Communication

Statistical Theory of Communication. By Y. W. Lee. John Wiley & Sons, Inc., New York, N. Y., 1960. Cloth, 6 × 9 in., xvii and 509 pp. $16.75.

REVIEWED BY V. E. BENES[1]

PROFESSOR LEE's book is an introductory account intended for an engineering audience. Except for very few passages, the presentation is detailed, at an elementary level, and slow enough so that the book could be used by undergraduates who know some Fourier analysis and electrical engineering. The principal emphasis is on harmonic analysis rather than on stochastic processes and probability. The part of probability theory that is covered in the text consists of elementary probability and simple random wave-forms, e.g., shot noise. The bulk of the book is devoted to the properties and uses of spectra and correlation functions in linear systems, e.g., the Wiener-Hopf equation.

Since mechanical and electrical systems differ mostly in point of the bandwidths and frequencies of the signals, the emphasis on harmonic analysis in the book makes it more interesting to mechanical engineers than would have been a treatise (equally well described by the title) on abstract information after the style of Feinstein or Khinchin. The book is valuable in two chief respects: (a) It contains a careful explanation of generalized harmonic analysis; (b) it gives a usable exposition and a collection of examples from the classical theory of linear optimum least-squares filtering and prediction. Further than this it does not go, because the statistical and probabilistic aspects of the theory occupy such an elementary and ancillary place in the exposition.

No attempt is made to present the material in the context of the general theory of stochastic processes. The sophisticated detection methods suggested by mathematical statistics (e.g., maximum likelihood, likelihood ratios) are not mentioned, and neither are the linear representations and Hilbert space methods of Karhunen, Loéve, Grenander, and Parzen. Perhaps these topics do not belong in even a graduate text. Still, there are other, simpler topics (covered by the title) that could have been included; e.g., the special properties of Gaussian processes, particularly in regard to nonlinear prediction with a concave even error criterion (instead of the squared error), the role of conditional expectations, the use of Fokker-Planck equations to describe the passage of white noise through a dynamical system (linear or not), and so forth.

The attenuated nature of the probabilistic material may leave unsophisticated readers with erroneous impressions of simplicity or complexity. For example, the distinction between the auto-correlation of a function and the covariance of an ensemble (stochastic process) is blurred, and the senses in which harmonic analysis can be applied to a process are not adequately explained. On the other hand, during the lip service to statistical mechanics in the chapter on ensemble averages it is not explained that ergodic hypotheses are not necessary for the existence of a covariance function, and so for harmonic analysis of the process.

The work is a gracious, well-deserved tribute to N. Wiener from his former student. Nevertheless, some references to other contributors to the field were in order. The reviewer was surprised to find no mention of Khinchin and Kolmogorov, nor of Bochner. The methods of Shannon and Bode for optimal filtering and prediction, with their useful physical interpretations in terms of white noise, deserved mention in connection with the Wiener-Hopf equation. The author's debt to his mentor sometimes beclouds the exposition: the phrase "the Wiener theorem" occurs too frequently to be informative for someone who is not already familiar with the signal contributions of Wiener to harmonic analysis and cannot tell from the context which theorem of Wiener is meant.

Combustion

The Internal Combustion Engine in Theory and Practice. By C. F. Taylor. John Wiley & Sons, Inc., New York, N. Y., 1960. Cloth, x and 574 pp., illus. $16.

REVIEWED BY E. GLAISTER[2]

A SPECIFICATION for the production of a definitive book on the theory and practice of internal-combustion engines might require the author to have spent at least 20 years in personal research and in directing the work of others, to possess a sound knowledge of thermodynamics, preferably some teaching experience, a critical and balanced judgment which takes account of the contributions of other workers in the field, an awareness of the needs both of the advanced student and the designer, and the ability for lucid exposition. Such a specification might well have been written around the qualifications of the author of the present book, who is Director of the Sloan Laboratories for Aircraft and Automotive Engines and Professor of Automotive Engineering at M.I.T., and it can be said at once, almost without reserve, that his book comes well up to our expectations.

The present volume, the first of two, deals with thermodynamics, fluid flow, and performance. Vol. II is to cover fuels, combustion, materials, dynamics, and design procedure. On the whole, the treatment is well-balanced, and although it is only natural that topics in which the author and his team have been personally involved should be given more detailed consideration than others, the author's outlook is comprehensive.

Chap. I is introductory; Chap. II contains a succinct and lucid treatment of the air cycle and emphasizes the essential interrelation of the constant-volume, constant-pressure, and "mixed" variants. The use of dimensionless ratios both here and in Chap. IV for the idealized fuel-air cycle is valuable in affording a concise statement of the effect of compression ratio on cycle quantities. Chap. III contains a rather brief discussion of the thermodynamics of the working fluid, leading to the use of the charts provided at the end of the book, and Chap. IV extends the discussion to the evaluation of the indicator diagram and the efficiency of fuel-air cycles. Chap. V discusses the actual cycle and the effect of operating variables on the indicator diagram. The M.I.T. balanced-pressure indicator is described—the Bibliography contains a reference to the "Farnboro'" prototype (but not to the first description of this indicator by Wood in *Rep. and Memo.* 807 of April, 1922, or Proc. I. Mech. E., 1923).

Chap. VI contains a useful discussion of the factors which control volumetric efficiency, a topic whose importance is often insufficiently stressed, and Chap. VII presents a very complete treatment of the 2-stroke engine and the scavenging process, much of it based on original work at M.I.T. The discussion on heat loss and engine cooling in Chap. VIII is valuable, although in view of the supremacy (until the advent of the gas turbine) of the air-

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