Book Reviews

Dr. Brian J. Thompson
Director, The Institute of Optics
The University of Rochester
College of Engineering and Applied Science
Rochester, New York

Comment

A new inexpensive series has recently appeared to assist the engineer to keep abreast of today's technologies and tools. The Professional Engineering Career Development Series (PECDS) is published by Barnes & Noble under consulting editorship of Dr. John J. McKetta, Jr. and Dr. Maurits Dekker. These gentlemen are supported by an eminent editorial advisory committee and a large engineering professional advisory group. The emphasis of the series is clearly stated by Dean E. Griffith in a signed statement that appears on the rear cover of the early volumes.

"If you are an engineer, do engineering work, work with engineers, or make decisions concerning engineering, you appreciate the difficulties of keeping one step ahead of today's vast information flux.

The books in the Professional Engineering Career Development Series are planned and coordinated in terms of titles, authors, content, approach, and perspective with you, the practitioner, in mind. Each book is a building block providing the proven tools, techniques, and vocabulary that enable you to comprehend and apply up-to-date engineering.

The series is a means to fill in your inventory of professional skills, to build your confidence for future challenges".

Four volumes have appeared so far, two of which are certainly of interest to readers of the journal and hence they are reviewed. The other two volumes are also mentioned but only to indicate content.

PROBABILITY FOR PRACTICING ENGINEERS – By Henry L. Gray & Patrick L. Odell. (Professional Engineering Career Development Series) Barnes & Noble Inc., New York 1970. Price $4.95.

The book concerns itself with an exposition at intermediate calculus level of the basic concepts and nature of probability theory and its application to physical problems. The method of presentation chosen by the authors is essentially the "theorem-corollary" system extensively modified by discussion of important points that are embodied in the theorems.

The authors start out with a chapter on basics and then follow a clear discussion of moments and limit theorems and spend considerable time in presenting the properties and applications of the more important probability density functions. Here they introduce the concept of reliability and hazard functions (instantaneous failure ratio) as applied to physical systems or ensembles of articles. These concepts are then used to draw comparisons between some of the more useful density functions, exponential, weibull, log normal etc.

The next section on statistical estimation of process parameters is in this reviewer's opinion the best section of the book. The text is clear and there are many worked examples. Here the authors cover the topics of unbiased, minimum variance, maximum likehood and interval estimators. They have taken great pains to point out the limiting properties associated with each method of estimation.

The appendices contain the necessary tables of Chi-squared, and cumulative t and F distributions.

The concluding two chapters contain discussions of stochastic processes and linear estimation of stochastic processes. The discussion of time average and ergodicity is clear but the concluding chapter on linear estimation, while well structured is extremely compact.

The text is understandable in its clear presentations of the basics of probability theory for the mathematically inclined reader. It should be most useful as a concise reference of ideas and concepts to the engineer who already has some background in engineering statistics and who wants to sharpen his basic knowledge in this field.

John C. Heurtley

APPLIED ENGINEERING STATISTICS FOR PRACTICING ENGINEERS – By Lawrence Mann, Jr. (Professional Engineering Career Development Series) Barnes & Noble Inc., New York 1970. Price $4.95.

If the application of Statistical Methods to practical problems encountered in engineering or manufacturing decision-making situations are your concerns, you will find this book a clear, well written comprehensive guide. The author, who developed the book based upon in-plant seminars and short courses, has taken pains to include many detailed examples arising from practical concerns. There is the expected discussion on the concepts of probability, statistical parameters and the meaning and interrelationships of both discrete and continuous variable probability distribution functions.

The discussion and applications of Student's t test are particularly interesting, the examples including comparison of paired-tests and tests for difference between means of two different samples of a process. The discussion on analysis of variance in Chapter 5 is focussed upon applications. Here the reader is guided in a systematic way on how to statistically decompose a manufacturing situation into component parts so that structured similarities and dissimilarities are exposed. For example there is presented a detailed example on testing whether or not there is a statistically significant interrelation of the effects of alloy composition, stressing and machining upon the strength of metal specimens.

The book concludes with a clear exposition on regression models, both linear and curvilinear and how one goes about ascertaining which model best fits a given set of data. As usual, the discussion is strengthened by extensive use of examples.

The remarkable clarity achieved by the author, permits the reader to gain both a general understanding of the subject as well as, if desired, a working knowledge that can be applied to actual situations. There is a good choice of selected references categorized as to mathematical difficulty as well as a glossary, an index and eight appendices containing necessary tables. Characterized by its clarity and exposition, this self-contained text should be in the library of any engineer who is interested in the practical application of statistical methods.

John C. Heurtley

QUANTITATIVE MANAGEMENT METHODS FOR PRACTICING ENGINEERS – By Scott T. Poage. (Professional Engineering Career Development Series) Barnes & Noble Inc., New York 1970. Price $4.95.

The author's intent is to provide the reader with "a working command of the area of modern quantitative management". The scientific process and decision theory are covered in early chapters. Replacement models, queuing theory, networks, inventory models, programming, simulation, forecasting, production systems and organizational models are chapter headings which indicate the content of this volume.

B. J. Thompson

CORROSION PREVENTION FOR PRACTICING ENGINEERS – By Joseph F. Bosich. (Professional Engineering Career Development Series) Barnes & Noble Inc., New York 1970. Price $4.95.

Mr. Bosich opens the book with the sobering statement that the cost of corrosion is $20 billion per year in the United States. The first chapter also contains a clear statement of "what is known about corrosion" and then an equally clear statement on "what is not known about corrosion". The many types of corrosion are commented upon briefly. The subsequent chapters deal with principles of cathodic protection, protective coatings, paint testing, corrosion testing, fundamentals of plastics in corrosion control. The final chapter in the book consists of a very interesting set of case histories.

B. J. Thompson

MICROPHOTOGRAPHY – Photography and Photofabrication at Extreme Resolution, 2nd Edition. By G. W. W. Stevens. John Wiley, New York, 1970., 510 pp. Price $25.00.

Microphotography is the art of forming, and reproducing, greatly reduced images of documents, charts, and other plane objects, on high-resolution photographic film. Microphotography was practiced in the early days of photography as an amusement device and for sending secret messages in wartime. Today microphotography is used extensively in information storage and dissemination (microfilms), and for the manufacture of solid-state microcircuits, linear and angular scales, diffraction gratings, reticles, fine sieves, aperture masks for color television tubes, and numerous other minute objects, by the use of photoresist and etching techniques.

The magnification ratios used in microphotography extend from unity (1:1 copying) to 1/200 or even smaller, but the object being photographed is generally plane and stationary, and extended exposure times are possible with monochromatic light. These limitations enable the optician to produce, albeit with very great difficulty, lenses adequate for the purpose, even though startlingly high resolving power and very high response at lower spatial frequencies are demanded.

It seems quite certain, to anyone reading this fascinating book, that the author has tried many if not all of the techniques he describes. He gives hints, and lists the precautions that must be taken to secure a satisfactory record. He discusses in great detail the procedure for focussing the camera and determining the optimum exposure, and indicates numerous gadgets and special procedures that he has found helpful in these operations. After all, an image which shows lines clearly resolved at a spacing of 1000 lines per millimeter is at the borderline of what is possible using light of wavelength about 1/2000 mm. Yet such fine lines are routinely recorded in some microphotographic work.

This book is not only easy to read, it is positively exciting! One feels the urge to go to the laboratory and try to repeat some of these fantastic recording achievements for himself. For instance, we read that E. Goldberg was able to produce legible images of a page of Bible only 0.1 mm high; thus he could in principle photograph 50 complete Bibles on one square inch of film. Indeed, for a time "Bibles per square inch" became a unit for expressing achievement in microphotography!

Full details are given of the processes used in the incredible microcircuit industry of today. That such devices are possible is a tribute to the lens maker, the emulsion maker, and the person who operates the various step-and-repeat and copying cameras used in this work. Microphotography on a photoresist, followed by chemical etching, has been used to make holes as small as 1/1000 inch in diameter in thin metal for sieves, and for many other microforming operations, which would be quite impossible in any other way. Practical transmission diffraction gratings can be made by photographing fine interference fringes on high-resolution film, while fine scales of considerable length can be made by similar techniques.

One may say that this remarkable book is a necessary and almost sufficient guide for the making of microfilms and for most of the other present-day applications of microphotography. It is strongly recommended for anyone working in any field in which ultra-small photographic images must be made and used. Although written in England, the American reader is constantly kept in mind, and the author gives U.S. equivalents for the many British terms, manufacturers, and customs referred to in the book.

R. Kingslake

LASERS AND MASERS – By Charles A. Pike. Howard W. Sams, Publisher, 176 pp. Price $4.95.

LASERS AND MASERS is a book which is aimed at teaching the fundamentals of laser operation to the increasing number of people who are coming into contact with laser devices and whose background in atomic physics and optics is weak. This group of people includes a wide scope ranging from technicians in the laser industry itself to medical researchers; from surveyors to dress-makers. Such a group of people will be found to lack both the time and the desire to attend a formal college course on laser fundamentals even where these are

available. The presentation of material in the book is designed for just such a group of people: the approach is that of programmed learning. The first half of the book is devoted to a presentation of the principles of atomic and molecular physics and the interaction of radiation and matter. The second half of the book is given over to a discussion of particular laser systems and applications.

The portion of the book dealing with atomic physics and basic laser principles is well done and effective as far as it goes. However, it is desperately short of any discussion of optical resonators and their influence on the propagation characteristics of laser beams. In addition, it appears that the author has misunderstood the concepts of temporal and spatial coherence especially as applied to lasers. The figure on page 153 which is supposed to illustrate the difference between spatially coherent and incoherent beams actually shows two beams which are completely coherent but of different phase!

The second half of the book, dealing with specific devices, is unfortunately inadequate and out of date. There is no discussion of any important laser system developed since 1961. This includes the various forms of Neodymium lasers, the noble gas ion lasers, the molecular lasers (such as CO_2), and the dye lasers.

The chapter on applications could usefully be expanded, especially in the areas which emphasize the unique optical properties of laser beams. For example, only three lines are devoted to holography and no mention is made of the role of lasers in testing optical components. In fairness, it is difficult to survey all the important applications of lasers in a 20 page chapter. It would be better to offer a second volume on this subject.

In summary, the weaknesses of the book arise generally from errors of omission rather than from misstatements. Thus the book will still make an important contribution if it stimulates the reader's appetite for more information in this rapidly developing field.

J. M. Forsyth

Conference Calendar

June

9–12 Internat. Fed. of Assoc. of Textile Chemists and Colourists, Baden Baden *Verein der Textilchemiker und Coloristen VTCC, D-69, Heidelberg, Rohrbachstr. 65, Germany.*

13–16 ASME Summer Ann. Mtg., Marriott Hotel, Saddlebrook, N.J. *A. B. Conlin, Jr., ASME Tech. Depts., E. 47th St., New York, N.Y. 10017.*

14–18 26th Ann. Molecular Spectroscopy Symp., OSU *K. N. Rao, Phys. Dept., OSU, 174 W. 18 St., Columbus, Ohio 43210.*

21–24 Ann. Cong. Canadian Assn. of Physicists, Ottawa *J. L. Meunier, 151 Slater St., Suite 903, Ottawa 4, Ont., Can.*

21–24 ISA-AIP 5th Temperature Measurement and Control in Sci. and Industry Symp., Washington, D.C. *O. L. Roberson, Owens-Ctr., Granville, Ohio 43023.*

21–25 Electron Probe Microanalysis and Scanning Electron Microscopy, course, Lehigh Univ. *Joe Goldstein, Lehigh Univ., Bethlehem, Pa.*

21–July 2 MIT Summer Prog. in ir Spectrosc., Cambridge *J. M. Austin, Room E19-356, MIT, Cambridge, Mass. 02139.*

27–July 2 ASTM, Atlantic City, N.J. *ASTM, 1916 Race St., Phila., Pa. 19103.*

28–30 AAS, Washington Plaza, Seattle *H. Kennet, Spacecraft Br., Boeing Co., Box 3999, Seattle, Wash. 98124.*

July

5–11 Modern Optics in Metrology, course, Inst. d'Optique, Paris *Summer School Office, Inst. D'Optique, 3, Boulevard Pasteur, 75 Paris 15e.*

8–9 Rensselaer Polytech. Inst., Color Technology for Management, course, Troy *Office of Cont. Studies, Rensselaer Polytech. Inst., Troy, N.Y. 12181.*

12–16 Fundamentals of Infrared Tech., Univ. of Mich., Ann Arbor *Continuing Engrg. Ed., Chrysler Center – North Campus, Univ. of Mich., Ann Arbor, Mich. 48105.*

12–16 Rensselaer Polytech. Inst., Prin. of Color Tech., course, Troy *Office of Cont. Studies, Rensselaer Polytech. Inst., Troy, N.Y. 12181.*

12–23 Computer Graphics for Designers, Univ. of Mich., Ann Arbor *Continuing Engrg. Ed., Chrysler Center – North Campus, Univ. of Mich., Ann Arbor, Mich. 48105.*

19–23 Advanced Color Measurement, course, Rensselaer Polytech. Inst., Troy *Office of Cont. Studies, Rensselaer Polytech. Inst., Troy, N.Y. 12181.*

19–23 Advanced Infrared Technology, Univ. of Mich., Ann Arbor *Continuing Engrg. Ed., Chrysler Center – North Campus, Univ. of Mich., Ann Arbor, Mich. 48105.*

19–23 2nd Internat. Conf. on Light Scattering in Solids, Paris *M. Balkanski, Faculte des Sciences, Tour 13, 9, Quai Saint-Bernard, Paris, 5e, France.*

21–23 Visual Performance when Using Optical Instruments, symp., GOC, ICO, Munich *H. Scholber, Inst. für Medizinische Optik, 8 München 13, Barbarastrasse 16.*

26–Aug. 6 Inst. of Optics, Contemporary Optics, course, Univ. of Rochester *B. J. Thompson, Univ. of Rochester, Rochester, N.Y. 14627.*

26–Aug. 6 Optical Processing: Fundamentals with Applications, Univ. of Mich., Ann Arbor *Continuing Engrg. Ed., Chrysler Center – North Campus, Univ. of Mich., Ann Arbor, Mich. 48105.*