Modern Lens Design (McGraw-Hill Professional Engineering)

Warren J. Smith
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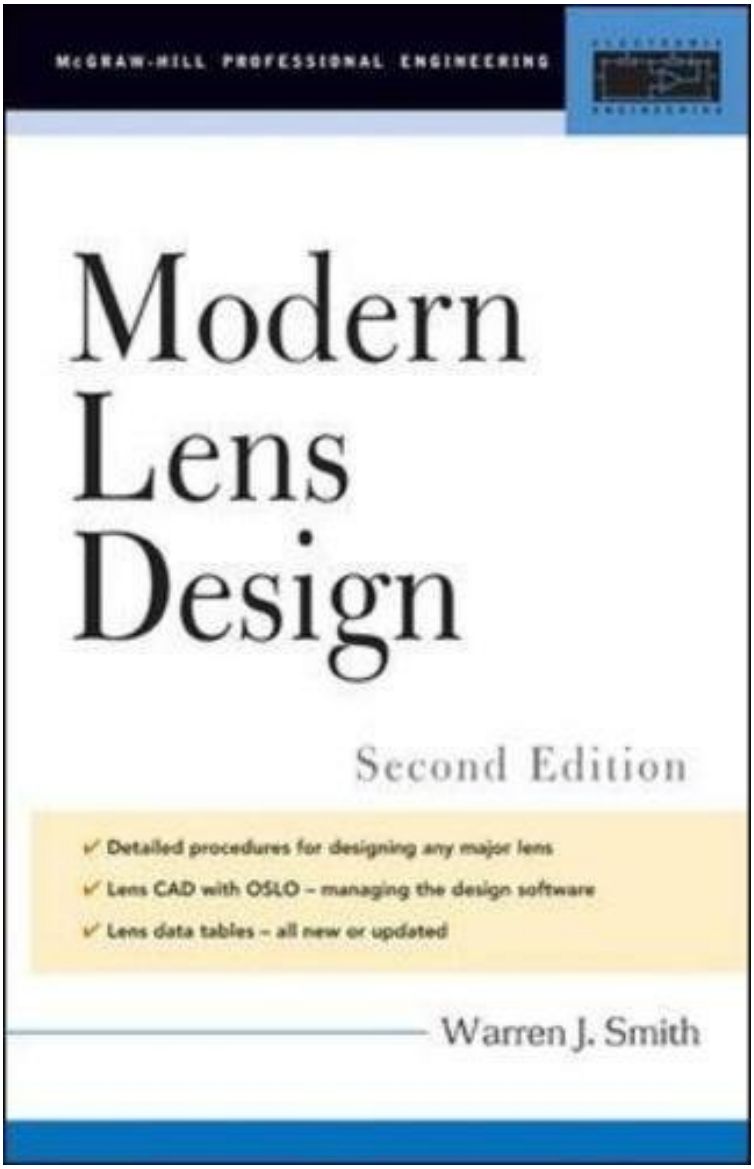

#1354928 in Books Warren J Smith 2004-11-12Original language:EnglishPDF # 1 9.30 x 1.37 x 6.30l, 2.26 #File Name: 0071438300631 pagesModern Lens Design | File size: 61.Mb

Warren J. Smith : Modern Lens Design (McGraw-Hill Professional Engineering) before purchasing it in order to gage whether or not it would be worth my time, and all praised Modern Lens Design (McGraw-Hill Professional Engineering):

0 of 0 people found the following review helpful. Excellent textbookBy David LambertModern Lens Design is an excellent textbook in optical design using personal computer software. Even though there has been much progress in

optical design software since the book was written, the principles are timeless.0 of 0 people found the following review helpful. Clear description.By Pak Soo JongThe description is very clear to follow. It is very useful to learn optical design.26 of 34 people found the following review helpful. Practical Textbook on lens design now in 2nd EditionBy P. NagyExcerpt: My personal optical design experience has spanned more than five decades. They have been exciting, fascinating, and delightful decades; I have enjoyed each one. During that half century, lens design has changed radically. In the mid-twentieth century, lens design was still a semi-intuitive art, practiced by a few dedicated individuals of great per-severance, knowledge, and skill. And by mid-century most of the classic lens design forms had already been created. To this day, these designs are still the basis of many excellent modern optical systems.Of course the practice of lens design today is radically different from what it was in the 1940s and 50s. Then, most optical design was done with an electromechanical desk calculator (e.g., Marchant, Frieden, and Monroe), and the raytracing rate, measured in terms of the number of surfaces through which one could trace the path of a ray in a given amount of time, was to the order of one ray surface in about 250s (if one were to work at it continuously through the day). Thus, using the cur-rent dimensions for raytracing speed, one did about 0.004 ray-surfaces per second. And these were only meridional two-dimensional rays, not the three-dimensional general rays ordinarily traced today. A great deal of ingenuity (and elegant theory) went into finding ways to avoid tracing any more rays than were absolutely necessary.Thanks to the modern personal computer or PC, the computing rate has increased almost unbelievably. Today a run-of-the-mill PC is capable of calculating several million ray-surfaces per second; this is about nine or ten orders of magnitude faster. Needless to say the techniques of lens design today differ mightily from those of fifty or sixty years ago. Then, the designer might calculate the derivatives of a few aberrations with respect to a limited number of constructional parameters and solve a small set of simultaneous, linear equations in the course of correcting his lens. These limited calculations were all carefully selected on the basis of theory, experience, and intuition. (Interestingly, one of the very real problems facing designers today is that the computer spews outnumbers so rapidly that it takes strong self-discipline just to make one-self stop and think.)In modern lens design work, a computer program almost instantaneously calculates and solves equations which are far more than an order of magnitude more complex and extensive than those cited above. It is not atypical for the computer program to control about 50 lens performance characteristics by adjusting the values of some 20 or 30 construction parameters of the optical system. These latter numbers imply a design space with 20 or 30 dimensions, a complex space indeed.There are, however, some real limitations on the power of a so-called automatic lens design program. The typical program proceeds from a given starting design and drives the design to the nearest local optimum, a form at which any small structural changes will degrade the system performance. System performance is judged by a set of calculated characteristics defined in a merit function, which would be better termed a defect or error function, since the characteristics in it represent departures from desired values.Obviously then, the final automatic design solution is completely and uniquely determined by (a) the merit function, (b) the starting design form, and (c) the algorithm by which the computer solves the problem of locating an optimum design form with the minimum value of the merit function.When the first edition of Modern Lens Design (MLD) was published, there was a great need for a collection of suitable design forms at which to start the design process, and MLD provided almost 300 lens designs for this purpose. These designs were selected not only as starting points, but also as illustrations of important design principles. At the present time the need for sample designs, while still real, is significantly less, largely because most optical design programs now include libraries of lens designs. (These programs also include random search design capabilities which permit large changes in lens forms.) For example, all of the lens designs in the first edition of MLD (plus many others) are included in the lens libraries of the optical design program OSLO (a product of Lambda Research Corp.). Another program, LensVIEW by Brian Caldwell, is a compilation of over 30,000 lens designs and patents.That said, it is (at least it is for me) far more easy and convenient to scan and compare a series of printed design pages than it is to do the same thing on a computer screen (even with the multiwindow capabilities of many programs). For this and other reasons this second edition of MLD has retained about half of the original designs and has added some new ones. The reader may also find some additional designs in the works referenced at the end of the book.The practice of lens design is now essentially an engineering discipline. While this book is intended to be self-contained, we deliberatelydo not include a lot of derivations, or even the mechanics of exact ray tracing. And as valuable and cherished as they may be in academia, we happily omit any derivations from first principles, Maxwell's equations, or Fermat's principle. These are simply not necessary for a book on lens design. We make one exception to the no "ray tracing" rule, namely for the tracing of paraxial rays, which a lens designer often carries out by hand, or with a programmed pocket calculator. This topic is covered in the Formulary of Chapter 24, along with other valuable and frequently used geometrical optics relationships.However, there is currently a growing need for a more detailed exposition of basic lens design and theory in a single volume. The first edition of MLD was a "companion" volume to the author's Modern Optical Engineering. Several very basic lens design books have recently appeared; some are almost extended user manuals written for a specific design program. This edition of MLD is definitely not intended as a user manual, or as a guide to any specific program. It is an attempt to go well beyond this level by presenting both the basics of, and a more advanced approach to, lens design. The intent is to advise the reader how to get the most from any computer lens design program. To this

end, about half of the lens designs in the first edition of MLD have been eliminated to make room for quite a bit of new material.The text is, as far as possible, completely program neutral. I have tried to make the material regarding design programs as generic as I could, discussing features that are available in almost all commercial soft-ware. I have used OSLO for the design work demonstrated in the text, and for preparing the new figures. (The lens analysis figures in the first edition of MLD were prepared with a customized version of the program GENII, using a new and unique presentation style which is now widely available; for an example, see the OSLO aberration plots herein.)Most neophyte lens designers very quickly get past the basics and learn to use their computer programs with a high level of proficiency. At this point, what they need most is an answer to the question, "What do I do now?" Much of the new material in this edition is designed to this end and takes the form of actual design projects carried out from scratch, warts and all. (In other words, I have not papered over the blunders I made in the design process.) These designs include a cemented doublet, a triplet anastigmat, a Tessar, a Heliar, a Dogmar, a telephoto, a Schmidt cassegrain, a binocular eyepiece, an apochromatic triplet, and a landscape lens. Many of these design stories are carried out to some length to illustrate all of the possible steps that can be taken to improve a design. Every initial assumption is explained and justified. These design descriptions not only show the basic designapproach, but continue on with advanced steps and the rationale for them.I have surveyed the literature at some length for any design techniques which might have a general applicability (as well as the reported specific use for the writer's specific problem). Some were found in the references listed at the end of the book. For the most part, the design techniques described here are those which I have found to be useful in working with an optimization program. Many of the techniques have been developed or refined during more than two decades of teaching courses in lens design; indeed some of these ideas were suggested or inspired by my students. Other valuable sources were the many informal discussions that I have been fortunate to have with my colleagues.For better or worse, one can never seem to squeeze all the material that you want into a book. At the manuscript deadline date there is always at least one more feature that you wished there was enough time to develop, write, and include. But I suppose that if there were time, no book would ever be finished.Surprisingly, there are only a modest number of well-understood and widely utilized principles of optical design. If one can master a thorough understanding of these principles, their effects, and their mechanisms, it is easy to recognize them in existing designs and also easy to apply them to one's own design work. It is the intent here to promote such understanding by presenting both expositions and annotated design examples of these principles.Readers are free to use the designs in this book as starting points for their own design efforts, or in any other way they see fit. The reader must accept full responsibility for meeting whatever limitations are imposed on the use of these designs by any patent, copyright, or other (whether indicated herein or not).

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, theres no lens an optical engineer cant design.

In this new edition of Smith's book, the focus has changed with the times. There are about half as many lens designs in the new edition, and the new material is directed toward design projects. Smith shows what he did, including blunders, to design a lens from first concept to final design. The designs include a cemented doublet, a triplet anastigmat, a Heliar, a Schmidt-Cassegrain, a landscape lens, and many more. The computer program OSLO was used to design the work, but the write-ups are program-neutral. Therefore, this book can be used with any lens design software. This book is a working person's text; there are very few derivations of techniques or derivations from first principles, Maxwell's equations, or Fermat's principle. The assumption is that the reader understands the basic optical principles and may have a command of the fundamentals of classical optical design methods. In short, a compendium of design techniques available today and a prescriptive resource for a variety of already designed lens types that can be starting points for a lens designer's efforts. Summing Up: Recommended. Upper-division undergraduates through professionals. -- D.B. Mason, Albright CollegeFrom the Back Cover"This authoritative work is truly a rare find ... Smith's book is clearly written and exceedingly well organized ... When read from start to finish, the book makes it clear how the simple techniques demonstrated in the early chapters are developed and applied to more complex lens design forms." --Laser Focus, on the previous edition "An authoritative collection of lens design forms in a clear, readable format, Modern Lens Design is well worth acquiring by any student of the art of lens design. -- Optical Engineering, on the previous edition A MASTER CLASS IN PRACTICAL ENGINEERING TECHNIQUES AND THE ART OF LENS DESIGN In this fully revised and updated Second Edition of Modern Lens Design, optics legend Warren J. Smith leads you through the mechanics of lens design, revealing tested methods for designing top-quality lenses. A paragon of design instruction, this volume offers clear explanations of processes, including the use of market-leading design software. You also get 7 comprehensive worked examples, all new to this edition. With this book in hand, there's no lens an optical engineer -- or an enthusiastic amateur -- can't design. Warren J. Smith's Modern Lens

Design helps you with every aspect of any major lens design project, including: The prescription: Radii, spacings, materials, EFL, BFL, vertex length, object and image distances, magnification, Petzval radius, wavelength, clear apertures, and more Rays: The axial-marginal ray and the chief ray Plotting lens aberrations: Ray intercept plots for axis, 0.5, 0.7, and full field, field curvature, distortion, and lateral color This text features new and updated lens design tables as well as comprehensive instruction in the lens design process, both traditional and CAD. Beginners and experts alike will turn to this book as the definitive source of lens design techniques time and time again. LENS DESIGN INSTRUCTION, CHAPTER BY CHAPTER: Introduction to Lens Design * Lens CAD: Managing the Software * Improving a Design * Cooke Triplet Anastigmats * Reversed Telephoto Lenses * Infrared Systems * Lens Design Tables * Example Designs * FormularyAbout the AuthorWarren J. Smith is Chief Scientist at Kaiser Electro-Optics as well as an independent consultant. He is the author of three prior books on lens design, including the first edition of this one, and the classics, Modern Optical Engineering and Practical Optical System Layout. He lives in Carlsbad, California.