# Comsol Optical Waveguide Simulation

Presents an introduction to the field of optical guided waves and devices for optoelectronic engineers, optical communication engineers and physicists. This text incorporates the topic of integrated optics and provides a balance between theoretical foundations and practical applications.

The optical filter is resonator based. The required passband shape of ring resonator-filters can be custom designed by the use of configurations of various ring coupled resonators. This book describes the current state-of-the-art on these devices. It provides an in-depth knowledge of the simulation, fabrication and characterization of ring resonators for use as example filters, lasers, sensors.

Current developments in optical technologies are being directed toward nanoscale devices with subwavelength dimensions, in which photons are manipulated on the nanoscale. Although light is clearly the fastest means to send information to and from the nanoscale, there is a fundamental incompatibility between light at the microscale and devices and processes at the nanoscale. Nanostructured metals which support surface plasmon modes can concentrate electromagnetic (EM) fields to a small fraction of a wavelength while enhancing local field strengths by several orders of magnitude. For this reason, plasmonic nanostructures can serve as optical couplers across the nano–micro interface: metal–dielectric and metal–semiconductor nanostructures can act as optical nanoantennae and enhance light matter coupling in nanoscale devices. This book describes how one can fully integrate plasmonic nanostructures into dielectric, semiconductor, and molecular photonic devices, for guiding photons across the nano–micro interface and for detecting molecules with unsurpassed sensitivity. ·Nanophotonics and Nanoplasmonics ·Metamaterials and negative-index materials ·Plasmon-enhanced sensing and spectroscopy ·Imaging and sensing on the nanoscale ·Metal Optics

This book presents the principles of non-linear integrated optics.The first objective is to provide the reader with a thoroughunderstanding of integrated optics so that they may be able todevelop the theoretical and experimental tools to study and controlthe linear and non-linear optical properties of waveguides. The potential use of these structures can then be determined inorder to realize integrated optical components for light modulationand generation. The theoretical models are accompanied byexperimental tools and their setting in order to characterize thestudied phenomenon. The passage from theory to practice makes thecomprehension of the physical phenomena simple and didactic. The book also gives a presentation of the industrial applicationsof the integrated optical components. The studied topics range fromthe theory of waveguides and the linear and non-linear opticalcharacterization techniques to photonic crystals. This last fieldconstitutes a major challenge of photonic technologies of the 21stcentury.

This book presents the latest results of quantum properties of light in the nanostructured environment supporting surface plasmons, including waveguide quantum electrodynamics, quantum emitters, strong-coupling phenomena and lasing in plasmonic structures. Different approaches are described for controlling the emission and propagation of light with extreme light confinement and field enhancement provided by surface plasmons. Recent progress is reviewed in both experimental and theoretical investigations within quantum plasmonics, elucidating the fundamental physical

phenomena involved and discussing the realization of quantum-controlled devices, including single-photon sources, transistors and ultra-compact circuitry at the nanoscale.

From the beginning Integrated Photonics introduces numerical techniques for studying non-analytic structures. Most chapters have numerical problems designed for solution using a computational program such as Matlab or Mathematica. An entire chapter is devoted to one of the numeric simulation techniques being used in optoelectronic design (the Beam Propagation Method), and provides opportunity for students to explore some novel optical structures without too much effort. Small pieces of code are supplied where appropriate to get the reader started on the numeric work. Integrated Photonics is designed for the senior/first year graduate student, and requires a basic familiarity with electromagnetic waves, and the ability to solve differential equations with boundary conditions.

This reference offers tools for engineers, scientists, biologists, and others working with the computational techniques of nanophotonics. It introduces the key concepts of computational methods in a manner that is easily digestible for newcomers to the field. The book also examines future applications of nanophotonics in the technical industry and covers new developments and interdisciplinary research in engineering, science, and medicine. It provides an overview of the key computational nanophotonics and describes the technologies with an emphasis on how they work and their key benefits.

2014A-8 The complete, up-to-date technical overview of optical communications. Fibre in the WAN, MAN, local loop, campus and LAN. Up-to-the-minute coverage of Wavelength Division Multiplexing. Previews today's advanced research--tomorrow's practical applications. Over the past 15 years, optical fibre's low cost, accuracy and enormous capacity has revolutionized wide area communications--making possible the Internet as we know it. Now a second fibre revolution is underway. Advanced technologies such as Wavelength Division Multiplexing (WDM) are adding even more capacity, and fibre is increasingly the media of choice in MANs, campuses, buildings, LANs--soon, even homes. If you need to understand the state-of-the-art in optical communications, Understanding Optical Communications is the most complete, up-to-date technical overview available. Fundamental principles and components of optical communications. Optical communications systems, interfaces and engineering challenges. FDDI, Ethernet on Fibre, ESCON, Fibre Channel, SONET/SDH and ATM. WDM: sparse and dense approaches, photonic networking, WDM for LANs and WDM standards. Fibre in the local loop, integration with HFC networks and passive optical networks. Understanding Optical Communications reviews key technical issues facing engineers as they extend fibre into new applications and markets. It presents an up-to-the-minute status report on WDM for LANs and MANs, including a rare glimpse at IBM's latest experimental systems. It points to the advanced research most likely to bear fruit: dark and spatial solitons, advanced fibres, plastic technologies, optical CDMA, TDM and packet-networks and more. Whether you're building optical systems or planning for them, this is the briefing you've been looking for.

Microwaves can be effectively used in the processing of industrial materials under a wide range of conditions. However, microwave processing is complex and multidisciplinary in nature, and a high degree of technical knowledge is needed to determine how, when, and where the technology can be most profitably utilized. This book assesses the potential of

microwave technology for industrial applications, reviews the latest equipment and processing methods, and identifies both the gaps in understanding of microwave processing technology and the promising development opportunities that take advantage of this new technology's unique performance characteristics.

Optical communication is very much useful in telecommunication systems, data processing and networking. It consists of a transmitter that encodes a message into an optical signal, a channel that carries the signal to its desired destination, and a receiver that reproduces the message from the received optical signal. It presents up to date results on communication systems, along with the explanations of their relevance, from leading researchers in this field. The chapters cover general concepts of optical communication, components, systems, networks, signal processing and MIMO systems. In recent years, optical components and other enhanced signal processing functions are also considered in depth for optical communications systems. The researcher has also concentrated on optical devices, networking, signal processing, and MIMO systems and other enhanced functions for optical communication. This book is targeted at research, development and design engineers from the teams in manufacturing industry, academia and telecommunication industries.

Since it was first published in 1995, Photonic Crystals has remained the definitive text for both undergraduates and researchers on photonic band-gap materials and their use in controlling the propagation of light. This newly expanded and revised edition covers the latest developments in the field, providing the most up-to-date, concise, and comprehensive book available on these novel materials and their applications. Starting from Maxwell's equations and Fourier analysis, the authors develop the theoretical tools of photonics using principles of linear algebra and symmetry, emphasizing analogies with traditional solid-state physics and quantum theory. They then investigate the unique phenomena that take place within photonic crystals at defect sites and surfaces, from one to three dimensions. This new edition includes entirely new chapters describing important hybrid structures that use band gaps or periodicity only in some directions: periodic waveguides, photonic-crystal slabs, and photonic-crystal fibers. The authors demonstrate how the capabilities of photonic crystals to localize light can be put to work in devices such as filters and splitters. A new appendix provides an overview of computational methods for electromagnetism. Existing chapters have been considerably updated and expanded to include many new three-dimensional photonic crystals, an extensive tutorial on device design using temporal coupled-mode theory, discussions of diffraction and refraction at crystal interfaces, and more. Richly illustrated and accessibly written, Photonic Crystals is an indispensable resource for students and researchers. Extensively revised and expanded Features improved graphics throughout Includes new chapters on photonic-crystal fibers and combined index-and band-gap-guiding Provides an introduction to coupled-mode theory as a powerful tool for device design Covers many new topics, including omnidirectional reflection, anomalous refraction and diffraction, computational photonics, and much more.

This book is meant as an introduction to graphene plasmonics and aims at the advanced undergraduate and graduate students entering the field of plasmonics in graphene. In it different theoretical methods are introduced, starting with an elementary description of graphene plasmonics and evolving towards more advanced topics. This book is essentially self-contained and brings together a number of different topics about the field that are scattered in the vast literature. The text is composed of eleven chapters and of a set of detailed appendices. It can be read in two different ways: Reading only the chapters to get acquainted with the field of plasmonics in graphene or reading the chapters and studying the appendices to get a working knowledge of the topic. The study of the material in this book will bring the students to the forefront of the research in this field. Errata(s) Errata (159 KB) Contents: IntroductionElectromagnetic Properties of Solids in a NutshellSurface Plasmon–Polaritons at Dielectric–Metal InterfacesGraphene Surface PlasmonsExcitation of Graphene Surface

PlasmonsLaunching Plasmons Using a Metallic AntennaPlasmonics in Periodic Arrays of Graphene RibbonsPlasmons in Graphene Nanostructures and in One-dimensional ChannelsExcitation of Surface Plasmon–Polaritons Using Dielectric GratingsExcitation of Plasmons by an Emitting DipoleConcluding Remarks Readership: Advanced undergraduate and graduate students entering the field of graphene plasmonics.

This book features state-of-the-art contributions in mathematical, experimental and numerical simulations in engineering sciences. The contributions in this book, which comprise twelve chapters, are organized in six sections spanning mechanical, aerospace, electrical, electronic, computer, materials, geotechnical and chemical engineering. Topics include metal micro-forming, compressible reactive flows, radio frequency circuits, barrier infrared detectors, fiber Bragg and long-period fiber gratings, semiconductor modelling, many-core architecture computers, laser processing of materials, alloy phase decomposition, nanofluids, geo-materials and rheo-kinetics. Contributors are from Europe, China, Mexico, Malaysia and Iran. The chapters feature many sophisticated approaches including Monte Carlo simulation, FLUENT and ABAQUS computational modelling, discrete element modelling and partitioned frequency-time methods. The book will be of interest to researchers and also consultants engaged in many areas of engineering simulation.

Interactions of electromagnetic fields with materials at high frequencies have given rise to a vast array of practical applications in industry, science, medicine, and consumer markets. Applicators or probes, which are the front end of these systems, provide the field that interacts with the material. This book takes an integrated approach to the area of high frequency applicators and probes for material interactions, providing a toolkit for those who design these devices. Particular attention is given to real-world applications and the latest developments in the area. Mathematical methods are provided as design tools, and are often simplified via curve-fitting techniques that are particularly usable by handheld calculators. Useful equations and numerically solved examples, using situations encountered in practice, are supplied. Above all, this volume is a comprehensive and useful reference where the reader can find design rules and principles of high frequency applicators and probes for material processing and sensing applications. Electronic and electrical R&D engineers, physicists, university professors and students will all find this book a valuable reference. Mehrdad Mehdizadeh is with the DuPont Company, Engineering Research & Technology Division in Wilmington, Delaware. His areas of expertise include high frequency hardware and electromagnetic methods of processing, sensing, and characterization of materials. His work and innovation in industrial, scientific, and medical applications of radio frequency and microwaves has resulted in 19 US patents and a number of publications. He earned his Ph.D. and M.S. from Marquette University (1983, 1980), and a B.S. from Sharif University of Technology (1977), all in electrical engineering. Dr. Mehdizadeh is a Senior Member of the Institute of Electrical and Electronic Engineers (IEEE ), Sigma Xi (Scientific Research Society), the International Microwave Power Institute (IMPI ), and a voting member of IEEE Standard Association. • Books in this area are usually theoretical; this book provides practical information for those who actually intend to design a system • Features real world and numerically solved examples, and curve-fitted simple equations to replace complex equations provided in typical texts • Author is a voting member of IEEE Standards Association

"Phase Change Materials: Science and Applications" provides a unique introduction of this rapidly developing field. Clearly written and well-structured, this volume describes the material science of these fascinating materials from a theoretical and experimental perspective. Readers will find an in-depth description of their existing and potential applications in optical and solid state storage devices as well as reconfigurable logic applications. Researchers, graduate students and scientists with an interest in this field will find "Phase Change Materials" to be a valuable reference.

A comprehensive treatment of nonlinear optics emphasizing physical concepts and the relationhip between theory and experiment. Systematically describes a number of sub-topics in the field. Up-to-date references and numerous illustrations will help both beginners and practitioners interested in gaining a more thorough understanding of the subject.

Respected for its accuracy, its smooth and logical flow of ideas, and its clear presentation, 'Field and Wave Electromagnetics' has become an established textbook in the field of electromagnetics. This book builds the electromagnetic model using an axiomatic approach in steps: first for static electric fields, then for static magnetic fields, and finally for time-varying fields leading to Maxwell's equations.

An introduction to photonics and lasers that does not rely oncomplex mathematics This book evolved from a series of courses developed by the authorand taught in the areas of lasers and photonics. This thoroughlyclassroom-tested work fills a unique need for students,instructors, and industry professionals in search of anintroductory-level book that covers a wide range of topics in theseareas. Comparable books tend to be aimed either too high or toolow, or they cover only a portion of the topics that are needed fora comprehensive treatment. Photonics and Lasers is divided into four parts: * Propagation of Light * Generation and Detection of Light * Laser Light * Light-Based Communication The author has ensured that complex mathematics does not become anobstacle to understanding key physical concepts. Physical argumentsand explanations are clearly set forth while, at the same time,sufficient mathematical detail is provided for a quantitativeunderstanding. As an additional aid to readers who are learning tothink symbolically, some equations are expressed in words as wellas symbols. Problem sets are provided throughout the book for readers to testtheir knowledge and grasp of key concepts. A solutions manual isalso available for instructors. Finally, the detailed bibliographyleads readers to in-depth explorations of particular topics. The book's topics, lasers and photonics, are often treatedseparately in other texts; however, the author skillfullydemonstrates their natural synergy. Because of the combinedcoverage, this text can be used for a two-semester course or aone-semester course emphasizing either lasers or photonics. This isa perfect introductory textbook for both undergraduate and graduatestudents, additionally serving as a practical reference forengineers in telecommunications, optics, and laser electronics.

A new edition of the leading textbook on the finite element method, incorporating major advancements and further applications in the field of electromagnetics The finite element method (FEM) is a powerful simulation technique used to solve boundary-value problems in a variety of engineering circumstances. It has been widely used for analysis of electromagnetic fields in antennas, radar scattering, RF and microwave engineering, high-speed/high-frequency circuits, wireless communication, electromagnetic compatibility, photonics, remote sensing, biomedical engineering, and space exploration. The Finite Element Method in Electromagnetics, Third Edition explains the method’s processes and techniques

in careful, meticulous prose and covers not only essential finite element method theory, but also its latest developments and applications—giving engineers a methodical way to quickly master this very powerful numerical technique for solving practical, often complicated, electromagnetic problems. Featuring over thirty percent new material, the third edition of this essential and comprehensive text now includes: A wider range of applications, including antennas, phased arrays, electric machines, high-frequency circuits, and crystal photonics The finite element analysis of wave propagation, scattering, and radiation in periodic structures The time-domain finite element method for analysis of wideband antennas and transient electromagnetic phenomena Novel domain decomposition techniques for parallel computation and efficient simulation of large-scale problems, such as phased-array antennas and photonic crystals Along with a great many examples, The Finite Element Method in Electromagnetics is an ideal book for engineering students as well as for professionals in the field.

This pictorial manuscript is a step-by-step graphical illustrations for waveguides and devices modeling and computational physics simulation using COMSOL Multiphysics with Ray Optics, Wave Optics and AC/DC Electrostatics modules. All the example models investigated and visualized with the help of Finite Element Analysis are referenced from the standard USA undergraduate text on Optical Guided Waves and Devices by Richard Syms and John Cozens. The simulations include the use of geometrical ray tracings for point source and full electromagnetic waves source employing the Maxwell's wave equations for plane wave input. Both 2D and 3D simulation results will help in visualize the electromagnetic field propagating inside the waveguides and devices. Readers without fundamental handle on optics modeling are suggested to read the Optics Modeling and Visualization with COMSOL Multiphysics: A step by step graphical instruction manuscripts for detailed discussion. These models may be expanded to post-graduate research and industrial photonics waveguides and devices development. There are 46 chapters of different 2D and 3D optical waveguides & devices structures modeled and simulated in Volume 1 and 2. Volume 1 models include 3D single mode optical fiber, planar waveguide, channel waveguide, longitudinal and transverse phase modulator, surface plasmon, optical square waveguide, tapered waveguide, FTIR beamsplitter in ray tracing and electromagnetic wave solvers, full prism coupler, halved prism coupler, plano convex overlay lens, overlay Luneburg lens, geodesic lens with control setup for resulted electric field comparison, corrugated gratings, transmission and reflection gratings, chirped grating lens, beam expander grating, grating coupler, chirped grating coupler, buried channel waveguide. Volume 2 models continue with the ridge channel waveguide, strip loaded channel waveguide, GaAs GaAlAs planar waveguide, GaAs GaAlAs heterostructure waveguide, radiation leaks at fiber bend, radiation leaks at waveguide bend, c-axis Calcite polarizer waveguide, integrated optic normal reflector, horn channel waveguide, Y-

Junction waveguide, optical phase modulator, cut off modulator, electro optic Mach-Zehnder interferometer waveguide, parallel coupling waveguide, electro optic directional coupler, single polished fiber directional coupler, double polished fiber directional coupler, tunable-coupling strength of polished double fiber coupler, cross sectional coaxial fiber coupler, 2D directional coupler with tapered coupling, corrugated reflection gratings, optical fiber grating on half polished fiber coupler, and track-changing reflector with grating assisted-coupling fiber.
Progress in Electromagnetics Research Symposium (PIERS) provides an international forum for reporting progress and recent advances in the modern development of electromagnetic theory and its new and exciting applications Topics include radiation, propagation, diffraction, scattering, guidance, resonance, power, energy and force issues, acoustics, wave physics , wave functional materialsand all other modern developments, with spectra ranging from statics to RF, microwave, terahertz, photonics, and beyond
Reviews the fundamental concepts behind the theory and computation of electromagnetic fields The book is divided in two parts. The first part covers both fundamental theories (such as vector analysis, Maxwell's equations, boundary condition, and transmission line theory) and advanced topics (such as wave transformation, addition theorems, and fields in layered media) in order to benefit students at all levels. The second part of the book covers the major computational methods for numerical analysis of electromagnetic fields for engineering applications. These methods include the three fundamental approaches for numerical analysis of electromagnetic fields: the finite difference method (the finite difference time-domain method in particular), the finite element method, and the integral equation-based moment method. The second part also examines fast algorithms for solving integral equations and hybrid techniques that combine different numerical methods to seek more efficient solutions of complicated electromagnetic problems. Theory and Computation of Electromagnetic Fields, Second Edition: Provides the foundation necessary for graduate students to learn and understand more advanced topics Discusses electromagnetic analysis in rectangular, cylindrical and spherical coordinates Covers computational electromagnetics in both frequency and time domains Includes new and updated homework problems and examples Theory and Computation of Electromagnetic Fields, Second Edition is written for advanced undergraduate and graduate level electrical engineering students. This book can also be used as a reference for professional engineers interested in learning about analysis and computation skills.
Silicon photonics technology, which has the DNA of silicon electronics technology, promises to provide a compact photonic integration platform with high integration density, mass-producibility, and excellent cost performance. This technology has been used to develop and to integrate various photonic functions on silicon substrate. Moreover, photonics-electronics convergence based on silicon substrate is now being pursued. Thanks to these features, silicon

photonics will have the potential to be a superior technology used in the construction of energy-efficient cost-effective apparatuses for various applications, such as communications, information processing, and sensing. Considering the material characteristics of silicon and difficulties in microfabrication technology, however, silicon by itself is not necessarily an ideal material. For example, silicon is not suitable for light emitting devices because it is an indirect transition material. The resolution and dynamic range of silicon-based interference devices, such as wavelength filters, are significantly limited by fabrication errors in microfabrication processes. For further performance improvement, therefore, various assisting materials, such as indium-phosphide, silicon-nitride, germanium-tin, are now being imported into silicon photonics by using various heterogeneous integration technologies, such as low-temperature film deposition and wafer/die bonding. These assisting materials and heterogeneous integration technologies would also expand the application field of silicon photonics technology. Fortunately, silicon photonics technology has superior flexibility and robustness for heterogeneous integration. Moreover, along with photonic functions, silicon photonics technology has an ability of integration of electronic functions. In other words, we are on the verge of obtaining an ultimate technology that can integrate all photonic and electronic functions on a single Si chip. This e-Book aims at covering recent developments of the silicon photonic platform and novel functionalities with heterogeneous material integrations on this platform.

Nanoplasmonics is a young topic of research, which is part of nanophotonics and nano-optics. Nanoplasmonics concerns to the investigation of electron oscillations in metallic nanostructures and nanoparticles. Surface plasmons have optical properties, which are very interesting. For instance, surface plasmons have the unique capacity to confine light at the nanoscale. Moreover, surface plasmons are very sensitive to the surrounding medium and the properties of the materials on which they propagate. In addition to the above, the surface plasmon resonances can be controlled by adjusting the size, shape, periodicity, and materials' nature. All these optical properties can enable a great number of applications, such as biosensors, optical modulators, photodetectors, and photovoltaic devices. This book is intended for a broad audience and provides an overview of some of the fundamental knowledges and applications of nanoplasmonics.

A comprehensive manual on the efficient modeling and analysis of photonic devices through building numerical codes, this book provides graduate students and researchers with the theoretical background and MATLAB programs necessary for them to start their own numerical experiments. Beginning by summarizing topics in optics and electromagnetism, the book discusses optical planar waveguides, linear optical fiber, the propagation of linear pulses, laser diodes, optical amplifiers, optical receivers, finite-difference time-domain method, beam propagation method and some wavelength division devices, solitons, solar cells and metamaterials. Assuming only a basic knowledge of physics and numerical methods, the book is ideal for engineers, physicists and practising scientists. It concentrates on the operating

principles of optical devices, as well as the models and numerical methods used to describe them.

This book is a comprehensive contributed volume that aims to describe and explain the design, fabrication, operating characteristics, and specific applications of the most popular and useful types of specialty optical fibers. These “specialty fibers include any kind of optical fiber that has been architecturally manipulated to diverge from a conventional structure. For instance, metal-coated fibers can be utilized for bandwidth improvement, and hollow core fibers offer more controllable dispersion for sensitive medical procedures. Applications for these specialty fibers abound in the biomedical, sensors, and industrial fields, as well as in more traditional communications capacities. This book will act as a specialty fiber “guided tour, hosted by the top names in the discipline. The globally renowned editors, Drs. Mendez and Morse, have extensive experience in research, academia, and industry. *Completely covers biomedical and industrial sensor technology with emphasis on real world applications *Comparative studies of pros and cons of all fiber types with relation to test and measurement, mechanical properties and strength, and reliability *Easy to access essential facts and details at the begining of each chapter

This book is volume II of a series of books on silicon photonics. It gives a fascinating picture of the state-of-the-art in silicon photonics from a component perspective. It presents a perspective on what can be expected in the near future. It is formed from a selected number of reviews authored by world leaders in the field, and is written from both academic and industrial viewpoints. An in-depth discussion of the route towards fully integrated silicon photonics is presented. This book will be useful not only to physicists, chemists, materials scientists, and engineers but also to graduate students who are interested in the fields of micro- and nanophotonics and optoelectronics.

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)

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.

Advanced textbook on crystal nonlinear optics.

This hands-on introduction to silicon photonics engineering equips students with everything they need to begin creating foundry-ready designs.

Considered a major field of photonics, plasmonics offers the potential to confine and guide light below the diffraction limit and promises a new generation of highly miniaturized photonic devices. This book combines a comprehensive introduction with an extensive overview of the current state of the art. Coverage includes plasmon waveguides, cavities for field-

enhancement, nonlinear processes and the emerging field of active plasmonics studying interactions of surface plasmons with active media.

This book provides a comprehensive review of the state-of-the art of optical signal processing technologies and devices. It presents breakthrough solutions for enabling a pervasive use of optics in data communication and signal storage applications. It presents presents optical signal processing as solution to overcome the capacity crunch in communication networks. The book content ranges from the development of innovative materials and devices, such as graphene and slow light structures, to the use of nonlinear optics for secure quantum information processing and overcoming the classical Shannon limit on channel capacity and microwave signal processing. Although it holds the promise for a substantial speed improvement, today’s communication infrastructure optics remains largely confined to the signal transport layer, as it lags behind electronics as far as signal processing is concerned. This situation will change in the near future as the tremendous growth of data traffic requires energy efficient and fully transparent all-optical networks. The book is written by leaders in the field.

This manuscript is a step-by-step graphical instructions for COMSOL Multiphysics with Ray Optics Module and Wave Optics module modeling and computational physics simulation. All the example models investigated and visualized with the help of Finite Element Analysis are referenced from the standard USA undergraduate text on Optics by E. Hecht. The simulations include the use of geometrical ray tracings for point source, hemispherical, and conic rays as well as full electromagnetic waves source employing the Maxwell's wave equations for Gaussian waves input. Both 2D and 3D computational physics approach will be discussed with the introduction of the trick-of-the-trades meshings, and modeling skill besides setup options that are skillfully hidden in the simulation software from plain sight.The geometrical model covers 2D and 3D electromagnetic waves propagation in user defined refractive index domain; Laws of Refraction for 2D converging and diverging lens; Laws of Reflection for specular mirrors, 3D Prism, 3D Prism mirror equivalent system; Polarizations for 3D linear polarizers, 3D circular polarizer, 3D linear wave retarder such as half wave plate, quarter wave plate; the Theory of Superposition for the 2D Young's double slits Wavefront-splitting interference experiment, 3D thin film uniform thickness Amplitude-splitting interference experiment, 2D Michelson interferometer Mirrored-interference setup with the 1D interference fringes line graph; Fermat's principle for 2D single slits diffraction, 3D circular aperture diffraction experiment, 3D rectangular slit diffraction experiment, 3D diffraction gratings experiment with Fresnel near field and Fraunhofer far field diffraction pattern, diffraction pattern: Sinc() function observation discussions, the Limitation of ray tracing physics vs. full electromagnetic waves simulations in the physics of optics, the Babinet's principle of transparent openings or opaque obstacles diffraction slit; and finally the Modern optics of 2D and 3D LASER cavity

multiphysics models with the application of multiple release time of rays for Stimulated Emission lasing. One of the most important and crucial component of the computational physics subject, the user customizable library of material properties that governs the realisticality of the final modeled results, is highlighted in the appendix section.

This textbook offers the first unified treatment of wave propagation in electronic and electromagnetic systems and introduces readers to the essentials of the transfer matrix method, a powerful analytical tool that can be used to model and study an array of problems pertaining to wave propagation in electrons and photons. It is aimed at graduate and advanced undergraduate students in physics, materials science, electrical and computer engineering, and mathematics, and is ideal for researchers in photonic crystals, negative index materials, left-handed materials, plasmonics, nonlinear effects, and optics. Peter Markos and Costas Soukoulis begin by establishing the analogy between wave propagation in electronic systems and electromagnetic media and then show how the transfer matrix can be easily applied to any type of wave propagation, such as electromagnetic, acoustic, and elastic waves. The transfer matrix approach of the tight-binding model allows readers to understand its implementation quickly and all the concepts of solid-state physics are clearly introduced. Markos and Soukoulis then build the discussion of such topics as random systems and localized and delocalized modes around the transfer matrix, bringing remarkable clarity to the subject. Total internal reflection, Brewster angles, evanescent waves, surface waves, and resonant tunneling in left-handed materials are introduced and treated in detail, as are important new developments like photonic crystals, negative index materials, and surface plasmons. Problem sets aid students working through the subject for the first time.

Optical Waveguides and Devices Modeling and Visualization Using COMSOL Multiphysics Volume 1A Graphical Instructional GuideCreatespace Independent Publishing Platform

Recently, the rapid development of radiofrequency (RF)/microwave and photonic/optical waveguide technologies has had a significant impact on the current electronic industrial, medical and information and communication technology (ICT) fields. This book is a self-contained collection of valuable scholarly papers related to waveguide design, modeling, and applications. This book contains 20 chapters that cover three main subtopics of waveguide technologies, namely RF and microwave waveguide, photonic and optical waveguide and waveguide analytical solutions. Hence, this book is particularly useful to the academics, scientists, practicing researchers and postgraduate students whose work relates to the latest waveguide technologies.

This is the first book dedicated to wavelength filters for fibre optics. It provides a comprehensive account of the principles and applications of such filters, including their technological realizations. It explains the relevant performance parameters, the particular advantages and shortcomings of the various concepts and

components, and the preferred applications. There is also in-depth information on the characteristics of commercially available devices.