

Plasmonic Waveguide Analysis Comsol Multiphysics

A comprehensive treatment of nonlinear optics emphasizing physical concepts and the relationship 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.

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.

Plasmonics is entering the curriculum of many universities, either as a stand alone subject, or as part of some course or courses. Nanotechnology institutes have been, and are being, established in universities, in which plasmonics is a significant topic of research. Modern Plasmonics book offers a comprehensive presentation of the properties of surface plasmon polaritons, in systems of different structures and various natures, e.g. active, nonlinear, graded, theoretical/computational and experimental techniques for studying them, and their use in a variety of applications. Contains material not found in existing books on plasmonics,

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including basic properties of these surface waves, theoretical/computational and experimental approaches, and new applications of them. Each chapter is written by an expert in the subject to which it is devoted. Emphasis on applications of plasmonics that have been realized, not just predicted or proposed.

This book provides a cutting-edge research overview on the latest developments in the field of Optics and Photonics. All chapters are authored by the pioneers in their field and will cover the developments in Quantum Photonics, Optical properties of 2D Materials, Optical Sensors, Organic Optoelectronics, Nanophotonics, Metamaterials, Plasmonics, Quantum Cascade lasers, LEDs, Biophotonics and biomedical photonics and spectroscopy.

This book provides the fundamental understanding of the functioning of solar cells and the materials for the effective utilization of energy resources. The main objective of writing this book is to create a comprehensive and easy-to-understand source of information on the advances in the rapidly growing research on solar cells. Emerging Solar Energy Materials comprises 12 chapters written by the experts in the solar cell field and is organized with the intention to provide a big picture of the latest progress in the solar cell field and at the same time give an in-depth discussion on fundamentals of solar cells for interested audiences. In this book, each part opens with a new author's essay highlighting their work for contribution toward solar energy. Critical, cutting-edge subjects are addressed, including: Photovoltaic device technology and energy applications; Functional solar energy materials; New concept in solar energy; Perovskite solar cells; Dye-sensitized solar cells; Organic solar cells; Thin-film solar cells. The book is written for a large and broad readership including researchers and university graduate students from diverse backgrounds

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such as chemistry, physics, materials science, and photovoltaic device technology. The book includes enough information on the basics to be used as a textbook undergraduate coursework in engineering and the sciences. Excellent, informative volume focuses on dynamics of nonradiating fluids, problems involving waves, shocks and stellar winds, physics of radiation, radiation transport, and the dynamics of radiating fluids. 1984 edition.

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 beginning of each chapter

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

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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 book is a compendium of the finest research in nanoplasmonic sensing done around the world in the last decade. It describes basic theoretical considerations of nanoplasmons in the dielectric environment, gives examples of the multitude of applications of nanoplasmonics in biomedical and chemical sensing,

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and provides an overview of future trends in optical and non-optical nanoplasmonic sensing. Specifically, readers are guided through both the fundamentals and the latest research in the two major fields nanoplasmonic sensing is applied to – bio- and chemo-sensing – then given the state-of-the-art recipes used in nanoplasmonic sensing research.

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

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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.

Textbook on the physical principles of optical fibers - for advanced undergraduates and graduates in physics or electrical engineering.

Optical Waveguides and Devices Modeling and

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Visualization Using COMSOL Multiphysics Volume 2A
Graphical Instructional Guide
Createspace Independent
Publishing Platform

The Finite Difference Time Domain (FDTD) method is an essential tool in modeling inhomogeneous, anisotropic, and dispersive media with random, multilayered, and periodic fundamental (or device) nanostructures due to its features of extreme flexibility and easy implementation. It has led to many new discoveries concerning guided modes in nanoplasmonic waveguides and continues to attract attention from researchers across the globe. Written in a manner that is easily digestible to beginners and useful to seasoned professionals, *Computational Nanotechnology Using Finite Difference Time Domain* describes the key concepts of the computational FDTD method used in nanotechnology. The book discusses the newest and most popular computational nanotechnologies using the FDTD method, considering their primary benefits. It also predicts future applications of nanotechnology in technical industry by examining the results of interdisciplinary research conducted by world-renowned experts. Complete with case studies, examples, supportive appendices, and FDTD codes accessible via a companion website, *Computational Nanotechnology Using Finite Difference Time Domain* not only delivers a practical introduction to the use of FDTD in nanotechnology but also serves as a valuable reference for academia and professionals working in the fields of physics, chemistry, biology, medicine, material science, quantum science, electrical and electronic engineering,

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electromagnetics, photonics, optical science, computer science, mechanical engineering, chemical engineering, and aerospace engineering.

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,

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negative index materials, and surface plasmons. Problem sets aid students working through the subject for the first time.

Nanocomposites for Photonic and Electronic Applications addresses a range of aspects of different nanocomposites and their possible applications to illustrate the techniques used to prepare and characterize them. In addition, the book discusses possible optical, electronic, biophotonic, photonic and renewable energy applications, presenting a panorama of current research in the field of nanostructures for photonic applications. This is an important reference source for academics and industry engineers who are looking to learn more about how nanocomposites can be used to make cheaper, more efficient products in the electronic and photonic fields. Explores the use of different types of amorphous and crystalline nanocomposites based on fluorides, tellurite, borates and lasers Discusses the applications of nanocomposites for photonics, biophotonics and renewable energy applications Assesses the advantages and disadvantages of using different types of nanocomposite in the design of different electronic and photonic products

This book presents the principles of non-linear integrated optics. The first objective is to provide the reader with a thorough understanding of integrated optics so that they may be able to develop the theoretical and experimental tools to study and control the linear and non-linear optical properties of waveguides. The potential use of these structures can then be determined in order to realize

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integrated optical components for light modulation and generation. The theoretical models are accompanied by experimental tools and their setting in order to characterize the studied phenomenon. The passage from theory to practice makes the comprehension of the physical phenomena simple and didactic. The book also gives a presentation of the industrial applications of the integrated optical components. The studied topics range from the theory of waveguides and the linear and non-linear optical characterization techniques to photonic crystals. This last field constitutes a major challenge of photonic technologies of the 21st century.

This thesis presents a comprehensive theoretical description of classical and quantum aspects of plasmonics in three and two dimensions, and also in transdimensional systems containing elements with different dimensionalities. It focuses on the theoretical understanding of the salient features of plasmons in nanosystems as well as on the multifaceted aspects of plasmon-enhanced light–matter interactions at the nanometer scale. Special emphasis is given to the modeling of nonclassical behavior across the transition regime bridging the classical and the quantum domains. The research presented in this dissertation provides useful tools for understanding surface plasmons in various two- and three-dimensional nanostructures, as well as quantum mechanical effects in their response and their joint impact on light–matter interactions at the extreme nanoscale. These

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contributions constitute novel and solid advancements in the research field of plasmonics and nanophotonics that will help guide future experimental investigations in the blossoming field of nanophotonics, and also facilitate the design of the next generation of truly nanoscale nanophotonic devices.

This hands-on introduction to silicon photonics engineering equips students with everything they need to begin creating foundry-ready designs. Plasmonic resonators, composed of metallic micro- and nanostructures, belong to the category of excited-state physics on resonances from gigahertz to petahertz. Dynamical physics is in contrast to ground-state physics, which includes thermal states, and is connected to diverse applications to enhance existing photo-induced effects and phenomena such as plasmon-enhanced photoluminescence and Raman scattering. This book has three main aims: to provide fundamental knowledge on plasmonic resonators, to explain diverse plasmonic resonators, and to stimulate further development in plasmonic resonators. Plasmon-related studies, which are sometimes called plasmonics and include a substantial portion of metamaterials, have shown significant development since the 1980s. The piled-up results are too numerous to study from the beginning, but this book summarizes those results, including the history (past), all the possible types of

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plasmonic resonators (present), and their wide range of applications (future). It provides the basics of plasmons and resonant physics for undergraduate students, the systematic knowledge on plasmonic resonators for graduate students, and cutting-edge and in-depth information on plasmon-enhancement studies for researchers who are not experts in plasmonics and metamaterials, thereby benefitting a wide range of readers who are interested in the nanotechnology involving metallic nanostructures. There is hardly a field of science or engineering that does not have some interest in light scattering by small particles. For example, this subject is important to climatology because the energy budget for the Earth's atmosphere is strongly affected by scattering of solar radiation by cloud and aerosol particles, and the whole discipline of remote sensing relies largely on analyzing the parameters of radiation scattered by aerosols, clouds, and precipitation. The scattering of light by spherical particles can be easily computed using the conventional Mie theory. However, most small solid particles encountered in natural and laboratory conditions have nonspherical shapes. Examples are soot and mineral aerosols, cirrus cloud particles, snow and frost crystals, ocean hydrosols, interplanetary and cometary dust grains, and microorganisms. It is now well known that scattering properties of nonspherical particles can differ dramatically from those of "equivalent" (e.g.,

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equal-volume or equal-surface-area) spheres. Therefore, the ability to accurately compute or measure light scattering by nonspherical particles in order to clearly understand the effects of particle nonsphericity on light scattering is very important. The rapid improvement of computers and experimental techniques over the past 20 years and the development of efficient numerical approaches have resulted in major advances in this field which have not been systematically summarized. Because of the universal importance of electromagnetic scattering by nonspherical particles, papers on different aspects of this subject are scattered over dozens of diverse research and engineering journals. Often experts in one discipline (e.g., biology) are unaware of potentially useful results obtained in another discipline (e.g., antennas and propagation). This leads to an inefficient use of the accumulated knowledge and unnecessary redundancy in research activities. This book offers the first systematic and unified discussion of light scattering by nonspherical particles and its practical applications and represents the state-of-the-art of this important research field. Individual chapters are written by leading experts in respective areas and cover three major disciplines: theoretical and numerical techniques, laboratory measurements, and practical applications. An overview chapter provides a concise general introduction to the

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subject of nonspherical scattering and should be especially useful to beginners and those interested in fast practical applications. The audience for this book will include graduate students, scientists, and engineers working on specific aspects of electromagnetic scattering by small particles and its applications in remote sensing, geophysics, astrophysics, biomedical optics, and optical engineering. The first systematic and comprehensive treatment of electromagnetic scattering by nonspherical particles and its applications Individual chapters are written by leading experts in respective areas Includes a survey of all the relevant literature scattered over dozens of basic and applied research journals Consistent use of unified definitions and notation makes the book a coherent volume An overview chapter provides a concise general introduction to the subject of light scattering by nonspherical particles Theoretical chapters describe specific easy-to-use computer codes publicly available on the World Wide Web Extensively illustrated with over 200 figures, 4 in color 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

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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. 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

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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. Hyperbolic metamaterials were originally introduced to overcome the diffraction limit of optical imaging. Soon thereafter it was realized that hyperbolic metamaterials demonstrate a number of novel phenomena resulting from the broadband singular behavior of their density of photonic states. These novel phenomena and applications include super resolution imaging, new stealth technologies, enhanced quantum-electrodynamic effects, thermal hyperconductivity, superconductivity, and interesting gravitation theory analogs. Here I review typical material systems, which exhibit hyperbolic behavior and outline important new applications of hyperbolic metamaterials, such as imaging experiments with plasmonic hyperbolic metamaterials and novel VCSEL geometries, in which the Bragg mirrors may be engineered in such a way that they exhibit hyperbolic properties in the long wavelength infrared range, so that they may be used to efficiently remove excess heat from the laser cavity. I will also discuss potential applications of self-assembled photonic hypercrystals. This system bypasses 3D nanofabrication issues, which typically limit hyperbolic metamaterial applications. Photonic

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hypercrystals combine the most interesting features of hyperbolic metamaterials and photonic crystals. 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

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This book provides an in-depth analysis as well as an overview of phononic crystals. This book discusses numerous techniques for the analysis of phononic crystals and covers, among other material, sonic and ultrasonic structures, hypersonic planar structures and their characterization, and novel applications of phononic crystals. This is an ideal book for those working with micro and nanotechnology, MEMS (microelectromechanical systems), and acoustic devices. This book also: Presents an introduction to the fundamentals and properties of phononic crystals Covers simulation techniques for the analysis of phononic crystals Discusses sonic and ultrasonic, hypersonic and planar, and three-dimensional phononic crystal structures Illustrates how phononic crystal structures are being deployed in communication systems and sensing systems

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

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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.

For decades, the surface-plasmon-polariton wave guided by the interface of simple isotropic materials dominated the scene. However, in recent times research on electromagnetic surface waves guided by planar interfaces has expanded into new and exciting areas. In the 1990's research focused on advancing knowledge of the newly discovered Dyakonov wave. More recently, much of the surface wave research is motivated by the proliferation of nanotechnology and the growing number of materials available with novel properties. This book leads the reader from the relatively simple surface-plasmon-polariton wave with isotropic materials to the latest research on various types of electromagnetic surface waves guided by the interfaces of complex materials enabled by recent developments in nanotechnology. This includes: Dyakonov waves guided by interfaces formed with columnar thin films, Dyakonov-Tamm waves guided by interfaces formed with sculptured thin films, and multiple modes of surface-plasmon-polariton waves guided by the interface of a metal and a periodically varying dielectric material. Gathers research from the past 5 years in a single comprehensive view of

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electromagnetic surface waves. Written by the foremost experts and researchers in the field. Layered presentation explains topics with an introductory overview level up to a highly technical level.

Presenting innovative, promising and unconventional techniques, Post-modern Electromagnetics outlines the essential tools for the creation of numerical methods. Hafner offers a comparative analysis of the fundamental computational electromagnetics methods and proposes future adaptive strategies. Complementary to Max-1: A Visual Electromagnetics Platform, this unique text challenges current thinking and provides guidance through the solution of practical problems. Features Include: * Outline of Maxwell theory from simple material properties to complex media and wave equations * Discussion of intelligent optimization strategies such as genetic algorithms designed to improve the performance of existing techniques * Applications section demonstrating solutions in statics, scattering, gratings, antenna, antenna arrays, guided waves, resonators, coupling and waveguide discontinuities * Explanation of the background to numerical methods showing how the various approaches to computational electromagnetics can be generalized and combined Students and researchers interested in advanced numerical approaches and design engineers developing new codes for computational

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electromagnetics will benefit from this exploration of creative electromagnetics solutions.

During the last few years, nanomaterials have attracted the attention of the scientific community due to their extraordinary and unique properties. Their small size, and the distinctive features that come with it, makes these materials very attractive for use in different important fields like biomedicine, sensors, or catalysis. One of the most important properties of these materials is their interaction with light and is called surface plasmon resonance. It is a phenomenon that happens on the surface of certain nanomaterials that confers them with unique properties. This remarkable characteristic has opened a whole new field called nanoplasmonics that is acquiring more and more importance among the scientific community. This book aims to review the state of the art in this new field and provide the reader with a wide overview of the new nanomaterials available and their current and future applications.

This contributed volume summarizes recent theoretical developments in plasmonics and its applications in physics, chemistry, materials science, engineering, and medicine. It focuses on recent advances in several major areas of plasmonics including plasmon-enhanced spectroscopies, light scattering, many-body effects, nonlinear optics, and ultrafast dynamics. The theoretical and

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computational methods used in these investigations include electromagnetic calculations, density functional theory calculations, and nonequilibrium electron dynamics calculations. The book presents a comprehensive overview of these methods as well as their applications to various current problems of interest.

The future of electric vehicles relies nearly entirely on the design, monitoring, and control of the vehicle battery and its associated systems. Along with an initial optimal design of the cell/pack-level structure, the runtime performance of the battery needs to be continuously monitored and optimized for a safe and reliable operation and prolonged life. Improved charging techniques need to be developed to protect and preserve the battery. The scope of this Special Issue is to address all the above issues by promoting innovative design concepts, modeling and state estimation techniques, charging/discharging management, and hybridization with other storage components.

This book provides a comprehensive overview of the photonic sensing field by covering plasmonics, photonic crystal, and SOI techniques from theory to real sensing applications. A literature review of ultra-sensitive photonic sensors, including their design and application in industry, makes this a self-contained and comprehensive resource for different types of sensors, with high value to the biosensor

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sector in particular. The book is organized into four parts: Part I covers the basic theory of wave propagation, basic principles of sensing, surface plasmon resonance, and silicon photonics; Part II details the computational modeling techniques for the analysis and prediction of photonic sensors; Part III and Part IV cover the various mechanisms and light matter interaction scenarios behind the design of photonic sensors including photonic crystal fiber sensors and SOI sensors. This book is appropriate for academics and researchers specializing in photonic sensors; graduate students in the early and intermediate stages working in the areas of photonics, sensors, biophysics, and biomedical engineering; and to biomedical, environmental, and chemical engineers.

A comprehensive overview, from fundamental theory and numerical methods to the design of real plasmonic structures for nanoelectronic and sensing applications.

Plasmonics is a rapidly developing field that combines fundamental research and applications ranging from areas such as physics to engineering, chemistry, biology, medicine, food sciences, and the environmental sciences. Plasmonics appeared in the 1950s with the discovery of surface plasmon polaritons. Plasmonics then went through a novel propulsion in the mid-1970s, when surface-enhanced Raman scattering was discovered.

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Nevertheless, it is in this last decade that a very significant explosion of plasmonics and its applications has occurred. Thus, this book provides a snapshot of the current advances in these various areas of plasmonics and its applications, such as engineering, sensing, surface-enhanced fluorescence, catalysis, and photovoltaic devices. 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.

This book brings together reviews by internationally renowned experts on quantum optics and photonics. It

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describes novel experiments at the limit of single photons, and presents advances in this emerging research area. It also includes reprints and historical descriptions of some of the first pioneering experiments at a single-photon level and nonlinear optics, performed before the inception of lasers and modern light detectors, often with the human eye serving as a single-photon detector. The book comprises 19 chapters, 10 of which describe modern quantum photonics results, including single-photon sources, direct measurement of the photon's spatial wave function, nonlinear interactions and non-classical light, nanophotonics for room-temperature single-photon sources, time-multiplexed methods for optical quantum information processing, the role of photon statistics in visual perception, light-by-light coherent control using metamaterials, nonlinear nanoplasmonics, nonlinear polarization optics, and ultrafast nonlinear optics in the mid-infrared.

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

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and describes the technologies with an emphasis on how they work and their key benefits.

This unique resource explains the fundamental physics of semiconductor nanolasers, and provides detailed insights into their design, fabrication, characterization, and applications. Topics covered range from the theoretical treatment of the underlying physics of nanoscale phenomena, such as temperature dependent quantum effects and active medium selection, to practical design aspects, including the multi-physics cavity design that extends beyond pure electromagnetic consideration, thermal management and performance optimization, and nanoscale device fabrication and characterization techniques. The authors also discuss technological applications of semiconductor nanolasers in areas such as photonic integrated circuits and sensing. Providing a comprehensive overview of the field, detailed design and analysis procedures, a thorough investigation of important applications, and insights into future trends, this is essential reading for graduate students, researchers, and professionals in optoelectronics, applied photonics, physics, nanotechnology, and materials science.

Plasmonics is a highly dynamic field, and a number of researchers and scientists from other disciplines have become involved in it. This book presents the most widely employed approaches to plasmonics and the numerous applications associated with it.

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There are several underlying elements in plasmonics research. Advances in nanoscience and nanotechnology have made possible the fabrication of plasmonic nanostructures, deposition of thin films, and development of highly sensitive optical characterization techniques. The different approaches to nanostructuring metals have led to a wealth of interesting optical properties and functionality via manipulation of the plasmon modes that such structures support. The sensitivity of plasmonic structures to the changes in their local dielectric environment has led to the development of new sensing strategies and systems for chemical analysis and identification. The book discusses all of these aspects.

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