SPIE Reports

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Book Reviews

Steven C. Gustafson, Book Reviews Editor

Send books for review to the Managing Editor, Optical Engineering, P.O. Box 10, Bellingham, WA 98227-0010. Since there is not space to review all books received, the Book Reviews Editor will use his discretion in selecting those of most interest to the readership of this journal.

Absolute Radiometry: Electrically Calibrated Thermal Detectors of Optical Radiation

F. Hengtsberger, ed., xvi + 266 pp., illus., index, references. ISBN 0-12-340810-5. Academic Press, 1250 Sixth Ave., San Diego, CA 92101 (1989) $69.50 hardbound.

Reviewed by William L. Wolfe, Optical Sciences Center, University of Arizona, Tucson, AZ 85721.

This is a nice collection of eight chapters on various aspects of absolute radiometry, which is also called electrical substitution radiometry. It deals with the measurement of flux with a thermal receiver that is calibrated by the dissipation of electrical energy. The chapters are as follows: The Absolute Measurement of Radiant Power (116 pp.), Absorbers of Optical Radiation (23 pp.), Thermal Detectors of Optical Radiation (10 pp.), Analysis of the Temperature Distribution in a Detector Element (13 pp.), Environmental Corrections in Absolute Radiometry (21 pp.), Instrumental Corrections in Absolute Radiometry (36 pp.), Alternative Optical Power Scales (12 pp.), and DC Substitution Methods Used in Other Areas of Metrology (13 pp.). Five of the eight chapters were written by the editor; the other authors were A. Ono, L. P. Boivin, and K. Mostl.

Chapter one (Hengtsberger), the largest by far, introduces the SI system of units, discusses the fundamentals of radiative transfer, and describes the basics and history of absolute radiometry—from Kurlbaum and Ångström to the work of today. The radiometers of the different Bureaus of Standards are described, and in a single table, 47 different instruments are briefly compared in terms of NEP, responsivity, and estimated uncertainty. The latter ranges from 0.004% to 1%! The treatment is more general

and descriptive than analytical, but the concepts are well described and ample references are given for those who wish the nitty gritty.

Chapter two (Mostl) describes cavity absorbers; disk absorbers, with and without reflectors; cone absorbers; cylindro-cone absorbers; and paints (Nextel, Parson's, Eppley-Parson's, Kodak Black Baking Lacquer, Krylon, Chemglaze Z306 and Z302, Metal Blacks, Metal Films, Carbon Blacks, Electrodepositions, and 10 others that have appeared from time to time). The treatment is descriptive, with directional-hemispherical spectral curves for most of the surface coatings, a general idea of how the cones and cavities work, and some of their pitfalls. The reader can count that only about a page is devoted to each of the absorbers.

Chapter three (Hengtsberger) covers NEI, NEP, responsivity, detectivity, specific detectivity, and the time constant for describing detector performance and then goes on to discuss thermopiles, bolometers, pyroelectrics, and other possibilities for thermal detection. The responsivity equation for each is given, and the use of the detector in absolute radiometry is described. The treatment is adequate for the purpose but surely does not substitute for one of the good books on infrared detectors already in print.

Chapter four (Ono) seems out of place. It is a very detailed calculation of the temperature distribution in a thermal detector. Classical techniques of heat flow and numerical computations are used for several different configurations.

Chapter five (Boivin) reminds us about and gives quantitative results on corrections needed for diffraction at the aperture, atmospheric absorption, refraction, and filters that are tilted.

Chapter six (Hengtsberger) gives general descriptions and calculations of the instrumental corrections, with emphasis on those related to lead heating, reflection from the absorber, case heating, diffraction (although the details of the previous chapter are not repeated), nonequivalence, nonuniformity, dual detectors, feedback, aperture area, response nonlinearity, and a few others.

Chapter seven (Hengtsberger) discusses the techniques of using blackbody simulators and synchrotrons as standard sources and silicon diodes as standard receivers. The treatment is intentionally brief, but the comparison of these techniques to absolute radiometry is very welcome.

Chapter eight (Hengtsberger) is a very brief excursion into calibrations in the microwave region and for particle beams. It lends a nice perspective.

This book arose from the work of a subcommittee on absolute radiometry of the International Commission on Illumination. The group published CIE Technical Report 65 (1985) entitled "Electrically calibrated thermal detectors of optical radiation (absolute radiometers)," in itself a very nice summary of the subject. They felt, however, that they had compiled some additional, valuable material that should not be lost, and they were right. The book covers the subject like a blanket. The exposition is clear, and there are abundant references for the determined reader to pursue. It is very specific in its coverage of absolute radiometry; the audience may be small, but anyone in this field should have the book. If what you want on absolute calibration is not in here, there is a reference to it.

Books Received

Introduction to Surface Roughness and Scattering, by Jean M. Bennett and Lars Mattsson. viii + 110 pp., illus. (with some color plates), subject index, references, two appendixes. ISBN 1-55752-108-5. Optical Society of America, 1816 Jefferson Pl., N.W., Washington, DC 20036 (1989) $44.95 softbound. Defines roughness and discusses how we see and measure this phenomenon. Also covers scattering theories (focusing on classical scattering) and surface statistics.

Fluoride Glasses, edited by Alan E. Comyns. Critical Reports on Applied Chemistry Vol. 27, published on behalf of the Society of Chemical Industry. ix + 219 pp., illus., subject index, index to glass compositions, references following each chapter. ISBN 0-471-92352-4. John Wiley & Sons, Inc., 1 Wiley Drive, Somerset, NJ 08875-1272 (1989) $89.95 hardbound. Discusses glass systems and structures; nucleation and crystallization; raw materials; optical, physical, and chemical properties; fiber drawing; and applications and prospects.

Optical Recording: A Technical Overview, by Alan B. Marchant. Part of the Addison-

Wesley Series in New Horizons in Technology. xvii + 408 pp., illus., subject index, references following each chapter, glossary of terms and acronyms. ISBN 0-201-76247-1. Addison-Wesley Publishing Co., Inc., 1 Jacob Way, Reading, MA 01867-9984 (1990) $47.50 hardbound. Discusses new applications, optical head technology, formats and codes, and media technology.

Progress in Optics, Vol. XXVII, edited by Emil Wolf. xix + 419 pp., illus., subject and author indexes and cumulative index for Vols. I- XXVII, references following each chapter. ISBN 0-444-87425-9. Elsevier Science Publishing Co., 52 Vanderbilt Ave., New York, NY 10010 (1989) $114.50 hardbound. Discusses theory and applications of self-imaging, meso-optical devices, nonimaging optics, nonlinear guided waves, and holography and its application to various inverse wave-theoretical problems.

The Fabry-Perot Interferometer: History, Theory, Practice and Applications, by J. M. Vaughan. Part of the Adam Hilger Series on Optics and Optoelectronics, E. R. Pike and W. T. Welford, series editors. xix + 583 pp., illus., subject index, reference/bibliography list, 20 appendixes. ISBN 0-85274-138-3. Adam Hilger, IOP Publishing Ltd., Techno House, Redcliffe Way, Bristol BS1 6NX England (1989) $130 hardbound. Provides a comprehensive theoretical treatment combined with a strong emphasis on practical details of design, construction,

testing, and operation to provide a grounding in necessary optical and spectroscopic techniques.

Fiber Optics & Optoelectronics, Second Edition, by Peter K. Cheo. Part of the Prentice Hall Series in Solid State Physical Electronics, N. Holonyak, Jr., series editor. xv +448 pp., illus., subject index, references and problems following each chapter. ISBN 0-13-315045-3. Prentice Hall, Englewood Cliffs, NJ 07632 (1990) $49.20 hardbound. Discusses planar and cylindrical dielectric waveguides; dispersion, mode coupling, and loss mechanisms; single mode fibers; light-emission processes in semiconductors; semiconductor lasers; optical transmitters; photodetectors; and optical receivers.

Systolic Array Processors, edited by John McCanny, John McWhirter, and Earl Swartzlander, Jr. xv + 680 pp., illus., references. ISBN 0-13-473422-X. Prentice Hall, Inc., Englewood Cliffs, NJ 07632 (1989) $61.60 hardbound. Sections on hardware systems, algorithms and architectures, bit-level systems, matrix algorithms, general purpose architectures, VLSI implementation, VLSI architecture/fault tolerance, fault tolerance, design tools/synthesis, and software issues.

Digital Control System Analysis and Design, Second Edition, by Charles L. Phillips, H. Troy Nagle. xviii + 631 pp., illus., index, references, problems. ISBN 0-13-213596-5. Prentice Hall, Inc., Englewood Cliffs, NJ 07632 (1990) $54.40 hardbound. Chapters

on discrete-time systems and the z transform, sampling and reconstruction, open-loop discrete time systems, closed-loop systems, system time-response characteristics, stability analysis techniques, digital controller design, pole-assignment design and state estimation, linear quadratic optimal control, sampled-data transformation of analog filters, digital filter structures, microcomputer implementation of digital filters, finite-wordlength effects, and case studies.

Fundamental Concepts in Communication, by Pierre Lafrance. xiv + 432 pp., illus., index, references/bibliography. ISBN 0-13-335738-4. Prentice Hall, Inc., Englewood Cliffs, NJ 07632 (1990) $49.20 hardbound. Sections cover signal theory, noise, information theory and coding, statistical detection theory, communication performance, error control coding, and rate-distortion theory.

Dynamics of Structures, by Jagmohan L. Humar. Prentice Hall International Series in Civil Engineering and Engineering Mechanics, William J. Hall, series editor. xix + 780 pp., illus., index, list of symbols, selected readings, problem sets. ISBN 0-13-222068-7. Prentice Hall, Inc., Englewood Cliffs, NJ 07632 (1990) $57.40 hardbound. Sections cover formulation of the equations of motion for discrete parameter systems, including continuous systems, and solution of the equations of motion for both single- and multiple-degrees-of-freedom systems.   ☉

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.

February 1990—Santa Clara, Calif.

These courses will be offered in conjunction with the SPIE/SPSE 1990 Symposium on Electronic Imaging Science and Technology, Feb. 11-16, Santa Clara, Calif.

Image Sensors ═══════════

Scientific Charge-Coupled Devices, James R. Janesick, Jet Propulsion Lab., Sun., 8:00 am-5:00 pm.

Advances in Solid-State Image Sensors, Walter F. Kosonocky, New Jersey Inst. of Technology and David Sarnoff Research Ctr., Wed., 8:00 am-5:00 pm.

Image Tube Technology, Illes P. Csorba, Imaging Tubes Technology, Tues., 8:00 am-noon.

Image Processing ═══════════

Imaging in Medicine: Techniques, Systems and Information, Hans Roehrig, Univ. of Arizona, Sun., 8:00 am-5:00 pm.

Picture Archiving and Communication Systems, William J. Dallas, Univ. of Arizona, Sun., 8:00 am-noon.

Digital Image Enhancement, Majid Rabbani, Eastman Kodak Research Labs., Sun., 8:00 am-noon.

Digital Image Restoration, Majid Rabbani, Eastman Kodak Research Labs., Sun., 1:30-5:30 pm.

Digital Image Compression, Majid Rabbani, Eastman Kodak Research Labs., Mon., 8:00 am-5:00 pm.

Nonlinear Image Processing, Gonzalo R. Arce, Univ. of Delaware; Edward J. Delp, Purdue Univ.; Sun., 8:00 am-5:00 pm.

Digital Image Processing Fundamentals, Mohan M. Trivedi, Univ. of Tennessee, Wed., 8:00 am-5:00 pm.

Image Storage ═══════════

Basics of Magnetic Recording, John C. Mallinson, Univ. of California/San Diego, Sun., 8:00 am-noon.

The Future of Magnetic Recording, John C. Mallinson, Univ. of California/San Diego, Sun., 1:30-5:30 pm.

Principles of Magneto-Optical Data Storage, Masud Mansuripur, Univ. of Arizona, Mon., 8:00 am-5:00 pm.

Read Only Optical Storage: Principles and Practice, David H. Davies, 3M Mountain View Lab., Sun., 1:30-5:30 pm.

Introduction to Signal Processing in Digital Recording, Dennis G. Howe, Eastman Kodak Co., Mon., 8:00 am-5:00 pm.

Design of Digital Servo Control for High Density Magnetic Recording, Hal H. Ottesen, IBM Corp., Fri., 8:00 am-5:00 pm.

Vision ═══════════

Colorimetry: A Tool for Device Independent Specification, Roy S. Berns, Rochester Inst. of Technology, Sun., 8:00 am-5:00 pm.

Models of Human Vision, Andrew B. Watson, NASA/ Ames Research Ctr., Sun., 8:00 am-noon.