matlab code for the synthesis and optimization of several kinds of fiber Bragg gratings by using the directed tabu search, the simulated annealing method and the genetic algorithm. Physical and optical parameters of uniform, chirped and sampled fiber Bragg gratings are then reconstructed with these algorithms.

Tailoring Light Emission Properties with Metal Nanostructures CRC Press
Wireless communications allow high-speed mobile access to a global Internet based on ultra-wideband backbone intercontinental and terrestrial networks. Both of these environments support the carrying of information via electromagnetic waves that are wireless (in free air) or guided through optical fibers. Wireless and Guided Wave Electromagnetics: Fundamentals and Applications explores the fundamental aspects of electromagnetic waves in wireless media and wired guided media. This is an essential subject for engineers and physicists working with communication technologies, mobile networks, and optical communications. This comprehensive book: Builds from the basics to modern topics in electromagnetics for wireless and optical fiber communication Examines wireless radiation and the guiding of optical waves, which are crucial for carrying high-speed information in long-reach optical networking scenarios Explains the physical phenomena and practical aspects of guiding optical waves that may not require detailed electromagnetic solutions Explores applications of electromagnetic waves in optical communication systems and networks based on frequency domain transfer functions in the linear regions, which simplifies the physical complexity of the waves but still allows them to be examined from a system engineering perspective Uses MATLAB® and Simulink® models to simulate and illustrate the electromagnetic fields Includes worked examples, laboratory exercises, and problem sets to test understanding The book's modular structure makes it suitable for a variety of courses, for self-study, or as a resource for research and development. Throughout, the author emphasizes issues commonly faced by engineers. Going a step beyond traditional electromagnetics textbooks, this book highlights specific uses of electromagnetic waves

with a focus on the wireless and optical technologies that are increasingly important for high-speed transmission over very long distances.

Proceedings of the International Conference, I3SET 2016
MATLAB-based Finite Element Programming in Electromagnetic Modeling
Enhanced light-matter interactions in light-confining structures (such as optical cavities) have been extensively investigated for both fundamental studies and practical applications. Plasmonic nanostructures, which can confine and manipulate light down to ~ 1 nm scale, are becoming increasingly important. Many areas of optical physics and devices can benefit from such extreme light concentration and manipulation. For example, fluorescent molecule or quantum dot (QD) emission can be strongly modified and controlled via surface plasmon polariton (SPP) coupling. In this dissertation, we present our theoretical and experimental studies on QD emission in metal nanogap structures that can provide extreme field concentration, enhancing light-matter interactions significantly. We start with a theoretical analysis of dipole emission in metal-dielectric-metal (MDM) waveguide structures. We look at both infinite (i.e. planar) and finite thickness MDM structures. We find that both structures exhibit strong spontaneous emission enhancements due to the tight confinement of modes between two metallic plates and that light emission is dominated by gap SPP coupling. For planar structures we present analytical solutions for the enhanced dipole decay rate, while for finite thickness MDM structures (i.e. nanoslits) we present results from numerical simulations. Next, we present our experiments on the SPP coupling of CdSe/ZnS QD emission in metal nanoslits. First, we observed clear lifetime and polarization state changes of QD emission with slit width due to gap SPP excitation. Second, with optimized side grooves (i.e. combined slit-groove and hole-groove structures), we collimated QD emission vertically into a very narrow angle, achieving an unprecedented level of directionality control, and visualized it with confocal scanning microscopy. Third, by using two metal plates as electrodes, we dynamically modulated the QD emission intensity and wavelength with external voltage. Finally, we extend our dipole emission calculation to several slot waveguide structures. We consider light emission in metal slots, metal-oxide-Si slots, and Si slot waveguides. We find that large spontaneous emission

enhancements can be obtained over a broad range of wavelengths and that light emission is strongly funneled into slot waveguide modes. These represent broadband waveguide QED (quantum electro-dynamics) systems, which have unique merits for on-chip light sources and quantum information processing. These theoretical and experimental studies show that the SPP coupling of light emission is a very promising way to control light emission properties and may find broad application in spectroscopy, sensing, optoelectronics, and integrated optics.
Electromagnetic and Photonic Simulation for the Beginner: Finite-Difference Frequency-Domain in MATLAB® Springer Nature
This unique book presents simple, easy-to-use, but effectiveshort codes as well as virtual tools that can be used byelectrical, electronic, communication, and computer engineers in abroad range of electrical engineering problems Electromagnetic modeling is essential to the design and modelingof antenna, radar, satellite, medical imaging, and otherapplications. In this book, author Levent Sevgi explains techniquesfor solving real-time complex physical problems using MATLAB-basedshort scripts and comprehensive virtual tools. Unique in coverage and tutorial approach, ElectromagneticModeling and Simulation covers fundamental analytical andnumerical models that are widely used in teaching, research, andengineering designs—including mode and ray summationapproaches with the canonical 2D nonpenetrable parallel platewaveguide as well as FDTD, MoM, and SSPE scripts. The book alsoestablishes an intelligent balance among the essentials of EMMODSIM: The Problem (the physics), The Theory and Models(mathematical background and analytical solutions), and TheSimulations (code developing plus validation, verification, andcalibration). Classroom tested in graduate-level and short courses,Electromagnetic Modeling and Simulation: Clarifies concepts through numerous worked problems and quizzesprovided throughout the book Features valuable MATLAB-based, user-friendly, effectiveengineering and research virtual design tools Includes sample scenarios and video clips recorded duringcharacteristic simulations that visually impactlearning—available on wiley.com Provides readers with their first steps in EM MODSIM as well astools for medium and high-level code developers and users Electromagnetic Modeling and Simulation thoroughly coversthe physics, mathematical background, analytical solutions, andcode development of electromagnetic modeling, making it an idealresource for electrical engineers and researchers.
Computational Photonics Springer Nature
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)

Transform Methods for Solving Partial Differential Equations John Wiley & Sons

Despite the dramatic growth in the availability of powerful computer resources, the EM community lacks a comprehensive text on the computational techniques used to solve EM problems. The first edition of Numerical Techniques in Electromagnetics filled that gap and became the reference of choice for thousands of engineers, researchers, and students. This third edition of the bestselling text reflects the continuing increase in awareness and use of numerical techniques and incorporates advances and refinements made in recent years. Most notable among these are the improvements made to the standard algorithm for the finite-difference time-domain (FDTD) method and treatment of absorbing boundary conditions in FDTD, finite element, and transmission-line-matrix methods. The author also has added a chapter on the method of lines. Numerical Techniques in Electromagnetics with MATLAB® , Third Edition continues to teach readers how to pose, numerically analyze, and solve EM problems, to give them the ability to expand their problem-solving skills using a variety of methods, and to prepare them for research in electromagnetism. Now the Third Edition goes even further toward providing a comprehensive resource that addresses all of the most useful computation methods for EM problems and includes MATLAB code instead of FORTRAN.

Electromagnetics CRC Press

This comprehensive, modular treatment of the challenging issues involved in very high-speed optical transmission systems contains all the theory and practical design criteria required to optimise transmission system design. Each chapter covers the theoretical modelling of a given system; chapters are well supported by real-world worked examples and accompanied by MATLAB code and receiver design examples. Critical analysis and comparison of engineering solutions is presented, to make clear the principles underlying system performance optimisation, and a broad range of transmission systems is discussed, including the status and performance demands of the Terabit systems now entering the next generation market. Blending theoretical and practical considerations for high-speed fibre optic systems design, this is an indispensable reference for all forward-looking professionals and researchers in optical communications.

Electromagnetic Waves, Materials, and Computation with MATLAB Artech House

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.

Fundamentals and Applications with MATLAB Stanford University

In this book, we explore an eclectic mix of articles that highlight some new potential applications of SiC and different ways to achieve specific properties. Some articles describe well-established processing methods, while others highlight phase equilibria or machining methods. A resurgence of interest in the structural arena is evident, while new ways to utilize the interesting electromagnetic properties of SiC continue to increase.

Quick Finite Elements for Electromagnetic Waves CRC Press

The Essence of Dielectric Waveguides provides an overview of the fundamental behavior of guided waves, essential to finding and interpreting the results of electromagnetic waveguide problems. Clearly and concisely written as well as brilliantly organized, this volume includes a detailed description of the fundamentals of electromagnetics, as well as a new discussion on boundary conditions and attenuation. It also covers the propagation characteristics of guided waves along classical canonical dielectric structures – planar, circular cylindrical, rectangular and elliptical waveguides. What's more, the authors have included extensive coverage of inhomogeneous structures and approximate methods, as well as several powerful numerical approaches specifically applicable to dielectric waveguides.

Early Transmission Lines Approach Cambridge University Press MATLAB-based Finite Element Programming in Electromagnetic ModelingCRC Press