



Handbook of **OPTICAL METROLOGY**

Principles and Applications

Edited by
Toru Yoshizawa



CRC Press
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Handbook Of Optical Metrology

Carolyn Mercer



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Handbook of Optical Metrology Toru Yoshizawa, 2017-07-28 Handbook of Optical Metrology Principles and Applications begins by discussing key principles and techniques before exploring practical applications of optical metrology. Designed to provide beginners with an introduction to optical metrology without sacrificing academic rigor, this comprehensive text covers fundamentals of light sources, lenses, prisms, and mirrors, as well as optoelectronic sensors, optical devices, and optomechanical elements. Addresses interferometry, holography, and speckle methods and applications. Explains Moiré metrology and the optical heterodyne measurement method. Delves into the specifics of diffraction, scattering, polarization, and near field optics. Considers applications for measuring length and size, displacement, straightness, and parallelism, flatness, and three-dimensional shapes. This new Second Edition is fully revised to reflect the latest developments. It also includes four new chapters: nearly 100 pages on optical coherence tomography for industrial applications; interference microscopy for surface structure analysis; noncontact dimensional and profile metrology by video measurement; and optical metrology in manufacturing technology.

Handbook of Optical Dimensional Metrology Kevin Harding, 2013-02-26 Due to their speed, data density, and versatility, optical metrology tools play important roles in today's high-speed industrial manufacturing applications. Handbook of Optical Dimensional Metrology provides useful background information and practical examples to help readers understand and effectively use state-of-the-art optical metrology methods. The book first builds a foundation for evaluating optical measurement methods. It explores the many terms of optical metrology and compares it to other forms of metrology, such as mechanical gaging, highlighting the limitations and errors associated with each mode of measurement at a general level. This comparison is particularly helpful to current industry users who operate the most widely applied mechanical tools. The book then focuses on each application area of measurement, working down from large area to medium sized to submicron measurements. It describes the measurement of large objects on the scale of buildings, the measurement of durable manufactured goods such as aircraft engines and appliances, and the measurement of fine features on the micron and nanometer scales. In each area, the book covers fast, coarse measures as well as the finest measurements possible. Best practices and practical examples for each technology aid readers in effectively using the methods. Requiring no prior expertise in optical dimensional metrology, this handbook helps engineers and quality specialists understand the capabilities and limitations of optical metrology methods. It also shows them how to successfully apply optical metrology to a vast array of current engineering and scientific problems.

Handbook of Optical Metrology Toru Yoshizawa, 2009-02-25 The field of optical metrology offers a wealth of both practical and theoretical accomplishments and can cite any number of academic papers recording such. However, while several books covering specific areas of optical metrology do exist, until the pages herein were researched, written, and compiled, the field lacked for a comprehensive handbook, one providing an overview of optical metrology that covers practical applications as well as fundamentals. Carefully

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Optical Metrology Kjell J. Gåsvik, 2003-04-11 New material on computerized optical processes computerized ray tracing and the fast Fourier transform Bire Bragg sensors and temporal phase unwrapping New introductory sections to all chapters Detailed discussion on lasers and laser principles including an introduction to radiometry and photometry Thorough coverage of the CCD camera **Handbook of Optical Systems, Volume 5** Bernd Dörband, Henriette Möller, Herbert Gross, 2012-05-14 The state of the art full colored handbook gives a comprehensive introduction to the principles and the practice of calculation layout and understanding of optical systems and lens design Written by reputed industrial experts in the field this text introduces the user to the basic properties of optical systems aberration theory classification and characterization of systems advanced simulation models measuring of system quality and manufacturing issues In this Volume Volume 5 topics comprise the methods of measuring the properties of optical systems The different fundamental techniques such as propagation measurement and polarimetry are introduced and discussed in detail and clarity The presentation allows the reader after having devised an optical system to perform the measurements best suited to ascertain that the system fulfills the specific needs and requirements The following chapters provide a survey on materials coatings and surfaces of optical components and combine this with a treatment of light and radiation The book thus serves as a one stop reference for metrology of optical systems Other Volumes Volume 1 Fundamentals of Technical Optics Volume 2 Physical Image Formation Volume 3 Aberration Theory and Correction of Optical Systems Volume 4 Survey of Optical

Instruments **A Practical Guide to Optical Metrology for Thin Films** Michael Quinten, 2012-09-24 A one stop concise guide on determining and measuring thin film thickness by optical methods This practical book covers the laws of electromagnetic radiation and interaction of light with matter as well as the theory and practice of thickness measurement and modern applications In so doing it shows the capabilities and opportunities of optical thickness determination and discusses the strengths and weaknesses of measurement devices along with their evaluation methods Following an introduction to the topic Chapter 2 presents the basics of the propagation of light and other electromagnetic radiation in space and matter The main topic of this book the determination of the thickness of a layer in a layer stack by measuring the spectral reflectance or transmittance is treated in the following three chapters The color of thin layers is discussed in chapter 6 Finally in chapter 7 the author discusses several industrial applications of the layer thickness measurement including high reflection and anti reflection coatings photolithographic structuring of semiconductors silicon on insulator transparent conductive films oxides and polymers thin film photovoltaics and heavily doped silicon Aimed at industrial and academic researchers engineers developers and manufacturers involved in all areas of optical layer and thin optical film measurement and metrology process control real time monitoring and applications **Handbook of 3D Machine Vision** Song

Zhang, 2016-04-19 Choosing from the numerous 3D vision methods available can be frustrating for scientists and engineers especially without a comprehensive resource to consult Filling this gap this handbook gives an in depth look at the most popular 3D imaging techniques Written by key players in the field and inventors of important imaging technologies it helps you understand the core of 3D imaging technology and choose the proper 3D imaging technique for your needs For each technique the book provides its mathematical foundations summarizes its successful applications and discusses its limitations

Handbook of Optical Engineering Daniel Malacara, 2001-05-31 This handbook explains principles processes methods and procedures of optical engineering in a concise and practical way It emphasizes fundamental approaches and provides useful formulas and step by step worked out examples to demonstrate applications and clarify calculation methods The book covers refractive reflective and diffractive optical components lens optical devices modern fringe pattern analysis optical metrology Fourier optics and optical image processing electro optical and acousto optical devices spatial and spectral filters optical fibers and accessories optical fabrication and more It includes over 2 000 tables flow charts graphs schematics drawings photographs and mathematical expressions **Handbook of Semiconductor Manufacturing Technology** Yoshio

Nishi, Robert Doering, 2017-12-19 Retaining the comprehensive and in depth approach that cemented the bestselling first edition s place as a standard reference in the field the Handbook of Semiconductor Manufacturing Technology Second Edition features new and updated material that keeps it at the vanguard of today s most dynamic and rapidly growing field Iconic experts Robert Doering and Yoshio Nishi have again assembled a team of the world s leading specialists in every area of semiconductor manufacturing to provide the most reliable authoritative and industry leading information available Stay

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Optical Metrology for Fluids, Combustion and Solids Carolyn Mercer, 2013-04-17 Optical Metrology for Fluids Combustion and Solids is the first practical handbook that presents the assemblage of the techniques necessary to provide a basic understanding of optical measurement for fluids combustion and solids The use of light as a measurement tool has grown over the past twenty years from a narrowly specialized activity to a mainstay of modern research today Until recently the knowledge that could be extracted from the light interaction of light with physical objects was limited to specialized activities The invention of the laser the computer and microelectronics has enabled a measurement revolution such that virtually every parameter of engineering interest can be measured using the minimally intrusive properties of light The authors of this book's chapters are leaders in this revolution They work on the front lines of research in government industry and universities inventing yet more ways to harness the power of light for the generation of knowledge

Handbook of Optical Engineering Daniel Malacara, 2001-05-31 This handbook explains principles processes methods and procedures of optical engineering in a concise and practical way It emphasizes fundamental approaches and provides useful formulas and step by step worked out examples to demonstrate applications and clarify calculation methods The book covers refractive reflective and diffractive optical components lens optical devices modern fringe pattern analysis optical metrology Fourier optics and optical image processing electro optical and acousto optical devices spatial and spectral filters optical fibers and accessories optical fabrication and more It includes over 2 000 tables flow charts graphs schematics drawings photographs and mathematical expressions

Dimensional Metrology Han Haitjema, Richard Leach, 2025-07-22 This book provides in depth coverage of metrology principles for students practicing engineers technologists and researchers Dimensional Metrology presents and explains mathematical principles and treatments and practical applications of metrology with numerous chapter exercises that link theory to the solution of practical problems Computer based classes of dimensional metrology are covered such as CMM technology areal surface measurement and X ray computed tomography Readers are shown how to perform and evaluate dimensional measurements and interpret the results Measuring instruments and methods are explained so that readers can determine which one to use for specific applications This book aims to give both technicians and academic researchers in the field a thorough understanding of both the mathematical principles and uses

and their applications It can well act as the basis for a course series at the bachelor s and master s level for students in mechanical engineering

Handbook of VLSI Microlithography William B. Glendinning, John N. Helbert, 2012-12-02 This handbook gives readers a close look at the entire technology of printing very high resolution and high density integrated circuit IC patterns into thin resist process transfer coatings including optical lithography electron beam ion beam and x ray lithography The book s main theme is the special printing process needed to achieve volume high density IC chip production especially in the Dynamic Random Access Memory DRAM industry The book leads off with a comparison of various lithography methods covering the three major patterning parameters of line space resolution line edge and pattern feature dimension control The book s explanation of resist and resist process equipment technology may well be the first practical description of the relationship between the resist process and equipment parameters The basics of resist technology are completely covered including an entire chapter on resist process defectivity and the potential yield limiting effect on device production Each alternative lithographic technique and testing method is considered and evaluated basic metrology including optical scanning electron microscope SEM techniques and electrical test devices along with explanations of actual printing tools and their design construction and performance The editor devotes an entire chapter to today s sophisticated complex electron beam printers and to the emerging x ray printing technology now used in high density CMOS devices Energetic ion particle printing is a controllable steerable technology that does not rely on resist and occupies a final section of the handbook

Handbook of Machine and Computer Vision Alexander Hornberg, 2017-03-07 The second edition of this accepted reference work has been updated to reflect the rapid developments in the field and now covers both 2D and 3D imaging Written by expert practitioners from leading companies operating in machine vision this one stop handbook guides readers through all aspects of image acquisition and image processing including optics electronics and software The authors approach the subject in terms of industrial applications elucidating such topics as illumination and camera calibration Initial chapters concentrate on the latest hardware aspects ranging from lenses and camera systems to camera computer interfaces with the software necessary discussed to an equal depth in later sections These include digital image basics as well as image analysis and image processing The book concludes with extended coverage of industrial applications in optics and electronics backed by case studies and design strategies for the conception of complete machine vision systems As a result readers are not only able to understand the latest systems but also to plan and evaluate this technology With more than 500 images and tables to illustrate relevant principles and steps

Introduction to Optical Metrology Rajpal S. Sirohi, 2025-09-26 This book describes both the theory and practice of optical techniques to measure various parameters encountered routinely in science and engineering Introduction to Optical Metrology Second Edition examines the theory and practice of various measurement methodologies utilizing both the corpuscular and 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 It discusses

interferometry holography speckle metrology the moir phenomenon photoelasticity and microscopy The remaining chapters describe techniques and methods of measurements of refractive index thickness radii of curvature angle velocity pressure length optical testing and fiber optic based methods Apart from these this edition includes a chapter on temperature measurement sections on fringe unwrapping methods testing of free form optics shearography etc Featuring new and updated exercise problems at the end of each chapter this edition provides an applied understanding of essential optical measurement concepts techniques and procedures The primary audience for this book is undergraduate and graduate students who specialize in optics It will also be useful to researchers and professionals working on optical testing and fiber optic based and MEMS based measurements A solutions manual and figure slides are available for adopting professors

Micromanufacturing Processes V.K. Jain, 2016-04-19 Increased demand for and developments in micromanufacturing have created a need for a resource that covers both the science and technology of this rapidly growing area With contributions from eminent professors and researchers actively engaged in teaching research and development

Micromanufacturing Processes details the basic principles tools **Polarized Light and the Mueller Matrix Approach** Jose Jorge Gil Perez, Razvigor Ossikovski, 2017-07-12 An Up to Date Compendium on the Physics and Mathematics of Polarization Phenomena *Polarized Light and the Mueller Matrix Approach* thoroughly and cohesively integrates basic concepts of polarization phenomena from the dual viewpoints of the states of polarization of electromagnetic waves and the transformations of these states by the action of material media Through selected examples it also illustrates actual and potential applications in materials science biology and optics technology The book begins with the basic concepts related to two and three dimensional polarization states It next describes the nondepolarizing linear transformations of the states of polarization through the Jones and Mueller Jones approaches The authors then discuss the forms and properties of the Jones and Mueller matrices associated with different types of nondepolarizing media address the foundations of the Mueller matrix and delve more deeply into the analysis of the physical parameters associated with Mueller matrices The authors proceed to interpret arbitrary decomposition and other interesting parallel decompositions as well as compare the powerful serial decompositions of depolarizing Mueller matrix M They also analyze the general formalism and specific algebraic quantities and notions related to the concept of differential Mueller matrix The book concludes with useful approaches that provide a geometric point of view on the polarization effects exhibited by different types of media Suitable for novices and more seasoned professionals this book covers the main aspects of polarized radiation and polarization effects of material media It expertly combines physical and mathematical concepts with important approaches for representing media through equivalent systems composed of simple components Fundamentals of Picoscience Klaus D. Sattler, 2013-09-26 Ushering in the next technological era this state of the art book focuses on the instrumentation and experiments emerging at the picometer scale International scientists and researchers at the forefront of the field address the key challenges in developing new

instrumentation and techniques to visualize and measure structures at this sub nanometer level The book helps you understand how picoscience is an extension of nanoscience determine which experimental technique to use in your research and connect basic studies to the development of next generation picoelectronic devices **Springer Handbook of Experimental Solid Mechanics** William N. Sharpe, Jr., William N. Sharpe, 2008-12-04 The Springer Handbook of Experimental Solid Mechanics documents both the traditional techniques as well as the new methods for experimental studies of materials components and structures The emergence of new materials and new disciplines together with the escalating use of on and off line computers for rapid data processing and the combined use of experimental and numerical techniques have greatly expanded the capabilities of experimental mechanics New exciting topics are included on biological materials MEMS and NEMS nanoindentation digital photomechanics photoacoustic characterization and atomic force microscopy in experimental solid mechanics Presenting complete instructions to various areas of experimental solid mechanics guidance to detailed expositions in important references and a description of state of the art applications in important technical areas this thoroughly revised and updated edition is an excellent reference to a widespread academic industrial and professional engineering audience

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