



# Modern Lens Design

**Donald C. O'Shea**

## **Modern Lens Design:**

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. **Modern Lens Design** Warren J. Smith, 2004-11-12 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.

Modern Lens Design, 2nd Edition Warren Smith, 2004 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.

Modern Optical Engineering, 4th Ed. Warren Smith, 2007-12-04 The Latest Advances in Optical Engineering and Lens Technology Long established as the definitive optics text and reference, Modern Optical Engineering has been completely revised and updated to equip you with all the latest optical and lens advances. The Fourth Edition now contains cutting edge information on optical engineering theory, design, and practice, including new chapters on ray tracing, optical system design, and third order aberration theory. Written by the renowned optical scientist Warren J. Smith, this state of the art guide provides unsurpassed coverage of image formation, basic optical devices, image evaluation, fabrication, and testing methods, and more. Comprehensive and up to date, Modern Optical Engineering features the latest information on optical engineering theory, design, and practice. Over 150 detailed illustrations. New to this edition: new coverage of ray tracing, optical system design, and third order aberration theory; new lens designs; new optical design software; and new problems and exercises. Inside This Updated Optical Engineering

Classic Image formation, Aberrations, Prisms and mirrors, The eye, Stops and apertures, Optical materials, Interference, coatings

Radiometry and photometry Basic optical devices Optical systems Ray tracing Third order aberration theory Image evaluation Design of optical systems 44 lens designs Optics fabrication and testing **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 **Topics in Modern Lens Design** Dmitry Reshidko, 2016 Many advances have occurred in the field of optical design during the past decade Some of the newer topics and concepts associated with the design and use of optical systems are complex and require comprehensive understanding of theory expertise in state of the art technology and extensive computer simulations This dissertation focuses on development of practical methods and tools for successful lens design and evaluation of state of the art imaging and illumination systems The dissertation addresses several current topics in modern optical engineering and utilizes approaches to provide insights into the inner workings of optical systems Examples of modern mobile camera lenses are provided to show how specific methods can help to better understand these lens designs and to expand the imaging capabilities of miniature camera systems Two simple but effective real ray tracing methods for correcting chromatic aberrations in imaging systems are described The proposed methods separate monochromatic and chromatic aberration correction into two independent problems This two step approach provides effective alternatives in correcting chromatic aberrations A number of unique calculations have been performed and some novel and interesting theoretical results including the fourth order theory of irradiance changes in axially symmetric optical systems are reported The specific relationships between the irradiance distribution and wavefront aberration coefficients to fourth order are derived for the first time The practical case of relative illumination at the image plane of an optical system is also discussed in some detail

**Elements of Modern Optical Design** Donald C. O'Shea, 1985-08-14 A textbook for elementary optical design that treats lasers modulators and scanners as part of the design process Moves from the simplest concepts in optics to a basic understanding of ray tracing in optical systems the components of those systems and the process by which a design is produced Features numerous problems examples and figures **Lens Design** Donald Dilworth, 2018-07-31 Lens Design Automatic and Quasi Autonomous Computational Methods and Techniques is the first book that interactively describes the newest modern lens design tools Detailing design methods for a variety of lens forms this book shows that fixed focus and

zoom lenses can be optimized starting from plane parallel surfaces in a brief time on a modern fast PC compared to traditional tools that require many days or weeks of tedious work. Loaded with tips and ideas resulting from over 50 years of experience the reader will improve their lens design skill. Experienced and aspiring lens designers who master the power of the tools methods and principles taught in this book will be able to develop excellent designs now and in the future. Part of Series in Emerging Technologies in Optics and Photonics [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.

[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 is no lens an optical engineer can't design.

[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.

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[Modern Optical Engineering](#) Joseph M. Reinhardt, Warren J. Smith, Josien P. W. Pluim, Society of

Photo-optical Instrumentation Engineers,American Association of Physicists in Medicine,2007-12-10 The definitive optics text completely revised Long established as the definitive reference on optical engineering and lens technology Modern Optical Engineering has been updated to include all of the latest advances in optical design technology The Fourth Edition now contains leading edge content on optical engineering theory design and practice including new chapters on ray tracing optical system design and third order aberration theory Written by world renowned lens designer Warren J Smith this comprehensive guide provides unsurpassed coverage of such topics as image formation basic optical devices image evaluation and fabrication and testing methods With over 150 detailed illustrations Modern Optical Engineering also features new lens designs as well as new problems and exercises Copublished with McGraw Hill Inside this Classic Image formation Aberrations Prisms and mirrors The eye Stops and apertures Optical materials Interference coatings Radiometry and photometry Basic optical devices Optical systems Ray tracing Third order aberration theory Image evaluation Design of optical systems 44 lens designs Optics fabrication and testing **Practical Optical System Layout: And Use of Stock Lenses** Warren J. Smith,1997 Publisher s Note Products purchased from Third Party sellers are not guaranteed by the publisher for quality authenticity or access to any online entitlements included with the product A complete optical systems design course for general optical engineers The first cut design of an optical system anything from a telescope to a complicated VR helmet is usually not done by a specialist but by a more general optical engineer This book details the basic design principles and techniques for doing so in a clear concise low math way that such generalists will readily understand and appreciate Practical step by step coverage includes succinct equations simple diagrams and clear explanations The chapter on selecting stock lens to test a concept or to prove out a possible finished device should be especially useful

Modern Geometrical Optics Richard Dittman,1997-11-03 From basic terms and concepts to advanced optimization techniques a complete practical introduction to modern geometrical optics Most books on geometrical optics present only matrix methods Modern Geometrical Optics although it covers matrix methods emphasizes ray tracing methods which are used most commonly by optical engineers and are easier to adapt to third order optics and ray diagrams Moving by logical degrees from fundamental principles to advanced optical analysis and design methods this book bridges the gap between the optical theory taught in introductory physics texts and advanced books on lens design Providing the background material needed to understand advanced material it covers important topics such as field of view stops pupils and windows exact ray tracing image quality and optimization of the image Important features of Modern Geometrical Optics include Examples of all important techniques presented Extensive problem sets in each chapter Optical analysis and design software Chapters covering ray diagrams optimization and lens design This book is both a primer for professionals called upon to design optical systems and an ideal text for courses in modern geometrical optics Companion Software Special lens design and analysis software capable of solving all problems presented in the book is available via Wiley s FTP site This software also serves as

an introduction to the use of commercial lens design software Appendix C is a user s manual for the software **Modern Lens Antennas for Communications Engineering** John Thornton,Kao-Cheng Huang,2013-03-06 The aim of this book is to present the modern design principles and analysis of lens antennas It gives graduates and RF Microwave professionals the design insights in order to make full use of lens antennas Why do we want to write a book in lens antennas Because this topic has not been thoroughly publicized its importance is underestimated As antennas play a key role in communication systems recent development in wireless communications would indeed benefit from the characteristics of lens antennas low profile and low cost etc The major advantages of lens antennas are narrow beamwidth high gain low sidelobes and low noise temperature Their structures can be more compact and weigh less than horn antennas and parabolic antennas Lens antennas with their quasi optical characteristics also have low loss particularly at near millimeter and submillimeter wavelengths where they have particular advantages This book systematically conducts advanced and up to date treatment of lens antennas

**Modern Optics** B. D. Guenther,2018 Modern Optics is a fundamental study of the principles of optics using a rigorous physical approach based on Maxwell s Equations The treatment provides the mathematical foundations needed to understand a number of applications such as laser optics fiber optics and medical imaging covered in an engineering curriculum as well as the traditional topics covered in a physics based course in optics In addition to treating the fundamentals in optical science the student is given an exposure to actual optics engineering problems such as paraxial matrix optics aberrations with experimental examples Fourier transform optics Fresnel Kirchhoff formulation Gaussian waves thin films photonic crystals surface plasmons and fiber optics Through its many pictures figures and diagrams the text provides a good physical insight into the topics covered The course content can be modified to reflect the interests of the instructor as well as the student through the selection of optional material provided in appendixes

### **Modern Optics**

**Simplified** B. D. Guenther,2019 This text reduces the complexity of the coverage of optics to allow students with elementary calculus to learn the principles of optics and modern Fourier theory of diffraction and imaging Each chapter offers simple examples from real engineering problems and includes current topics in imaging such as optical coherence tomography and fiber optics

[Lens Design for Imaging](#) Herbert Gross,2025-10-28 Master the foundational principles that drive successful optical system design in modern imaging applications Lens Design for Imaging Volume 1 Fundamentals of Optical Systems by Herbert Gross delivers a comprehensive discussion of the theoretical foundations of optical systems Gross draws on his extensive industrial and academic experience in lens design to close the gap between purely theoretical examinations of lens design and practical application The author provides a systematic and robust methodology for lens design that guides you through the conceptual design analysis and optimization of complex imaging systems across diverse applications In this first volume the basic preconditions to understand optical imaging systems are presented The book covers twelve domains of optical system fundamentals from material properties and geometrical optics to advanced topics like diffraction theory

Fourier optics and digital image processing Each chapter combines rigorous theory with illustrations and hands on examples making complex concepts accessible while maintaining the mathematical depth demanded by professional practice Lens Design for Imaging Volume 1 encompasses the necessary knowledge and critical review about optical materials dispersion the geometrical optics approximation ray tracing methodologies component design principles imaging system theory physical optics effects and modern computational approaches Readers will also find Comprehensive coverage of optical materials including dispersion models in particular for short pulse systems absorption and thermal properties and specialized materials for UV IR and consumer applications Detailed ray tracing methods with complete equation sets for aspherical surfaces gradient media and diffractive elements Presentation of physical models for diffraction effects point spread functions and optical transfer functions of optical systems with practical calculation schemes with discussion of approximations and limitations Advanced topics including Gaussian beam propagation limits of Gaussian beam models photometric analysis and phase space representations for system analysis An integrated approach to digital imaging methods covering realistic image simulation enhancement techniques and modern imaging modalities Perfect for optical engineers lens designers and advanced students in optics and photonics Lens Design for Imaging Volume 1 provides authoritative coverage of optical system fundamentals It contains the systematic knowledge practitioners and students require to tackle complex design challenges

**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

This book delves into Modern Lens Design. Modern Lens Design is an essential topic that must be grasped by everyone, from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Modern Lens Design, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:

- Chapter 1: Introduction to Modern Lens Design
- Chapter 2: Essential Elements of Modern Lens Design
- Chapter 3: Modern Lens Design in Everyday Life
- Chapter 4: Modern Lens Design in Specific Contexts
- Chapter 5: Conclusion

2. In chapter 1, this book will provide an overview of Modern Lens Design. The first chapter will explore what Modern Lens Design is, why Modern Lens Design is vital, and how to effectively learn about Modern Lens Design.
3. In chapter 2, the author will delve into the foundational concepts of Modern Lens Design. This chapter will elucidate the essential principles that must be understood to grasp Modern Lens Design in its entirety.
4. In chapter 3, this book will examine the practical applications of Modern Lens Design in daily life. This chapter will showcase real-world examples of how Modern Lens Design can be effectively utilized in everyday scenarios.
5. In chapter 4, the author will scrutinize the relevance of Modern Lens Design in specific contexts. The fourth chapter will explore how Modern Lens Design is applied in specialized fields, such as education, business, and technology.
6. In chapter 5, the author will draw a conclusion about Modern Lens Design. The final chapter will summarize the key points that have been discussed throughout the book.

This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Modern Lens Design.

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## **Modern Lens Design Introduction**

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