which was later acquired by International Telephone and Telegraph Co. Mr. Farnsworth served as President and Technical Director of the ITT Farnsworth Research Corp. and Technical Consultant to ITT Industrial Laboratories at Fort Wayne. He retired in 1967.

His development of a working system of television transmission occured simultaneously with that of Vladimir Zworykin, but Mr. Farnsworth is believed to have made the first transmission. Although best known for his work in television, he also helped develop radar systems and special-purpose vacuum tubes.

Membership in professional organizations other than the SMPTE included American Association for the Advancement of Science, Institute of Electrical and Electronic Engineers, Royal Society of Arts and Royal Society for the Encouragement of Arts.

books reviewed

Parametric Amplifiers

By D. P. Howson and R. B. Smith. Published (1970) by McGraw-Hill Publishing Co. Ltd., Maidenhead, Berkshire, England (Available in the United States from McGraw-Hill Book Co., 330 W. 42 St., New York, NY 10036). 165 + viii pp. Illus. Diagrams. 5½ by 8½ in. Price $12.75.

The object of this book is to provide a comprehensive background to the subject of parametric amplifiers and frequency converters. Chapter two provides a good treatment of the physics of the varactor and its noise. Chapter three offers a discussion of the general principles of the amplifier and frequency converter as based on Manley-Rowe equations for energy transfer in the nonlinear reactance circuits. No mention is made of the more fundamental approach based on the Mathieu equation. Chapter four covers the amplifier design considerations. This, for a practicing microwave engineer, is the most important aspect of the subject, and, unfortunately, the treatment here is too general to enable one to carry out a complete design. Lacking are the details of the varactor loading circuits and their effect on the amplifier bandwidth. The improvement of bandwidth by filter techniques is mentioned but a treatment of the most widely used double-tuning of the signal circuit is not included. The last two chapters deal with the four frequency amplifiers and converters. Although this is of some the-

oretical interest, in view of the circuit complexity, these are seldom used in practice.

The book concludes with a brief treatment of two diode circuits. In view of their practical importance, this should have been expanded in greater detail.

The book offers a comprehensive list of references.—*Paul Bura,* RCA Corp. Defense Electronic Products, Astro-Electronics Div., P.O. Box 800, Princeton, NJ 08540.

Introduction to Signal Transmission

By William R. Bennett. Published (1970) by McGraw-Hill Book Co., 330 W. 42 St., New York, NY 10036. 266 + xvi pp. Diagrams. 6 by 9 in. Price $12.50.

The author states in the preface that this book was prepared from "the text for a two-semester course offered to seniors and first-year graduate students in electrical engineering." Further, the author states that "the basis of the present offering is that communications theory is essentially a study of sine waves and that the student should learn how this comes about before getting embroiled in more complicated matters."

The first chapter deals with representing signals by sine waves. The second chapter extends the idea of sine waves as building blocks to the representation of noise waves and introduces some elementary notions of probability. Chapter 3 shows how the fundamental principles can be applied to the baseband transmission of telephone signals. Chapter 4 deals with the baseband transmission of telegraph signals and provides the student with foundations to progress into modern high-speed digital transmission. Chapter 5 discusses the baseband television signal. It is a short chapter of seven pages dealing with the Fourier series representation of a television signal and the aperture effect in television transducers. Chapter 6 deals with the basic principles of modulation by which process baseband signals are translated to frequencies more suitable for long-distance transmission. Chapter 7 is a more comprehensive study of linear modulation systems, and chapter 8 deals in like manner with nonlinear modulation systems. Chapter 9 introduces multiplexing. The characteristic features of frequency division (F.D.M.) and time division multiplexing (T.D.M.) are explained in terms of sine wave models. The tenth and final chapter deals with the digitizing of analog signals. There is an Appendix on Bessel Functions. Each chapter has a list of references and a number of problems are offered for the serious student.

The author is presently Charles Batchelor Professor of Engineering at Columbia University. He was formerly Head of the Data Theory Department at Bell Telephone Laboratories.

The treatment is largely mathematical. The author assumes that the reader has had exposure to Fourier analysis. Although the book is oriented to the needs of the telephone company engineer, there is much of importance to the broadcast engineer. In particular, the chapters on noise and modulation are basic to broadcasting. Many of the problems, too, are of direct and practical interest to the broadcast engineer. For example, at the end of the chapter on modulation there is the question "What sources of interference and distortion would you expect to be significant in the reception of the NTSC signals?"—*S. F. Quinn,* Canadian Broadcasting Corp., 7925 Cote St. Luc Rd., Montreal 267, P.Q.

International Lighting Vocabulary, 3rd Ed.

Published by Bureau Central de la CIE, 4 Av du Recteur Poincarè, 75 Paris (16), France. Available in the United States from H. K. Hammond, III, Secretary, U.S. National Committee, CIE, National Bureau of Standards, Washington, DC 20234. 359 pp. paperbound. Price $16.00. (Checks should be made payable to "U.S. National Committee, CIE").

This monumental work contains internationally accepted definitions for some 660 terms in the general fields of radiation and lighting, each in four languages: French, English, German and Russian. The terms only, but not the definitions, are also given in five other languages: Spanish, Italian, Dutch, Polish and Swedish. Synonyms are included to bring the total number of terms defined to nearly 900.

This volume is primarily the work of Committee E-1.1 (Definitions-Vocabulary) of the International Commission on Illumination (CIE), and Group $1/WG_p45$ of the International Electrotechnical Commission (IEC), with the cooperation of other CIE and IEC committees, various international organizations, including, among others, ISO/TC 12, the SUN Commission of the International Union of Pure and Applied Physics, the Association of Lighthouse Authorities, and many individuals throughout the world.

Units employed in the vocabulary are in the International System of Units (SI). The symbols for the units, quantities, etc., conform to the recommendations of international organizations [ISO/TC 12, CIE, IEC (Publication 27) SUN Commission]. A few units, not belonging to the SI system, are quoted solely for information.

The definitions and symbols are consistent with those in USA Standard Nomenclature and Definitions for Illuminating Engineering, USA Z7.1—1967 Revision of Z7.1-1942, UDC 653.014.8:-621.32, sponsored by the Illuminating Engineering Society and approved August 16, 1967, by the USA Standards Institute. Each volume contains some terms not included in the other.

The scope of the definitions in the *International Lighting Vocabulary* is indicated by the Section and Subsection headings. In each case the number in brackets following the heading indicates the number of terms defined under that heading. *Radiation* — 1. Fundamental concepts [22], 2. Quantities [17], 3. Thermal radiation [16]; *Photometry Quantities and Units* [28]; *Colorimetry: Fundamental Concepts and Quantities* [54]; *Optical Properties of Matter* [46]; *Eye and Vision* [65]; Color rendering [7]; *Radiometric, Photometric and Colorimetric Measurements* [41]; *Physical Receptors* [20]; *The Production of Light* [23]; *Lamps* — 1. Incandescent lamps [9], Discharge lamps and arc lamps [29], Lamps of special types for special purposes [28]; *Components of Lamps and Auxiliary Apparatus* [57]; *Illuminating* — General [45], Daylighting [7]; *Lighting Fittings and Their Components* [54]; *Projectors* [9]; *Lighting for Traffic and Signalling* — 1. General terms [14], 2. Navigation [7], 3. Air-traffic [34], 4. Street-traffic [19], 5. Retroreflectors [12].

Preliminary remarks at the beginning of each section dealing with quantities and units explain some of the conventions used, and the applicability of some of the defined terms. Spelling in general follows English usage, rather than American, where the two differ.

Usefulness of the *Vocabulary* is greatly enhanced by nine indexes, one in each of the nine languages.

This book should be in the reference library of every serious worker in the fields of color, lighting, radiometry, thermal radiation measurements and photometry. Use of the terms and symbols defined in this volume by all writers in these fields will greatly aid in the exchange of information—*Joseph C. Richmond,* Institute for Basic Standards, National Bureau of Standards, Washington, DC 20234.

Optical Data Processing

By Arnold Roy Shulman. Published (1970) by John Wiley & Sons, 605 Third Ave., New York, NY 10016. 710 + viii pp. Illus. Diagrams, 6 by 9 in. Price $27.50.

It is only in recent years that it has been recognized that optical processes embody the carrying out of mathematical operations, and that they can therefore be used as analog computer elements. In his introduction the author points out that "Optical data processing permits with a relatively simple configuration of lenses and apertures the implementation of mathematical functions such as multiplication, Fourier transformation, correlation, and convolution... A signal can vary from point to point in a plane and thus depends on two coordinates. This two-dimensional characteristic of optical signals represents an advantage over electronic systems that are limited to only one coordinate (usually time). Two-dimensional signals such as pictures or printed matter (pages) can be processed as a whole without scanning as in electronic systems (which is required to reduce them to a single dimension). Thus an entire block or page of information can be processed simultaneously rather than bit by bit."

The author goes to great lengths to introduce the subject to the novice by extensive chapters on optics, Fourier transforms, optical spectrum analysis, photographic film, and a detailed analysis of optical data processing systems. He also includes detailed examination of holographic techniques.

The major weaknesses of optical processing are its difficulties with phase as compared with amplitude and the need for the use of coherent light with its complications, or bias to eliminate negative quantities, and the relatively limited accuracy practically achievable. Nevertheless it has shown interesting possibilities where it is applicable. The field is, of course, specialized, and even marginal in the area of scientific

photography. — *Pierre Mertz*, Consultant, 66 Leamington St., Lido, Long Beach, NY 11561

Expanded Cinema

By Gene Youngblood. Published (1970) by E. P. Dutton & Co., 201 Park Ave. S., New York, NY 10003. 432 pp. Illus. 5½ by 8 in. Paperbound. Price $4.95 (in Canada, $5.95).

"Youngblood's *Expanded Cinema* is the beginning of the new era educational system itself. Tomorrow's youth will employ the video cassette resources to bring in the scenario documents of all of humanity's most capable thinkers and conceivers. Only through the scenario can man possibly 'houseclean' swiftly enough the conceptual resources of his spontaneous formulation." — from the 25-page Introduction by R. Buckminster Fuller.

This is an exciting, a challenging, a puzzling and a practical book. Exciting, because it suggests that things really are different ("things" = ways of communicating, ways of learning, and ways of coping with a frightening universe) and that any King Canutish attempts to keep "things" as they were in, say, 1950, will end up with the attempter either beneath the waves or in a terrified scramble up the beach. Challenging, because not everyone "likes" or is even very much interested in what the talented young ones are doing with film, television and videotape. Puzzling, because not all of us have the referents to understand what the young filmmakers are "talking" about — Jung, *I Ching*, *The Tibetan Book of the Dead*, St. Augustine, and films that have no "story" but only images, colors and sounds and that "show a little more than human beings are supposed to see" (p. 163) — instead of "story line, stunt men, costuming." Practical, because of "how to and why" discussions of new machines and techniques, including EVR. In the chapter on Cybernetic Cinema, for example, the author says, "Three types of computer output hardware can be used to produce movies: the mechanical analogue plotter, the 'passive' microfilm plotter and the 'active' cathode-ray (CRT) display console." Among the tools of expanded cinema, the author devotes chapters to such techniques as Keying and Chroma-Keying; Feedback ("Video feedback may be intentionally induced and carefully controlled..."); Telecine Projection; and Videotronic Mixing, Switching and Editing. He devotes an entire section (Section Seven — the last section) to Holographic Cinema: A New World. This section contains, among others, chapters on Wavefront Reconstruction; Lenseless Photography; Dr. Alex Jacobson: Holography in Motion; Limitation of Holographic Cinema; and Projecting Holographic Movies.

Perhaps all that can be said about this book is that it must be read (and studied) because it is impossible to give anything but the most shadowy notion of what it really is in a brief review. It contains 284 photographs, of which 60 are in color. — *Edit.*