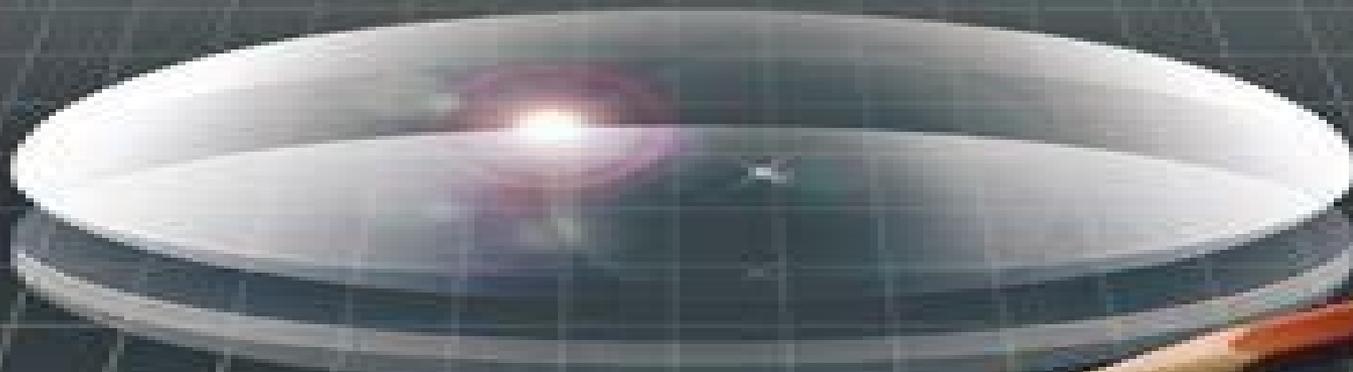


INTRODUCTION TO

# LENS DESIGN

With Practical ZEMAX® Examples



Joseph M. Geary  
Center for Applied Optics

# Introduction To Lens Design With Practical Zemax Examples

**Peipei Pang**



## **Introduction To Lens Design With Practical Zemax Examples:**

**Introduction to Lens Design** Joseph M. Geary, 2002      **Adaptive Optics for Vision Science** Jason Porter, Hope Queener, Julianna Lin, Karen Thorn, Abdul A. S. Awwal, 2006-07-21

Leading experts present the latest technology and applications in adaptive optics for vision science Featuring contributions from the foremost researchers in the field Adaptive Optics for Vision Science is the first book devoted entirely to providing the fundamentals of adaptive optics along with its practical applications in vision science The material for this book stems from collaborations fostered by the Center for Adaptive Optics a consortium of more than thirty universities government laboratories and corporations Although the book is written primarily for researchers in vision science and ophthalmology the field of adaptive optics has strong roots in astronomy Researchers in both fields share this technology and for this reason the book includes chapters by both astronomers and vision scientists Following the introduction chapters are divided into the following sections Wavefront Measurement and Correction Retinal Imaging Applications Vision Correction Applications Design Examples Readers will discover the remarkable proliferation of new applications of wavefront related technologies developed for the human eye For example the book explores how wavefront sensors offer the promise of a new generation of vision correction methods that can deal with higher order aberrations beyond defocus and astigmatism and how adaptive optics can produce images of the living retina with unprecedented resolution An appendix includes the Optical Society of America s Standards for Reporting Optical Aberrations A glossary of terms and a symbol table are also included Adaptive Optics for Vision Science arms engineers scientists clinicians and students with the basic concepts engineering tools and techniques needed to master adaptive optics applications in vision science and ophthalmology Moreover readers will discover the latest thinking and findings from the leading innovators in the field

**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

**Optical Engineering Science** Stephen Rolt, 2020-02-10 A practical guide for engineers and students that covers a wide range of optical design and optical metrology topics Optical Engineering Science offers a comprehensive and authoritative review of the science of optical engineering The book bridges the gap between the basic theoretical principles of classical optics and the practical application of optics in the commercial world Written by a noted expert in the field the book examines a range of practical topics that are related to optical design optical metrology and manufacturing The book fills a void in the literature by covering all three topics in a single volume Optical engineering science is at the foundation of the design of commercial optical systems such as mobile phone cameras and digital cameras as well as highly sophisticated instruments for commercial and research applications It spans the design manufacture and testing of space or aerospace instrumentation

to the optical sensor technology for environmental monitoring Optics engineering science has a wide variety of applications both commercial and research This important book Offers a comprehensive review of the topic of optical engineering Covers topics such as optical fibers waveguides aspheric surfaces Zernike polynomials polarisation birefringence and more Targets engineering professionals and students Filled with illustrative examples and mathematical equations Written for professional practitioners optical engineers optical designers optical systems engineers and students Optical Engineering Science offers an authoritative guide that covers the broad range of optical design and optical metrology topics and their applications

Engineering Illumination Optics Henning Rehn, Julius Muschaweck, 2026-03-03 Unique guide offering a detailed and practical exploration of illumination optics from fundamentals to real world applications Engineering Illumination Optics explores the field of illumination optics focusing on the mathematical and physical calculations behind the design and their application in a wide variety of use cases The book provides a solid knowledge of the radiometric foundation and of the fundamental concepts of illumination optics to empower the reader to develop a deep understanding of the interaction of light sources with dedicated optics It covers the necessary calculation methods and formulas as a basis for efficient illumination design This book helps readers avoid costly design errors by focusing on the essentials and quick estimates to ensure they can perform precise calculations and judge their accuracy Numerous exercises based on real world problems with detailed solutions make the book an ideal self study tool and reference to hone readers practical skills Written by a team of highly qualified authors Engineering Illumination Optics includes information on sample topics including Angles and solid angles refraction paraxial optics laser beams and conic sections Rays etendue light tubes radiometry black body and solar radiation and spectral calculus color and vision Light sources solar collection astronomy daylighting horticulture lighting light detection projectors and stage lights and headlamps Principles of optics and their application for the design process covering predesign calculus evaluation of datasheets and product specifications and the according selection of suitable light sources Engineering Illumination Optics is an essential reference for optical engineers and designers in general and specialty lighting in particular architectural stage and medical lighting and horticulture who are seeking to learn how to solve problems using fundamental principles and practical calculations Advanced students in adjacent fields and physicists in industry will also find the book valuable

**5th International Symposium of Space Optical Instruments and Applications** H. Paul Urbach, Qifeng Yu, 2020-01-30 This book gathers selected and expanded contributions presented at the 5th Symposium on Space Optical Instruments and Applications which was held in Beijing China on September 5 7 2018 This conference series is organized by the Sino Holland Space Optical Instruments Laboratory a cooperative platform between China and the Netherlands The symposium focused on key technological problems regarding optical instruments and their applications in a space context It covered the latest developments experiments and results on the theory instrumentation and applications of space optics The book is split into five main sections The first covers optical remote sensing system design the

second focuses on advanced optical system design and the third addresses remote sensor calibration and measurement Remote sensing data processing and information extraction are then presented followed by a final section on remote sensing data applications

*Optical Test and Measurement Technology and Equipment*, 2006 **American Book Publishing Record**, 2002

**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

**Books in Print Supplement**, 2002 *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

*Optical Engineering*, 1999 Publishes papers reporting on research and development in optical science and engineering and the practical applications of known optical science engineering and technology

**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 optimization 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 *Lens Design Fundamentals* Rudolf Kingslake, R. Barry Johnson, 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

**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

*Introduction to Lens Design* José Sasián, 2019-09-26 Optical lenses have many important applications from telescopes and spectacles to microscopes and lasers This concise introductory book provides an overview of the subtle art of lens design It covers the fundamental optical theory and the practical methods and tools employed in lens design in a succinct and accessible manner Topics covered include first order optics optical aberrations achromatic doublets optical relays lens tolerances designing with off the shelf lenses miniature lenses and zoom lenses Covering all the key concepts of lens design 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 in addition to engineers and technicians working in the optics and imaging industries

*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 layout 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

*Handbook of Optical Design, Third Edition* Daniel Malacara-Hernández, Zacarías Malacara-Hernández, 2013-02-20 Handbook of Optical Design Third Edition covers the fundamental principles of geometric optics and their application to lens design in one volume It incorporates classic aspects of lens design along with important modern methods tools and instruments including contemporary astronomical telescopes Gaussian beams and computer lens design Written by respected researchers the book has been extensively classroom tested

and developed in their lens design courses This well illustrated handbook clearly and concisely explains the intricacies of optical system design and evaluation It also discusses component selection optimization and integration for the development of effective optical apparatus The authors analyze the performance of a wide range of optical materials components and systems from simple magnifiers to complex lenses used in photography ophthalmology telescopes microscopes and projection systems Throughout the book includes a wealth of design examples illustrations and equations most of which are derived from basic principles Appendices supply additional background information What's New in This Edition Improved figures including 32 now in color Updates throughout reflecting advances in the field New material on Buchdahl high order aberrations Expanded and improved coverage of the calculation of wavefront aberrations based on optical path An updated list of optical materials in the appendix A clearer more detailed description of primary aberrations References to important new publications Optical system design examples updated to include newly available glasses 25 new design examples This comprehensive book combines basic theory and practical details for the design of optical systems It is an invaluable reference for optical students as well as scientists and engineers working with optical instrumentation

*Modern Lens Design, Third Edition* Warren J. Smith, Julie L. Bentley, Stephen Craig Olson, 2025-12-22 The definitive guide to the art and science of lens design fully updated to reflect the latest advances This benchmark optical engineering resource offers an encyclopedic overview of all forms of lenses and optical systems Revised from start to finish this new edition brings all existing content up to date and adds new sections on design advances from the last 10 years With this book in hand there's no lens that you can't design *Modern Lens Design Third Edition* leads you through the fundamentals and hands on practices of optical engineering covering time tested methods for designing top quality lenses Long a paragon of design instruction the book provides clear explanations examples and hands on instruction and fully covers the latest software and optimization techniques Features new coverage of cell phone cameras panoramic and 360 degree lenses and large format focal planes Clarifies and consolidates a wide range of crucial lens design information Two industry recognized experts expand on the authorship of the late Warren Smith

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