

DEPARTMENTS

BOOK REVIEWS

Principles of Modern Optical Systems, Volume II

Edited by Deepak Uttamchandani and Ivan Andonovic, ix + 319 pages, illus., index, and references. ISBN 0-89006-538-1. Artech House, Inc., Boston, MA 02062 (1992) \$75 hardbound.

Reviewed by Mohammad A. Karim, University of Dayton, Center for Electro-Optics, 300 College Park, Dayton, OH 45469-0227.

This book is an extension of *Principles of Modern Optical Systems*, which was published by Artech in 1989. The original book (now referred to as Volume I) resulted from an annual course taught at Strathclyde University, Glasgow, United Kingdom. The current volume is much smaller (about half the size of Volume I) and contains 10 chapters as opposed to 17. All but 1 of the 12 contributors are from Europe. The book can stand alone, but it is better read in conjunction with Volume I. My general feeling is that the new volume is much improved.

Chapter 1, the introduction, talks about the foundation, organization, and purpose of the book. Unfortunately, this chapter provides no serious additional information and therefore could have been condensed and included in the preface. In Chap. 2, Opto-Electronic Materials, R. T. Bailey describes various inorganic materials (such as multiquantum wells and photorefractive materials) and organic materials (such as crystal and polymer materials) capable of forming the basis of some important optoelectronic devices. The description of optoelectronic materials in this chapter is somewhat limited since the author largely ignores GaAs/Si- and GeSi/Si-type heterostructures.

In Chap. 3, N. Langford and A. I. Ferguson provide very thorough coverage of rare-earth-doped silica fiber amplifiers and lasers. In particular, the authors discuss Nd³⁺-, Er³⁺-, Yb³⁺-, and Ho³⁺-doped fiber lasers as well as modelocking of such lasers with integrated devices. This chapter is very well written. In

Chap. 4, Digital Optics, F. A. P. Tooley and A. L. Lentine describes optical bistability and nonlinearity, introduce the Fabry-Pérot etalon, and then provide a thorough treatment of quantum-well self-electro-optic devices (SEEDs). The coverage of SEEDs is excellent; however, since the authors do not cover any other topics in digital optical computing, I consider their choice of chapter title to be seriously flawed.

Chapter 5 by M. C. Brain is entitled Coherent Optical Systems and Networks. The title is again misleading since the chapter deals only with fiber optic networks. The author introduces heterodyne and homodyne detection, elaborates on device requirements, stresses polarization matching, and then examines a couple of applications of fiber optic systems. Chapter 6 by J. C. A. Chaimowicz provides a good treatment of atmospheric and intersatellite optical communication. The author elaborates on the architectures of point-to-point fiberless optical communication links, transmitter and receiver terminals, and atmospheric turbulence and its effects on propagation, acquisition and tracking, and intersatellite links.

Chapter 7 on thermal imaging is somewhat out of place in this book. The editors describe (in Chap. 1) the modern optical systems considered in this book "to be those that rely on the use of coherent optical radiation." Furthermore, in my opinion, the treatment of thermal imaging could have been much improved. The next two chapters, both written by A. Malvern, deal with gyroscopes: Chap. 8 covers ring laser gyroscopes and Chap. 9 treats passive optical gyroscopes. Both of these chapters are well written.

The last chapter, written by J. D. C. Jones, is entitled Holography and Its Applications. Following a description of holographic principles, it considers holographic interferometry, electronic speckle pattern interferometry, and the use of fibers in holography.

All of the chapters except the first have ample references. The chapters do offer readers a glimpse of what is available in some important modern optical systems. I must note, how-

ever, that the book does not stress *systems* but the *principles* of such systems. The depth of coverage varies from chapter to chapter, but the book reads smoothly.

Laser Light Scattering: Basic Principles and Practice

Benjamin Chu, 2nd ed., 343 pages, illus., index, references, and appendixes. ISBN 0-12-174551-1. Academic Press, Inc., 1250 Sixth Avenue, San Diego, CA 92101 (1991) \$74.50 hardbound.

Reviewed by Larry P. Goss, Systems Research Laboratories, Inc., A Division of Arvin/Calspan, 2800 Indian Ripple Road, Dayton, OH 45440-3696.

Since the appearance of the first edition of *Laser Light Scattering* in 1974, laser light scattering has become a routine analytical tool for particle sizing in many scientific fields including biology, chemistry, engineering, medicine, and physics. Many technical advances have been made through the use of laser light scattering that account for its popularity; the basic principles of this technique, however, remain unchanged. The second edition of this book, like the first, emphasizes the basic principles and practices of laser light scattering. Recent developments in optical arrangements and correlation schemes are also discussed.

Chapter I is an overview of laser light scattering, including its relation to other scattering techniques. Also included is an extensive list of review articles, books, and technical papers covering various aspects of the technique, which should be helpful to both the novice and the experienced user. In Chap. II, basic equations are developed for the time-averaged scattering intensity, the spectrum of scattered light, and coherence effects due to the finite size of the scattering volume. The fundamental equations that govern optical-mixing spectrometers, including self-beating and homodyne-heterodyne

instruments, are derived in Chap. III, while Chap. IV presents the basic equations for photon-correlation spectroscopy. Chapter V introduces the principles of interferometry for the sake of completeness of the text. Chapter VI deals extensively with the experimental implementation of the laser light scattering technique, from the laser source to the sample-cell geometry to the use of photodetectors. Experimentalists new to the field will find this chapter of practical importance in choosing lasers, optics, photodetectors, and correlators. In this reviewer's opinion, Chap. VII is extremely important because it treats the ill-posed nature of the Laplace inversion problem involved in data analysis. Several analysis schemes are presented to demonstrate that reliable solutions can be obtained for the characteristic linewidth distribution from the intensity and time-correlation functions. Chapter VIII contains a detailed discussion of the application of laser light scattering to the determination of polymer-molecular-weight distributions; the novice will find this chapter especially helpful because of the step-by-step description of the experimental and analytical procedures.

BOOKS RECEIVED

Analysis and Modeling of Neural Systems, edited by Frank H. Eeckman. 421 pp., illus., index, references following each chapter. ISBN 0-7923-9217-5. Kluwer Academic Publishers, 101 Philip Drive, Assinippi Park, Norwell, Massachusetts 02061 (1991) \$87.50 hardbound. Proceedings from the 1989 conference on Analysis and Modeling of Neural Systems, held July 25-27, in Berkeley, CA. Covers analysis and modeling tools and techniques, sensory systems, auditory system, and motor systems.

Directions in Electromagnetic Wave Modeling, edited by Henry L. Bertoni, Leopold B. Felsen. 671 pp., illus., index, ref. ISBN 0-306-44023-7. Plenum Press, 233 Spring Street, New York, NY 10013 (1991) \$115.00 hardbound. Covers wave objects, spectra, and their role in analytic modeling, phase-space sampling in asymptotic diffraction theory, derivation of extended parabolic theories for vector electromagnetic wave propagation, high frequency EM scattering by non-uniform open waveguide cavities containing an interior obstacle, waves and beams in biological media, combinations of local scattering operators and global propagators, transient plane wave scat-

tering from a circular cylinder backed by a slit-coupled coaxial cavity, diffracted microwave fields near dielectric shells: computation, measurement, and decomposition, state of the art and future directions in finite-difference and related techniques, improvements of spectral domain analysis techniques for arbitrary planar circuits, spectral changes induced by scattering from space-time fluctuations, fractal electro-dynamics and modeling, derivation and application to approximate boundary conditions, parametric excitation of Whistler waves by circularly polarized electromagnetic pumps in nonuniform magnetoplasma: modeling and analysis.

Lasers and Non-linear Optics, second ed., by B. B. Laud. 260 pp., illus., index, references. ISBN 0-470-21731-6. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158 (1991). Covers Einstein's quantum theory of radiation; interaction of radiation with matter; masers; theory of some simple optical processes; basic principles of lasers; solid state lasers; gas lasers; semiconductor lasers; liquid-, dye-, and chemical lasers; dynamics of the laser processes and advances in laser physics; holography; nonlinear optics; multiphoton processes; laser spectroscopy; some laser induced phenomena, and applications of lasers.



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Editors: Robert Bud, Science Museum, London (UK);
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