

lems as signal detection, and also as including statistical filtering and prediction.

An understanding both of probability and of "generalized harmonic analysis" is required before the student can handle statistical signal detection and optimum filtering problems. About half of Professor Lee's text is devoted to these preliminary topics.

"Generalized harmonic analysis" is treated in a hundred-page chapter bearing this title. By easy stages, Professor Lee progresses from the Fourier series description of periodic functions through the Fourier transform treatment of transient functions to an appropriate discussion of random functions (functions describable only by their statistics). By introducing the concept of auto- and of crosscorrelation into his discussion first of Fourier series and then of Fourier transforms, Professor Lee lays the groundwork on which Professor Norbert Wiener built the mechanism for treating random functions. Following Wiener, the text demonstrates the derivation of the power density spectrum from the autocorrelation function of a random function. This treatment is straightforward and uncomplicated. The proofs of the many relations sometimes are less rigorous than a mathematician would expect, but the rigor is adequate for the engineering applications toward which this material is directed.

About one hundred fifty pages of *Statistical Theory of Communication* are devoted to a treatment of probability and statistics. Clearly in this short span it is impractical to cover the broad field. Professor Lee has restricted his analysis to those few concepts which must be understood if statistical detection of signals and optimum filtering are to be studied. Proceeding slowly and in easy stages, Professor Lee has managed quite well in covering this limited area of probability and statistical theory. The mathematician again would not be happy with some of the heuristic proofs in this portion of the book. For the purpose for which the material is derived however, the proofs are quite adequate. One important restriction on the statistics of signals and of noise which may be handled by the methods developed further in this book is mentioned with no more emphasis than any other part of the development of the statistical theory. This is the restriction that the signals and the noise must belong to stationary random ensembles. From an engineering point of view this limitation of the development does not reduce its value to any appreciable degree.

The second half of the book contains Professor Lee's principal contributions. Here he is on firm ground in his discussions of signal detection by correlation and of optimum filtering and prediction. His developments are illustrated by examples from the laboratory, which add appreciably to the interest of this portion of his text.

Professor Lee has elected to follow Professor Wiener in measuring the performance of optimum systems in terms of minimized mean-square error. He indicates that other error measures might be more useful in some problems but suggests that their use leads to mathematical difficulties in most cases. It would have

added to the value of this text if the penalty paid for this limitation had been discussed.

The book closes with two chapters on the use of orthonormal functions, one for the representation of the measures of random signals and noise, and the other for their use in network synthesis.

Statistical Theory of Communication probably is most useful as a textbook. Engineers and physicists working in the field will find its value limited, in part by the leisurely pace at which the material is presented, and in part by the use of basic references which are in limited circulation.

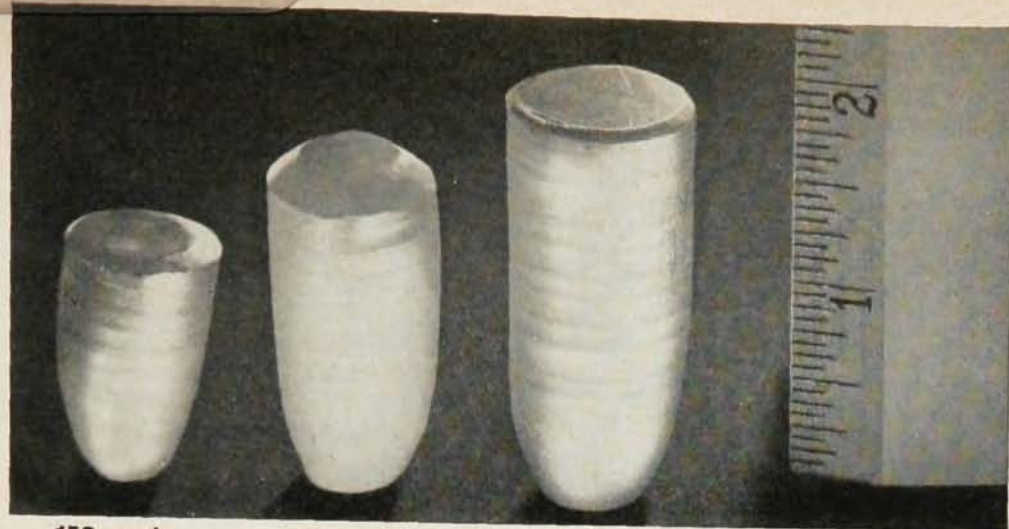
The choice of this book as a text will depend on the pattern of courses and the philosophy of education in a graduate school. Clearly it is ideal for Professor Lee's use in his institution. Others, however, may prefer to cover the same ground using selected material from, for example, Middleton's far more complete text.

Controlled Thermonuclear Reactions. An Introduction to Theory and Experiment. By Samuel Glasstone and Ralph H. Lovberg. 523 pp. D. Van Nostrand Co., Inc., Princeton, N. J., 1960. \$5.60. *Reviewed by Sanborn C. Brown, Massachusetts Institute of Technology.*

ONE of the characteristics of mid-twentieth century scientific endeavor is the growth of the great government laboratories dedicated to solving some of our central problems in modern physics. The present book is a classic in terms of a well and carefully written scientific statement of the efforts of the Sherwood Project scientists and engineers to develop practical devices to use controlled thermonuclear reactions. The book is well and clearly written. The physics is carefully and lucidly explained and the coverage is complete, although its present title does not describe the contents. It is not a book about controlled thermonuclear reactions, but rather about the attempts to make controlled thermonuclear machines operate.

I hope that everyone who reads this book will read it twice, once for the physics and the interesting problems and insights into the operation of plasma machines which it so ably describes, and a second time to appreciate the book as an outstanding description of the ecology of a modern laboratory operating under the peculiar conditions which were forced on the Sherwood Project.

It would be unfair to the authors to imply that they are in any way responsible for the peculiar situation which arises in many of the great government laboratories, isolated by security and geographical self-sufficiency. Without detracting in any way from the value of the book itself, this reviewer found it a provocative illustration of the provincialism which such laboratories breed. It is written completely within the framework of the Sherwood Project. It uses the Sherwood Project jargon. It captures the enthusiasm which characterized the Sherwood pioneers, and it chronicles for posterity not only the scientific effort but the intellectual devel-



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opment and the scientific sociological attitudes of one of these project phenomena of the twentieth century.

Let me illustrate briefly with a few examples. There is a chapter entitled "Plasma Diagnostics". Now diagnostics means studying the physics of the plasma. The jargon itself is indicative of a point of view. The object of the Sherwood Project is to make a practical controlled thermonuclear machine. When an organism full of plasma does not function properly, a diagnostician is summoned to analyze and prescribe. The analogy leading to the terminology is obvious. The intellectual provincialism illustrated by this whole book can be pointed out by a study of the references to this chapter on diagnostic techniques. One of the most powerful tools in the hands of the modern physicist is spectroscopic in nature, and two generations of physicists have relied heavily upon the work in this field of physics. In discussing this technique, Glasstone and Lovberg refer only twice to work done outside the Sherwood Project, and most of their references are to AEC Sherwood Reports. Since the early work in gas discharges, studying the physics of ionized gases by rf fields has generated a great literature on this subject. In referring to the sections of this chapter on rf diagnostics, 90 percent of the references are to Sherwood Project authors and no mention in the text is made of any work except that carried out specifically on thermonuclear machines. Without belaboring the point, it is somewhat amusing to note that even the vast European and Russian literature is almost totally neglected except for references to published documents concerned with the Second International Conference on the Peaceful Uses of Atomic Energy, which was so brilliantly dominated by the American Sherwood Project.

Because of the excellence of its descriptions, this book deserves a place in the library of every modern physicist, but I hope that the historians of science will also find it. When the time comes for our present age to be studied in its historical perspective, this surely will be a major reference source on the operation of laboratories encompassed by the boundary conditions which were set on Project Sherwood.

Digital Computers and Nuclear Reactor Calculations. By Ward C. Sangren. 208 pp. John Wiley & Sons, Inc., New York, 1960. \$8.50. Reviewed by Fernando Jose Corbató, Massachusetts Institute of Technology.

AS the title indicates, the present book consists of two major sections. The first three chapters of 51 pages consist of an introduction to digital computers. A brief history of the development of digital computers is given, and a survey is made of the operating characteristics of modern computers. Programming is discussed only in a broad vein (with the reader referred to McCracken's book for further details). Programming philosophy is offered as well as advice on good habits of computer usage.

There is a 39-page chapter on numerical analysis, which touches lightly on approximations, number sys-