

Structured Light Fields Applications In Optical Trapping Manipulation And Organisation Springer Theses

Light Driven Micromachines Structured Singular Light Fields 3D Biometrics DICOM Structured Reporting Topics in Modal Analysis, Volume 7 Time-of-Flight Cameras 3D Biometrics Fourier Ptychographic Imaging Complex Light and Optical Forces Extreme Photonics & Applications Spatial Augmented Reality Structured Light Fields Structured Light and Its Applications Machine Vision Applications in Industrial Inspection Practical Holography Quantum Photonics: Pioneering Advances and Emerging Applications The Angular Momentum of Light Computer Vision Metrics High-Speed 3D Imaging with Digital Fringe Projection Techniques Engineering Optics 2.0 Time-of-Flight and Structured Light Depth Cameras Photonic Applications Based on the Use of Structured Light A Survey on 3D Cameras: Metrological Comparison of Time-of-Flight, Structured-Light and Active Stereoscopy Technologies 3-D Imaging Technologies in Facial Plastic Surgery, An Issue of Facial Plastic Surgery Clinics - E-Book MEMS Mirrors Optically Polarized Atoms Fiber Optics Optics in Our Time Computer Vision - ECCV 2012 Photonics, Volume 13 D Shape Analysis Visible Light Active Structured Photocatalysts for the Removal of Emerging Contaminants Proceedings of the 11th International Conference on Modelling, Identification and Control (ICMIC2019) Structured Light and Its Applications Structured Light from Pupil Plane to Focal Field Neurophotonics and Biomedical Spectroscopy Optically Induced Nanostructures Light Robotics - Structure-mediated Nanobiophotonics Ion acceleration and extreme light field generation based on ultra-short and ultra-intense lasers Advances in Microfluidics

Light Driven Micromachines

This book provides a comprehensive overview of the key technologies and applications related to new cameras that have brought 3D data acquisition to the mass market. It covers both the theoretical principles behind the acquisition devices and the practical implementation aspects of the computer vision algorithms needed for the various applications. Real data examples are used in order to show the performances of the various algorithms. The performance and limitations of the depth camera technology are explored, along with an extensive review of the most effective methods for addressing challenges in common applications. Applications covered in specific detail include scene segmentation, 3D scene reconstruction, human pose estimation and tracking and gesture recognition. This book offers students, practitioners and researchers the tools necessary to explore the potential uses of depth data in light of the expanding number of devices available for sale. It explores the impact of these devices on the rapidly growing field of depth-based computer vision.

Structured Singular Light Fields

Visible Light Active Structured Photocatalysts for the Removal of Emerging Contaminants: Science and Engineering addresses the potential role of visible active photocatalytic processes for the removal of emerging contaminants. The book discusses the classification, sources and potential risks of emerging pollutants in water as well as the different synthesis methods of visible active structured photocatalysts with relation to their applications in photocatalytic processes for the removal of organic and inorganic emerging contaminants. Finally, the possible reaction pathways occurring during the visible or solar photocatalytic processes together with toxicity assessment are discussed. The book is a useful guide for academics, researchers and technicians in chemical engineering, chemistry and environmental sciences. Defines emerging contaminants and what can be included in that group of contaminants commonly named "contaminants of emerging concern" Presents different synthesis methods of visible active structured photocatalysts and their applications in solar or visible light photocatalytic systems for the removal of organic and inorganic emerging contaminants Analyzes reaction pathways that occur during the visible or solar photocatalytic processes, also including toxicity assessments

3D Biometrics

This book demonstrates the concept of Fourier ptychography, a new imaging technique that bypasses the resolution limit of the employed optics. In particular, it transforms the general challenge of high-throughput, high-resolution imaging from one that is coupled to the physical limitations of the optics to one that is solvable through computation. Demonstrated in a tutorial form and providing many MATLAB® simulation examples for the reader, it also discusses the experimental implementation and recent developments of Fourier ptychography. This book will be of interest to researchers and engineers learning simulation techniques for Fourier optics and the Fourier ptychography concept.

DICOM Structured Reporting

Increasing innovations and applications make microfluidics a versatile choice for researchers in many disciplines. This book consists of multiple review chapters that aim to cover recent advances and new applications of microfluidics in biology, electronics, energy, and materials sciences. It provides comprehensive views of various aspects of microfluidics ranging from fundamentals of fabrication, flow control, and droplet manipulation to the most recent exploration in emerging areas such as material synthesis, imaging and novel spectroscopy, and marriage with electronics. The chapters have many illustrations showcasing exciting results. This book should be useful for those who are eager to learn more about microfluidics as well as researchers who want to pick up new concepts and developments in this fast-growing field.

Topics in Modal Analysis, Volume 7

Proceedings of SPIE present the original research papers presented at SPIE conferences and other high-quality conferences in the broad-ranging fields of optics and photonics. These books provide prompt access to the latest innovations in research and technology in their respective fields. Proceedings of SPIE are among the most cited references in patent literature.

Time-of-Flight Cameras

The seven-volume set comprising LNCS volumes 7572-7578 constitutes the refereed proceedings of the 12th European Conference on Computer Vision, ECCV 2012, held in Florence, Italy, in October 2012. The 408 revised papers presented were carefully reviewed and selected from 1437 submissions. The papers are organized in topical sections on geometry, 2D and 3D shapes, 3D reconstruction, visual recognition and classification, visual features and image matching, visual monitoring: action and activities, models, optimisation, learning, visual tracking and image registration, photometry: lighting and colour, and image segmentation.

3D Biometrics

New possibilities have recently emerged for producing optical beams with complex and intricate structures, and for the non-contact optical manipulation of matter. Structured Light and Its Applications fully describes the electromagnetic theory, optical properties, methods and applications associated with this new technology. Detailed discussions are given of unique beam characteristics, such as optical vortices and other wavefront structures, the associated phase properties and photonic aspects, along with applications ranging from cold atom manipulation to optically driven micromachines. Features include: Comprehensive and authoritative treatments of the latest research in this area of nanophotonics, written by the leading researchers Accounts of numerous microfluidics, nanofabrication, quantum informatics and optical manipulation applications Coverage that fully spans the subject area, from fundamental theory and simulations to experimental methods and results Graduate students and established researchers in academia, national laboratories and industry will find this book an invaluable guide to the latest technologies in this rapidly developing field. Comprehensive and definitive source of the latest research in nanotechnology written by the leading people in the field From theory to applications - all is presented in detail Editor is Chair of the SPIE Nanotechnology Technical Group and is leading the way in generation and manipulation of complex beams

Fourier Ptychographic Imaging

Time-of-flight (TOF) cameras provide a depth value at each pixel, from which the 3D structure of the scene can be estimated. This new type of active sensor makes it possible to go beyond traditional 2D image processing, directly to depth-

based and 3D scene processing. Many computer vision and graphics applications can benefit from TOF data, including 3D reconstruction, activity and gesture recognition, motion capture and face detection. It is already possible to use multiple TOF cameras, in order to increase the scene coverage, and to combine the depth data with images from several colour cameras. Mixed TOF and colour systems can be used for computational photography, including full 3D scene modelling, as well as for illumination and depth-of-field manipulations. This work is a technical introduction to TOF sensors, from architectural and design issues, to selected image processing and computer vision methods.

Complex Light and Optical Forces

Extreme Photonics & Applications

Spatial Augmented Reality

Light and light based technologies have played an important role in transforming our lives via scientific contributions spanned over thousands of years. In this book we present a vast collection of articles on various aspects of light and its applications in the contemporary world at a popular or semi-popular level. These articles are written by the world authorities in their respective fields. This is therefore a rare volume where the world experts have come together to present the developments in this most important field of science in an almost pedagogical manner. This volume covers five aspects related to light. The first presents two articles, one on the history of the nature of light, and the other on the scientific achievements of Ibn-Haitham (Alhazen), who is broadly considered the father of modern optics. These are then followed by an article on ultrafast phenomena and the invisible world. The third part includes papers on specific sources of light, the discoveries of which have revolutionized optical technologies in our lifetime. They discuss the nature and the characteristics of lasers, Solid-state lighting based on the Light Emitting Diode (LED) technology, and finally modern electron optics and its relationship to the Muslim golden age in science. The book's fourth part discusses various applications of optics and light in today's world, including biophotonics, art, optical communication, nanotechnology, the eye as an optical instrument, remote sensing, and optics in medicine. In turn, the last part focuses on quantum optics, a modern field that grew out of the interaction of light and matter. Topics addressed include atom optics, slow, stored and stationary light, optical tests of the foundation of physics, quantum mechanical properties of light fields carrying orbital angular momentum, quantum communication, and Wave-Particle dualism in action.

Structured Light Fields

This book is a valuable resource to deeply understand the technology used in 3D cameras. In this book, the authors summarize and compare the specifications of the main 3D cameras available in the mass market. The authors present a deep metrological analysis of the main camera based on the three main technologies: Time-of-Flight, Structured-Light and Active Stereoscopy, and provide qualitative results for any user to understand the underlying technology within 3D camera, as well as practical guidance on how to get the most of them for a given application.

Structured Light and Its Applications

"Extreme Photonics & Applications" arises from the 2008 NATO Advanced Study Institute in Laser Control & Monitoring in New Materials, Biomedicine, Environment, Security and Defense. Leading experts in the manipulation of light offered by recent advances in laser physics and nanoscience were invited to give lectures in their fields of expertise and participate in discussions on current research, applications and new directions. The sum of their contributions to this book is a primer for the state of scientific knowledge and the issues within the subject of photonics taken to the extreme frontiers: molding light at the ultra-fine scales, which represents the beginning of the end to limitations in optical science for the benefit of 21st Century technological societies. Laser light is an exquisite tool for physical and chemical research. Physicists have recently developed pulsed lasers with such short durations that one laser shot takes the time of one molecular vibration or one electron rotation in an atom, which makes it possible to observe their internal electronic structure, thereby enabling the study of physical processes and new chemical reactions. In parallel, advances in micro- and nano-structured photonic materials allow the precise manipulation of light on its natural scale of a wavelength. Photonic crystals, plasmons and related metamaterials - composed of subwavelength nanostructures - permit the manipulation of their dispersive properties and have allowed the experimental confirmation of bizarre new effects such as slow light and negative refraction. These advances open a vista on a new era in which it is possible to build lasers and engineer materials to control and use photons as precisely as it is already possible to do with electrons. <http://www.photonics.uottawa.ca/nato-asi-2008/>

Machine Vision Applications in Industrial Inspection

Automatic personal authentication using biometric information is becoming more essential in applications of public security, access control, forensics, banking, etc. Many kinds of biometric authentication techniques have been developed based on different biometric characteristics. However, most of the physical biometric recognition techniques are based on two dimensional (2D) images, despite the fact that human characteristics are three dimensional (3D) surfaces. Recently, 3D techniques have been applied to biometric applications such as 3D face, 3D palmprint, 3D fingerprint, and 3D ear recognition. This book introduces four typical 3D imaging methods, and presents some case studies in the field of 3D biometrics. This book also includes many efficient 3D feature extraction, matching, and fusion algorithms. These 3D

imaging methods and their applications are given as follows: - Single view imaging with line structured-light: 3D ear identification - Single view imaging with multi-line structured-light: 3D palmprint authentication - Single view imaging using only 3D camera: 3D hand verification - Multi-view imaging: 3D fingerprint recognition 3D Biometrics: Systems and Applications is a comprehensive introduction to both theoretical issues and practical implementation in 3D biometric authentication. It will serve as a textbook or as a useful reference for graduate students and researchers in the fields of computer science, electrical engineering, systems science, and information technology. Researchers and practitioners in industry and R&D laboratories working on security system design, biometrics, immigration, law enforcement, control, and pattern recognition will also find much of interest in this book.

Practical Holography

Light Robotics - Structure-Mediated Nanobiophotonics covers the latest means of sculpting of both light and matter for achieving bioprobing and manipulation at the smallest scales. The synergy between photonics, nanotechnology and biotechnology spans the rapidly growing field of nanobiophotonics. Nanoscale resolutions enable optical scientists to assess ever more accurate information. However, scientific hypothesis testing demands tools, not only for observing nanoscopic phenomena, but also for reaching into and manipulating nanoscale constituents. Taking an application based focus, this book explores how nanophotonics can productively be used in both the biomedical and life sciences, allowing readers to clearly see how structure-mediated nanobiophotonics can be used to increase our engineering toolbox for biology at the smallest scales. This book will be of great use to researchers and scientists working in the fields of optics and photonics. It will also be of great value to those working in the field of biotechnology, showcasing how nanotechnology can help provide new, effective ways to solve biomedical problems. Presents cutting-edge research on the principles, mechanisms, optical techniques, fabrication, modeling, devices and applications of nanobiophotonics Brings together the diverse field of structure-mediated nanobiophotonics into one coherent volume Showcases how nanophotonics can be used to create new, more effective micro- and nano-biodevices

Quantum Photonics: Pioneering Advances and Emerging Applications

This book is addressed at upper-division undergraduate and graduate students involved in research in Atomic, Molecular, and Optical Physics. It will also be useful to researchers practicing in this field. It gives an intuitive, yet sufficiently detailed and rigorous introduction to light-atom interactions with a particular emphasis on the symmetry aspects of the interaction, especially those associated with the angular momentum of atoms and light. The book comes with a software package for a variety of atomic-physics calculations and further interactive examples that is freely downloadable from the book's web page, as well as additional materials (such as power-point presentations) available to Instructors who adopt the text for their

courses.

The Angular Momentum of Light

The first comprehensive and authoritative coverage of the angular momentum of light, illustrating both its theoretical and applied aspects.

Computer Vision Metrics

This book provides comprehensive information on the history and status quo of a new research field, which we refer to as Engineering Optics 2.0. The content covers both the theoretical basis and the engineering aspects in connection with various applications. The field of Engineering Optics employs optical theories to practical applications in a broad range of areas. However, the foundation of traditional Engineering Optics was formed several hundred years ago, and the field has developed only very gradually. With technological innovations in both the fabrication and characterization of microstructures, the past few decades have witnessed many groundbreaking changes to the bases of optics, including the generalizing of refraction, reflection, diffraction, radiation and absorption theories. These new theories enable us to break through the barriers in traditional optical technologies, yielding revolutionary advances in traditional optical systems such as microscopes, telescopes and lithography systems.

High-Speed 3D Imaging with Digital Fringe Projection Techniques

It is well known that an optical field consists of phase, amplitude, and the state of polarization (SOP). Spatially customized optical field within the cross section have drawn significant attention recently and expected to lead to new effects and phenomena that can expand the functionality and enhance the capability of optical systems. Under high numerical-aperture (NA) focusing these customized structured lights are expected to exhibit novel phenomena when interact with various type of structured-materials. These interactions may find important applications in super-resolution microscopy, particle trapping and manipulation, materials characterization, as well as three-dimensional high-density optical storage. This dissertation is organized in two parts. In the first part, many different methods to generate complex optical fields using diffractive elements will be reviewed. Among these methods, we will focus on the Vectorial Optical Field Generator (VOF-Gen), which is capable of creating an arbitrary beam with independent controls of phase, amplitude and polarization on the pixel level utilizing high resolution reflective phase-only liquid crystal (LC) spatial light modulator (SLM). Experimental results will be presented, where various optical fields containing phase, amplitude, polarization and retardation modulations are successfully demonstrated. In the second part, focus shaping, three-dimensional (3D) state of polarization and

magnetization control, and focusing with spatially variant polarization are investigated and demonstrated. An approach to create diffraction-limited optical focal spots with arbitrarily oriented magnetic dipolar field components in 4Pi microscopy configuration is proposed. This is achieved by focusing two counter-propagating modulated vector beams consisting of complex intensity and polarization distribution. Through combining the magnetic dipole radiation pattern and the Richards-Wolf vectorial diffraction method, the required illuminations at the pupil plane of a 4Pi focusing configuration for the reconstruction of magnetic dipole focal field are found analytically. Furthermore, the orientation of the doughnut shape focal field can be rotated arbitrarily by modulating the pupil field distribution carefully. As an extension, a three-dimensional optical bubble encloses a transversely spinning magnetic field can be obtained by introducing a second magnetic dipole oriented in the orthogonal plane with appropriate amplitude and phase differences.

Engineering Optics 2.0

Topics in Modal Analysis, Volume 7: Proceedings of the 31st IMAC, A Conference and Exposition on Structural Dynamics, 2013, the seventh volume of seven from the Conference, brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics, including papers on: Fluid Structure Interaction Adaptive Structures Experimental Techniques Analytical Methods Damage Detection Damping of Materials & Members Modal Parameter Identification Modal Testing Methods System Identification Active Control Modal Parameter Estimation Processing Modal Data

Time-of-Flight and Structured Light Depth Cameras

Structured light beams, this is, beams whose phase changes from point to point in the transverse plane, provides with an alternative tool to search for new applications, or simply to expand the capabilities of current applications where commonly used light beams have encountered physical limitations. Applications can be found not only in the field of optics but also in areas as diverse as astrophysics, telecommunications and quantum computing, to mention some. In this thesis we put forward three new applications in which the use of structured light beams plays a crucial role. In the field of optical remote sensing, the Doppler effect is widely used to measure the component of the velocity along the line of sight, $\textit{i.e.}$, the longitudinal component. The Doppler effect alone, does not allow to measure the transverse component. In this context, structured light beams provides with a tool that makes this possible: its structured phase. The main idea resides in the fact that this beams, reflected from transversally moving targets, are frequency shifted proportional to the velocity of the target. The information of the velocity can be extracted using interferometric methods, in a similar way to the longitudinal Doppler shift. In a first experiment we validated this theoretical concept for two particular cases: rotation and longitudinal motions along the transverse plane of illumination. Some current existing techniques to measure small layer thicknesses

are based on the use of common-pant interferometers. In particular the self-referencing type, in which both the reference and the signal beams are generated locally. A reflective surface is engineered in the form of a ridge or cliff, in such a way when illuminated with a Gaussian beam half of it is reflected from the top and the other half from the base. This two "new beams" acquire a phase difference that depends on the height of the ridge and the wavelength of the illuminating source. This phase variations are detected on-axis in the far field as intensity changes. Hence, if we place a thick layer on top of the ridge, the change in intensity will immediately yield the height of the layer. This scheme becomes highly sensitive to small phase variations when the height of the ridge is $\lambda/8$ of the wavelength, known as the quadrature condition. This restriction might unfortunately limit the use of this technique to specific cases, since it highly depends on the construction of the ridge. To overcome this drawback we proposed and demonstrated experimentally a technique in which the quadrature condition is not needed a priori. Our approach is based on the use of spatial mode projection. For its implementation, we project the light reflected from the sample onto appropriately tailored spatial modes. Finally, we investigated theoretically the role that light endowed with Orbital Angular Momentum (OAM) might play for the discrimination of chiral molecules. Traditionally, this discrimination has been always related to Circularly Polarized Light (CPL), this is, to the Spin angular momentum of light. In this approach, the chiral response of molecules only depends on the properties of the same, and in many cases is very small. An approach to enhance this response was proposed very recently, in which the electromagnetic field that illuminates the molecule is properly tailored, in such a way the chiral response depends on both the molecular properties and the electromagnetic field. These types of electromagnetic fields have been termed "chiral fields" and are characterised through a quantity known as optical chirality (denoted as C). This quantity measures how contorted is the field at each point in space, the higher the value of C , the higher the chiral response. In our approach, we started from exact solutions to the Helmholtz equation. We found that a proper superposition of this two beams produces an on-axis, enhanced chiral response that can be several times larger.

Photonic Applications Based on the Use of Structured Light

This book is a printed edition of the Special Issue "MEMS Mirrors" that was published in Micromachines

A Survey on 3D Cameras: Metrological Comparison of Time-of-Flight, Structured-Light and Active Stereoscopy Technologies

Computer Vision Metrics provides an extensive survey and analysis of over 100 current and historical feature description and machine vision methods, with a detailed taxonomy for local, regional and global features. This book provides necessary background to develop intuition about why interest point detectors and feature descriptors actually work, how they are designed, with observations about tuning the methods for achieving robustness and invariance targets for specific

applications. The survey is broader than it is deep, with over 540 references provided to dig deeper. The taxonomy includes search methods, spectra components, descriptor representation, shape, distance functions, accuracy, efficiency, robustness and invariance attributes, and more. Rather than providing 'how-to' source code examples and shortcuts, this book provides a counterpoint discussion to the many fine opencv community source code resources available for hands-on practitioners.

3-D Imaging Technologies in Facial Plastic Surgery, An Issue of Facial Plastic Surgery Clinics - E-Book

MEMS Mirrors

Digital fringe projection (DFP) techniques are used for non-contact shape measurement of 3D images. In the rapidly expanding field of 3D high-speed imaging, the demand for DFP continues to grow due to the technology's fast speed, flexibility, low cost, and high accuracy. High-Speed 3D Imaging with Digital Fringe Projection Techniques discusses the generation of digital fringe with digital video projection devices, covering a variety of core technical aspects. The book begins by establishing the theoretical foundations of fringe pattern analysis, reviewing various 3D imaging techniques while highlighting the advantages of DFP. The author then: Describes the differences between digital light processing (DLP), liquid crystal display (LCD), and liquid crystal on silicon (LCoS) Explains how to unwrap phase maps temporally and spatially Shows how to generate fringe patterns with video projectors Demonstrates how to convert phase to coordinates through system calibrations Provides a detailed example of a built-from-scratch 3D imaging system Incorporating valuable insights gained during the author's 15+ years of 3D imaging research, High-Speed 3D Imaging with Digital Fringe Projection Techniques illuminates the pathway to advancement in high-speed 3D optical imaging using DFP.

Optically Polarized Atoms

The optical trapping of colloidal matter is an unequalled field of technology for enabling precise handling of particles on microscopic scales, solely by the force of light. Although the basic concept of optical tweezers, which are based on a single laser beam, has matured and found a vast number of exciting applications, in particular in the life sciences, there are strong demands for more sophisticated approaches. This thesis gives an introductory overview of existing optical micromanipulation techniques and reviews the state-of-the-art of the emerging field of structured light fields and their applications in optical trapping, micromanipulation, and organisation. The author presents established, and introduces novel concepts for the holographic and non-holographic shaping of a light field. A special emphasis of the work is the

demonstration of advanced applications of the thus created structured light fields in optical micromanipulation, utilising various geometries and unconventional light propagation properties. While most of the concepts developed are demonstrated with artificial microscopic reference particles, the work concludes with a comprehensive demonstration of optical control and alignment of bacterial cells, and hierarchical supramolecular organisation utilising dedicated nanocontainer particles.

Fiber Optics

New possibilities have recently emerged for producing optical beams with complex and intricate structures, and for the non-contact optical manipulation of matter. Structured Light and Its Applications fully describes the electromagnetic theory, optical properties, methods and applications associated with this new technology. Detailed discussions are given of unique beam characteristics, such as optical vortices and other wavefront structures, the associated phase properties and photonic aspects, along with applications ranging from cold atom manipulation to optically driven micromachines. Features include: Comprehensive and authoritative treatments of the latest research in this area of nanophotonics, written by the leading researchers Accounts of numerous microfluidics, nanofabrication, quantum informatics and optical manipulation applications Coverage that fully spans the subject area, from fundamental theory and simulations to experimental methods and results Graduate students and established researchers in academia, national laboratories and industry will find this book an invaluable guide to the latest technologies in this rapidly developing field. Comprehensive and definitive source of the latest research in nanotechnology written by the leading people in the field From theory to applications - all is presented in detail Editor is Chair of the SPIE Nanotechnology Technical Group and is leading the way in generation and manipulation of complex beams

Optics in Our Time

A global pool of surgeons and researchers using 3-dimensional imaging for facial plastic surgery present topics on: Image fusion in pre-operative planning; The use of 3D imaging tools including stereolithographic modeling and intraoperative navigation for maxillo-mandibular and complex orbital reconstruction; Custom-made, three-dimensional, intraoperative surgical guides for nasal reconstruction; The benefits and limits of using an integrated 3D virtual approach for maxillofacial surgery; 3D volume assessment techniques and computer-aided design and manufacturing for pre-operative fabrication of implants in head and neck reconstruction; A comparison of different new 3D imaging technologies in facial plastic surgery; 3-D photography in the objective analysis of volume augmentation including fat augmentation and dermal fillers; Assessment of different rhinoplasty techniques by overlay of before and after 3D images; 3D volumetric analysis of combined facial lifting and volumizing (volume enhancement); 3-D facial measurements and perceptions of attractiveness;

Teaching 3-D sculpting to Facial Plastic Surgeons, 3-D insights on aesthetics; Creation of the virtual patient for the study of facial morphology; 3-dimensional video analysis of facial movement; 3D modeling of the behavior of facial soft tissues for understanding facial plastic surgery interventions.

Computer Vision - ECCV 2012

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

Photonics, Volume 1

Covers modern photonics accessibly and discusses the basic physical principles underlying all the applications and technology of photonics. This volume covers the basic physical principles underlying the technology and all applications of photonics from statistical optics to quantum optics. The topics discussed in this volume are: Photons in perspective; Coherence and Statistical Optics; Complex Light and Singular Optics; Electrodynamics of Dielectric Media; Fast and slow Light; Holography; Multiphoton Processes; Optical Angular Momentum; Optical Forces, Trapping and Manipulation; Polarization States; Quantum Electrodynamics; Quantum Information and Computing; Quantum Optics; Resonance Energy Transfer; Surface Optics; Ultrafast Pulse Phenomena. Comprehensive and accessible coverage of the whole of modern photonics Emphasizes processes and applications that specifically exploit photon attributes of light Deals with the rapidly advancing area of modern optics Chapters are written by top scientists in their field Written for the graduate level student in physical sciences; Industrial and academic researchers in photonics, graduate students in the area; College lecturers, educators, policymakers, consultants, Scientific and technical libraries, government laboratories, NIH.

3D Shape Analysis

This book includes original, peer-reviewed research papers from the 11th International Conference on Modelling,

Identification and Control (ICMIC2019), held in Tianjin, China on July 13-15, 2019. The topics covered include but are not limited to: System Identification, Linear/Nonlinear Control Systems, Data-driven Modelling and Control, Process Modelling and Process Control, Fault Diagnosis and Reliable Control, Intelligent Systems, and Machine Learning and Artificial Intelligence. The papers showcased here share the latest findings on methodologies, algorithms and applications in modelling, identification, and control, integrated with Artificial Intelligence (AI), making the book a valuable asset for researchers, engineers, and university students alike.

Visible Light Active Structured Photocatalysts for the Removal of Emerging Contaminants

Nanostructuring of materials is a task at the heart of many modern disciplines in mechanical engineering, as well as optics, electronics, and the life sciences. This book includes an introduction to the relevant nonlinear optical processes associated with very short laser pulses for the generation of structures far below the classical optical diffraction limit of about 200 nanometers as well as coverage of state-of-the-art technical and biomedical applications. These applications include silicon and glass wafer processing, production of nanowires, laser transfection and cell reprogramming, optical cleaning, surface treatments of implants, nanowires, 3D nanoprinting, STED lithography, friction modification, and integrated optics. The book highlights also the use of modern femtosecond laser microscopes and nanoscopes as novel nanoprocessing tools.

Proceedings of the 11th International Conference on Modelling, Identification and Control (ICMIC2019)

Neurophotonics and Biomedical Spectroscopy addresses the novel state-of-the-art work in non-invasive optical spectroscopic methods that detect the onset and progression of diseases and other conditions, including pre-malignancy, cancer, Alzheimer's disease, tissue and cell response to therapeutic intervention, unintended injury and laser energy deposition. The book then highlights research in neurophotonics that investigates single and multi-photon excitation optical signatures of normal/diseased nerve tissues and in the brain, providing a better understanding of the underlying biochemical and structural changes of tissues and cells that are responsible for the observed spectroscopic signatures. Topics cover a wide array of well-established UV, visible, NIR and IR optical and spectroscopic techniques and novel approaches to diagnose tissue changes, including: label free in vivo and ex vivo fluorescence spectroscopy, Stoke shift spectroscopy, spectral imaging, Resonance Raman spectroscopy, multiphoton two Photon excitation, and more. Provides an overview of the spectroscopic properties of tissue and tissue-light interaction, describing techniques to exploit these properties in imaging Explores the potential and significance of molecule-specific imaging and its capacity to reveal vital new information on nanoscale structures Offers a concise overview of different spectroscopic methods and their potential benefits for solving diagnostic and therapeutic problems

Structured Light and Its Applications

Like virtual reality, augmented reality is becoming an emerging platform in new application areas for museums, edutainment, home entertainment, research, industry, and the art communities using novel approaches which have taken augmented reality beyond traditional eye-worn or hand-held displays. In this book, the authors discuss spatial augmented r

Structured Light from Pupil Plane to Focal Field

An in-depth description of the state-of-the-art of 3D shape analysis techniques and their applications This book discusses the different topics that come under the title of "3D shape analysis". It covers the theoretical foundations and the major solutions that have been presented in the literature. It also establishes links between solutions proposed by different communities that studied 3D shape, such as mathematics and statistics, medical imaging, computer vision, and computer graphics. The first part of 3D Shape Analysis: Fundamentals, Theory, and Applications provides a review of the background concepts such as methods for the acquisition and representation of 3D geometries, and the fundamentals of geometry and topology. It specifically covers stereo matching, structured light, and intrinsic vs. extrinsic properties of shape. Parts 2 and 3 present a range of mathematical and algorithmic tools (which are used for e.g., global descriptors, keypoint detectors, local feature descriptors, and algorithms) that are commonly used for the detection, registration, recognition, classification, and retrieval of 3D objects. Both also place strong emphasis on recent techniques motivated by the spread of commodity devices for 3D acquisition. Part 4 demonstrates the use of these techniques in a selection of 3D shape analysis applications. It covers 3D face recognition, object recognition in 3D scenes, and 3D shape retrieval. It also discusses examples of semantic applications and cross domain 3D retrieval, i.e. how to retrieve 3D models using various types of modalities, e.g. sketches and/or images. The book concludes with a summary of the main ideas and discussions of the future trends. 3D Shape Analysis: Fundamentals, Theory, and Applications is an excellent reference for graduate students, researchers, and professionals in different fields of mathematics, computer science, and engineering. It is also ideal for courses in computer vision and computer graphics, as well as for those seeking 3D industrial/commercial solutions.

Neurophotronics and Biomedical Spectroscopy

Optically Induced Nanostructures

This book is dedicated to the relativistic (laser intensity above 10^{18} W/cm²) laser-plasma interactions, which mainly concerns two important aspects: ion acceleration and extreme-light-field (ELF). Based on the ultra-intense and ultra-short

CP lasers, this book proposes a new method that significantly improves the efficiency of heavy-ion acceleration, and deals with the critical thickness issues of light pressure acceleration. More importantly, a series of plasma approaches for producing ELF, such as the relativistic single-cycle laser pulse, the intense broad-spectrum chirped laser pulse and the ultra-intense isolated attosecond (10-18s) pulse are introduced. This book illustrates that plasma not only affords a tremendous accelerating gradient for ion acceleration but also serves as a novel medium for ELF generation, and hence has the potential of plasma-based optics, which have a great advantage on the light intensity due to the absence of device damage threshold.

Light Robotics - Structure-mediated Nanobiophotonics

Light Driven Micromachines addresses the fundamental characteristics of light activated and optically powered microstructures, simple mechanisms, and complex machines that perform mechanical work at the micro- and nano-scale. It provides a background for how light can initiate physical movement by inducing material or bending or inducing microforces on the surrounding medium. Then, it covers how the forces of light can be harnessed for trapping and manipulating micron-sized mechanical components. Smart materials that exhibit direct optical-to-mechanical energy conversion are examined from the perspective of designing photo-responsive actuators and optically driven systems.

Ion acceleration and extreme light field generation based on ultra-short and ultra-intense lasers

Automatic personal authentication using biometric information is becoming more essential in applications of public security, access control, forensics, banking, etc. Many kinds of biometric authentication techniques have been developed based on different biometric characteristics. However, most of the physical biometric recognition techniques are based on two dimensional (2D) images, despite the fact that human characteristics are three dimensional (3D) surfaces. Recently, 3D techniques have been applied to biometric applications such as 3D face, 3D palmprint, 3D fingerprint, and 3D ear recognition. This book introduces four typical 3D imaging methods, and presents some case studies in the field of 3D biometrics. This book also includes many efficient 3D feature extraction, matching, and fusion algorithms. These 3D imaging methods and their applications are given as follows: - Single view imaging with line structured-light: 3D ear identification - Single view imaging with multi-line structured-light: 3D palmprint authentication - Single view imaging using only 3D camera: 3D hand verification - Multi-view imaging: 3D fingerprint recognition 3D Biometrics: Systems and Applications is a comprehensive introduction to both theoretical issues and practical implementation in 3D biometric authentication. It will serve as a textbook or as a useful reference for graduate students and researchers in the fields of computer science, electrical engineering, systems science, and information technology. Researchers and practitioners in

industry and R&D laboratories working on security system design, biometrics, immigration, law enforcement, control, and pattern recognition will also find much of interest in this book.

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