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Myung K. Kim

# Digital Holographic Microscopy

Principles, Techniques, and Applications



Springer

# Digital Holographic Microscopy Principles Techniques And Applications Springer Series In Optical Sciences

**Rajpal S. Sirohi**



## **Digital Holographic Microscopy Principles Techniques And Applications Springer Series In Optical Sciences:**

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**Micro- and Nanophotonic Technologies** Patrick Meyrueis, Kazuaki Sakoda, Marcel Van de Voorde, 2017-03-20 Edited and authored by leading experts from top institutions in Europe the US and Asia this comprehensive overview of micro and nanophotonics covers the physical and chemical fundamentals while clearly focusing on the technologies and applications in industrial R light conversion and energy generation light based fabrication of materials and micro and nanophotonic devices in metrology and control

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International License via link [springer.com](https://www.springer.com) **A Practical Guide to Optical Microscopy** John Girkin, 2019-06-14 Choice Recommended Title March 2020 Optical microscopy is used in a vast range of applications ranging from materials engineering to in vivo observations and clinical diagnosis and thanks to the latest advances in technology there has been a rapid growth in the number of methods available This book is aimed at providing users with a practical guide to help them select and then use the most suitable method for their application It explores the principles behind the different forms of optical microscopy without the use of complex maths to provide an understanding to help the reader utilise a specific method and then interpret the results Detailed physics is provided in boxed sections which can be bypassed by the non specialist It is an invaluable tool for use within research groups and laboratories in the life and physical sciences acting as a first source for practical information to guide less experienced users or those new to a particular methodology on the range of techniques available Features The first book to cover all current optical microscopy methods for practical applications Written to be understood by a non optical expert with inserts to provide the physical science background Brings together conventional widefield and confocal microscopy with advanced non linear and super resolution methods in one book To learn more about the author please visit [here](https://www.john-girkin.com)

**Biomedical Optical Phase Microscopy and Nanoscopy** Natan T. Shaked, Zeev Zalevsky, Lisa L Satterwhite, 2012-11-05 Written by leading optical phase microscopy experts this book is a comprehensive reference to phase microscopy and nanoscopy techniques for biomedical applications including differential interference contrast DIC microscopy phase contrast microscopy digital holographic microscopy optical coherence tomography tomographic phase microscopy spectral domain phase detection and nanoparticle usage for phase nanoscopy The Editors show biomedical and optical engineers how to use phase microscopy for visualizing unstained specimens and support the theoretical coverage with applied content and examples on designing systems and interpreting results in bio and nanoscience applications Provides a comprehensive overview of the principles and techniques of optical phase microscopy and nanoscopy with biomedical applications Tips advice on building systems and working with advanced imaging biomedical techniques including interpretation of phase images and techniques for quantitative analysis based on phase microscopy Interdisciplinary approach that combines optical engineering nanotechnology biology and medical aspects of this topic Each chapter includes practical implementations and worked examples [Advancement of Optical Methods & Digital Image](#)

Correlation in Experimental Mechanics, Volume 3 Luciano Lamberti, Ming-Tzer Lin, Cosme Furlong, Cesar Sciammarella, 2025-08-07 Advancement of Optical Methods DIC Applications for Challenging Environments Optical Methods in SEM History Mechanical Characterization of Materials Bioengineering *Cell Volume Regulation*, 2018-09-20 Cell Volume Regulation and Fluid Secretion Volume 81 the latest release in the Current Topics in Membranes series highlights new advances in the field with this new volume presenting interesting chapters on General principles of cell volume regulation Cell volume maintenance water and salt homeostasis The search for ubiquitous cell volume sensor the role of plasma membrane and cytoplasmic hydrogel More than membranes Cellular and membrane biomechanics of CVR response Molecular identities of volume regulatory anion channels Molecular biology and physiology of volume regulated anion channel VRAC the Role of WNKs in the modulation of intracellular chloride amongst other topics Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Current Topics in Membranes series Includes the latest information on Cell Volume Regulation Electrodynamics and Optics Wolfgang Demtröder, 2019-08-30 This engaging text offers an accessible and clear treatment of the fundamentals of electromagnetics and optics a core part of the standard undergraduate physics curriculum Starting with static electric and magnetic fields the book works through electromagnetic oscillations and the formation and propagation of electromagnetic waves before moving on to geometric and wave optics optical instrumentation and some discussion of new technologies in optics The text is written from the experimental physics point of view giving numerous real life examples and applications of devices This highly motivating presentation deepens the knowledge in a very accessible way carefully interweaving theory and practical applications Students are guided through the material with well chosen examples and case studies and helpful chapter summaries are provided together with numerous exercises and detailed solutions all intended to motivate and develop a well founded understanding of the subject matter *Holoscopy* Dierck Hillmann, 2014-07-08 Holoscopy is a new tomographic imaging modality that combines techniques of digital holography with Fourier domain optical coherence tomography FD OCT Dierck Hillmann gives a theoretical introduction to the mathematics and physics of holoscopy and develops an efficient numerical reconstruction procedure Compared to FD OCT holoscopy provides unique advantages by enabling tomographic imaging without a limited depth of focus but results in an increased numerical cost for reconstruction In further chapters the author introduces techniques for FD OCT that are relevant to holoscopy as well He demonstrates and compares numerical reconstruction methods for FD OCT and shows how motion and dispersion artifacts in FD OCT can be numerically compensated Label-Free Super-Resolution Microscopy Vasily Astratov, 2019-08-31 This book presents the advances in super resolution microscopy in physics and biomedical optics for nanoscale imaging In the last decade super resolved fluorescence imaging has opened new horizons in improving the resolution of optical microscopes far beyond the classical diffraction limit leading to the Nobel Prize in Chemistry in 2014 This book represents the first comprehensive review of a

different type of super resolved microscopy which does not rely on using fluorescent markers Such label free super resolution microscopy enables potentially even broader applications in life sciences and nanoscale imaging but is much more challenging and it is based on different physical concepts and approaches A unique feature of this book is that it combines insights into mechanisms of label free super resolution with a vast range of applications from fast imaging of living cells to inorganic nanostructures This book can be used by researchers in biological and medical physics Due to its logically organizational structure it can be also used as a teaching tool in graduate and upper division undergraduate level courses devoted to super resolved microscopy nanoscale imaging microscopy instrumentation and biomedical imaging

**Introduction to Optical Metrology** Rajpal S. Sirohi, 2017-07-12 Introduction to Optical Metrology examines the theory and practice of various measurement methodologies utilizing the wave nature of light The book begins by introducing the subject of optics and then addresses the propagation of laser beams through free space and optical systems After explaining how a Gaussian beam propagates how to set up a collimator to get a collimated beam for experimentation and how to detect and record optical signals the text Discusses interferometry speckle metrology moir phenomenon photoelasticity and microscopy Describes the different principles used to measure the refractive indices of solids liquids and gases Presents methods for measuring curvature focal length angle thickness velocity pressure and length Details techniques for optical testing as well as for making fiber optic and MEMS based measurements Depicts a wave propagating in the positive z direction by  $e^{i(kz - \omega t)}$  as opposed to  $e^{i(kz + \omega t)}$  Featuring exercise problems at the end of each chapter Introduction to Optical Metrology provides an applied understanding of essential optical measurement concepts techniques and procedures

**Optical Holography** Pierre-Alexandre Blanche, 2019-10-23 Optical Holography Materials Theory and Applications provides researchers the fundamentals of holography through diffraction optics and an overview of the most relevant materials and applications ranging from computer holograms to holographic data storage Dr Pierre Blanche leads a team of thought leaders in academia and industry in this practical reference for researchers and engineers in the field of holography This book presents all the information readers need in order to understand how holographic techniques can be applied to a variety of applications the benefits of those techniques and the materials that enable these technologies Researchers and engineers will gain comprehensive knowledge on how to select the best holographic techniques for their needs Covers current applications of holographic techniques in areas such as 3D television solar concentration non destructive testing and data storage Describes holographic recording materials and their most relevant applications Provides the fundamentals of holography and diffraction optics

**Advanced Optical Instruments and Techniques** Daniel Malacara Hernández, 2017-11-22 Advanced Optical Instruments and Techniques includes twenty three chapters providing processes methods and procedures of cutting edge optics engineering design and instrumentation Topics include biomedical instrumentation and basic and advanced interferometry Optical metrology is discussed including point and full field methods

Active and adaptive optics holography radiometry the human eye and visible light are covered as well as materials including photonics nanophotonics anisotropic materials and metamaterials      **Digital Holographic Methods** Stephan

Stuerwald,2018-10-12 This book presents not only the simultaneous combination of optical methods based on holographic principles for marker free imaging real time trapping identification and tracking of micro objects but also the application of substantial low coherent light sources and non diffractive beams It first provides an overview of digital holographic microscopy DHM and holographic optical tweezers as well as non diffracting beam types for minimal invasive real time and marker free imaging as well as manipulation of micro and nano objects It then investigates the design concepts for the optical layout of holographic optical tweezers HOTs and their optimization using optical simulations and experimental methods In a further part the book characterizes the corresponding system modules that allow the addition of HOTs to commercial microscopes with regard to stability and diffraction efficiency Further based on experiments and microfluidic applications it demonstrates the functionality of the combined setup and discusses several types of non diffracting beams and their application in optical manipulation The book shows that holographic optical tweezers including several non diffracting beam types like Mathieu beams combined parabolic and Airy beams not only open up the possibility of generating efficient multiple dynamic traps for micro and nano particles with forces in the pico and nano newton range but also the opportunity to exert optical torque with special beams like Bessel beams which can facilitate the movement and rotation of particles by generating microfluidic flows The last part discusses the potential use of a slightly modified DHM HOT system to explore the functionality of direct laser writing based on a two photon absorption process in a negative photoresist with a continuous wave laser      **JPEG Series** K.R. Rao,Humberto Ochoa Domínguez,2022-09-01 While the JPEG image standard was developed

more than 25 years ago it is still dominant in terms of image formation manipulation and transmission over the internet and other media As technology advances new demands have arisen for the efficient transmission and storage of images causing other formats to emerge Over the years several extensions such as JPEGLS JPEG2K JPEGXT JPEGXR JPEGXS and JPEG Pleno have been added constructing a series of standards for the compression and transmission of images This book is the first to bring together most of the series of JPEG standards in a book This book covers the descriptions of the JPEG standards and gives the reader an overview of the latest advances in the standards of the Joint Photographic Experts Group Topics discussed include JPEG XR JPEG XT JPEG 2000 JPEG XS JPEG Pleno JPEG AIC JPEG LS JPEG XL JPSearch JPEG Systems JBIG      **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      **Computer Holography** Tomoyoshi

Shimobaba, Tomoyoshi Ito, 2019-01-30 This book describes algorithms and hardware implementations of computer holography especially in terms of fast calculation. It summarizes the basics of holography and computer holography and describes how conventional diffraction calculations play a central role. Numerical implementations by actual codes will also be discussed. This book will explain new fast diffraction calculations such as scaled scalar diffraction. Computer Holography will also explain acceleration algorithms for computer generated hologram CGH generation and digital holography with 3D objects composed of point clouds using look up table LUT based algorithms and a wave front recording plane 3D objects composed of polygons using tilted plane diffraction expressed by multi view images and RGB D images will be explained in this book. Digital holography including inline off axis Gabor digital holography and phase shift digital holography will also be explored. This book introduces applications of computer holography including phase retrieval algorithm holographic memory holographic projection and deep learning in computer holography while explaining hardware implementations for computer holography. Recently several parallel processors have been released for example multi core CPU GPU Xeon Phi and FPGA. Readers will learn how to apply algorithms to these processors. Features: Provides an introduction of the basics of holography and computer holography. Summarizes the latest advancements in computer generated holograms. Showcases the latest researchers of digital holography. Discusses fast CGH algorithms and diffraction calculations and their actual codes. Includes hardware implementation for computer holography and its actual codes and quasi codes.

**Digital Holography and Wavefront Sensing** Ulf Schnars, Claas Falldorf, John Watson, Werner Jüptner, 2014-09-19 This highly practical and self contained guidebook explains the principles and major applications of digital hologram recording and numerical reconstruction. Digital Holography A special chapter is designated to digital holographic interferometry with applications in deformation and shape measurement and refractive index determination. Applications in imaging and microscopy are also described. Special techniques such as digital light in flight holography holographic endoscopy information encrypting comparative holography and related techniques of speckle metrology are also treated.



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**Introduction**

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