

Introduction to Lens Design

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, as well as for engineers and technicians working in the optics and imaging industries.

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With appreciation to my lens design students.

This is evident even more when we realize that the combinations of lenses are very capricious entities, which in certain arrangements, probably because of laws deeply hidden in the building blocks of complicated functions, will give either not a good image at all, or one that is inevitably curved or distorted, and one understands easily that a lack of knowledge of these laws can lead to high costs and great useless efforts.

Joseph Maximillian Petzval
*Bericht über die Ergebnisse einiger dioptrischen
Untersuchungen* (Pest, 1843)

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Preface

I have been fortunate to have taught for many years the course Lens Design OPTI517 at the James C. Wyant College of Optical Sciences at the University of Arizona. The thrust of this course is to help graduate students to acquire the skill of lens design and obtain a solid foundation in the subject in the space of about 16 weeks, which is the duration of the Fall academic term. Behind the scenes, the challenge has been how to completely and effectively achieve this thrust. This book is the result of teaching OPTI517 for about 20 years, and outlines the essential material interested students or optical engineers should know.

I have had the support and help from many individuals and I would like to acknowledge and to thank them. Robert Shannon handed me OPTI517, which he initiated and taught for many years at the then Optical Sciences Center. My colleagues Russell Chipman, John Greivenkamp, Angus Macleod, Jim Burge, Yuzuru Takashima, Tom Milster, Ron Liang, Buddy Martin, Hong Hua, Jim Schwiegerling, Roland Shack, Masud Mansuripur, Roger Angel, Stanley Pau, Bill Wolfe, Roy Frieden, Brian Anderson, Arvind Marathay, Rolf Binder, Dae Woo Kim, Eustace Dereniak, Steve Jacobs, Harry Barrett, Charles Falco, Jack Gaskill, John Koshel, and Dan Vukobratovich have been helpful and inspirational. I also would like to thank Richard Powell, Jim Wyant, and Tom Koch for the support they have provided me.

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