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Book Reviews

Steven C. Gustafson, Book Reviews Editor

Ozone Measuring Instruments for the Stratosphere

William B. Grant, ed., Collected Works in Optics, Vol. 1, x + 438 pp., illus., index, references, acronym list, and a section of published reprints. ISBN: 1-55752-042-9. Optical Society of America, 1816 Jefferson Place, N.W., Washington, DC 20036 (1989) $77 softbound.

Reviewed by Ernest Hilsenrath, NASA, Goddard Space Flight Center, Greenbelt, MD 20771.

This book is a compilation of descriptions of atmospheric ozone measuring techniques and includes details of various instruments employing those techniques. The purpose of the volume, as stated by the author, is to provide an understanding of how ozone is measured throughout the atmosphere with emphasis on the stratosphere. More than 30 instruments are described with a quick review of the principles employed. Most of the instruments described employ remote sensing techniques that cover the ultraviolet through the infrared wavelength region. A few in situ measurements are also discussed. The instruments operate from several platforms, including satellites, rockets, balloons, aircraft, and from the ground. Some instruments are nearly obsolete, others routinely flown, while others are planned for future programs. For each instrument type, precision and accuracy are discussed, which are essential factors in understanding a measurement capability.

There are six chapters, five of which are organized primarily by measurement principles, that include "Direct-Absorption Measuring Instruments," "Ground-Based Indirect-Absorption- Measuring Instruments," "Space-Based Indirect-Absorption-Measuring Instruments," "Emission-Measuring Instruments," and "Miscellaneous In Situ Instruments." Each chapter begins with a short introduction on the measurement principles with a discussion of advantages and disadvantages. Each introduction also contains several references that will provide the reader with additional source information. Within each chapter there is a quick overview of several instruments employing each technique. Each overview also contains numerous references that will give the more interested reader a wealth of information on the measurement techniques and data produced by the measurements. As with similar publications from the Optical Society of America, this book contains numerous samples of published reprints representing the measurement technique and specific instruments that give the reader quick access to source information. As an example, some reprints provide details on instrumentation with a detailed error analysis, while others provide interesting observational results.

Three quarters of the volume consists of the reprints. The introduction contains two very useful tables that give the reader a quick and broad overview of the observational capabilities. The first table lists the instruments and their observing characteristics, e.g., platform, coverage, etc., while the second table lists the operating spectral region, spatial resolution, precision, and accuracy.

The reader of this volume will quickly realize that atmospheric ozone measurements have reached a fairly mature level. Regular observations began more than 40 years ago, well before ozone depletion became an environmental issue. These observations were performed using a variety of techniques from different platforms that allow measurements over a range of spatial and time scales. This capability has provided a fairly accurate description of the natural variations of global atmospheric ozone.

The last chapter is titled "Intercomparisons." Intercomparisons represent the measurement community's attempt to verify accuracy and precision. The chapter reviews results from most of the major intercomparison campaigns conducted and includes no less than 26 references covering the subject. The author points out in the introduction that ozone measurements have reached a milestone where there is now a good understanding of ozone climatology, and the emphasis is now directed to improving accuracy and precision to the level where small trends can be detected.

In summary, the book meets the goals stated by the author and gives a sense of history about the measurement techniques and the ongoing activities to improve our observational capabilities. Since the volume also includes techniques that are still in the development stage or about to be flown, it is not likely to become obsolete in the near future. The collected reprints and the extensive index make this a useful source to atmospheric scientists and engineers as well as planners and policy makers dealing with environmental issues.

Optical Integrated Circuits

Hiroshi Nishihara, Masamitsu Haruna, and Toshiaki Suhara, xv+374 pp., illus., index, references. ISBN 0-07-046092-2. McGraw-Hill Optical and Electro-optical Engineering Series, Robert E. Fischer and Warren J. Smith, series editors. McGraw-Hill Book Company, 11 W. 19th St., New York, NY 10010 (1985, 1989) $44.95 hardbound.

Reviewed by Richard P. Kenan, Georgia Institute of Technology, School of Electrical Engineering, Atlanta, GA 30332-0250.

This book is devoted exclusively to hybrid integrated optical circuits—that means no semiconductor waveguides. The authors are all active and very productive researchers in hybrid integrated optics. They explain in the preface that they were moved to write a text in which "waveguide theory, device design and fabrication are systematically explained, and which included their own research results." In this, they have succeeded admirably.

The book may be divided into three parts: waveguide theory and waveguide control (Chaps. 2 through 5), fabrication and evaluation methods (Chaps. 6 through 8), and waveguide devices (Chaps. 9 through 11). Chapter 1 is an introduction. A concluding chapter entitled "Subjects of Optical Integrated Circuits" covers several important topics (such as further reduction of absorption and scattering losses, improvement of extinction ratios in switches, materials improvements, etc.) related to needed progress in the field. It gives a brief explanation of why optoelectronic integrated circuits are not dealt with and a short discussion of the trends of development in optical integrated circuits.

The coverage of the subject matter is very extensive and, with the exception of some typographical errors, quite good. I am amazed at the

variety of topics they manage to cover in a relatively short book. As might be expected, the details of derivations are largely omitted, the final results usually being simply stated. However, the discussions leading up to the results are very well chosen. The result is a readable treatise for those already conversant with the field.

In the first part, on theory, the results are remarkably complete. Chapter 2, on waveguide theory, covers step and graded-index guides of both planar and channel types. A short but good discussion of approximation methods for graded-index and for channel guides is given. Tapers, branches, and curves are covered for channel guides. Chapter 3 is a short but sufficient discussion of coupled-wave theory and directional couplers, which forms the basis for following chapters. Chapter 4 is devoted entirely to the use of gratings in integrated optics and contains a very complete discussion of the theoretical issues from the viewpoint of coupled-wave theory. Chapter 5 is titled "Guided-Wave Control" and is a careful survey of how various externally applied fields (electro-, acousto-, thermo-, opto-, and magneto-optic effects) can be used to control the intensity and/or phase of light in a waveguide. Formulas governing each effect are given, along with discussions of appropriate materials. At the end of the chapter is a short table of materials properties for the commonly used materials.

Chapter 6 is a thorough discussion of materials and fabrication techniques for hybrid IOCs. Chapter 7 discusses the microfabrication and processing methods commonly used. Summary tables of chemical etching techniques and of dry etching techniques are given. Much detail on methods for forming gratings on waveguides is included; this is not surprising, in view of the background of the authors. Chapter 8 covers methods for exciting the waveguide modes, once the guide is fabricated. Again, the coverage is extensive.

Chapters 9 through 11 are devoted to discussions of devices—passive devices such as prisms, lenses, gratings, bends, curves, and tapers in Chap. 9; "Functional" (actively controlled) devices such as switches, modulators, and phase shifters in Chap. 10; and IOCs involving combinations of these elements in Chap. 11.

As a text, the extensive coverage without derivations makes it unsuitable for introductory courses in integrated optics. Supplemented with other, more detailed, texts [like Lee's *Electromagnetic Principles of Integrated Optics* (Wiley, 1986)], the book would make a fine resource for an advanced course. However, I would not recommend it, even with supplementary texts, for beginning students.

For researchers in the field, this book is a "must." The references alone are a valuable resource; the collection of all of this material in one book makes it a natural on the reference shelf.

BOOKS RECEIVED

Fiber Optic Communications, Second Edition, by Joseph C. Palais. xi + 291 pp., illus., subject index, references and problems following each chapter, bibliography. ISBN 0-13-314527-1. Prentice Hall, Englewood Cliffs, NJ 07632 (1988). An introductory book on the design, operation, and capabilities of fiber systems for beginners with no background in fiber optics or optical communications. Simple concepts from algebra and trigonometry are used in explaining characteristics of fiber systems, with background material on optics, electronics, and communications.

X-Ray Lasers, by Raymond C. Elton. xiv + 287 pp., illus., subject index, references following each chapter, list of symbols. ISBN 0-12-238080-0. Academic Press, 1250 Sixth Avenue, San Diego, CA 92101 (1990) $59.95 hardbound. Discusses fundamental definitions and practices important to x-ray laser research; basic principles of designing, operating, and diagnosing x-ray lasers; pumping methods for plasma x-ray lasers; and compares x-ray lasers with other high-brightness sources.

Fundamentals of Infrared Detector Operation & Testing, by John David Vincent. From the Wiley Series in Pure and Applied Optics. xxii + 477 pp., illus., subject index, references, problems, and suggested readings, glossary, appendixes of symbols and abbreviations, decibel convention, and characterization of semiconductor materials. ISBN 0-471-50272-3. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158-0012 (1990). An introductory reference for the operation and testing of infrared detectors. Discusses electromagnetic radiation, detector types, mechanisms and operation, radiometric concepts and calculations, test sets, and related skills such as cryogenics, vacuum practices, optics, and electronics.

Superconducting Devices, edited by Steven T. Ruggiero and David A. Rudman. xiii + 396 pp., illus., subject index, references following each chapter. ISBN 0-12-601715-8. Academic Press, 1250 Sixth Avenue, San Diego, CA 92101 (1990) $49.95 hardbound. Presents an up-to-date discussion of the theory, fabrication, and qualification of superconducting device elements and integrated circuitry. Chapters cover new possibilities for superconductor devices, superconducting quantum interference devices, computing, Josephson arrays as high frequency sources, quasiparticle mixers and detectors, digital signal processing, wideband analog signal processing, three-terminal devices, and artificial tunnel barriers.

A Digital Signal Processing Laboratory Using the TMS320C25, by Bernard A. Hutchins and Thomas W. Park. From the Prentice Hall and Texas Instruments Digital Signal Processing Series. xii + 148 pp., illus., subject index, references, six appendixes, disk containing sample problems included. ISBN 0-13-211723-1. Prentice Hall, Englewood Cliffs, NJ 07632 (1990). A guidebook for laboratory setup on the TMS320C25 signal processing system. Assumes that the reader is familiar with the fundamentals of digital signal processing and the general ideas of programming. Topics discussed include assembly language programming, sampling, FIR digital filtering, digital sinewave oscillators, Hilbert transformer and single-sideband modulators, and advanced projects.

Solid Shape, by Jan J. Koenderink. From the Artificial Intelligence Series. xiv + 699 pp., illus., subject index, bibliography, and two appendixes, which include a glossary. ISBN 0-262-11139-X. The MIT Press, 55 Hayward Street, Cambridge, MA 02142 (1990) $65.00 hardbound. Gives engineers and applied scientists access to the extensive mathematical literature on three-dimensional shapes. Chapters discuss shape and space, Euclidean space, curved submanifolds, curves, local patches, global patches, applications in ecological optics, morphogenesis, shape in flux, and flux models.

Radiation Exchange, by Jack H. Taylor. xii + 127 pp., illus., subject index, references following some chapters, one appendix. ISBN 0-12-684560-3. Academic Press, 1250 Sixth Avenue, San Diego, CA 92101 (1990) $24.95 hardbound. Discusses radiation laws, the phenomenon of radiation exchange, and the quantification of radiation. Chapters cover radiation exchange, energy associated with electromagnetic radiation, Planck's radiation law, Kirchhoff's radiation law, radiant emissivity, radiometric calibration, along with applications of radiation exchange such as ice and space, and planetary studies.

SIGMA: A Knowledge-Based Aerial Image Understanding System, by Takashi Matsuyama and Vincent Shang-Shouq Hwang. From the Advances in Computer Vision and Machine Intelligence Series. xvi + 277 pp., illus., subject index, references. ISBN 0-306-43301-X. Plenum Press, 233 Spring Street, New York, NY 10013 (1990) $59.50 hardbound. Discusses various fundamental problems in image understanding and how to cope with them using modern artificial intelligence techniques. Included are surveys of aerial image understanding systems, spatial reasoning methods, algorithms for evidence accumulation, and expert systems for image processing.

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Handbook of Microwave and Optical Components, Volume 3 Optical Components, Kai Chang, editor, xv + 616 pp., illus., subject index, references following each chapter, ISBN 0-471-61367-3. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158 (1990) hardbound $74.95. Covers all of the important components in microwave, millimeter wave, submillimeter wave, infrared, and optical frequency spectra. Information is practical in nature with theoretical and mathematical formulations given only where essential.

Electro-Optical Devices and Systems, by Mohammad A. Karim, xii + 468 pp., illus., subject index, four appendixes. References, problems, and suggested reading list following each chapter. ISBN 0-534-91630-9. PWS-Kent Publishing Company, 20 Park Plaza, Boston, MA 02116 (1990) hardbound $62.25. Emphasizes applying the characteristics of devices and systems to the solutions of optical engineering problems. Topics covered include quantum electronics, optical radiation, photoemitters and photodetectors, lasers, and Fourier- and fiber-optics-based devices and systems.

Probability and Statistics for the Engineering, Computing, and Physical Sciences, by Edward R. Dougherty, xv + 800 pp., illus., subject index, three appendixes, problems follow each chapter. ISBN 0-13-711995-X. Prentice Hall, Englewood Cliffs, NJ 07632 (1990) softbound $51.40. Covers estimation theory, hypothesis testing, statistical methods, probability distributions, and experimental design. Also includes extensive use of operating characteristic curves and wide coverage of mulivariate distributions.

Ozone Measuring Instruments for the Stratosphere, Vol. 1 of Collected Works in Optics, William B. Grant, editor, x + 438 pp., illus., subject index., list of acronyms, references following each paper. ISBN 1-55752-042-9. Optical Society of America, Executive Office, 1816 Jefferson Place, N.W., Washington, DC 20036 (1989) softbound $77. Key breakthrough papers provide a review of the ozone literature. Also includes the editor's discussion of 33 major instruments used in ozone studies.

Short Courses

SPIE EDUCATIONAL PROGRAMS

SPIE short courses are organized to provide fundamental, practical instruction to scientists, engineers, and technical managers whose work focuses on, or is expanding into, optics, electro-optics, and integrated optoelectronics. Course lengths range from a half day (3 1/2 hours) to a full day (6 1/2 hours) to two days (12 hours) of instruction. For more information on SPIE short courses, contact SPIE's Educational Programs Department, P.O. Box 10, Bellingham, WA 98227-0010. 206/676-3290. Fax 206/647-1445. Telex 46-7053.

July 1990—San Diego, Calif.

These courses will be offered in conjunction with SPIE's 1990 International Symposium on Optical & Optoelectronic Applied Science & Engineering, July 8-13, San Diego, Calif.

Basic Optics

Introduction to Optics, Clint D. Harper, Moorpark College, Sun., 9:00 am-6:00 pm and Mon., 9:00 am-12:30 pm.

Introduction to Lasers, Clint D. Harper, Moorpark College, Mon., 2:00-5:30 pm and Tues., 9:00 am-6:00 pm.

Specifying and Tolerancing Optical Coatings, Ronald R. Willey, Opto Mechanik, Inc., Sun., 8:30 am-12:30 pm.

Applications of Optical Coatings, Alfred J. Thelen, Univ. of Kaiserslautern (FRG), Sun., 2:00-6:00 pm.

A Primer in Optical Coating Technology, Michael R. Jacobson, Optical Sciences Ctr./Univ. of Arizona, Mon., 8:30 am-6:00 pm.

Optics of Materials, James D. Evans, Teledyne Brown Engineering, Mon., 2:00-6:00 pm.

Thin Films

Enhanced and Advanced Desposition Techniques for Optical Coatings, Karl H. Guenther, Univ. of Central Florida; Frank K. Urban, Univ. of Miami, Sun., 8:30 am-6:00 pm.

Characterization of Thin Dielectric Layers, Paul W. Bohn, Univ. of Illinois, Tues., 2:00-6:00 pm.

Thin Film Nucleation, Growth and Microstructure: Computer Simulation and Experimental Observation, Karl H. Guenther, Univ. of Central Florida, Wed., 2:00-6:00 pm.

Optical Characterization of CVD Grown Diamond Films, Lawrence H. Robins, National Inst. of Standards and Technology, Sun., 8:30 am-12:30 pm.

Synthesis and Applications of CVD Diamond, Walter A. Yarbrough, The Pennsylvania State Univ., Sun., 2:00-6:00 pm.

Optical Materials

Properties and Performance of Optical Materials, Michael E. Thomas, Johns Hopkins Univ., Mon., 8:30 am-6:00 pm.

Glasses for Bulk, Fiber Optic, and Planar Wave Guide Applications, George H. Sigel, Rutgers Univ., Tues., 8:30 am-12:30 pm.

Infrared Window and Dome Materials: Processing and Performance, Daniel C. Harris, Naval Weapons Ctr., Tues., 2:00-6:00 pm.

Gradient-Index Optics, Duncan T. Moore, Inst. of Optics/Univ. of Rochester, Wed., 2:00-6:00 pm.

Optics of Spectroscopy, Jeremy M. Lerner, Instruments SA, Inc., Thurs., 8:30 am-6:00 pm.

Design and Scattering

Optical Design and Engineering: A Practical Introduction, Robert E. Fischer, Ernst Leitz Canada Ltd. and OPTICS 1, Inc., Sun., 9:00 am-6:00 pm and Mon., 9:00 am-12:30 pm.

Principles of Polarized Light, Robert A. Fisher, RA Fisher Associates, Sun., 8:30 am-6:00 pm.

Principles of Optical Systems Layout, Warren J. Smith, Kaiser Electro-Optics, Inc., Wed., 8:30 am-6:00 pm.

Intermediate Optical Design, Michael J. Kidger, Kidger Optics Ltd., Thurs.-Fri., 9:00 am-6:00 pm.

Binary Optics: Theory, Design, and Applications, Robert E. Knowlden, MIT, Fri., 8:30 am-12:30 pm.

Theory and Measurement of Optical Scattering from Microrough Surfaces, William L. Wolfe, Optical Sciences Ctr./Univ. of Arizona, Sun., 2:00-6:00 pm.

Stray Light in Optical Systems: Causes and Cures, Robert P. Breault, Breault Research Organization, Inc., Mon., 8:30 am-6:00 pm.

Metrology and Fabrication

Principles of Interferometry, James C. Wyant, WYKO Corp., Tues., 8:30 am-12:30 pm.

Modern Optical Testing, James C. Wyant, WYKO Corp., Tues., 2:00-6:00 pm.

Wavefront Measurement and Analysis, Katherine Creath, WYKO Corp., Tues., 8:30 am-12:30 pm.

TV-Holograph (ESPI): Design and Applications, Ole J. Løkberg, Norwegian Inst. of Technology, Sun., 2:00-6:00 pm.

Surface Finish Metrology, Theodore V. Vorburger, National Inst. of Standards and Technology, Mon., 8:30 am-12:30 pm.

Scanning Tunneling Microscope and Atomic Force Microscope: Instruments for Analysis and Inspection of Surfaces on a Scale Varying from a Micrometer to an Angstrom, Yves Martin, IBM Research, Mon., 2:00-6:00 pm.

Nontraditional Optical Fabrication Methods, Robert E. Parks, Optical Sciences Ctr./Univ. of Arizona, Sun., 2:00-6:00 pm.

Optomechanics

Optics for Optomechanical Design, Jonathan Maxwell, Imperial College London (UK), Sun., 8:30 am-6:00 pm.

Introduction to Optomechanical Design for Mechanical Engineers, Daniel Vukobratovich, Optical Sciences Ctr./Univ. of Arizona, Mon.-Tues., 9:00 am-6:00 pm.

Introduction to Optical Alignment Techniques, Mitchell C. Ruda, Talandic Research Corp., Sun.-Mon., 9:00 am-6:00 pm.

Image Vibration and Motion MTFs, Norman S. Kopeika, Ben-Gurion Univ. of the Negev (Israel), Tues., 8:30 am-12:30 pm.

Athermalization of Optical Structures, Michael H.