

# Speckle Phenomena In Optics Theory And The Applications

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**Lightwave Communications** - George C. Pape 2019-01-10

This pioneering, course-tested text is the first to combine communications theory with the physics of optical communications. Comprehensive and rigorous, it brings together an in-depth treatment of the physical characteristics of the guided lightwave channel with the study of modern methods of algorithmic-based communication in time and space. The many different levels at which a lightwave communication signal can be described are integrated to provide a unified explanation of how a commonplace bit stream is transformed into a physical lightwave, how that lightwave travels through an optical fiber, and how it is then transformed back into the bit stream. Background fundamentals such as linear systems and electromagnetics are explained in relation to modern topics such as channel models, encoding, modulation and interference, and end-of-chapter problems are provided throughout. This is an essential text for students taking courses on optical communications, as well as researchers and professionals working in the area.

**Phase-Contrast and Dark-Field Imaging** - Simon Zabler 2019-01-08

This book is a printed edition of the Special Issue "Phase-Contrast and Dark-Field Imaging" that was published in *J. Imaging*

**Springer Series in Light Scattering** - Alexander Kokhanovsky 2019-06-29

This book describes recent advances in radiative transfer, atmospheric remote sensing, polarization optics of random media, and light scattering. It is a valuable resource for anyone involved in light scattering research. Providing numerous step-by-step tutorials, it allows readers to quickly learn about various aspects of theoretical and experimental light scattering media optics. The book features among others a chapter on aerosol remote sensing that helps readers to define and solve various aerosol remote sensing problems.

**Laser Radar** - National Research Council 2014-03-14

In today's world, the range of technologies with the potential to threaten the security of U.S. military forces is extremely broad. These include developments in explosive materials, sensors, control systems, robotics, satellite systems, and computing power, to name just a few. Such technologies have not only enhanced the capabilities of U.S. military forces, but also offer enhanced offensive capabilities to potential adversaries - either directly through the development of more sophisticated weapons, or more indirectly through opportunities for interrupting the function of defensive U.S. military systems. Passive and active electro-optical (EO) sensing technologies are prime examples. Laser Radar considers the potential of active EO technologies to create surprise; i.e., systems that use a source of visible or infrared light to interrogate a target in combination with sensitive detectors and processors to analyze the returned light. The addition of an interrogating light source to the system adds rich new phenomenologies that enable new capabilities to be explored. This report evaluates the fundamental, physical limits to active EO sensor technologies with potential military utility; identifies key technologies that may help overcome the impediments within a 5-10 year timeframe; considers the pros and cons of implementing each existing or emerging technology; and evaluates the potential uses of active EO sensing technologies, including 3D mapping and multi-discriminate laser radar technologies.

**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.

**X-Ray Lasers 2012** - Stéphane Sebban 2013-09-17

These proceedings comprise of invited and contributed papers presented at the 13th International Conference on X-Ray Lasers (ICXRL 2012) which was held 11-15 June 2012 in Paris, France, in the famous Quartier Latin, inside the historical Center of Cordeliers. This conference is part of a continuing series dedicated to recent developments and applications of x-ray lasers and other coherent x-ray sources with attention to supporting technologies and instrumentation. New results in the generation of intense coherent x-rays and progress towards practical devices and their applications are reported in these proceedings, including areas of research in plasma-based x-ray lasers, 4th generation accelerator-based sources and higher harmonic generation. Recent achievements related to the increase of the repetition rate up to 100 Hz and shorter wavelength collisional plasma-based soft x-ray lasers down to about 7 nm are presented. Seeding the amplifying plasma with a femtosecond high-order harmonic of infrared laser was foreseen as the required breakthrough to break the picosecond frontier. Numerical simulations based on the Maxwell-Bloch model are presented in these proceedings, transposing the chirped pulse amplification technique to the x-ray domain in order to increase the time over which the femtosecond seed can be amplified. These proceedings also include innovative applications of soft x-ray lasers based on techniques and diagnostics relevant to topical domains such as EUV lithography, inertial confinement fusion, or warm dense matter physics.

**Integrated Optics: Theory and Technology** - Robert G. Hunsperger 2013-11-11

Our intent in producing this book was to provide a text that would be comprehensive enough for an introductory course in integrated optics, yet concise enough in its mathematical derivations to be easily readable by a practicing engineer who desires an overview of the field. The response to the first edition has indeed been gratifying; unusually strong demand has caused it to be sold out during the initial year of publication, thus providing us with an early opportunity to produce this updated and improved second edition. This development is fortunate, because integrated optics is a very rapidly progressing field, with significant new research being regularly reported. Hence, a new chapter (Chap. 17) has been added to review recent progress and to provide numerous additional references to the relevant technical literature. Also, thirty-five new problems for practice have been included to supplement those at the ends of chapters in the first edition. Chapters I through 16 are essentially unchanged, except for brief updating revisions and corrections of typographical errors. Because of the time limitations imposed by the need to provide an uninterrupted supply of this book to those using it as a course text, it has been possible to include new references and to briefly describe recent developments only in Chapter 17. However, we hope to provide details of this continuing progress in a future edition.

**Advances in Optics, Vol. 3** - Sergey Yurish 2018-04-26

Advances in Optics: Reviews Book Series is a comprehensive study of the field of optics, which provides readers with the most up-to-date coverage of optics, photonics and lasers with a good balance of practical

and theoretical aspects. Directed towards both physicists and engineers this Book Series is also suitable for audiences focusing on applications of optics. The Vol.3 is devoted to various topics of applied optics and contains 17 chapters written by 49 experts in the field from 14 countries: Australia, China, India, Israel, Italy, Japan, Malaysia, Mexico, The Netherlands, Poland, Taiwan, UK, USA, Vietnam A clear comprehensive presentation makes these books work well as both a teaching resources and a reference books. The book is intended for researchers and scientists in physics and optics, in academia and industry, as well as postgraduate students.

Advances in Speckle Metrology and Related Techniques - Guillermo H. Kaufmann 2011-01-25

Speckle metrology includes various optical techniques that are based on the speckle fields generated by reflection from a rough surface or by transmission through a rough diffuser. These techniques have proven to be very useful in testing different materials in a non-destructive way. They have changed dramatically during the last years due to the development of modern optical components, with faster and more powerful digital computers, and novel data processing approaches. This most up-to-date overview of the topic describes new techniques developed in the field of speckle metrology over the last decade, as well as applications to experimental mechanics, material science, optical testing, and fringe analysis.

Integrated Optics: Theory and Technology - R. G. Hunsperger 2013-11-11

This book is an introduction to the theory and technology of integrated optics for graduate students in electrical engineering, and for practicing engineers and scientists who wish to improve their understanding of the principles and applications of this relatively new, and rapidly growing, field. Integrated Optics is the name given to a new generation of optoelectronic systems in which the familiar wires and cables are replaced by light waveguiding optical fibers, and conventional integrated circuits are replaced by optical integrated circuits (OIC's). In an OIC, the signal is carried by means of a beam of light rather than by an electrical current, and the various circuit elements are interconnected on the substrate wafer by optical wave guides. Some advantages of an integrated-optic system are reduced weight, increased bandwidth (or multiplexing capability), resistance to electromagnetic interference, and low loss signal transmission. Because of the voluminous work that has been done in the field of integrated optics since its inception in the late 1960's, the areas of fiber optics and optical integrated circuits have usually been treated separately at conferences and in textbooks. In the author's opinion, this separation is unfortunate because the two areas are closely related. Nevertheless, it cannot be denied that it may be a practical necessity.

Introduction to Modern Digital Holography - Ting-Chung Poon 2014-01-23

Building up from the basic principles of optics, this straightforward introduction to digital holography, aimed at graduate students, engineers and researchers, describes modern techniques and applications, plus all the necessary underlying theory. Supporting Matlab code is available for download online, and homework problems are accompanied by an instructor solution manual.

Laser Speckle and Applications in Optics - M Francon 2012-12-02

Laser Speckle and Applications in Optics focuses on developments in laser speckle techniques, with emphasis on the experimental aspect of phenomena and on applications in optics. These applications include interference with scattered light, optical processing of images, and studies of surface roughness as well as displacements and deformations of diffuse objects. This book is comprised of 10 chapters and begins by reviewing the elements of diffraction theory and the properties of speckle in the image of a diffuse object. The discussion then turns to speckle in the near field and interferometry with diffuse light, along with experiments in which interference patterns are produced from photographically superimposed laterally shifted speckle patterns. The following chapters consider optical processing of images modulated by speckle; deformations and displacements of diffuse objects; speckle applications in astronomy; and surface roughness measurements. The final chapter looks at the use of laser speckle to study transparent objects; the average shape of diffuse surfaces; the transfer functions and aberrations of optical systems; and the movement of diffuse objects. This monograph will be of value to physicists and researchers as well as those interested in lasers and optics.

Understanding Biophotonics - Kevin Tsia 2016-01-05

Biophotonics involves understanding how light interacts with biological matter, from molecules and cells, to tissues and even whole organisms.

Light can be used to probe biomolecular events, such as gene expression and protein-protein interaction, with impressively high sensitivity and specificity. The spatial and temporal distribution of biochemical constituents can also be visualized with light and, thus, the corresponding physiological dynamics in living cells, tissues, and organisms in real time. Light can also be used to alter the properties and behaviors of biological matter, such as to damage cancerous cells by laser surgery or therapy, and manipulate the neuronal signaling in a brain network. Fueled by the innovations in photonic technologies in the past half century, biophotonics continues to play a ubiquitous role in revolutionizing basic life science studies as well as biomedical diagnostics and therapies. Advancements in biophotonics in the past few decades can be seen not only in biochemistry and cell/molecular biology, but also in numerous preclinical applications. Researchers around the world are searching for ways to bring biophotonic technologies into real clinical practices, particularly cellular and molecular optical imaging. Meanwhile, emerging technologies, such as laser nanosurgery and nanoplasmonics, have created new insights for understanding, monitoring, and even curing diseases on a molecular basis. This book presents the essential basics of optics and biophotonics to newcomers (senior undergraduates or postgraduate researchers) who are interested in this multidisciplinary research field. With stellar contributions from leading experts, the book highlights the major advancements in preclinical diagnostics using optical microscopy and spectroscopy, including multiphoton microscopy, super-resolution microscopy, and endomicroscopy. It also introduces a number of emerging techniques and toolsets for biophotonics applications, such as nanoplasmonics, microresonators for molecular detection, and subcellular optical nanosurgery.

Speckle Phenomena in Optics - Joseph W. Goodman 2007

Speckle Phenomena in Optics provides a comprehensive discussion of the statistical properties of speckle, as well as detailed coverage of its role in applications. Some of the applications discussed include speckle in astronomy, speckle in the eye, speckle in projection displays, speckle in coherence tomography, speckle in lithography, speckle in waveguides (modal noise), speckle in optical radar detection, and speckle in metrology. This book is aimed at graduate students and professionals working in a wide variety of fields.

Advanced Biophotonics - Ruikang K. Wang 2016-04-19

Despite a number of books on biophotonics imaging for medical diagnostics and therapy, the field still lacks a comprehensive imaging book that describes state-of-the-art biophotonics imaging approaches intensively developed in recent years. Addressing this shortfall, *Advanced Biophotonics: Tissue Optical Sectioning* presents contemporary methods and applications of biophotonics imaging. Gathering research otherwise scattered in numerous physical, chemical, biophysical, and biomedical journals, the book helps researchers, bioengineers, and medical doctors understand major recent bioimaging technologies and the underlying biophotonics science. Well-known international experts explore a variety of "hot" biomedical optics and biophotonics problems, including the use of photoacoustic imaging to investigate the molecular and cellular processes in living systems. The book also covers Monte Carlo modeling, tissue optics and tissue optical clearing, nonlinear optical microscopy, various aspects of optical coherence tomography, multimodal tomography, adaptive optics, and signal imaging. With 58 color images, this book represents a valuable contribution to the biomedical and biophotonics literature. Designed for researchers and practitioners in biophotonics, the book is also a useful resource for scientists in laser physics and technology, fiber optics, spectroscopy, materials science, biology, and medicine as well as students studying biomedical physics and engineering, biomedical optics, and biophotonics.

Advances in Atomic, Molecular, and Optical Physics - 2008-10-28

This volume continues the tradition of the *Advances* series. It contains contributions from experts in the field of atomic, molecular, and optical (AMO) physics. The articles contain some review material, but are intended to provide a comprehensive picture of recent important developments in AMO physics. Both theoretical and experimental articles are included in the volume. • International experts • Comprehensive articles • New developments

Statistical Optics - Joseph W. Goodman 2015-04-20

This book discusses statistical methods that are useful for treating problems in modern optics, and the application of these methods to solving a variety of such problems. This book covers a variety of statistical problems in optics, including both theory and applications. The

text covers the necessary background in statistics, statistical properties of light waves of various types, the theory of partial coherence and its applications, imaging with partially coherent light, atmospheric degradations of images, and noise limitations in the detection of light. New topics have been introduced in the second edition, including: Analysis of the Vander Pol oscillator model of laser light Coverage on coherence tomography and coherence multiplexing of fiber sensors An expansion of the chapter on imaging with partially coherent light, including several new examples An expanded section on speckle and its properties New sections on the cross-spectrum and bispectrum techniques for obtaining images free from atmospheric distortions A new section on imaging through atmospheric turbulence using coherent light The addition of the effects of "read noise" to the discussions of limitations encountered in detecting very weak optical signals A number of new problems and many new references have been added Statistical Optics, Second Edition is written for researchers and engineering students interested in optics, physicists and chemists, as well as graduate level courses in a University Engineering or Physics Department.

**Dynamic Laser Speckle and Applications** - Hector J. Rabal  
2018-10-03

Speckle study constitutes a multidisciplinary area with inherent complexities. In order to conquer challenges such as the variability of samples and sensitive measurements, researchers must develop a theoretical and statistical understanding of both biological and non-biological metrology using dynamic speckle laser. *Dynamic Laser Speckle and Applications* discusses the main methodologies used to analyze biospeckle phenomena with a strong focus on experimentation. After establishing a theoretical background in both speckle and biospeckle, the book presents the main methodologies for statistical and image analysis. It then deals with the concept of frequency decomposition before moving on to a discussion of fuzzy methods to treat dynamic speckle data. The book dedicates two sections to applications, including agricultural approaches. Additional features include photo images of experiments and software to aid in easy start-up of dynamic speckle usage. A systematic approach to new dynamic speckle laser phenomena, this book provides the physical theory and statistical background needed to analyze images formed by laser illumination in biological and non-biological samples.

**Variant Construction from Theoretical Foundation to Applications**  
- Jeffrey Zheng 2018-12-17

This open access book presents theoretical framework and sample applications of variant construction. The first part includes the components variant logic, variant measurements, and variant maps, while the second part covers sample applications such as variation with functions, variant stream ciphers, quantum interference, classical/quantum random sequences, whole DNA sequences, and multiple-valued pulse sequences. Addressing topics ranging from logic and measuring foundation to typical applications and including various illustrated maps, it is a valuable guide for theoretical researchers in discrete mathematics; computing-, quantum- and communication scientists; big data engineers; as well as graduate and upper undergraduate students.

**Optical Methods for Solid Mechanics** - Pramod K. Rastogi 2013-03-11

Unique within the field for being written in a tutorial style, this textbook adopts a step-by-step approach to the background needed for understanding a wide range of full-field optical measurement techniques in solid mechanics. This method familiarizes readers with the essentials of imaging and full-field optical measurement techniques, helping them to identify the appropriate techniques and in assessing measurement systems. In addition, readers learn the appropriate rules of thumb as a guide to better experimental performance from the applied techniques. Rather than presenting an exhaustive overview on the subject, each chapter provides a concise introduction to the concepts and principles, integrates solved problems within the text, summarizes the essence at the end, and includes unsolved problems. With its coverage of topics also relevant for industry, this text is aimed at graduate students, researchers, and engineers involved in non-destructive testing for acoustics, mechanics, medicine, diagnosis on artwork and construction, and civil engineering.

**Augmented Reality and Its Application** - Dragan Cvetković 2022-03-16  
Augmented Reality (AR) is a discipline that includes the interactive experience of a real-world environment, in which real-world objects and elements are enhanced using computer perceptual information. It has many potential applications in education, medicine, and engineering,

among other fields. This book explores these potential uses, presenting case studies and investigations of AR for vocational training, emergency response, interior design, architecture, and much more.

**Fundamentals of Electro-Optic Systems Design** - Sherman Karp  
2012-12-20

Using fundamentals of communication theory, thermodynamics, information theory and propagation theory, this book explains the universal principles underlying a diverse range of electro-optical systems. From fiber optics and infra-red imaging to free space communications and laser remote sensing, the authors relate key concepts in science and device engineering to practical systems issues. A broad spectrum of coherent and incoherent imaging and communications systems is considered, accompanied by many real-world examples. The authors also present new insights into LIDAR and free space communications and imaging, providing practical guidance on identifying the fundamental limitations of transmission and imaging through deleterious channels. Accompanied by online examples of processed images and videos, this uniquely tailored guide to the fundamental principles underlying modern electro-optical systems is an essential reference for all practising engineers and academic researchers in optical engineering.

**Fourier Optics and Computational Imaging** - Kedar Khare  
2015-09-21

This book covers both the mathematics of inverse problems and optical systems design, and includes a review of the mathematical methods and Fourier optics. The first part of the book deals with the mathematical tools in detail with minimal assumption about prior knowledge on the part of the reader. The second part of the book discusses concepts in optics, particularly propagation of optical waves and coherence properties of optical fields that form the basis of the computational models used for image recovery. The third part provides a discussion of specific imaging systems that illustrate the power of the hybrid computational imaging model in enhancing imaging performance. A number of exercises are provided for readers to develop further understanding of computational imaging. While the focus of the book is largely on optical imaging systems, the key concepts are discussed in a fairly general manner so as to provide useful background for understanding the mechanisms of a diverse range of imaging modalities.

**Digital Optical Measurement Techniques and Applications** - Pramod Rastogi 2015-05-01

This new resource explains the principles and applications of today's digital optical measurement techniques. From start to finish, each chapter provides a concise introduction to the concepts and principles of digital optical metrology, followed by a detailed presentation of their applications. The development of all these topics, including their numerous methods, principles, and applications, has been illustrated using a large number of easy-to-understand figures. This book aims to not only help the reader identify the appropriate techniques in function of the measurement requirements, but also assess modern digital measurement systems.

**Microcirculation Imaging** - Martin J. Leahy 2012-05-22

Adopting a multidisciplinary approach with input from physicists, researchers and medical professionals, this is the first book to introduce many different technical approaches for the visualization of microcirculation, including laser Doppler and laser speckle, optical coherence tomography and photo-acoustic tomography. It covers everything from basic research to medical applications, providing the technical details while also outlining the respective strengths and weaknesses of each imaging technique. Edited by an international team of top experts, this is the ultimate handbook for every clinician and researcher relying on microcirculation imaging.

**Proceedings of the 2009 Annual Symposium of the IEEE Photonics Benelux Chapter** - S. Beri 2010

"This book contains the proceedings of the 2009 Annual Symposium of the IEEE Photonics Benelux Chapter. This is the yearly meeting of all scientists working in the field of optics and photonics in the Benelux countries (Belgium, the Netherlands, and Luxembourg). The book contains research articles on lasers, integrated optics, optical fibres, optical communication systems and devices, optical sensors, physics of novel materials, nonlinear optics, quantum electronics, and quantum optics."--Publisher description

**Ultracold Atoms in Optical Lattices** - Maciej Lewenstein 2012-03-08

This book explores the physics of atoms frozen to ultralow temperatures and trapped in periodic light structures. It introduces the reader to the spectacular progress achieved on the field of ultracold gases and

describes present and future challenges in condensed matter physics, high energy physics, and quantum computation.

**ICOL-2019** - Kehar Singh 2021-04-12

This book presents peer-reviewed articles from the International Conference on Optics and Electro-optics, ICOL-2019, held at Dehradun in India. It brings together leading researchers and professionals in the field of optics/optical engineering/optical materials and provides a platform to present and establish collaborations in this important area, with the theme "Trends in Electro-optics Instrumentation for Strategic Applications". Topics covered but not limited to are Optical Engineering, Optical Thin Films, Optical Materials, IR Sensors, Image Processing & Systems, Photonic Band Gap Materials, Adaptive Optics, Optical Image Processing & Holography, Lasers, Fiber Lasers & its Applications, Diffractive Optics, Innovative packaging of Optical Systems, Nanophotonics Devices and Applications, Optical Interferometry & Metrology, Terahertz, Millimeter Wave & Microwave Photonics, Fiber, Integrated & Nonlinear Optics and Optics and Electro-optics for Strategic Applications.

**Nanomaterials and Nanocomposites, Nanostructure Surfaces, and Their Applications** - Olena Fesenko 2020-11-25

This book highlights some of the latest advances in nanotechnology and nanomaterials from leading researchers in Ukraine, Europe and beyond. It features contributions presented at the 7th International Science and Practice Conference Nanotechnology and Nanomaterials (NANO2019), which was held on August 27–30, 2019 at Lviv Polytechnic National University, and was jointly organized by the Institute of Physics of the National Academy of Sciences of Ukraine, University of Tartu (Estonia), University of Turin (Italy), and Pierre and Marie Curie University (France). Internationally recognized experts from a wide range of universities and research institutions share their knowledge and key findings on material properties, behavior, and synthesis. This book's companion volume also addresses topics such as nano-optics, energy storage, and biomedical applications.

**Contemporary Optoelectronics** - Oleksiy Shulika 2015-09-11

This book presents a collection of extended contributions on the physics and application of optoelectronic materials and metamaterials. The book is divided into three parts, respectively covering materials, metamaterials and optoelectronic devices. Individual chapters cover topics including phonon-polariton interaction, semiconductor and nonlinear organic materials, metallic, dielectric and gyrotropic metamaterials, singular optics, parity-time symmetry, nonlinear plasmonics, microstructured optical fibers, passive nonlinear shaping of ultrashort pulses, and pulse-preserving supercontinuum generation. The book contains both experimental and theoretical studies, and each contribution is a self-contained exposition of a particular topic, featuring an extensive reference list. The book will be a useful resource for graduate and postgraduate students, researchers and engineers involved in optoelectronics/photronics, quantum electronics, optics, and adjacent areas of science and technology.

**Introduction to Optical Microscopy** - Jerome Mertz 2019-08-01

This fully updated, self-contained textbook covering modern optical microscopy equips students with a solid understanding of the theory underlying a range of advanced techniques. Two new chapters cover pump-probe techniques, and imaging in scattering media, and additional material throughout covers light-sheet microscopy, image scanning microscopy, and much more. An array of practical techniques are discussed, from classical phase contrast and confocal microscopy, to holographic, structured illumination, multi-photon, and coherent Raman microscopy, and optical coherence tomography. Fundamental topics are also covered, including Fourier optics, partial coherence, 3D imaging theory, statistical optics, and the physics of scattering and fluorescence. With a wealth of end-of-chapter problems, and a solutions manual for instructors available online, this is an invaluable book for electrical engineering, biomedical engineering, and physics students taking graduate courses on optical microscopy, as well as advanced undergraduates, professionals, and researchers looking for an accessible introduction to the field.

**Random Light Beams** - Olga Korotkova 2017-12-19

Random Light Beams: Theory and Applications contemplates the potential in harnessing random light. This book discusses light-matter interactions, and concentrates on the various phenomena associated with beam-like fields. It explores natural and man-made light fields and gives an overview of recently introduced families of random light beams. It outlines mathematical tools for analysis, suggests schemes for realization, and discusses possible applications. The book introduces the

essential concepts needed for a deeper understanding of the subject, discusses various classes of deterministic paraxial beams and examines random scalar beams. It highlights electromagnetic random beams and matters relating to generation, propagation in free space and various media, and discusses transmission through optical systems. It includes applications that benefit from the use of random beams, as well as the interaction of beams with deterministic optical systems. • Includes detailed mathematical description of different model sources and beams • Explores a wide range of man-made and natural media for beam interaction • Contains more than 100 illustrations on beam behavior • Offers information that is based on the scientific results of the last several years • Points to general methods for dealing with random beams, on the basis of which the readers can do independent research It gives examples of light propagation through the human eye, laser resonators, and negative phase materials. It discusses in detail propagation of random beams in random media, the scattering of random beams from collections of scatterers and thin random layers as well as the possible uses for these beams in imaging, tomography, and smart illumination.

**Optical Wireless Communications** - Murat Uysal 2016-08-25

This book focuses on optical wireless communications (OWC), an emerging technology with huge potential for the provision of pervasive and reliable next-generation communications networks. It shows how the development of novel and efficient wireless technologies can contribute to a range of transmission links essential for the heterogeneous networks of the future to support various communications services and traffic patterns with ever-increasing demands for higher data-transfer rates. The book starts with a chapter reviewing the OWC field, which explains different sub-technologies (visible-light, ultraviolet (UV) and infrared (IR) communications) and introduces the spectrum of application areas (indoor, vehicular, terrestrial, underwater, intersatellite, deep space, etc.). This provides readers with the necessary background information to understand the specialist material in the main body of the book, which is in four parts. The first of these deals with propagation modelling and channel characterization of OWC channels at different spectral bands and with different applications. The second starts by providing a unified information-theoretic treatment of OWC and then discusses advanced physical-layer methodologies (including, but not limited to: advanced coding, modulation diversity, cooperation and multi-carrier techniques) and the ultimate limitations imposed by practical constraints. On top of the physical layer come the upper-layer protocols and cross-layer designs that are the subject of the third part of the book. The last part of the book features a chapter-by-chapter assessment of selected OWC applications. Optical Wireless Communications is a valuable reference guide for academic researchers and practitioners concerned with the future development of the world's communication networks. It succinctly but comprehensively presents the latest advances in the field.

**Handbook of Neurophotonics** - Francesco S. Pavone 2020-05-10

The Handbook of Neurophotonics provides a dedicated overview of neurophotonics, covering the use of advanced optical technologies to record, stimulate, and control the activity of the brain, yielding new insight and advantages over conventional tools due to the adaptability and non-invasive nature of light. Including 32 colour figures, this book addresses functional studies of neurovascular signaling, metabolism, electrical excitation, and hemodynamics, as well as clinical applications for imaging and manipulating brain structure and function. The unifying theme throughout is not only to highlight the technology, but to show how these novel methods are becoming critical to breakthroughs that will lead to advances in our ability to manage and treat human diseases of the brain. Key Features: Provides the first dedicated book on state-of-the-art optical techniques for sensing and imaging across at the cellular, molecular, network, and whole brain levels. Highlights how the methods are used for measurement, control, and tracking of molecular events in live neuronal cells, both in basic research and clinical practice. Covers the entire spectrum of approaches, from optogenetics to functional methods, photostimulation, optical dissection, multiscale imaging, microscopy, and structural imaging. Includes chapters that show use of voltage-sensitive dye imaging, hemodynamic imaging, multiphoton imaging, temporal multiplexing, multiplane microscopy, optoacoustic imaging, near-infrared spectroscopy, and miniature neuroimaging devices to track cortical brain activity.

**X-ray Phase-Contrast Imaging Using Near-Field Speckles** - Marie-Christine Zdora 2021-02-16

This thesis presents research on novel X-ray imaging methods that improve the study of specimens with small density differences, revealing

their inner structure and density distribution. Exploiting the phase shift of X-rays in a material can significantly increase the image contrast compared to conventional absorption imaging. This thesis provides a practical guide to X-ray phase-contrast imaging with a strong focus on X-ray speckle-based imaging, the most recently developed phase-sensitive method. X-ray speckle-based imaging only requires a piece of abrasive paper in addition to the standard X-ray imaging setup. Its simplicity and robustness combined with the compatibility with laboratory X-ray sources, make it an ideal candidate for wide user uptake in a range of fields. An in-depth overview of the state of the art of X-ray speckle-based imaging and its latest developments is given in this thesis. It, furthermore, explores a broad range of applications, from X-ray optics characterisation, to biomedical imaging for 3D virtual histology and geological studies of volcanic rocks, demonstrating its promising potential. Moreover, the speckle-based technique is placed in the context of other phase-sensitive X-ray imaging methods to assist in the choice of a suitable method, hence serving as a guide and reference work for future users.

*Proceedings of the Singaporean-French Ipal Symposium 2009 -*

Frontiers in Optics and Photonics - Federico Capasso 2021-06-08

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 Opto-electronics, Nanophotonics, Metamaterials, Plasmonics, Quantum Cascade lasers, LEDs, Biophotonics and biomedical photonics and spectroscopy.

**Free Space Optical Systems Engineering** - Larry B. Stotts 2017-03-29

Gets you quickly up to speed with the theoretical and practical aspects of free space optical systems engineering design and analysis. One of today's fastest growing system design and analysis disciplines is free space optical systems engineering for communications and remote sensing applications. It is concerned with creating a light signal with certain characteristics, how this signal is affected and changed by the medium it traverses, how these effects can be mitigated both pre- and post-detection, and if after detection, it can be differentiated from noise under a certain standard, e.g., receiver operating characteristic. Free space optical systems engineering is a complex process to design against

and analyze. While there are several good introductory texts devoted to key aspects of optics—such as lens design, lasers, detectors, fiber and free space, optical communications, and remote sensing—until now, there were none offering comprehensive coverage of the basics needed for optical systems engineering. If you're an upper-division undergraduate, or first-year graduate student, looking to acquire a practical understanding of electro-optical engineering basics, this book is intended for you. Topics and tools are covered that will prepare you for graduate research and engineering in either an academic or commercial environment. If you are an engineer or scientist considering making the move into the opportunity rich field of optics, this all-in-one guide brings you up to speed with everything you need to know to hit the ground running, leveraging your experience and expertise acquired previously in alternate fields. Following an overview of the mathematical fundamentals, this book provides a concise, yet thorough coverage of, among other crucial topics: Maxwell Equations, Geometrical Optics, Fourier Optics, Partial Coherence theory Linear algebra, Basic probability theory, Statistics, Detection and Estimation theory, Replacement Model detection theory, LADAR/LIDAR detection theory, optical communications theory Critical aspects of atmospheric propagation in real environments, including commonly used models for characterizing beam, and spherical and plane wave propagation through free space, turbulent and particulate channels Lasers, blackbodies/graybodies sources and photodetectors (e.g., PIN, ADP, PMT) and their inherent internal noise sources. The book provides clear, detailed discussions of the basics for free space optical systems design and analysis, along with a wealth of worked examples and practice problems—found throughout the book and on a companion website. Their intent is to help you test and hone your skill set and assess your comprehension of this important area. Free Space Optical Systems Engineering is an indispensable introduction for students and professionals alike.

*Lasers and Electro-optics* - Christopher C. Davis 2014-03-20

This book contains comprehensive coverage of topics in optical physics and engineering for undergraduate students studying laser physics, optoelectronics, photonics and optical engineering.

Guided-Wave Optics - Boris Malomed 2018-03-23

This book is a printed edition of the Special Issue "Guided-Wave Optics" that was published in Applied Sciences