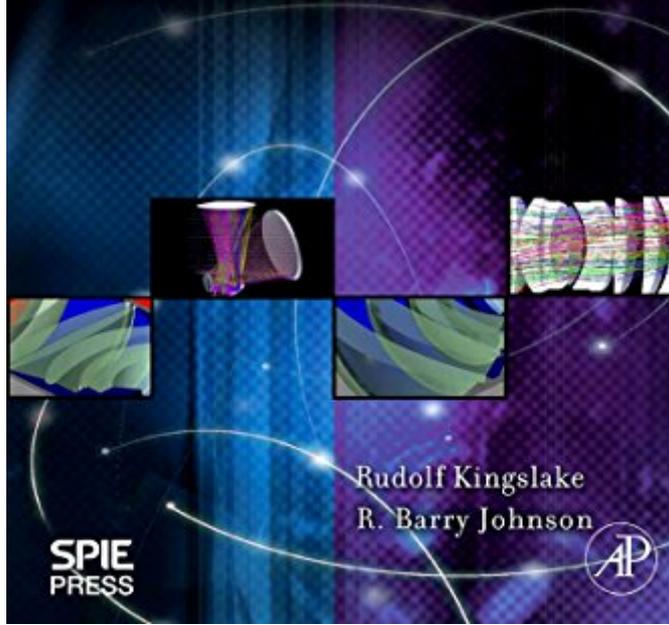


# Lens Design Fundamentals

SECOND EDITION



# [PDF] Lens Design Fundamentals

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**Lens Design Fundamentals**-Rudolf Kingslake  
2012-12-02 A large part of this book is devoted to a study of possible design procedures for various types of lens or mirror systems, with fully worked examples of each. The reader is urged to follow the logic of these examples and be sure that he understands what is happening, noticing particularly how each available degree of freedom is used to control one aberration. Not every type of lens has been considered, of course, but the design techniques illustrated here can readily be applied to the design of other more complex systems. It is assumed that the reader has access to a small computer to help with the ray tracing, otherwise he may find the computations so time-consuming that he is liable to lose track of what he is trying to accomplish.

**Lens Design Fundamentals**-Rudolf Kingslake  
2009-11-20 Thoroughly revised and expanded to reflect the substantial changes in the field since its publication in 1978 Strong emphasis on how to effectively use software design packages, indispensable to today's lens designer Many new lens design problems and examples - ranging from simple lenses to complex zoom lenses and mirror systems - give insight for both the newcomer and specialist in the field Rudolf Kingslake is regarded as the American father of lens design; his book, not revised since its publication in 1978, is viewed as a classic in the field. Naturally, the area has developed considerably since the book was published, the most obvious changes being the availability of powerful lens design software packages, theoretical advances, and new surface fabrication technologies. This book provides the skills and knowledge to move into the exciting

world of contemporary lens design and develop practical lenses needed for the great variety of 21st-century applications. Continuing to focus on fundamental methods and procedures of lens design, this revision by R. Barry Johnson of a classic modernizes symbology and nomenclature, improves conceptual clarity, broadens the study of aberrations, enhances discussion of multi-mirror systems, adds tilted and decentered systems with eccentric pupils, explores use of aberrations in the optimization process, enlarges field flattener concepts, expands discussion of image analysis, includes many new exemplary examples to illustrate concepts, and much more. Optical engineers working in lens design will find this book an invaluable guide to lens design in traditional and emerging areas of application; it is also suited to advanced undergraduate or graduate course in lens design principles and as a self-learning tutorial and reference for the practitioner. Rudolf Kingslake (1903-2003) was a founding faculty member of the Institute of Optics at The University of Rochester (1929) and remained teaching until 1983. Concurrently, in 1937 he became head of the lens design department at Eastman Kodak until his retirement in 1969. Dr. Kingslake published numerous papers, books, and was awarded many patents. He was a Fellow of SPIE and OSA, and an OSA President (1947-48). He was awarded the Progress Medal from SMPTE (1978), the Frederic Ives Medal (1973), and the Gold Medal of SPIE (1980). R. Barry Johnson has been involved for over 40 years in lens design, optical systems design, and electro-optical systems engineering. He has been a faculty member at three academic institutions engaged in optics education and research, co-founder of the Center for Applied Optics at the University of Alabama in Huntsville, employed by a number of companies, and provided consulting services. Dr. Johnson is an SPIE Fellow and Life Member, OSA

Fellow, and an SPIE President (1987). He published numerous papers and has been awarded many patents. Dr. Johnson was founder and Chairman of the SPIE Lens Design Working Group (1988-2002), is an active Program Committee member of the International Optical Design Conference, and perennial co-chair of the annual SPIE Current Developments in Lens Design and Optical Engineering Conference. Thoroughly revised and expanded to reflect the substantial changes in the field since its publication in 1978 Strong emphasis on how to effectively use software design packages, indispensable to today's lens designer Many new lens design problems and examples - ranging from simple lenses to complex zoom lenses and mirror systems - give insight for both the newcomer and specialist in the field

### **Lens Design Fundamentals, 2nd Edition-**

Rudolf Kingslake 2009 Thoroughly revised and expanded to reflect the substantial changes in the field since its publication in 1978 Strong emphasis on how to effectively use software design packages, indispensable to today's lens designer Many new lens design problems and examples - ranging from simple lenses to complex zoom lenses and mirror systems - give insight for both the newcomer and specialist in the field Rudolf Kingslake is regarded as the American father of lens design; his book, not revised since its publication in 1978, is viewed as a classic in the field. Naturally, the area has developed considerably since the book was published, the most obvious changes being the availability of powerful lens design software packages, theoretical advances, and new surface fabrication technologies. This book provides the skills and knowledge to move into the exciting world of contemporary lens design and develop practical lenses needed for the great variety of 21st-century applications. Continuing to focus on fundamental methods and procedures of lens design, this revision by R. Barry Johnson of a classic modernizes symbology and nomenclature, improves conceptual clarity, broadens the study of aberrations, enhances discussion of multi-mirror systems, adds tilted and decentered systems with eccentric pupils, explores use of aberrations in the optimization process, enlarges field flattener concepts, expands discussion of image analysis, includes many new exemplary examples to illustrate concepts, and much more. Optical engineers working in lens design will find this book an invaluable guide to lens design in

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### **Optical Design Fundamentals for Infrared**

**Systems**-Max J. Riedl 2001 The practical, popular 1995 tutorial has been thoroughly revised and updated, reflecting developments in technology and applications during the past decade. New chapters address wave aberrations, thermal effects, design examples, and diamond turning.

### **Lens Design Fundamentals, Second Edition-**

Rudolf Kingslake 2010

### **Lens Design Basics**-GERHARD 2020-12-31

### **Introduction to Lens Design**-José Sasián

2019-09-30 A concise introduction to lens design, including the fundamental theory, concepts, methods and tools used in the field. Covering all the essential concepts and providing suggestions for further reading at the end of each chapter, this book is an essential resource for graduate students working in optics and photonics.

### **Field Guide to Lens Design**-Julie Bentley

2012-01-01 The process of designing lenses is both an art and a science. While advancements in the field over the past two centuries have done much to transform it from the former category to the latter, much of the lens design process remains encapsulated in the experience and

knowledge of industry veterans. This Field Guide provides a working reference for practicing physicists, engineers, and scientists for deciphering the nuances of basic lens design. The book begins with an outline of the general process before delving into aberrations, basic lens design forms, and optimization. An entire section is devoted to techniques for improving lens performance. Sections on tolerancing, stray light, and optical systems are followed by an appendix covering related topics such as optical materials, nonimaging concepts, designing for sampled imaging, and ray tracing fundamentals.

**Interior Design Fundamentals**-Steven B. Webber 2019-11-28

**Modern Lens Design**-Warren Smith 2004-10-22 Unlike the first edition, which was more a collection of lens designs for use in larger projects, the 2nd edition of Modern Lens Design is an optical "how-to." Delving deep into the mechanics of lens design, optics legend Warren J. Smith reveals time-tested methods for designing top-quality lenses. He deals with lens design software, primarily OSLO, by far the current market leaders, and provides 7 comprehensive worked examples, all new to this edition. With this book in hand, there's no lens an optical engineer can't design.

**Spectrograph Design Fundamentals**-John James 2007-02-08 This book was first published in 2007, a time of enormous change in the field of optical spectrometry. Although the basic optical principles remained unchanged, the design considerations were very different and, in many cases, more demanding. Developments in computer ray-tracing and computer-aided design coped with the extra impositions and allowed the construction of a new generation of spectrographs. The book covers the general principles of spectrographic design at the time, and the practical and engineering aspects of a broad range of spectrographs and spectrometers. The book deals with materials and methods of construction and includes suggestions for the choice of optical table, the design of slit mechanisms, and adjustable mirror, grating and lens mounts, with suggestions for the alignment and calibration of the finished instrument.

**Optical Design**-Max J. Riedl 2009-01-01 This text is written for engineers and scientists who have some experience in the field of optics and want to know more about the details and derivations of equations used in optical design. Organized by topic, the book begins with the fundamental law of geometrical optics, Snell's law of refraction, and states the paraxial ray trace equations, then moves on to thin lenses and increasingly more sophisticated components and multi-element systems. Each topic is covered in depth and provides comprehensive information on performance and limitations. While the text is based on general optical laws, special emphasis has been placed on the two major infrared regions--the mid-wave (MWIR) and the long-wave (LWIR). This is particularly important with regard to diffractive hybrids, which have found their place in these long-wavelength areas for the correction of chromatic aberrations and athermalization. Comments relating to single-point diamond turning have also been included because this process is predominantly used to produce optical elements for the infrared regions.

**Handbook of Optical Systems, Volume 1**-Herbert Gross 2005-03-11 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 1 gives a general introduction to the field of technical optics. Although part of the series, it acts as a fully selfstanding book. With more than 700 full color graphs and it is a intuitive introduction for the beginner and a comprehensive reference for the professional. Table of Contents 1 Introduction 2 Paraxial optics 3 Dielectric interfaces 4 Materials 5 Raytracing 6 Photometry 7 Lightsources 8 Sensors and receivers 9 Theory of color 10 Optical systems 11 Aberrations 12 Waveoptics 13 Plates and prisms 14 Gratings 15 Special components 16 Testing Other Volumes Volume 2: Physical Image Formation Volume 3: Aberration Theory and Correction of Optical Systems Volume 4: Survey of Optical Instruments Volume 5: Advanced Physical Optics

**The Art of Game Design**-Jesse Schell

2014-11-06 Good game design happens when you view your game from as many perspectives as possible. Written by one of the world's top game designers, The Art of Game Design presents 100+ sets of questions, or different lenses, for viewing a game's design, encompassing diverse fields such as psychology, architecture, music, visual design, film, software engineering, theme park design, mathematics, puzzle design, and anthropology. This Second Edition of a Game Developer Front Line Award winner: Describes the deepest and most fundamental principles of game design Demonstrates how tactics used in board, card, and athletic games also work in top-quality video games Contains valuable insight from Jesse Schell, the former chair of the International Game Developers Association and award-winning designer of Disney online games The Art of Game Design, Second Edition gives readers useful perspectives on how to make better game designs faster. It provides practical instruction on creating world-class games that will be played again and again.

**Introduction to Lens Design**-Joseph M. Geary  
2002-01-01

**Fundamental Optical Design**-Michael J. Kidger  
2002 This book provides all the essential and best elements of Kidger's many courses taught worldwide on lens and optical design. It is written in a direct style that is compact, logical, and to the point--a tutorial in the best sense of the word. "I read my copy late last year and read it straight through, cover to cover. In fact, I read it no less than three times. Its elegant expositions, valuable insights, and up-front espousal of pre-design theory make it an outstanding work. It's in the same league with Conrady and Kingslake." Warren Smith.

**Lens Design**-Donald Dilworth 2018-07-31

**Lens Design**-Haiyin Sun 2016-12-19 A Practical Guide to Lens Design focuses on the very detailed practical process of lens design. Every step from setup specifications to finalizing the design for production is discussed in a straight forward, tangible way. Design examples of

several widely used modern lenses are provided. Optics basics are introduced and basic functions of Zemax are described. Zemax will be used throughout the book.

**The Art of Game Design**-Jesse Schell  
2008-08-04 Anyone can master the fundamentals of game design - no technological expertise is necessary. The Art of Game Design: A Book of Lenses shows that the same basic principles of psychology that work for board games, card games and athletic games also are the keys to making top-quality videogames. Good game design happens when you view your game from many different perspectives, or lenses. While touring through the unusual territory that is game design, this book gives the reader one hundred of these lenses - one hundred sets of insightful questions to ask yourself that will help make your game better. These lenses are gathered from fields as diverse as psychology, architecture, music, visual design, film, software engineering, theme park design, mathematics, writing, puzzle design, and anthropology. Anyone who reads this book will be inspired to become a better game designer - and will understand how to do it.

**A History of the Photographic Lens**-Rudolf Kingslake 1989-11-22 The lens is generally the most expensive and least understood part of any camera. In this book, Rudolf Kingslake traces the historical development of the various types of lenses from Daguerre's invention of photography in 1839 through lenses commonly used today. From an early lens still being manufactured for use in low-cost cameras to designs made possible through such innovations as lens coating, rare-earth glasses, and computer aided lens design and testing, the author details each major advance in design and fabrication. The book explains how and why each new lens type was developed, and why most of them have since been abandoned. This authoritative history of lens technology also includes brief biographies of several outstanding lens designers and manufacturers of the past.

**Optical Engineering Fundamentals**-Bruce H. Walker 1998 This text aims to expose students to the science of optics and optical engineering without the complications of advanced physics and mathematical theory.

### **Handbook of Visual Optics, Volume Two-**

Pablo Artal 2017-02-24 Handbook of Visual Optics offers an authoritative overview of encyclopedic knowledge in the field of physiological optics. It builds from fundamental concepts to the science and technology of instruments and practical procedures of vision correction, integrating expert knowledge from physics, medicine, biology, psychology, and engineering. The chapters comprehensively cover all aspects of modern study and practice, from optical principles and optics of the eye and retina to novel ophthalmic tools for imaging and visual testing, devices and techniques for visual correction, and the relationship between ocular optics and visual perception.

### **A Course in Lens Design-**Chris Velzel

2014-03-28 A Course in Lens Design is an instruction in the design of image-forming optical systems. It teaches how a satisfactory design can be obtained in a straightforward way. Theory is limited to a minimum, and used to support the practical design work. The book introduces geometrical optics, optical instruments and aberrations. It gives a description of the process of lens design and of the strategies used in this process. Half of its content is devoted to the design of sixteen types of lenses, described in detail from beginning to end. This book is different from most other books on lens design because it stresses the importance of the initial phases of the design process: (paraxial) lay-out and (thin-lens) pre-design. The argument for this change of accent is that in these phases much information can be obtained about the properties of the lens to be designed. This information can be used in later phases of the design. This makes A Course in Lens Design a useful self-study book and a suitable basis for an introductory course in lens design. The mathematics mainly used is college algebra, in a few sections calculus is applied. The book could be used by students of engineering and technical physics and by engineers and scientists.

### **Intermediate Optical Design-**Michael J. Kidger

2004 This second volume based on Michael Kidger's popular short courses and workshops is aimed at readers already familiar with the concepts presented in Fundamental Optical Design (SPIE Press Vol. PM92). It begins with a

sweeping discussion of optimization that is written with the user in mind and continues with a unique look at the role of higher-order aberrations. The book's key feature is its astounding presentation of a wide range of practical design examples, covering such problems as secondary spectrum correction, high numerical aperture designs, lasers, zoom lenses, tilted or decentered optical systems, and price and performance requirements. Each scenario is accompanied by an in-depth discussion that goes well beyond the ray aberration plot, including useful insights into an optical designer's thought processes

### **Fundamentals and Basic Optical**

**Instruments-**Daniel Malacara Hernández 2017-11-22 Fundamentals and Basic Optical Instruments includes thirteen chapters providing an introductory guide to the basics of optical engineering, instrumentation, and design. Topics include basic geometric optics, basic wave optics, and basic photon and quantum optics. Paraxial ray tracing, aberrations and optical design, and prisms and refractive optical components are included. Polarization and polarizing optical devices are covered, as well as optical instruments such as telescopes, microscopes, and spectrometers.

### **Optofluidics: Fundamentals, Devices, and Applications-**Yeshiahu Fainman 2009-09-08

Cutting-Edge Optofluidics Theories, Techniques, and Practices Add novel functionalities to your optical design projects by incorporating state-of-the-art microfluidic technologies and tools. Co-written by industry experts, Optofluidics: Fundamentals, Devices, and Applications covers the latest functional integration of optical devices and microfluidics, as well as automation techniques. This authoritative guide explains how to fabricate optical lab-on-a-chip devices, synthesize photonic crystals, develop solid and liquid core waveguides, use fluidic self-assembly methods, and accomplish direct microfabrication in solutions. The book includes details on developing biological sensors and arrays, handling maskless lithography, designing high-Q cavities, and working with nanoscale plasmonics. Research outcomes from the DARPA-funded Center for Optofluidics Integration are also discussed. Discover how to: Work with optofluidic sources, lenses, filters, switches, and splitters Use dielectric waveguiding devices to

input, move, and manipulate fluids Integrate colloidal crystals and fibers with microfluidic systems Develop bio-inspired fluidic lens systems and aspherical lenses Deploy miniaturized dye lasers, microscopes, biosensors, and resonators Analyze microfluidic systems using flow injection and fluorescent spectroscopy Build optofluidic direct fabrication platforms for innovative microstructures Accomplish optofluidic liquid actuation and particle manipulation

**The Art of Game Design**-Jesse Schell  
2019-08-20 Presents over 100 sets of questions, or different lenses, for viewing a game's design. Written by one of the world's top game designers, this book describes the deepest and most fundamental principles of game design, demonstrating how tactics used in board, card, and athletic games also work in video games. It provides practical instruction on creating world-class games that will be played again and again. New to this edition: many great examples from new VR and AR platforms as well as examples from modern games such as Uncharted 4 and The Last of Us, Free to Play games, hybrid games, transformational games, and more.

**Optics for Engineers**-Charles A. DiMarzio  
2011-08-09 The field of optics has become central to major developments in medical imaging, remote sensing, communication, micro- and nanofabrication, and consumer technology, among other areas. Applications of optics are now found in products such as laser printers, bar-code scanners, and even mobile phones. There is a growing need for engineers to understand

**Fundamentals of Geometrical Optics**-Virendra N. Mahajan  
2014-06-03 Optical imaging starts with geometrical optics, and ray tracing lies at its forefront. This book starts with Fermat's principle and derives the three laws of geometrical optics from it. After discussing imaging by refracting and reflecting systems, paraxial ray tracing is used to determine the size of imaging elements and obscuration in mirror systems. Stops, pupils, radiometry, and optical instruments are also discussed. The chromatic and monochromatic aberrations are addressed in detail, followed by spot sizes and spot diagrams of aberrated images of point objects. Each chapter ends with a summary and a set of

problems. The book ends with an epilogue that summarizes the imaging process and outlines the next steps within and beyond geometrical optics.

**Applied Optics and Optical Engineering**-Rudolf Kingslake  
2012-12-02 Applied Optics and Optical Engineering, Volume VI is an 11-chapter text that covers the principles and design of some optical devices and systems. The first three chapters deal with the principles, mode of operation, and application of several types of lasers, such as solid-state, gas, and semiconductor diode lasers. These topics are followed by the presentation of the physics and engineering of acousto-optic systems and coherent light valves. A chapter provides the fundamental considerations of the principles of scanning devices and systems, including the light beam, the scanning motions and patterns, and optical, mechanical, and electronic engineering considerations. The discussion then shifts to the potential applications of coherent optical processing techniques in mapping and the infrared detectors to the optical engineer. The remaining chapters examine the principles and applications of optical holography, image intensifiers, and fiber optics. This book is of great benefit to applied scientists and engineers who are interested in the conceptualization and design of new instruments and systems of coherent optics.

**Optical Design for Biomedical Imaging**-Rongguang Liang  
2010-01-01 Designing an efficient imaging system for biomedical optics requires a solid understanding of the special requirements of the optical systems for biomedical imaging and the optical components used in the systems. However, a lack of reference books on optical design (imaging and illumination) for biomedical imaging has led to some inefficient systems. This book fills the gap between biomedical optics and optical design by addressing the fundamentals of biomedical optics and optical engineering, and biomedical imaging systems. The first half provides a brief introduction to biomedical optics and then covers the fundamentals of optics, optical components, light sources, detectors, optical imaging system design, and illumination system design. This also includes important issues related to biomedical imaging, such as autofluorescence from optical materials. The second half of the text covers various biomedical imaging techniques and their

optical systems, along with design examples.

### **Free Space Optical Systems Engineering-**

Larry B. Sotts 2017-04-10 10.2 Spontaneous and Stimulated Emission Processes -- 10.2.1 The Two-Level System -- 10.2.2 The Three-Level System -- 10.2.3 The Four-Level System -- 10.3 Laser Pumping -- 10.3.1 Laser Pumping without Amplifier Radiation -- 10.3.2 Laser Pumping with Amplifier Radiation -- 10.4 Laser Gain and Phase-Shift Coefficients -- 10.5 Laser Cavity Gains and Losses -- 10.6 Optical Resonators -- 10.6.1 Planar Mirror Resonators - Longitudinal Modes -- 10.6.2 Planar Mirror Resonators - Transverse Modes -- 10.7 The ABCD Matrix and Resonator Stability -- 10.8 Stability of a Two-Mirror Resonator -- 10.9 Problems -- References -- Appendix A Stationary Phase and Saddle Point Methods -- A.1 Introduction -- A.2 The Method of Stationary Phase -- A.3 Saddle Point Method -- Appendix B Eye Diagram and its Interpretation -- B.1 Introduction -- B.2 Eye Diagram Overview -- Appendix C Vector-Space Image Representation - - C.1 Introduction -- C.2 Basic Formalism -- Reference -- Appendix D Paraxial Ray Tracing- Abcd Matrix -- D.1 Introduction -- D.2 Basic Formalism -- D.2.1 Propagation in a Homogeneous Medium -- D.2.2 Propagation Against a Curved Interface -- D.2.3 Propagation into a Refractive Index Interface -- References -- Index -- EULA

### **Fundamentals of Micro-Optics-**

Hans Zappe 2010-09-30 From optical fundamentals to advanced applications, this comprehensive guide to micro-optics covers all the key areas for those who need an in-depth introduction to micro-optic devices, technologies, and applications. Topics covered range from basic optics, optical materials, refraction, and diffraction, to micro-mirrors, micro-lenses, diffractive optics, optoelectronics, and fabrication. Advanced topics, such as tunable and nano-optics, are also discussed. Real-world case studies and numerous worked examples are provided throughout, making complex concepts easier to follow, whilst an extensive bibliography provides a valuable resource for further study. With exercises provided at the end of each chapter to aid and test understanding, this is an ideal textbook for graduate and advanced undergraduate students taking courses in optics, photonics, micro-optics, microsystems, and MEMs. It is also a useful self-study guide for research engineers working on

optics development.

### **Optical System Design-**

Rudolf Kingslake 2012-12-02 Optical System Design covers the basic knowledge of optics and the flow of light through an optical system. This book is organized into 16 chapters that deal with various components of an optical system, from light and images to spectroscopic apparatus. The book first discusses the simple components of an optical system, including its light, lens, oblique beams, and photochemical aspects. It then deals with the system's projection, plane mirrors, prisms, magnifying instruments, and telescope. Other components considered are the surveying instruments, mirror imaging systems, photographic optics, and spectroscopic apparatus. This book is of value to undergraduate students with courses in geometrical optics and system design.

### **The Fundamentals of Printed Textile Design-**

Alex Russell 2020-08-06 The Fundamentals of Printed Textile Design explores contemporary practice in printed textile design. It outlines the process of creating designs, looking at the vital role played by drawing, colour, style and content. It also analyses how to contextualise and communicate effectively in order to build a professional portfolio, whether through traditional design staples or via a more original approach. It examines the positions occupied by designers in the industry, and the technical and ethical considerations of which they must be aware. In order to design effectively, print and pattern practitioners need to understand not only how the industry works but must also consider the cultural and economic factors that can shape what future clients or consumers will require. This book suggests strategies for developing an understanding of these contexts within and beyond the fashion and textiles industry to provide an innovative resource for the designers of today and tomorrow.

### **Handbook of Optical Design-**

Daniel Malacara-Hernández 2003-09-21 Infused with more than 500 tables and figures, this reference clearly illustrates the intricacies of optical system design and evaluation and considers key aspects of component selection, optimization, and integration for the development of effective optical apparatus. The book provides a much-

needed update on the vanguard in the field with vivid e

### **Educational Game Design Fundamentals-**

George Kalmpourtzis 2018-07-11 Can we learn through play? Can we really play while learning? Of course! But how?! We all learn and educate others in our own unique ways. Successful educational games adapt to the particular learning needs of their players and facilitate the learning objectives of their designers. Educational Game Design Fundamentals embarks on a journey to explore the necessary aspects to create games that are both fun and help players learn. This book examines the art of educational game design through various perspectives and presents real examples that will help readers make more informed decisions when creating their own games. In this way, readers can have a better idea of how to prepare for and organize the design of their educational games, as well as evaluate their ideas through several prisms, such as feasibility or learning and intrinsic values. Everybody can become education game designers, no matter what their technical, artistic or pedagogic backgrounds. This book refers to educators and designers of all sorts: from kindergarten to lifelong learning, from corporate training to museum curators and from tabletop or video game designers to theme park creators!

### **The Art and Science of Optical Design-**

Robert R. Shannon 1997-06-13 The Art and Science of Optical Design is a comprehensive introduction to lens design, covering the fundamental physical principles and key engineering issues. Several practical examples of modern computer-aided lens design are worked out in detail from start to finish. The basic theory and results of optics are presented early on in the book, along with a discussion of optical materials. Aberrations, and their correction, and image analysis are then covered in great detail. Subsequent chapters deal with design optimisation and tolerance analysis. Several design examples are then given, beginning with basic lens design forms, and progressing to advanced systems, such as gradient index and diffractive optical components. In covering all aspects of optical design, including the use of modern lens design software, this book will be invaluable to students of optical engineering as well as to anyone engaged in optical design at any stage.

### **Fundamentals of Practical Aberration**

**Theory-**Yoshiya Matsui 1993-06-04 At present, although most of the optical design processes are automated with the aid of computer software, the fundamental question of how we can generate the initial optical configuration such that it can be dealt with by the computer remains. The answer can only be found in applying techniques based on the aberration theory. Previous works have explored this subject matter. None, however, has covered the full extent of first deriving the aberration theory and then illustrating with the help of various kinds of actual examples how it can be applied effectively to practical design problems. This book is significant in its attempt to put theory into practice for the first time to provide new insight and knowledge to its readers.

Contents:Introduction:The Role of the Aberration TheoryParaxial Theory as the Basis for Aberration TheoryApplication of Paraxial Theory to Lens DesignDerivation of Aberration Theory:Characteristic Function of HamiltonOutline of the Herzberger TheoryPractical Aberration Theory and Its Formulae:Transformation of the Herzberger Aberration Theory into Practical FormNormalization of Aberration CoefficientsAberration Coefficients for a Thin Lens SystemIntrinsic Coefficients and the Characteristic MatrixCase Studies:Determination of the Initial Configuration of an Optical System and the Application of Aberration TheoryDetermination of a Configuration for a Telephoto-Type LensDetermination of Configuration in a TripletDesign of a Catadioptric SystemHelmholtz-Lagrange InvariantDerivation of Formulae for Calculating Aberration Coefficients for Individual Surfaces in an Optical SystemDerivation of Formulae Calculating Chromatic Aberration Coefficients for Individual Surfaces in an Optical SystemInitial Values of Paraxial Rays for Calculating Aberration Coefficients Readership: Optical designers and engineers. keywords:Optical Design;Lens Design;Paraxial Theory;Aberration Theory;Aberration Coefficient;Petzval Coefficient;Lateral Aberration;Longitudinal Aberration;Helmholtz-Lagrange Invariant;Thin Lens System

### **Physics and Applications of Negative Refractive Index Materials-**

S. Anantha

Ramakrishna 2008-09-26 Ever since the first experimental demonstration was reported in 2000, the interest in metamaterials and left-handed media that exhibit a negative refractive index has increased exponentially. Surveying this explosive growth, *Physics and Applications of Negative Refractive Index Materials* covers the fundamental physical principles and emerging engineering applications of structured electromagnetic metamaterials that yield a negative refraction as well as other unexpected physical properties. It provides detailed explanations on the history, development, and main achievements of metamaterials. Making it easy to access relevant, up-to-date information on the field, the authors bring together the most important and influential papers related to metamaterials. They present the principles of negative refraction and compare the uniqueness of novel metamaterials with other media that

exhibit similar properties. The book discusses the design, optimization, and testing of structured metamaterials as well as applications of metamaterials at frequencies ranging from radio wave to optical. It also explores novel concepts and phenomena, such as the perfect lens for super-resolution imaging, hyper lenses that couple the near-field to radiative modes, electromagnetic cloaking and invisibility, and near-field optical imaging. Connecting theoretical ideas to recent experimental techniques and results, this state-of-the-art book enables an understanding of the basic principles of and research contributions to metamaterials with negative refractive index and their electromagnetic properties.