# Molded Optics Design And Manufacture Series In Optics

Design and Manufacture
Theory and Applications
The Failure Mechanisms of Coated Precision Glass Molding Tools
Fundamentals of Optomechanics
Advanced Optical Instruments and Techniques
Precision Lens Molding of Glass: A Process Perspective
Design, Fabrication and Metrology of Precision Molded Freeform Plastic Optics
Tissue Optical Sectioning
The 11th International Conference on Precision Engineering (ICPE) August 16-18, 2006, Tokyo, Japan
Handbook of 3D Machine Vision
Harnessing Light
Integrative Production Technology
Design, Fabrication and Evaluation of Nonconventional Optical Components
Opto-Mechanical Systems Design, Volume 1
Advanced Biophotonics
Molded Optics
Handbook of Optical Dimensional Metrology
Optical Compressive Imaging
Injection Molding Handbook
Handbook of Plastic Optics
Biomimetics in Photonics
Encyclopedia of Optical Engineering: Las-Pho, pages 1025-2048
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## RAIDEN AIYANA

*Design and Manufacture*
CRC Press
Opto-Mechanical Systems Design, Fourth Edition is different in many ways from its three earlier editions: coauthor Daniel Vukobratovich has brought his broad expertise in materials, opto-mechanical design, analysis of optical instruments, large mirrors, and structures to bear throughout the book; Jan Nijenhuis has contributed a comprehensive new chapter on kinematics and applications of flexures; and several other experts in special aspects of opto-mechanics have contributed portions of other chapters. An expanded feature—a total of 110 worked-out design examples—has been added to several chapters to show how the theory, equations, and analytical methods can be applied by the reader. Finally, the extended text, new illustrations, new tables of data, and new references have warranted publication of this work in the form of two separate but closely entwined volumes. The first volume, Design and Analysis of Opto-Mechanical Assemblies, addresses topics pertaining primarily to optics smaller than 50 cm aperture. It summarizes the opto-mechanical design process, considers pertinent environmental influences, lists and updates key parameters for materials, illustrates numerous ways for mounting individual and multiple lenses, shows typical ways to design and mount windows and similar components, details designs for many types of prisms and techniques for mounting them, suggests designs and mounting techniques for small mirrors, explains the benefits of kinematic design and uses of flexures, describes how to analyze various types of opto-mechanical interfaces, demonstrates how the strength of glass can be determined and how to estimate stress generated in optics, and explains how changing temperature affects opto-mechanical assemblies. The second volume, Design and Analysis of Large Mirrors and Structures, concentrates on the design and mounting of significantly larger optics and their structures, including a new and important topic: detailed consideration of factors affecting large mirror performance. The book details how to design and fabricate very large single-substrate, segmented, and lightweight mirrors; describes mountings for large mirrors with their optical axes in vertical, horizontal, and variable orientations; indicates how metal and composite mirrors differ from ones made of glass; explains key design aspects of optical instrument structural design; and takes a look at an emerging technology—the evolution and applications of silicon and silicon carbide in mirrors and other types of components for optical applications.
*Theory and Applications*
McGraw Hill Professional
This comprehensive handbook covers all major aspects of optomechanical engineering - from conceptual design to

fabrication and integration of complex optical systems. The practical information within is ideal for optical and optomechanical engineers and scientists involved in the design, development and integration of modern optical systems for commercial, space, and military applications. Charts, tables, figures, and photos augment this already impressive text. Fully revised, the new edition includes 4 new chapters: Plastic optics, Optomechanical tolerancing and error budgets, Analysis and design of flexures, and Optomechanical constraint equations.
*The Failure Mechanisms of Coated Precision Glass Molding Tools* Molded OpticsDesign and Manufacture
Selected by the American Library Association's 'Choice' magazine as "best technical book", the first edition of this book soon established itself as the standard reference work on all aspects of photographic lenses and associated optical systems. This is unsurprising, as Sidney Ray provides a complete, comprehensive reference source for anyone wanting information on photographic lenses, from the student to the practitioner or specialist working with visual and digital media worldwide. This third edition has been fully revised and expanded to include the rapid progress in the last decade in optical technology and advances in relevant electronic and digital forms of imaging. Every chapter has been revised and expanded using new figures and photographs as appropriate, as well as extended bibliographies. New chapters include details of filters, measurements from images and the optical systems of digital cameras. Details of electronic and digital imaging have been integrated throughout. More information is given on topics such as aspherics, diffractive optics, ED glasses, image stabilization, optical technology, video projection and new types of lenses. A selection of the contents includes chapters on: optical theory, aberrations, auto focus, lens testing, depth of field, development of photographic lenses, general properties of lenses, wide-angle lenses, telephoto lenses, video lenses, viewfinder systems, camera movements, projection systems and 3-D systems.
Fundamentals of Optomechanics Taylor & Francis
Biomimetic photonics is a burgeoning field. Biologists are finding and describing a whole menagerie of unique and astonishingly complex nano- and microstructures in fauna and flora. Material scientists are developing novel multifunctional and hierarchical structures with a wide variety of post-nano era photonics applications. Mathematicians and computer scientists are using computer models and simulations to understand the underlying principles of biomimetic structures. However, concepts, structures, and phenomena that are well known in one community are quite unknown in others. Exploring a biomimetic approach to developing photonic devices and structures, Biomimetics in Photonics discusses not only the role of and results of biomimicry in engineering, but also the true understanding of natural processes and the application of these techniques to established technologies. Featured

Topics Photonic structures in flowers, leaves and fruits and inorganic structures produced in aquatic environment by diatoms, sponges, and shells Mechanisms for biomineralization and how natural structures can be synthetically modified or even used as templates for artificial photonic materials Biological photonic structures in beetles and butterflies and their bio-inspired applications, including anti-reflecting surfaces, iridescent viruses, light reflection, metallic effects, and infrared sensors Suitable for researchers and graduate students, the book does more than describe how to extract good design from nature—Biomimetics in Photonics highlights natural design techniques in context, allowing for a more complete modeling picture. It demonstrates the possibilities and challenges in the move from a laboratory environment to industrial scale production of biomimetic photonic structures.

Advanced Optical Instruments and Techniques Taylor & Francis

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.

**Precision Lens Molding of Glass: A Process Perspective** MDPI

Precision glass molding is a net-shaping process to fabricate glass optics by replicating optical features from precision molds to glass at elevated temperature. The advantages of precision glass molding over traditional glass lens fabrication methods make it especially suitable for the production of optical components with complicated geometries, such as aspherical lenses, diffractive hybrid lenses, microlens arrays, etc. Despite of these advantages, a number of problems must be solved before this process can be used in industrial applications. The primary goal of this research is to determine the feasibility and performance of nonconventional optical components formed by precision glass molding. This research aimed to investigate glass molding by combing experiments and finite element method (FEM) based numerical simulations. The first step was to develop an integrated compensation solution for both surface deviation and refractive index drop of glass optics. An FEM simulation based on Tool-Narayanaswamy-Moynihan (TNM) model was applied to predict index drop of the molded optical glass. The predicted index value was then used to compensate for the optical design of the lens. Using commercially available general purpose software, ABAQUS, the entire process of glass molding was simulated to calculate the surface deviation from the adjusted lens geometry, which was applied to final mold shape modification. A case study on molding of an aspherical lens was conducted, demonstrating reductions in both geometry and wavefront

error by more than 60%. *Design, Fabrication and Metrology of Precision Molded Freeform Plastic Optics* Springer Science & Business Media

The main focus of this dissertation is to seek scientific and fundamental knowledge of nonconventional optical components including its optical design, ultraprecision prototyping, precision molds making, transition into industrial production and efficient evaluation. A nonconventional component in this dissertation is loosely defined as an optical component either that is not symmetric around its optical axis or that is aspherical surface with three or higher order coefficient.

Nonconventional optics have broadened the vision of optical designers and enhanced the design flexibility and thus are becoming increasingly important as a core next-generation optical component. These optical components have gradually been implemented to replace conventional spherical and aspherical counterparts in the fields of imaging (Plummer, 1982), illumination (Fournier & Rolland, 2008), aviation (Spano, 2008) , and energy (Zamora, et al., 2009) where freeform optics have demonstrated excellent optical performance and high degree of system integration. However, design, fabrication and metrology of nonconventional optics have not been developed at the same pace. Due to the complex nature of nonconventional optics manufacturing processes, the production efficiency and finished quality of nonconventional optical components are difficult to be improved. To validate optical performance, in this dissertation ultraprecision diamond tooling is applied to prototype the optical design, which is capable of generating precision optical features both on polymer blank and metal mold without post grinding and polishing process. In addition, the prototyping process also paves the way to mold fabrication. To produce low cost high volume high quality nonconventional optical components, precision compression/microinjection molding has been combined with ultraprecision diamond machining and cleanroom manufacturing respectively for different size scale and application. Once the low cost molded nonconventional optical components and assembly are fabricated, their optical performance needs to be characterized to ensure quality in industrial production. The geometric feature and principle optical parameter, such as focal length, are two important aspects that influence the final optical performance considerably. In order to solve the major problems in manufacturing affordable high quality nonconventional optical components, this dissertation will include several key steps: 1) Investigate nonconventional optics design that could be functionally and economically applied in various optical components or systems to further improve their performance; 2) Validate and evaluate nonconventional optics design by ultraprecision prototyping; 3) Develop the precision molds manufacturing process and the corresponding molding process both for miniaturized lens profile and micro scale diffraction structure; 4) Investigate the products quality by

crucial optical parameters measurement and surface profiling. Overall, this dissertation describes a comprehensive understanding of low cost high volume nonconventional optics manufacturing.

*Tissue Optical Sectioning* Springer

This textbook will provide the fundamentals of optomechanics. Starting from the basics, this textbook will lead you through the opto-mechanical design process, discussing materials selection, principles of kinematic design, as well as mounting of windows, individual lenses, and multiple lenses. Techniques for mounting prisms, mirror performance, and design and mounting of mirrors will be included. Written by the two top scientists in the field, this stand-alone, student-friendly textbook has been course-tested and will include homework problems as well as a solutions manual for adopting professors.

The 11th International Conference on Precision Engineering (ICPE) August 16-18, 2006, Tokyo, Japan Taylor & Francis

Opto-Mechanical Systems Design, Fourth Edition is different in many ways from its three earlier editions: coauthor Daniel Vukobratovich has brought his broad expertise in materials, opto-mechanical design, analysis of optical instruments, large mirrors, and structures to bear throughout the book; Jan Nijenhuis has contributed a comprehensive new chapter on kinematics and applications of flexures; and several other experts in special aspects of opto-mechanics have contributed portions of other chapters. An expanded feature—a total of 110 worked-out design examples—has been added to several chapters to show how the theory, equations, and analytical methods can be applied by the reader. Finally, the extended text, new illustrations, new tables of data, and new references have warranted publication of this work in the form of two separate but closely entwined volumes. This first volume, Design and Analysis of Opto-Mechanical Assemblies, addresses topics pertaining primarily to optics smaller than 50 cm aperture. It summarizes the opto-mechanical design process, considers pertinent environmental influences, lists and updates key parameters for materials, illustrates numerous ways for mounting individual and multiple lenses, shows typical ways to design and mount windows and similar components, details designs for many types of prisms and techniques for mounting them, suggests designs and mounting techniques for small mirrors, explains the benefits of kinematic design and uses of flexures, describes how to analyze various types of opto-mechanical interfaces, demonstrates how the strength of glass can be determined and how to estimate stress generated in optics, and explains how changing temperature affects opto-mechanical assemblies.

*Handbook of 3D Machine Vision* CRC Press

A coherent overview of the current status of injection molded optics, describing in detail all aspects of plastic optics, from design issues to production technology and quality control. This updated second edition is supplemented by a chapter on the equipment and process of injection wells as well as a look at recent applications. The contributors, each one a leading expert in their

discipline, have either a background in or strong ties to the industry, thus combining a large amount of practical experience. With its focus firmly set on practical applications, this is an indispensable reference for all those working in optics research and development.
Harnessing Light CRC Press
Molded OpticsDesign and ManufactureCRC Press
**Integrative Production Technology** Springer Nature
"This engagingly written text provides a useful pedagogical introduction to an extensive class of geometrical phenomena in the optics of polarization and phase, including simple explanations of much of the underlying mathematics." —Michael Berry, University of Bristol, UK "The author covers a vast number of topics in great detail, with a unifying mathematical treatment. It will be a useful reference for both beginners and experts...." —Enrique Galvez, Charles A. Dana Professor of Physics and Astronomy, Colgate University "a firm and comprehensive grounding both for those looking to acquaint themselves with the field and those of us that need reminding of the things we thought we knew, but hitherto did not understand: an essential point of reference." —Miles Padgett, Kelvin Chair of Natural Philosophy and Vice Principal (Research), University of Glasgow This book focuses on the various forms of wavefield singularities, including optical vortices and polarization singularities, as well as orbital angular momentum and associated applications. It highlights how an understanding of singular optics provides a completely different way to look at light. Whereas traditional optics focuses on the shape and structure of the non-zero portions of the wavefield, singular optics describes a wave's properties from its null regions. The contents cover the three main areas of the field: the study of generic features of wavefields, determination of unusual properties of vortices and wavefields that contain singularities, and practical applications of vortices and other singularities.
*Design, Fabrication and Evaluation of Nonconventional Optical Components* Routledge
This book highlights the tools and processes used to produce high-quality glass molded optics using commercially available equipment. Combining scientific data with easy-to-understand explanations of specific molding issues and general industry information based on firsthand studies and experimentation, it provides useful formulas for readers involved in developing develop in-house molding capabilities, or those who supply molded glass optics. Many of the techniques described are based on insights gained from industry and research over the past 50 years, and can easily be applied by anyone familiar with glass molding or optics manufacturing. There is an abundance of information from around the globe, but knowledge comes from the application of information, and there is no knowledge without experience. This book provides readers with information, to allow them to gain knowledge and achieve success in their glass molding endeavors.
Opto-Mechanical Systems Design, Volume 1 Springer Science & Business Media
"Molding processes continue to innovate and

push the boundaries of optical systems, not only for state-of-the-art, high-volume consumer products but also touching on almost every application where optics are used, from automotive headlights and medical endoscopes to thermal weapon sights for the warfighter. The most common optical molding technologies are injection molding of optical plastics and precision glass molding. This Field Guide primarily focuses on these two technologies but also covers the full spectrum of optical molding. It provides a convenient and concise source of knowledge on optical molding technologies and will be a valuable addition to a publication base that is rather limited"--

**Advanced Biophotonics** SPIE Press

With the ongoing release of 3D movies and the emergence of 3D TVs, 3D imaging technologies have penetrated our daily lives. Yet 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, Handbook of 3D Machine Vision: Optical Metro

*Molded Optics* SPIE-International Society for Optical Engineering

Recent advancements in computer technology have allowed for designers to have direct control over the production process through the help of computer-based tools, creating the possibility of a completely integrated design and manufacturing process. Over the last few decades, "artificial intelligence" (AI) techniques, such as machine learing and deep learning, have been topics of interest in computer-based design and manufacturing research fields. However, efforts to develop computer-based AI to handle big data in design and manufacturing have not yet been successful. This Special Issue aims to collect novel articles covering artificial intelligence-based design, manufacturing, and data-driven design. It will comprise academics, researchers, mechanical, manufacturing, production and industrial engineers and professionals related to engineering design and manufacturing.

*Handbook of Optical Dimensional Metrology* Springer Science & Business Media

This dedicated overview of optical compressive imaging addresses implementation aspects of the revolutionary theory of compressive sensing (CS) in the field of optical imaging and sensing. It overviews the technological opportunities and challenges involved in optical design and implementation, from basic theory to optical architectures and systems for compressive imaging in various spectral regimes, spectral and hyperspectral imaging, polarimetric sensing, three-dimensional imaging, super-resolution imaging, lens-free, on-chip microscopy, and phase sensing and retrieval. The reader will gain a complete introduction to theory, experiment, and practical use for reducing hardware, shortening image scanning time, and improving image resolution as well as other performance parameters. Optics practitioners and optical system designers, electrical and optical engineers, mathematicians, and signal processing professionals will all find the book a unique trove of information and practical guidance. Delivers the

first book on compressed sensing dealing with system development for a wide variety of optical imaging and sensing applications. Covers the fundamentals of CS theory, including noise and algorithms, as well as basic design approaches for data acquisition in optics. Addresses the challenges of implementing compressed sensing theory in the context of different optical imaging designs, from 3D imaging to tomography and microscopy. Provides an essential resource for the design of new and improved devices with improved image quality and shorter acquisition times. Adrian Stern, PhD, is associate professor and head of the Electro-Optical Engineering Unit at Ben-Gurion University of the Negev, Israel. He is an elected Fellow of SPIE.

**Optical Compressive Imaging** CRC Press

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

*Injection Molding Handbook* Taylor & Francis

Compiled by 330 of the most widely respected names in the electro-optical sciences, the Encyclopedia is destined to serve as the premiere guide in the field with nearly 2000 figures, 560 photographs, 260 tables, and 3800 equations. From astronomy to x-ray optics, this reference contains more than 230 vivid entries examining the most intriguing technological advances and perspectives from distinguished professionals around the globe. The contributors have selected topics of utmost importance in areas including digital image enhancement, biological modeling, biomedical spectroscopy, and ocean optics, providing thorough coverage of recent applications in this continually expanding field.

*Handbook of Plastic Optics* CRC Press

The main focus of this dissertation is to seek

scientific knowledge and fundamental understanding of molding process for freeform optical lens fabrication by integrating freeform optical design, precision freeform molding making, numerical modeling of polymer lens forming process, and evaluation of the molded freeform optics. Compared with conventional optics, freeform optics provides more flexibilities and better performance. However, due to the complex nature of freeform optics manufacturing processes, the productivity and quality is difficult to improve, which subsequently results in higher manufacturing cost. Therefore, in order to create affordable freeform lenses with high quality, the method combining ultraprecision diamond machining and optical molding is proposed. Ultraprecision diamond machining is a process that allows us to generate precision freeform optical features on mold surfaces without post polishing, while microinjection/compression molding is proven high volume manufacturing process used to reduce production cost. The diamond machining for both regular metal materials and brittle materials are discussed to obtain high quality molds with optical finish. In addition, two novel process designs are presented to fabricate hybrid glass-polymer achromatic lenses using compression molding and injection molding, respectively.

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