

Optical Microresonators Theory Fabrication And Applications

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[Handbook of Fiber Optic Data Communication](#) - Casimer DeCusatis
2011-10-13

Handbook of Fiber Optic Data Communication, Third Edition provides a comprehensive, easy to use guide to the field of optical fiber data communications. Written by experts in the industry from major companies such as IBM, Cisco and Nortel, the Handbook is a key reference for optical fiber technology, networking, protocols, applications, manufacturing, and future directions. It includes chapters on all the major industry standards, written by the same experts who developed them. This edition contains new material on transceiver form factors (QSFP, SFP+, XFP, X2), manufacturing standards, including JEDEC and RoHS, as well as the latest revisions to industry standards including 8G and 10G Fiber Channel, FICON, SONET GFP/LCAS, and 10 Gigabit Ethernet. The book also contains new chapters on emerging technologies and leading edge applications such as silicon photonics, nanophotonics, parallel optical interconnects, specialty fiber cable types, and optical backplanes. Features include: New Case Studies on Voice/Data Convergence, Redesigning Mainframe I/O, National LambdaRail, and optical peer-to-peer networks Includes an expanded listing of references on the World Wide Web, plus hard-to-find references for international, homologation, and type approval requirements Quick reference tables of all the key optical network parameters and a glossary that defines hundreds of technical terms and acronyms Written for engineers by engineers, this Handbook will be an indispensable, hands-on reference for optical networks and equipment developers, designers, and installers, as well as for students studying optical fiber communications wanting an understanding of, and insight into, professional practice. New Case Studies on Voice/Data Convergence, Redesigning Mainframe I/O, National LambdaRail, and optical peer-to-peer networks Includes an expanded listing of references on the World Wide Web, plus hard-to-find references for international, homologation, and type approval requirements Quick reference tables of all the key optical network parameters and a glossary that defines hundreds of technical terms and acronyms

Wavelength Filters in Fibre Optics - Herbert Venghaus 2006-09-21

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.

Silicon Nanomaterials Sourcebook - Klaus D. Sattler 2017-07-28

This comprehensive tutorial guide to silicon nanomaterials spans from fundamental properties, growth mechanisms, and processing of nanosilicon to electronic device, energy conversion and storage, biomedical, and environmental applications. It also presents core knowledge with basic mathematical equations, tables, and graphs in order to provide the reader with the tools necessary to understand the latest technology developments. From low-dimensional structures, quantum dots, and nanowires to hybrid materials, arrays, networks, and biomedical applications, this Sourcebook is a complete resource for anyone working with this materials: Covers fundamental concepts, properties, methods, and practical applications. Focuses on one important type of silicon nanomaterial in every chapter. Discusses formation, properties, and applications for each material. Written in a tutorial style with basic equations and fundamentals included in an

extended introduction. Highlights materials that show exceptional properties as well as strong prospects for future applications. Klaus D. Sattler is professor physics at the University of Hawaii, Honolulu, having earned his PhD at the Swiss Federal Institute of Technology (ETH) in Zurich. He was honored with the Walter Schottky Prize from the German Physical Society, and is the editor of the sister work also published by Taylor & Francis, Carbon Nanomaterials Sourcebook, as well as the acclaimed multi-volume Handbook of Nanophysics.

Handbook of Humidity Measurement, Volume 1 - Ghenadii Korotcenkov 2018-03-15

The first volume of The Handbook of Humidity Measurement focuses on the review of devices based on optical principles of measurement such as optical UV, fluorescence hygrometers, optical and fiber-optic sensors of various types. Numerous methods for monitoring the atmosphere have been developed in recent years, based on measuring the absorption of electromagnetic field in different spectral ranges. These methods, covering the optical (FTIR and Lidar techniques), as well as a microwave and THz ranges are discussed in detail in this volume. The role of humidity-sensitive materials in optical and fiber-optic sensors is also detailed. This volume describes the reasons for controlling the humidity, features of water and water vapors, and units used for humidity measurement.

Light-Driven Alignment - Boris P. Antonyuk 2009

This book deals with influencing the properties of solids by light-driven electron transport. The theoretical basis of these effects, light-driven ordering and self-organisation, as well as optical motors are presented. With light as a tool, new ways to produce materials are opened.

Nanomaterials, Polymers and Devices - E. S. W. Kong 2015-04-21

Providing an eclectic snapshot of the current state of the art and future implications of the field, Nanomaterials, Polymers, and Devices: Materials Functionalization and Device Fabrication presents topics grouped into three categorical focuses: The synthesis, mechanism and functionalization of nanomaterials, such as carbon nanotubes, graphene, silica, and quantum dots Various functional devices which properties and structures are tailored with emphasis on nanofabrication. Among discussed are light emitting diodes, nanophotonic, nano-optical, and photovoltaic devices Nanoelectronic devices, which include semiconductor, nanotube and nanowire-based electronics, single-walled carbon-nanotube based nanoelectronics, as well as thin-film transistors [Dynamic Control of Light in On-chip Microresonators](#) - Sunil Sandhu 2011

Optical microresonators have generated much progress in many aspects of optical science, such as in optical buffering, wavelength division-multiplexed filters for optical networks, optical switching, and in the enhancement of nonlinear effects. All these applications are made possible by the confinement of light within a small modal volume in the microresonator. The ability to actively tune the resonance within a microresonator has resulted in systems that can dynamically manipulate the flow of light. This thesis discusses some of the novel capabilities of these dynamic systems. Chapters 3 - 4 discusses the use of a dynamic delay line to suppress dispersion, and to overcome the gain-bandwidth product constraint of slow-light structures. This is followed by Chapter 5 which introduces a light-stopping scheme based on loss modulation. Finally, Chapter 6 shows how coherent control can be used in a microresonator system to enhance optical switching.

[Interferometry](#) - Bruno Ullrich 2019-08-28

The authors provide an overview of recent developments in the field of

interferometry. To achieve this aim, a broad range of topics is presented by experts who have summarized recent results drawn from theory and experiments. The simplicity and versatility of interferometry technique can be easily seen in the broad range of problems discussed in the text. This important book project presents recent, unique updates on interferometry.

Extending Moore's Law through Advanced Semiconductor Design and Processing Techniques - Wynand Lambrechts 2018-09-13

This book provides a methodological understanding of the theoretical and technical limitations to the longevity of Moore's law. The book presents research on factors that have significant impact on the future of Moore's law and those factors believed to sustain the trend of the last five decades. Research findings show that boundaries of Moore's law primarily include physical restrictions of scaling electronic components to levels beyond that of ordinary manufacturing principles and approaching the bounds of physics. The research presented in this book provides essential background and knowledge to grasp the following principles: Traditional and modern photolithography, the primary limiting factor of Moore's law Innovations in semiconductor manufacturing that makes current generation CMOS processing possible Multi-disciplinary technologies that could drive Moore's law forward significantly Design principles for microelectronic circuits and components that take advantage of technology miniaturization The semiconductor industry economic market trends and technical driving factors The complexity and cost associated with technology scaling have compelled researchers in the disciplines of engineering and physics to optimize previous generation nodes to improve system-on-chip performance. This is especially relevant to participate in the increased attractiveness of the Internet of Things (IoT). This book additionally provides scholarly and practical examples of principles in microelectronic circuit design and layout to mitigate technology limits of previous generation nodes. Readers are encouraged to intellectually apply the knowledge derived from this book to further research and innovation in prolonging Moore's law and associated principles.

Enhancing the Light Output of Solid-State Emitters - Christopher Woodhead 2018-06-16

The significance of the development of solid-state lighting was underscored by the award of a Nobel Prize in 2014. It is important to build upon this work and to produce practical and versatile sources of quantum light, because these are essential components for the advancement of quantum photonic devices. These devices, in turn, promise new technologies that have the potential to revolutionize society. This book explores various ways of coupling quantum light into, and out of, solid-state emitters. The research presented here has led to important discoveries that will help overcome major challenges in this field.

Advances in Smart Communication Technology and Information Processing - Soumen Banerjee 2021-02-15

This book is a collection of best selected research papers presented at the 6th International Conference on Opto-Electronics and Applied Optics (OPTRONIX 2020) organized by the University of Engineering & Management, Kolkata, India, in June 2020. The primary focus is to address issues and developments in optoelectronics with particular emphasis on communication technology, IoT and intelligent systems, information processing and its different kinds. The theme of the book is in alignment with the theme of the conference "Advances in Smart Communication Technology and Information Processing." The purpose of this book is to inform the scientists and researchers of this field in India and abroad about the latest developments in the relevant field and to raise awareness among the academic fraternity to get them involved in different activities in the years ahead - an effort to realize knowledge-based society.

Optical Microresonators - John Heebner 2008

Optical Micro-Resonators are an exciting new field of research that has gained prominence in the past few years due to the emergence of new fabrication technologies. This book is the first detailed text on the theory, fabrication, and applications of optical micro-resonators, and will be found useful by both graduate students and researchers in the field. *Plasmonics: Fundamentals and Applications* - Stefan Alexander Maier 2007-05-16

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. *Practical Applications of Microresonators in Optics and Photonics* - Andrey B. Matsko 2018-09-03

Assembling an international team of experts, this book reports on the progress in the rapidly growing field of monolithic micro- and nanoresonators. The book opens with a chapter on photonic crystal-based resonators (nanocavities). It goes on to describe resonators in which the closed trajectories of light are supported by any variety of total internal reflection in curved and polygonal transparent dielectric structures. The book also covers distributed feedback microresonators for slow light, controllable dispersion, and enhanced nonlinearity. A portion of coverage is dedicated to the unique properties of resonators, which are extremely efficient tools when conducting multiple applications.

Applications of Photonic Technology 2 - George A. Lampropoulos 2013-11-11

This book presents a current review of photonic technologies and their applications. The papers published in this book are extended versions of the papers presented at the International Conference on Applications of Photonic Technology (ICAPT'96) held in Montreal, Canada, on July 29 to August 1, 1996. The theme of this event was "Closing the Gap Between Theory, Developments and Applications." The term photonics covers both optics and optical engineering areas of growing scientific and commercial importance throughout the world. It is estimated that photonic technology-related applications to increase exponentially over the next few years and will play a significant role in the global economy by reaching a quarter of a trillion of US dollars by the year 2000. The global interest and advancements of this technology are represented in this book, where leading scientists of twenty-two countries with advanced technology in photonics present their latest results. The papers selected herein are grouped to address six distinct areas of photonic technology. The reader will find throughout the book a combination of invited and contributed papers which reflect the state of the art today and provide some insight about the future of this technology. The first two papers are invited. They discuss business aspects of photonic engineering. One examines if chip-to-chip interconnections by means of optical technology are a good economic choice, while the other discusses the photonic technology from entrepreneurial viewpoint. Papers related to materials and considered for photonic applications, e. g.

Optical Microcavities - Kerry Vahala 2004

Optical microcavities are structures that enable confinement of light to microscale volumes. The universal importance of these structures has made them indispensable to a wide range of fields. This important book describes the many applications and the related physics, providing both a review and a tutorial of key subjects by leading researchers from each field

Proceedings of the 7th International Conference on the Applications of Science and Mathematics 2021 - Aida Binti Mustapha 2022-06-28

This book presents peer-reviewed articles and recent advances on the potential applications of Science and Mathematics for future technologies, from the 7th International Conference on the Applications of Science and Mathematics (SCIEMATHIC 2021), held in Malaysia. It provides an insight about the leading trends in sustainable Science and Technology. The world is looking for sustainable solutions to problems more than ever. The synergistic approach of mathematicians, scientists and engineers has undeniable importance for future technologies. With this viewpoint, SCIEMATHIC 2021 has the theme "Quest for Sustainable Science and Mathematics for Future Technologies". The conference brings together physicists, mathematicians, statisticians and data scientists, providing a platform to find sustainable solutions to major problems around us. The works presented here are suitable for professionals and researchers globally in making the world a better and sustainable place.

Advanced Photonic Structures for Biological and Chemical Detection - Xudong Fan 2009-08-29

In my career I've found that "thinking outside the box" works better if I know what's "inside the box." Dave Grusin, composer and jazz musician Different people think in different time frames: scientists think in decades, engineers think in years, and investors think in quarters. Stan Williams, Director of Quantum Science Research, Hewlett Packard Laboratories Everything can be made smaller, never mind physics; Everything can be made more efficient, never mind thermodynamics; Everything will be more expensive, never mind common sense. Tomas

Hirschfeld, pioneer of industrial spectroscopy Integrated Analytical Systems Series Editor: Dr. Radislav A. Potyrailo, GE Global Research, Niskayuna, NY The book series Integrated Analytical Systems offers the most recent advances in all key aspects of development and applications of modern instrumentation for chemical and biological analysis. The key development aspects include (i) innovations in sample introduction through micro- and nanofluidic designs, (ii) new types and methods of fabrication of physical transducers and ion detectors, (iii) materials for sensors that became available due to the breakthroughs in biology, combinatorial materials science, and nanotechnology, and (iv) innovative data processing and mining methodologies that provide dramatically reduced rates of false alarms.

Springer Handbook of Optical Networks - Biswanath Mukherjee 2020-10-15

This handbook is an authoritative, comprehensive reference on optical networks, the backbone of today's communication and information society. The book reviews the many underlying technologies that enable the global optical communications infrastructure, but also explains current research trends targeted towards continued capacity scaling and enhanced networking flexibility in support of an unabated traffic growth fueled by ever-emerging new applications. The book is divided into four parts: Optical Subsystems for Transmission and Switching, Core Networks, Datacenter and Super-Computer Networking, and Optical Access and Wireless Networks. Each chapter is written by world-renowned experts that represent academia, industry, and international government and regulatory agencies. Every chapter provides a complete picture of its field, from entry-level information to a snapshot of the respective state-of-the-art technologies to emerging research trends, providing something useful for the novice who wants to get familiar with the field to the expert who wants to get a concise view of future trends.

Reviews in Plasmonics 2017 - Chris D. Geddes 2019-10-11

Reviews in Plasmonics is a comprehensive collection of current trends and emerging hot topics in the field of Plasmonics and closely related disciplines. It summarizes the years progress in Plasmonics and its applications, with authoritative analytical reviews specialized enough to be attractive to professional researchers, yet also appealing to the wider audience of scientists in related disciplines of Plasmonics.

Neuromorphic Photonics - Paul R. Prucnal 2017-05-08

This book sets out to build bridges between the domains of photonic device physics and neural networks, providing a comprehensive overview of the emerging field of "neuromorphic photonics." It includes a thorough discussion of evolution of neuromorphic photonics from the advent of fiber-optic neurons to today's state-of-the-art integrated laser neurons, which are a current focus of international research. Neuromorphic Photonics explores candidate interconnection architectures and devices for integrated neuromorphic networks, along with key functionality such as learning. It is written at a level accessible to graduate students, while also intending to serve as a comprehensive reference for experts in the field.

Advances in Computer, Communication and Control - Utpal Biswas 2019-02-14

The book discusses the recent research trends in various sub-domains of computing, communication and control. It includes research papers presented at the First International Conference on Emerging Trends in Engineering and Science. Focusing on areas such as optimization techniques, game theory, supply chain, green computing, 5g networks, Internet of Things, social networks, power electronics and robotics, it is a useful resource for academics and researchers alike.

Silicon-Based Photonics - Erich Kasper 2020-07-24

Silicon photonics has evolved rapidly as a research topic with enormous application potential. The high refractive index contrast of silicon-on-insulator (SOI) shows great promise for submicron waveguide structures suited for integration on the chip scale in the near-infrared region. Ge- and GeSn-Si heterostructures with different elastic strain levels already provide expansion of the spectral range, high-speed operation, efficient modulation and switching of optical signals, and enhanced light emission and lasing. This book focuses on the integration of heterostructure devices with silicon photonics. The authors have attempted to merge a concise treatment of classical silicon photonics with a description of principles, prospects, challenges, and technical solution paths of adding silicon-based heterostructures. The book discusses the basics of heterostructure-based silicon photonics, system layouts, and key device components, keeping in mind the application background. Special focus is placed on SOI-based waveguide configurations and Ge- and GeSn-Si heterostructure devices for light detection, modulation, and light

emission and lasing. The book also provides an overview of the technological and materials science challenges connected with integration on silicon. The first half of the book is mainly for readers who are interested in the topic because of its increasing importance in different fields, while the latter half covers different device structures for light emission, detection, modulation, extension of the wavelength beyond 1.6 μm , and lasing, as well as future challenges.

Applications of Silicon Photonics in Sensors and Waveguides - Lakshmi Narayana Deepak Kallepalli 2018-11-14

This book is a collection of five original research articles on silicon photonics. The discussed issues are organized into two parts. Part 1 describes the science behind the silicon photonics emphasizing the role of photonic circuits on silicon, and Part 2 describes applications in waveguide and optical transmissions. This book should be of interest to academic researchers and engineers. The chapters included are fundamental science and applications of silicon photonics, optical properties of thin nanocrystalline silicon films, microporous silicon in gas sensing, Mach-Zehnder interferometer cell-based silicon waveguide, experimental study of porous silicon films, and integrated optical switches and their applications.

Optik und Photonik - Bahaa E. A. Saleh 2020-04-22

Vollständig überarbeitete Neuauflage des maßgeblichen Grundlagen-Lehrbuchs zur Optik und Photonik - umfassend überarbeitet und mit einem neuen Kapitel zur Metamaterialoptik erweitert Die Optik ist eines der ältesten und faszinierendsten Teilgebiete der Physik und fest in den Curricula des Physikstudiums verankert. Sie beschäftigt sich mit der Ausbreitung von Licht und Phänomenen wie Interferenz, Brechung, Beugung und optischen Abbildungen. Die Photonik umfasst optische Phänomene, die primär auf der Wechselwirkung von (quantisiertem) Licht und Materie beruhen, und befasst sich mit dem Verständnis und der Entwicklung optischer Bauteile und Systeme wie etwa Lasern, LEDs und photonischen Kristallen. In bewährter Weise gibt die vollständig überarbeitete und erweiterte Neuauflage des "Saleh/Teich" eine Einführung in die Grundlagen der Optik und Photonik für Studierende der Physik und verwandter Wissenschaften. Ausführliche Erklärungen, rund 1000 Abbildungen und die zur quantitativen Durchdringung notwendige Mathematik ermöglichen ein tiefes Verständnis aller Teilgebiete der klassischen und modernen Optik. * Umfassend und verständlich: sämtliche Grundlagen der Optik und Photonik in einem Werk vereint * Geschrieben von hervorragenden Didaktikern mit langer Lehrerfahrung: optische Phänomene und deren Physik stehen im Vordergrund, der notwendige mathematische Apparat wird behutsam entwickelt * Überarbeitet und erweitert: alle Kapitel wurden mit Blick auf noch bessere Verständlichkeit kritisch geprüft und aktualisiert * Komplet neu: umfangreiches Kapitel zu Metamaterialoptik "Optik und Photonik" richtet sich an Bachelor- und Master-Studierende der Physik, Materialwissenschaften und Ingenieurwissenschaften.

Micro and Nano Fabrication Technology - Jiwang Yan 2018-07-21

This volume focuses on the state-of-the-art micro/nanofabrication technologies for creating miniature structures with high precision. These multidisciplinary technologies include mechanical, electrical, optical, physical, and chemical methods, as well as hybrid processes, covering subtractive and additive material manufacturing, as well as net-shape manufacturing. The materials the volume deals with include metals, alloys, semiconductors, polymers, crystals, glass, ceramics, composites, and nanomaterials. The volume is composed of 30 chapters, which are grouped into five parts. Engaging with the latest research in the field, these chapters provide important perspectives on key topics, from process developments at the shop level to scientific investigations at the academic level, offering both experimental work and theoretical analysis. Moreover, the content of this volume is highly interdisciplinary in nature, with insights from not only manufacturing technology but also mechanical/material science, optics, physics, chemistry, and more.

Nanodevices for Photonics and Electronics - Paolo Bettotti 2015-12-23

Photonics and electronics are endlessly converging into a single technology by exploiting the possibilities created by nanostructuring of materials and devices. It is expected that next-generation optoelectronic devices will show great improvements in terms of performance, flexibility, and energy consumption: the main limits of nanoelectronics will be overcome by using a photonics approach, while nanophotonics will become a mature technology, thanks to miniaturization strategies developed in microelectronics. Mastering such a complex subject requires a multidisciplinary approach and a solid knowledge of several topics. This book gives a broad overview of recent advances in several

topical aspects of nanophotonics and nanoelectronics, keeping an eye on real applications of such technologies, and focuses on the possibilities created by advanced photon management strategies in optoelectronic devices. Starting from pure photonic systems, the book provides several examples in which the interaction between photonics and electronics is exploited to achieve faster, compact, and more efficient devices. A large number of figures and tables also support each chapter. This book constitutes a valuable resource for researchers, engineers, and professionals working on the development of optoelectronics.

Integrated Optical Interconnect Architectures for Embedded Systems - Ian O'Connor 2012-11-07

This book provides a broad overview of current research in optical interconnect technologies and architectures. Introductory chapters on high-performance computing and the associated issues in conventional interconnect architectures, and on the fundamental building blocks for integrated optical interconnect, provide the foundations for the bulk of the book which brings together leading experts in the field of optical interconnect architectures for data communication. Particular emphasis is given to the ways in which the photonic components are assembled into architectures to address the needs of data-intensive on-chip communication, and to the performance evaluation of such architectures for specific applications.

Fundamentals of Photonics - Bahaa E. A. Saleh 2020-03-04

Fundamentals of Photonics A complete, thoroughly updated, full-color third edition Fundamentals of Photonics, Third Edition is a self-contained and up-to-date introductory-level textbook that thoroughly surveys this rapidly expanding area of engineering and applied physics. Featuring a blend of theory and applications, coverage includes detailed accounts of the primary theories of light, including ray optics, wave optics, electromagnetic optics, and photon optics, as well as the interaction of light and matter. Presented at increasing levels of complexity, preliminary sections build toward more advanced topics, such as Fourier optics and holography, photonic-crystal optics, guided-wave and fiber optics, LEDs and lasers, acousto-optic and electro-optic devices, nonlinear optical devices, ultrafast optics, optical interconnects and switches, and optical fiber communications. The third edition features an entirely new chapter on the optics of metals and plasmonic devices. Each chapter contains highlighted equations, exercises, problems, summaries, and selected reading lists. Examples of real systems are included to emphasize the concepts governing applications of current interest. Each of the twenty-four chapters of the second edition has been thoroughly updated.

Waveguide-Based Photonic Sensors: From Devices to Robust Systems - Milvich, Johannes 2022-03-15

Integrated photonic sensor systems are miniaturized, mass-producible devices that leverage the mature semiconductor fabrication technology and a well-established ecosystem for photonic circuits. This book aims at a holistic treatment of waveguide-based photonic sensor systems by analyzing photonic waveguide design, photonic circuit design and readout design. Across all levels, a special emphasis is given to system-level performance optimization under realistic environmental conditions.

Photonic Crystals, Theory, Applications and Fabrication - Dennis W Prather 2009-05-26

The Only Source You Need for Understanding the Design and Applications of Photonic Crystal-Based Devices This book presents in detail the fundamental theoretical background necessary to understand the unique optical phenomena arising from the crystalline nature of photonic-crystal structures and their application across a range of disciplines. Organized to take readers from basic concepts to more advanced topics, the book covers: Preliminary concepts of electromagnetic waves and periodic media Numerical methods for analyzing photonic-crystal structures Devices and applications based on photonic bandgaps Engineering photonic-crystal dispersion properties Fabrication of two- and three-dimensional photonic crystals The authors assume an elementary knowledge of electromagnetism, vector calculus, Fourier analysis, and complex number analysis. Therefore, the book is appropriate for advanced undergraduate students in physics, applied physics, optics, electronics, and chemical and electrical engineering, as well as graduate students and researchers in these fields.

Hyperbolic Metamaterials - Igor I Smolyaninov 2018-03-23

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

Microcavity Semiconductor Lasers - Yong-zhen Huang 2021-05-24

Microcavity Semiconductor Lasers Explore this thorough overview of integrable microcavity semiconductor lasers and their applications from two leading voices in the field Attracting a great deal of attention over the last decades for their promising applications in photonic integration and optical interconnects, microcavity semiconductor lasers continue to develop via advances in fundamental physics, theoretical analysis, and numerical simulations. In a new work that will be of interest to researchers and practitioners alike, Microcavity Semiconductor Lasers: Principles, Design, and Applications delivers an application-oriented and highly relevant exploration of the theory, fabrication, and applications of these practical devices. The book focuses on unidirectional emission microcavity lasers for photonic integrated circuits, including polygonal microresonators, microdisk, and microring lasers. After an introductory overview of optical microcavities for microlasers and detailed information of the lasers themselves, including mode structure control and characteristics, and lasing properties, the distinguished authors discuss fabrication and applications of different microcavity lasers. Prospects for future research and potential new applications round out the book. Readers will also benefit from the inclusion of: A thorough introduction to multilayer optical waveguides, the FDTD Method, and Padé Approximation, and deformed, chaos, and unidirectional emission microdisk lasers An exploration of mode analysis for triangle and square microresonators similar as FP Cavity Practical discussions of mode analysis and control for deformed square microlasers An examination of hexagonal microcavity lasers and polygonal microcavities, along with vertical radiation loss for 3D microcavities Perfect for laser specialists, semiconductor physicists, and solid-state physicists, Microcavity Semiconductor Lasers: Principles, Design, and Applications will also earn a place in the libraries of materials scientists and professionals working in the semiconductor and optical industries seeking a one-stop reference for integrable microcavity semiconductor lasers.

Small Scale Optics - Preecha Yupapin 2013-08-28

The behavior of light in small scale optics or nano/micro optical devices has shown promising results, which can be used for basic and applied research, especially in nanoelectronics. Small Scale Optics presents the use of optical nonlinear behaviors for spins, antennae, and whispering gallery modes within micro/nano devices and circuits, which can be used in many applications. This book proposes a new design for a small scale optical device—a microring resonator device. Most chapters are based on the proposed device, which uses a configuration know as a PANDA ring resonator. Analytical and numerical methods demonstrate that many applications can be exploited using this device, in particular when it is coated with metallic material. The book begins with the background and description of the PANDA ring resonator. The authors examine optical bistability in microring resonators and test the analytical results with those predicted by the OptiFDTD software package. They then describe their new design for a microring resonator device, which can be used to generate four forms of light on a chip, while also allowing the storing and harvesting of trapped atoms/molecules. The four behaviors of light, for instance, fast, slow, stopping, and storing, can be manipulated and seen simultaneously by using the PANDA ring planar waveguide, which can be fabricated and tested on-chip. Chapters examine optical spin, nano-antennas, optical mesh networks, micro-optical gyroscopes, and spin transport networks. They also address applications for optical devices, including molecular motors for drug discovery, short pulse lasers for treatment of cancer, microsurgery, nano-antenna use in radiotherapy, and neuron cell communications. There are many other possibilities of applications for the PANDA ring resonator, such as quantum coding, optical tweezers, and stopping light, which will play an important role in future optical devices.

Integrated Lasers on Silicon - Charles Cornet 2016-07-14

Integrated Lasers on Silicon provides a comprehensive overview of the state-of-the-art use of lasers on silicon for photonic integration. The authors demonstrate the need for efficient laser sources on silicon, motivated by the development of on-board/on-chip optical interconnects and the different integration schemes available. The authors include detailed descriptions of Group IV-based lasers, followed by a presentation of the results obtained through the bonding approach (hybrid III-V lasers). The monolithic integration of III-V semiconductor lasers are explored, concluding with a discussion of the different kinds of cavity geometries benchmarked with respect to their potential integration on silicon in an industrial environment. Features a clear description of the advantages, drawbacks, and challenges of laser integration on silicon Serves as a staple reference in the general field of silicon photonics Focuses on the promising developments of hybrid and monolithic III-V lasers on silicon, previously unreviewed Discusses the different kinds of cavity geometries benchmarked with respect to their potential integration on silicon in an industrial environment

Subwavelength and Nanometer Diameter Optical Fibers - Limin Tong 2011-01-30

Subwavelength and Nanometer Diameter Optical Fibers provides a comprehensive and up-to-date coverage of research on nanoscale optical fibers including the basic physics and engineering aspects of the fabrication, properties and applications. The book discusses optical micro/nanofibers that represent a perfect fusion of optical fibers and nanotechnology on subwavelength scale and covers a broad range of topics in modern optical engineering, photonics and nanotechnology spanning from fiber optics, near-field optics, nonlinear optics, atom optics to nanofabrication and microphotonic components/devices. It is intended for researchers and graduate students in the fields of photonics, nanotechnology, optical engineering and materials science. Dr. Limin Tong is a professor at Department of Optical Engineering and State Key Laboratory of Modern Optical Instrumentation of Zhejiang University, China; Dr. Michael Sumetsky is a researcher at OFS Laboratories, USA.

Photonic Microresonator Research and Applications - Ioannis Chremmos 2010-06-08

This book details how to design and fabricate microresonators. It covers the latest in microresonator research and discusses them in photonic crystals, microsphere circuits and sensors. It includes application-

oriented examples.

Handbook of Optical Microcavities - Anthony H. W. Choi 2014-10-06

An optical cavity confines light within its structure and constitutes an integral part of a laser device. Unlike traditional gas lasers, semiconductor lasers are invariably much smaller in dimensions, making optical confinement more critical than ever. In this book, modern methods that control and manipulate light at the micrometer and nanometer scales by using a variety of cavity geometries and demonstrate optical resonance from ultra-violet (UV) to infra-red (IR) bands across multiple material platforms are explored. The book has a comprehensive collection of chapters that cover a wide range of topics pertaining to resonance in optical cavities and are contributed by leading researchers in the field. The topics include theory, design, simulation, fabrication, and characterization of micrometer- and nanometer-scale structures and devices that support cavity resonance via various mechanisms such as Fabry-Pérot, whispering gallery, photonic bandgap, and plasmonic modes. The chapters discuss optical cavities that resonate from UV to IR wavelengths and are based on prominent III-V material systems, including Al, In, and Ga nitrides, ZnO, and GaAs.

Optomagnonic Structures: Novel Architectures For Simultaneous Control Of Light And Spin Waves - Evangelos Almpanis 2021-01-18

Understanding, controlling and, more importantly, enhancing the interaction between light (photons) and spin waves (magnons) can be, among others, a step towards the realization of magnon-mediated microwave-to-optical transducers for quantum computing applications or hybrid solid-state spintronic-photonic interconnections. In this respect, the development of novel composite multifunctional micro/nanostructures — so-called optomagnonic — which simultaneously control optical and spin waves and enhance their interaction, is particularly attractive. This book constitutes a collective work, comprising seven chapters from leading researchers in the field of optomagnonics and related areas. Apart from exciting recent developments, it provides the necessary fundamental knowledge in an explanatory manner and, therefore, it is accessible to non-experts. It is suitable for PhD students, post-docs, and researchers who are willing to get engaged in optomagnonics, while selected parts could also serve as lecture material for advanced courses. With increasing demand for miniaturized optomagnonic devices, this book will be an important resource to researchers working on optomagnonics, magneto-optics, spintronics, as well as on hybrid micro/nano devices for information processing.

Optical Processes in Microparticles and Nanostructures -