



Handbook of **OPTICAL METROLOGY**

Principles and Applications

Edited by
Toru Yoshizawa



CRC Press
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Handbook Of Optical Metrology

Daniel Malacara



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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

designed to make information accessible to beginners without sacrificing academic rigor the Handbook of Optical Metrology Principles and Applications discusses fundamental principles and techniques before exploring practical applications With contributions from veterans in the field as well as from up and coming researchers the Handbook offers 30 substantial and well referenced chapters In addition to the introductory matter forward thinking descriptions are included in every chapter that make this a valuable reference for all those involved with optical metrology *Handbook of Optical Metrology, 2nd Edition* Toru Yoshizawa, 2017 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 Moir 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

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 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

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

Optical Metrology Kjell J. Gåsvik, 2003-04-11 New material on computerized optical processes computerized ray tracing and the fast Fourier transform Bibre 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 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

Optical Metrology for Fluids, Combustion and Solids Carolyn Mercer, 2003-07-31 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.

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 Current with the Latest Technologies. In addition to updates to nearly every existing chapter, this edition features five entirely new contributions on Silicon on insulator (SOI) materials and devices, Supercritical CO₂ in semiconductor cleaning, Low dielectrics, Atomic layer deposition, Damascene copper electroplating, Effects of terrestrial radiation on integrated circuits (ICs). Reflecting rapid progress in many areas, several chapters were heavily revised and updated, and in some cases rewritten to reflect rapid advances in such areas as interconnect technologies, gate dielectrics, photomask fabrication, IC packaging, and 300 mm wafer fabrication. While no book can be up to the minute with the advances in the semiconductor field, the *Handbook of Semiconductor Manufacturing Technology* keeps the most important data, methods, tools, and techniques close at hand.

Optical Metrology for Precision Engineering Wei Gao, Yuki Shimizu, 2021-11-22 This book provides readers the fundamentals of optical metrology for precision engineering. The next generation measurement technologies based on ultrashort pulse laser and optical frequency comb are also presented, making it an essential reference book for various engineering fields. Introduces fundamental theories and techniques. Combines theories with practical applications. Presents technologies in an easy-to-understand way.

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 Optical Sensors Jose Luis Santos,Faramarz Farahi,2014-10-29 Handbook of Optical Sensors provides a comprehensive and integrated view of optical sensors addressing the fundamentals structures technologies applications and future perspectives Featuring chapters authored by recognized experts and major contributors to the field this essential reference Explains the basic aspects of optical sensors and the principles of optical metrology presenting a brief historical review Explores the role of optical waveguides in sensing and discusses sensor technologies based on intensity and phase modulation fluorescence and plasmonic waves Describes wavefront sensing multiphoton microscopy and imaging based on optical coherence tomography Covers optical fiber sensing from light guiding in standard and microstructured optical fibers to sensor multiplexing distributed sensing and fiber Bragg grating Offers a broad perspective of the field and identifies trends that could shape the future such as metamaterials and entangled quantum states of light Handbook of Optical Sensors is an ideal resource for practitioners and those seeking optical solutions for their specific needs as well as for students and investigators who are the intellectual driving force of optical sensing

Introduction to Optical Metrology Rajpal S. Sirohi,2025-08-25 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

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

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

Handbook of Optics Walter G. Driscoll, William Vaughan, Optical Society of America, 1978 This is an authoritative collection of data on the characteristics of materials components of optical systems

Sensor Systems Simulations Willem Dirk van Driel, Oliver Pyper, Cornelia Schumann, 2019-06-18 This book describes for readers various technical outcomes from the EU project IoSense The authors discuss sensor integration including LEDs dust sensors LIDAR for automotive driving and 8 more demonstrating their use in simulations for the design and fabrication of sensor systems Readers will benefit from the coverage of topics such as sensor technologies for both discrete and integrated innovative sensor devices suitable for high volume production electrical mechanical security and software resources for integration of sensor system components into IoT systems and IoT enabling systems and IoT sensor system reliability Describes from component to system level simulation

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