Contemporary Optics

Integrated Optics explains the subject of optoelectronic devices and their use in integrated optics and fiber optic systems. The approach taken is to emphasize the physics of how devices work and how they can be (and have been) used in various applications as the field of optoelectronics has progressed from microphotonics to nanophotonics. Illustrations and references from technical journals have been used to demonstrate the relevance of the theory to currently important topics in industry. By reading this book, scientists, engineers, students and engineering managers can obtain an overall view of the theory and the most recent technology in Integrated Optics.

This book presents a collection of memoir papers on the development of modern and contemporary optics and optoelectronics in China from the 18th to 20th centuries. The papers were written by famous scientists in China, including members of the Chinese Academy of Sciences and the Chinese Academy of Engineering, sharing their experience in different fields of optics and optoelectronics development. This is a unique book in understanding the natural science history of optics and optoelectronics. It gives you the general idea about how the western optical science spread to China in the 17th to 18th century; the cradle of the contemporary optics in China; Birth, development and application of lasers in China; high energy and high power lasers for laser antiballistic missile and laser nuclear fusion; development of Chinese optical communication and optical information storage; laser and infrared optics research for space science; development of Chinese optical instruments, etc. Contents:West–East Flow of Scientific Knowledge (GAN Fuxi)Optical Science and Technology in China in the First Half of the 20th Century (GAN Fuxi)Cradle of Contemporary Optics in China (GAN Fuxi)History of Optical Glass R&D in China (GAN Fuxi)Birth and Early Development of Lasers in China (GAN Fuxi)Lasers as Anti-Ballistic Missile Defense (GAN Fuxi)Quantum Electronics Research at the Institute of Electronics — The Early Days (LIN Fucheng)Opening Up Chinese Laser Research to the World (GAN Fuxi)Breakthrough and Development of Semiconductor Lasers in China (WANG Qiming and HUANG Yongzhen)Development of Solid State Laser Materials in China (GAN Fuxi)The History of Development of Nonlinear Optical Borate Crystals (CHEN Chuangtian and YAO Wenjiao)Daheng Company — An Early Experiment in Reforming Scientific and Technology Systems in China (GAN Fuxi)Role of 863 Program in Promoting Optoelectronics in China (GAN Fuxi)Building Up Optical Information Storage Capabilities in China (GAN Fuxi)Progress of Optical Communications in China — Fragments of Personal Reminiscence (FANG Zujie)Development Course of Astronomical Optical Instruments in China (PAN Junhua)Development of Infrared Science and Technology in China (XUE Yongqi and ZHU Junhao)A Review of Research on Atomic Clock and Laser Cooling of Gas Atoms in SIOM (WANG Yuzhu)A Glimpse of China's High-Power Laser and Inertial Confinement Fusion Research (FAN Dianyuan)My Scientific Research Career and China's Development of Optical Transient Technologies (HOU Xun) Readership: Students and scientists who are interested in the history of optics and optoelectronics in China. Keywords:Optics;Optoelectronics;Modern and Contemporary History;ChinaKey Features:This volume presents a collection of memoir papers on the development of modern and contemporary

optics and optoelectronics in China, written by seven Members of Chinese Academy of Sciences and Chinese Academy of Engineering

This book covers the applications of Fourier methods and linear systems theory to optical diffraction and imaging, and it will be of use to anyone seeking an understanding of Fourier series and Fourier transforms of one-and two-dimensional structures.

The monograph covers various meso-optical elements, diffraction free light beams, localized electromagnetic fields, gravitational lens, meso-optical devices for transportation of the synchrotron radiation, meso-optical microscopes for high energy elementary particle physics, and the history of meso-optics. Some integral transforms useful in meso-optics are presented in the Appendix.The author is an active participant of many investigations in meso-optics and provides an up-to-date encyclopedic review of the theoretical and experimental investigations on Meso-Optics (optics of the conical wave fields).

This textbook provides a sound foundation in physical optics by covering key concepts in a rigorous but accessible manner. Propagation of electromagnetic waves is examined from multiple perspectives, with explanation of which viewpoints and methods are best suited to different situations. After an introduction to the theory of electromagnetism, reflection, refraction, and dispersion, topics such as geometrical optics, interference, diffraction, coherence, laser beams, polarization, crystallography, and anisotropy are closely examined. Optical elements, including lenses, mirrors, prisms, classical and Fabry-Perot interferometers, resonant cavities, multilayer dielectric structures, interference and spatial filters, diffraction gratings, polarizers, and birefringent plates, are treated in depth. The coverage also encompasses such seldom-covered topics as modeling of general astigmatism via 4x4 matrices, FFT-based numerical methods, and bianisotropy, with a relativistic treatment of optical activity and the Faraday and Fresnel-Fizeau effects. Finally, the history of optics is discussed.

Optics clearly explains the principles of optics using excellent pedagogy to support student learning. Beginning with introductory ideas and equations, K.K. Sharma takes the reader through the world of optics by detailing problems encountered, advanced subjects, and actual applications. Elegantly written, this book rigorously examines optics with over 300 illustrations and several problems in each chapter. The book begins with light propagation in anisotropic media considered much later in most books. Nearly one third of the book deals with applications of optics. This simple idea of merging the sometimes overwhelming and dry subject of optics with real world applications will create better future engineers. It will make ‘optics’ jump off the page for readers and they will see it take shape in the world around them. In presenting optics practically, as well as theoretically, readers will come away not only with a complete knowledge base but a context in which to place it. This book is recommended for optical engineers, libraries, senior undergraduate students, graduate students, and professors. Strong emphasis on applications to demonstrate the relevance of the theory Includes chapter on problem solving of ray deviations, focusing errors, and distortion Problems are included at the end of each chapter for thorough understanding of this dense subject matter

Ray, wave and quantum concepts are central to diverse and seemingly incompatible models of light. Each model particularizes a specific "manifestation" of light, and then corresponds to adequate physical assumptions and formal

approximations, whose domains of applicability are well-established. Accordingly each model comprises its own set of geometric and dynamic postulates with the pertinent mathematical means. At a basic level, the book is a complete introduction to the Wigner optics, which bridges between ray and wave optics, offering the optical phase space as the ambience and the Wigner function based technique as the mathematical machinery to accommodate between the two opposite extremes of light representation: the localized ray of geometrical optics and the unlocalized wave function of wave optics. At a parallel level, the analogies with other branches of both classical and quantum physics, like classical and quantum mechanics, quantum optics, signal theory as well as magnetic optics, are evidenced by pertinent comments and/or rigorous mathematics. So, the Lie algebra and group methods are introduced and explained through the elementary optical systems within both the ray and wave optics contexts, the former being related to the symplectic group and the latter to the metaplectic group. In a like manner, the Wigner function is introduced by following the original issue to individualize a phase space representation of quantum mechanics, which is mirrored by the issue to individualize a local frequency spectrum within the signal theory context. The basic analogy with the optics of charged particles inherently underlying the ray-optics picture in phase space is also evidenced within the wave-optics picture in the Wigner phase space. · amalgamation of a great deal of contributions having witnessed the phase space picture of optics over the past 30 years · introduces abstract concepts through concrete systems · hosts of figures and logical diagrams to favour intuition and to introduce mathematics · emphasis on the interrelations with quantum optics, signal theory and magnetic optics · feeds a feeling for genuine issues in higher mathematics and theoretical physics

"A clear and straightforward introduction to the Fourier principles behind modern optics, this text is appropriate for advanced undergraduate and graduate students."--Page 4 of cover.

In geometrical optics, light propagation is analyzed in terms of light rays which define the path of propagation of light energy in the limit of the optical wavelength tending to zero. All of geometric optics can be derived from Fermat's principle which is an extremum principle. The counterpart in classical mechanics is of course Hamilton's principle. There is a very close analogy between mechanics of particles and optics of light rays. In Lagrangian Optics, the authors begin with Fermat's principle and obtain the Lagrangian and Hamiltonian pictures of ray propagation through various media. Given the current interest and activity in optical fibers and optical communication, analysis of light propagation in inhomogeneous media is dealt with in great detail. The past decade has witnessed great advances in adaptive optics and compensation for optical aberrations. The formalism described herein can be used to calculate aberrations of optical systems. Toward the end of the book, applications of the formalism to current research problems are presented. Of particular interest is the use of dynamic programming techniques which can be used to handle variational/extremum

problems. This method has only recently been applied to optical problems.

This textbook on optics provides an introduction to key concepts of wave optics and light propagation. It uniquely makes extensive use of Fourier methods and the angular-spectrum approach, especially to provide a unified approach to Fraunhofer and Fresnel diffraction. A recurring theme is that simple building blocks such as plane and spherical waves can be summed to construct useful solutions. The text pays particular attention to analysing topics in contemporary optics such as propagation, dispersion, laser beams and wave guides, apodisation, tightly-focused vector fields, unconventional polarization states, and light-matter interactions. Throughout the text, the principles are applied through worked examples, and the book is copiously illustrated with more than 240 figures. The 200 end-of-chapter exercises offer further opportunities for testing the reader's understanding.

This book presents a collection of memoir papers on the development of modern and contemporary optics and optoelectronics in China from the 18th to 20th centuries. The papers were written by famous scientists in China, including members of the Chinese Academy of Sciences and the Chinese Academy of Engineering, sharing their experience in different fields of optics and optoelectronics development. This is a unique book in understanding the natural science history of optics and optoelectronics. It gives you the general idea about how the western optical science spread to China in the 17th to 18th century; the cradle of the contemporary optics in China; Birth, development and application of lasers in China; high energy and high power lasers for laser antiballistic missile and laser nuclear fusion; development of Chinese optical communication and optical information storage; laser and infrared optics research for space science; development of Chinese optical instruments, etc. Contents: West Science vs. East (Gan Fuxi); Optical Science and Technology in China in the First Half of 20th Century (Gan Fuxi); The Cradle of the Contemporary Optics in China (Gan Fuxi); The History of Research and Development of Optical Glass in China (Gan Fuxi); Birth and Early Development of Lasers in China (Gan Fuxi); Laser ABM OCo One of the Strategic Defense Means in Early Time (Gan Fuxi); Memory of the Early Days OCo Quantum Electronics Research in the Institute of Electronics (Lin Fucheng); Chinese Laser Research Opened to the World (Gan Fuxi); Breakthroughs and Development of Semiconductor Lasers in China (Wang Qiming and Huang Yong-Zhen); Development of the Solid State Laser Materials in China (Gan Fuxi); Development of High Power Lasers in China (Fan Dianyuan); Establishment of the Daheng Company OCo A Pioneering Work of Chinese Scientific and Technological System Reform (Gan Fuxi); National 863 High Technology Program Promoted the Development of Optoelectronics in China (Gan Fuxi); Open Up the Optical Information Storage Technology in China (Gan Fuxi); Progress of Optical Communications in China OCo Fragments of Personal Reminiscences (Fang Zujie); The Course of Development of Astronomical Optical Instruments (Pan Junhua); Infra Red Optics Research and Application in Satellite

Monitoring (Xue Yongqi); High Speed Imaging and Monitoring Research and Development (Hou Xun); Research on Laser Cooling and Time Standard in Optical Wavelength Range (Wang Yuzhu); Industrial Development of Optical Instruments in China (Zhuang Songlin). Readership: Students and scientists who are interested in the history of optics and optoelectronics in China.

In the 50 years since the first volume of Progress in Optics was published, optics has become one of the most dynamic fields of science. The volumes in this series that have appeared up to now contain more than 300 review articles by distinguished research workers, which have become permanent records for many important developments, helping optical scientists and optical engineers stay abreast of their fields. Comprehensive, in-depth reviews Edited by the leading authority in the field Q1 in Thomson JCR ranking

This book is the culmination of twenty-five years of teaching Geometrical Optics. The volume is organised such that the single spherical refracting surface is the basic optical element. Spherical mirrors are treated as special cases of refraction, with the same applicable equations. Thin lens equations follow as combinations of spherical refracting surfaces while the cardinal points of the thick lens make it equivalent to a thin lens. Ultimately, one set of vergence equations are applicable to all these elements.The chapters are devoted to in-depth treatments of stops, pupils and ports; magnifiers, microscopes, telescopes, and camera lenses; ophthalmic instruments; resolving power and MTF; trigonometric ray tracing; and chromatic and monochromatic aberrations. There are over 100 worked examples, 400 homework problems and 400 illustrations.First published in 1994 by Penumbra Publishing Co.

This invaluable second edition provides more in-depth discussions and examples in various chapters. Based largely on the authors' own in-class lectures as well as research in the area, the comprehensive textbook serves two purposes. The first introduces some traditional topics such as matrix formalism of geometrical optics, wave propagation and diffraction, and some fundamental background on Fourier optics. The second presents the essentials of acousto-optics and electro-optics, and provides the students with experience in modeling the theory and applications using a commonly used software tool MATLAB®. Request Inspection Copy

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.

Generalized Phase Contrast elevates the phase contrast technique not only to improve phase imaging but also to cross over and interface with diverse and seemingly disparate fields of contemporary optics and photonics. This book presents a comprehensive introduction to the Generalized Phase Contrast (GPC) method including an overview of the range of current and potential applications of GPC in wavefront sensing and phase imaging, structured laser illumination and image projection, optical trapping and manipulation, and optical encryption and decryption. The GPC method goes further than the restrictive assumptions of conventional Zernike phase contrast analysis and achieves an expanded range of validity beyond weak phase perturbations. The generalized analysis yields design criteria for tuning experimental parameters to achieve optimal performance in terms of accuracy, fidelity and light efficiency. Optimization can address practical issues, such as finding an optimal spatial filter for the chosen application, and can even enable a Reverse Phase Contrast mode where intensity patterns are converted into a phase modulation.

This book provides a unified treatment of the characteristics of telescopes of all types, both those whose performance is set by geometrical aberrations and the effect of the atmosphere, and those diffraction-limited telescopes designed for observations from above the atmosphere. The emphasis throughout is on basic principles, such as Fermat's principle, and their application to optical systems specifically designed to image distant celestial sources. The book also contains thorough discussions of the principles underlying all spectroscopic instrumentation, with special emphasis on grating instruments used with telescopes. An introduction to adaptive optics provides the needed background for further inquiry into this rapidly developing area. Geometrical aberration theory based on Fermat's principle Diffraction theory and transfer function approach to near-perfect telescopes Thorough discussion of 2-mirror telescopes, including misalignments Basic principles of spectrometry; grating and echelle instruments Schmidt and other catadioptric telescopes Principles of adaptive optics Over 220 figures and nearly 90 summary tables

Uniting classical and modern photonics approaches by presenting optical analyses as solutions of Maxwell's equations, this unique book enables students and practising engineers to fully understand the similarities and differences between the different methods. The book begins with a thorough discussion of plane wave analysis, which provides a clear understanding of optics without considering boundary condition or device configuration. It then goes on to cover diffraction analysis of many applications, including a rigorous analysis of TEM waves using Maxwell's equations with boundaries. Laser cavity modes and Gaussian beams are presented, modal analysis is covered, and approximation

methods are discussed (including the perturbation technique, coupled mode analysis, and super mode analysis). With theory linked to practical examples throughout, it provides a clear understanding of the interplay between plane wave, diffraction and modal analysis, and how the different techniques can be applied to various areas including imaging, signal processing, and optoelectronic devices.

This book serves two purposes: first to introduce readers to the concepts of geometrical optics, physical optics and techniques of optical imaging and image processing, and secondly to provide them with experience in modeling the theory and applications using the commonly used software tool MATLAB®. A comprehensively revised version of the authors' earlier book Principles of Applied Optics, Contemporary Optical Image Processing with MATLAB brings out the systems aspect of optics. This includes ray optics, Fourier Optics, Gaussian beam propagation, the split-step beam propagation method, holography and complex spatial filtering, ray theory of holograms, optical scanning holography, acousto-optic image processing, edge enhancement and correlation using photorefractive materials, holographic phase distortion correction, to name a few. MATLAB examples are given throughout the text. MATLAB is emphasized since it is now a widely accepted software tool very routinely used in signal processing. A sizeable portion of this book is based on the authors' own in-class presentations, as well as research in the area. Instructive problems and MATLAB assignments are included at the end of each Chapter to enhance even further the value of this book to its readers. MATLAB is a registered trademark of The MathWorks, Inc.

With the advent of lasers, numerous applications of it such as optical information processing, holography, and optical communication have evolved. These applications have made the study of optics essential for scientists and engineers. The present volume, intended for senior under graduate and first-year graduate students, introduces basic concepts neces sary for an understanding of many of these applications. The book has grown out of lectures given at the Master's level to students of applied optics at the Indian Institute of Technology, New Delhi. Chapters 1-3 deal with geometrical optics, where we develop the theory behind the tracing of rays and calculation of aberrations. The formulas for aberrations are derived from first principles. We use the method in volving Luneburg's treatment starting from Hamilton's equations since we believe that this method is easy to understand. Chapters 4--8 discuss the more important aspects of contemporary physical optics, namely, diffraction, coherence, Fourier optics, and holog raphy. The basis for discussion is the scalar wave equation. A number of applications of spatial frequency filtering and holography are also discussed. With the availability of high-power laser beams, a large number of nonlinear optical phenomena have been studied. Of the various nonlinear phenomena, the self-focusing (or defocusing) of light beams due to the nonlinear dependence of the dielectric constant on intensity has received considerable attention. In Chapter 9 we discuss in detail the steady-state self-focusing of light beams.

Contemporary OpticsSpringer Science & Business Media

Optics and photonics technologies are ubiquitous: they are responsible for the displays on smart phones and computing devices, optical fiber that carries the information in the internet, advanced precision manufacturing, enhanced defense capabilities, and a

plethora of medical diagnostics tools. The opportunities arising from optics and photonics offer the potential for even greater societal impact in the next few decades, including solar power generation and new efficient lighting that could transform the nation's energy landscape and new optical capabilities that will be essential to support the continued exponential growth of the Internet. As described in the National Research Council report Optics and Photonics: Essential Technologies for our Nation, it is critical for the United States to take advantage of these emerging optical technologies for creating new industries and generating job growth. The report assesses the current state of optical science and engineering in the United States and abroad--including market trends, workforce needs, and the impact of photonics on the national economy. It identifies the technological opportunities that have arisen from recent advances in, and applications of, optical science and engineering. The report also calls for improved management of U.S. public and private research and development resources, emphasizing the need for public policy that encourages adoption of a portfolio approach to investing in the wide and diverse opportunities now available within photonics. Optics and Photonics: Essential Technologies for our Nation is a useful overview not only for policymakers, such as decision-makers at relevant Federal agencies on the current state of optics and photonics research and applications but also for individuals seeking a broad understanding of the fields of optics and photonics in many arenas.

Contemporary Nonlinear Optics discusses the different activities in the field of nonlinear optics. The book is comprised of 10 chapters. Chapter 1 presents a description of the field of nonlinear guided-wave optics. Chapter 2 surveys a new branch of nonlinear optics under the heading optical solitons. Chapter 3 reviews recent progress in the field of optical phase conjugation. Chapter 4 discusses ultrafast nonlinear optics, a field that is growing rapidly with the ability of generating and controlling femtosecond optical pulses. Chapter 5 examines a branch of nonlinear optics that may be termed nonlinear quantum optics. Chapter 6 reviews the new field of photorefractive adaptive neural networks. Chapter 7 presents a discussion of recent successes in the development of nonlinear optical media based on organic materials. Chapter 8 reviews the field of nonlinear optics in quantum confined structures. Chapter 9 reviews the field of nonlinear laser spectroscopy, with emphasis on advances made during the 1980s. Finally, Chapter 10 reviews the field of nonlinear optical dynamics by considering nonlinear optical systems that exhibit temporal, spatial, or spatio-temporal instabilities. This book is a valuable source for physicists and other scientists interested in optical systems and neural networks.

In last years increasing attention has been again devoted to interpretations of quantum theory. In the same time interesting quantum optical experiments have been performed using nonlinear optical processes, in particular frequency down conversion, which provided new information about nature of a photon on the basis of interference and correlation (coincidence) phenomena. Such single-photon and twin-photon effects of quantum optics provide new point of view of interpretations of quantum theory and new tests of its principles. The purpose of this book is to discuss these questions. To follow this goal we give brief reviews of principles of quantum theory and of quantum theory of measurement. As a fundamental theoretical tool the coherent state technique is adopted based on a general algebraic treatment, including the de scription of interaction of radiation and matter.

Typical quantum behaviour of physical systems is exhibited by nonclassical optical phenomena, which can be examined using photon interferences and correlations. These phenomena are closely related to violation of various classical inequalities and Bell's in equalities. The most important part of this book discusses quantum optical experiments supporting quantum theory. This book may be considered as a continuation of previous monographs by one of the authors on Coherence of Light (Van Nostrand Reinhold, London 1972, second edition D. Reidel, Dordrecht 1985) and on Quantum Statistics of Linear and Nonlinear Optical Phenomena (D. Reidel, Dordrecht 1984, second edition Kluwer, Dordrecht 1991), which may serve as a preparation for reading this book.

The first edition of this textbook was published only last year, and now, the publisher has decided to issue a paperback edition. This is intended to make the text more affordable to everyone who would like to broaden their knowledge of modem problems in optics. The aim of this book is to provide a basic understanding of the impor tant features of the various topics treated. A detailed study of all the sub jects comprising the field of engineering optics would fill several volumes. This book could perhaps be likened to a soup: it is easy to swallow, but sooner or later heartier sustenance is needed. It is my hope that this book will stimulate your appetite and prepare you for the banquet that could be yours. I would like to take this opportunity to thank those readers, especially Mr. Branislav Petrovic, who sent me appreciative letters and helpful com ments. These have encouraged me to introduce a few minor changes and improvements in this edition.

This book complements the more textually-based Bauhaus scholarship with a practice-oriented and creative interpretive method, which makes it possible to consider Bauhaus-related works in an unconventional light. Edit Toth argues that focusing on the functionalist approach of the Bauhaus has hindered scholars from properly understanding its design work. With a global scope and under-studied topics, the book advances current scholarly discussions concerning the relationship between image technologies and the body by calling attention to the materiality of image production and strategies of re-channeling image culture into material processes and physical body space, the space of dimensionality and everyday activity.