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book reviews

Engineering Metrology by G. G. Thomas, Halsted Press, 1974, 420 pages, $17.50.

REVIEWED BY R. A. DASKIVICH[1]

This book is written for readers with divergent interests. The first half treats the physics and mathematics of optical metrology while the final chapters include topics familiar to the practicing metrologist. Subject matter will be reviewed in order of appearance in the text.

Interferometers of various types are effectively presented in Chapter 1 through the use of many examples. Perhaps too much emphasis is placed on the physics of laser action in underlining the importance of this device as a coherent source. Once introduced, the laser is extensively discussed in the second chapter.

Fourier transform theory is used to present the concepts of spatial and temporal coherence in Chapter 2. The section on laser design and an exhaustive listing of various laser types are unexpected in a book addressing metrology. This level of detail continues in the following chapter on holography.

Fundamental principles of holography incorporate a mathematical development usually found in a graduate course in coherent optics. Holographic interferometry is discussed to the point of exploring the photochemical processes characteristic of various recording media. The object of this discussion is to provide an understanding of the resolution now obtainable with interferometric holograms. Factors which limit the uses of holography are the final topic in Chapter 3.

Moire fringes are easier to produce than holograms and the point is made early in Chapter 4 that most engineering measurements do not require precision to a fraction of a light wavelength. An analytical treatment of diffraction gratings accompanies the material on moire fringes. Details of diffraction grating manufacture (including a section on ruling engines) convey an appreciation for sources of error in optical gratings. This completes the optical metrology material, and the balance of the book encompasses subjects on the mechanics of metrology.

Length and diameter discussions commence with the SI definition of the meter in Chapter 5. Gauge blocks and the mysteries of wringing are treated thoroughly at the expense of diameter standards which receive only two pages. Instruments from the micrometer to 3-axis measuring machines are included with the notable omission of air gauges.

The chapter on angle measurement uses many developments from the National Physical Laboratory to illustrate calibration techniques. An extensive treatment of grating prisms is followed by an effective presentation of the autocollimator. Applications of the sine bar, radial gratings, and miscellaneous procedures of angle metrology round out this section.

While angle measurement requires no absolute reference standard, straightness is the fundamental form in metrology. Chapter 7 cites straightness measurement techniques from the knife-edge and theodolite to numerous applications of the alignment telescope including marine engine bearing alignment and nuclear power station layout. The author's broad industrial experience is further indicated by an illustration of the Rodolite to qualify a gear hobbing machine. This statement from the three pages on flatness illustrates the meager knowledge generally available on this concept: "Surface finish is a feature of flatness which is functional."

In Chapter 8 surface texture is addressed with emphasis on principles and history of instrumentation at the expense of current industrial practice. The relation between function, production costs, and surface texture permeates the text. The Opitz classification scheme for surface function serves as an outline for treating surface interactions during elastohydrodynamic lubrication, running-in, and solid-to-solid contact. Surface texture instruments surveyed include optical, electron-optical, interferometric, surface adsorption, capacitance and stylus devices. A brief history of the E-system and M-system precedes an enumeration of statistical parameters used to specify surface roughness. Present problems in surface texture measurement are succinctly stated at the end of the chapter. This and the succeeding chapter on roundness are most useful for the metrologist-engineer.

Departures from roundness have presented some of the greatest measuring challenges in metrology. The final chapter of the book contains a complete overview of the importance of roundness, the instrumentation used and the standards employed. A subtle distinction is made between roundness and circularity. The advantages and limitations of rotating spindle vs rotating part instruments are clearly delineated. A section on the interpretation of polar charts is well done, but more attention to reference centers might be warranted. Details of the least-squares center predominate the discussion although the minimum radial separation center is preferred in the U.S. Mention of several commercially available roundness instruments and material on calibration and accuracy end the book.

In summary, the first half of *Engineering Metrology* stresses the physics and mathematics of optical metrology. The format uses subject headings and well-placed line drawings effectively. The British standards cited throughout the text are most useful to those involved with engineering in the United Kingdom. As a whole, the book is a useful reference for metrologists and precision engineers. Finally, the chapters on surface texture and roundness provide a basis in metrology for students and practicing engineers alike.

Modern Developments in Lubrication Mechanics, J. A. Walowit and J. N. Anno, Halsted Press, 1975, $31.50.

REVIEWED BY B. J. HAMROCK[1]

The text treats three selected developments in lubrication mechanics; elastohydrodynamic lubrication, metalworking lubrication, and foil bearing operation. In giving a treatment of these three areas

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