

BOOK REVIEWS

Probability and information theory with applications to radar. By P. M. Woodward. McGraw-Hill Book Co., Inc., New York, and Pergamon Press, London, 1953. x + 128 pp. \$4.50.

This monograph is generally descriptive and demands no special mathematical preparation for anyone acquainted with the field. The first part reviews lightly the elements of probability and waveform analysis that have application in radar. There follows a chapter on information theory; however, for a deeper understanding of this theory the reader may well want to refer to the original papers by Shannon and Weaver which are cited. Succeeding chapters discuss: 1) the statistical problem of reception, 2) a simple theory for range measurement of a stationary point target in the presence of white Gaussian noise, 3) the mathematical analysis of radar information and 4) some aspects of the transmitted radar signal.

The book satisfies its goal of illustrating the way in which probability applies to communication and radar theory without requiring a highly advanced mathematical background but should not be regarded as a fundamental text for a student in the field of communication and radar.

L. C. MAXIMON

The mechanism of economic systems. By Arnold Tustin. Harvard University Press, Cambridge, Mass., 1953. xi + 161 pp. \$5.00.

Professor Tustin's book is well described by its subtitle: "An Approach to the Problem of Economic Stabilisation From the Point of View of Control-System Engineering." In his opening chapters the author translates into the language of systems diagrams a number of the most important theories advanced by modern economists for the explanation of economic fluctuations. These chapters serve the dual function of acquainting the economist with the techniques used by engineers to diagram dynamic systems, and acquainting the engineer with the general dynamic character of an economic system. The engineer who masters them will have advanced a long way toward an understanding of modern theories of the business cycle. The economist, to achieve an equivalent sophistication in modern control-system theory, will need to work carefully through Chapter 3; which provides an introduction—elementary, original in presentation, but compact—of methods of systems analysis.

With these chapters as foundation, the last half of the book carries both economist and engineer through a consideration of possible elaborations of the economic model to achieve adequate realism, and of the ways in which analogue computers might be used for the study of the inevitably complex and non-linear systems that would emerge from this elaboration. Professor Tustin makes a strong case for analogue computers as useful, and perhaps indispensable, tools for extending our knowledge of the economic mechanism to the point where we can evolve appropriate policy measures for its stabilisation.

Although Professor Tustin is very modest about his knowledge of economics, he shows considerable sophistication in that field, and a wide acquaintance with the relevant literature. Hence, his book can be recommended strongly to the engineer and natural scientist as a route, starting from thoroughly familiar territory, that will carry him into economic theory; and to the economist as a starting point in acquiring a knowledge of the techniques of servomechanism analysis and of computer possibilities. Both of them will be aided in their future study by an excellent bibliography. Readers, whatever their background, will also find in Professor Tustin's pages a rich source of original proposals about business cycle theory, which—whether in individual cases they turn out to be right or wrong—will provide many ideas for further investigation.

HERBERT A. SIMON

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Aerodynamics: selected topics in the light of their historical development. By Theodore von Kármán. Cornell University Press, Ithaca, N.Y., 1954. ix + 203 pp. \$4.75.

When the leading authority in any field writes a book in that field, one looks forward with anticipation to the reading of that book. The book under review here is just such a volume. In fact, its history in my office will probably be many times repeated. One day it arrived and lay unwrapped on the secretary's desk. Each person passing her desk stopped, looked and then picked up the book and sat down for a few minutes leafing through to get an idea of what was covered and how it was covered. In the present case, the book then disappeared, to turn up a day or two later in an adjacent office where it had been taken for more careful examination. However, I as the intended reviewer, got hold of it and read in detail the things that others were attempting to gather by hasty examination.

The book is not a text. It is intended as a presentation of the physical aspects of the ideas of aerodynamics and the historical order of development of these ideas with a few pertinent remarks about the men who made those developments. The very early aerodynamic ideas before the period of flight are shown in a perspective only possible now that the correct ideas can be selected from among the early incorrect ones. It is pointed out that some of the basic ideas are very early indeed. The development of aerodynamics ideas since actual flight of man began is traced through the lifting line notions, as developed by Lanchester and Prandtl. The importance of the ideas of Kutta and Joukowski are noted, and the general consequences and verification of the circulation picture as it developed is presented. Finally, some of the very recent ideas on theory of low aspect ratio wings as developed by Jones are described.

Next, the long, slow development of ideas about drag and skin friction which involves the development of the ideas of boundary layer, the vortex streets and the relation between laminar and turbulent flow are all given in relation to the contemporary flight problems. Next, a section on supersonic aerodynamics starts with the usual elementary picture of moving sound sources and goes on to develop linearized wing theory to introduce the shock wave. All these phenomena together with shock wave boundary layer interaction and a development of swept-back wings are given in relation to modern high speed flight.

In Chapter 5, a section on stability and aero-elasticity presents the dynamics of flight and the related problems of the stability of the structure of the aircraft. It is pointed out how the various instabilities of the flight path and instabilities of the elastic structure were gradually learned and understood and corrected. Finally, the aerodynamic problems of propulsion are considered in a chapter with a title suitable to the book at hand, "From Propeller to Space Rocket." As one reads this last section, one is impressed with the similarity between our understanding of space travel and the understanding of air travel as of, say, 100 years ago. No doubt, nearly all of the necessary basic ideas for space travel are already included in the many ideas that have been treated or speculated upon, but it remains for the future to show us which are the good ideas and which are not so useful.

In the propulsion section, general propeller theory and the jet and rocket engine types of propulsion are presented so far as basic ideas are concerned, and are given with proper reference to the originators and those who first worked on the various types.

Throughout, the book is written to appeal not only to professional aerodynamicists, but also to anyone who wants a good physical picture of where things stand in aerodynamics, and how we got there. Throughout, the author has introduced not only historical information and serious discussion, but also the occasional witty remark or wisecrack which has become popular in the aerodynamics field or is worthy of that fate.

The book will be of value both to the aerodynamics expert and to the educated layman and both will find it well worth the time of reading.

HOWARD W. EMMONS

Introduction to elliptic functions with applications. By F. Bowman. John Wiley & Sons, Inc., New York, 1953. 115 pp. \$2.50.

The purpose of this book is to present a short, practical, elementary account of the properties of the Jacobian elliptic functions and their applications for physicists, engineers and applied mathematicians. The book, unfortunately, is written in the vein of an elementary undergraduate text and includes so

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much detail and repetition that anyone competent in mathematical manipulation could more easily and quickly obtain the desired material from a standard handbook while the less sophisticated person would find it difficult to draw the needed information from the detailed mathematical computations. Most of the formulas in the book are developed in exhaustive detail and the same applies to the exceedingly numerous illustrative examples. There are a total of 128 problems for the reader to work out, two-thirds of which are relatively trivial exercises in manipulation. No numerical tables are given but references to available tables are made throughout the book. (See, however, A. Fletcher, *Guide to Tables of Elliptic Functions*, Math. Tables and other Aids to Computation, 3, 229-281, 1948.) Except for the above mentioned shortcomings, this book does present as much information about Jacobian elliptic functions and integrals as the average consumer would ordinarily need. The collection and detailed analysis of conformal transformations in which various elliptic functions and integrals appear certainly illustrates the usefulness of these functions, in particular in relation to the use of the Schwarz-Christoffel transformation and the chapter on the reduction of elliptic integrals to standard form is clearly presented. (For a better and more useful presentation see, however, P. F. Byrd and M. D. Friedman, *Handbook of Elliptic Integrals for Engineers and Physicists*, Springer-Verlag, Berlin, 1954.)

PETER CHIARULLI

Proceedings of the symposium on nonlinear circuit analysis. Sponsored by the Microwave Research Institute of Polytechnic Institute of Brooklyn, in cooperation with The Institute of Radio Engineers Professional Group on Circuit Theory, and co-sponsored by the Office of Naval Research, The Office of Scientific Research, The Signal Corps, New York, 1953. xi + 411 pp. \$4.00.

This book, the second volume to appear in the Network Symposia Series sponsored by the Microwave Research Institute of Polytechnic Institute of Brooklyn, concerns nonlinear network analysis, i.e., nonlinear differential equations. Following several introductory papers by Weber, Stoker, Friedrichs, and Lefschetz, are seventeen papers covering topics from purely numerical analysis of nonlinear differential equations to physical systems exhibiting subharmonic behavior.

While a complete table of contents is unwarranted here, a breakdown of the classification of papers is in order. Excepting the four introductory papers, six treat mathematical techniques for analyzing nonlinear systems, two each on perturbation methods and response of systems to special inputs, one each on stability of differential-difference equations, impossible behavior of nonlinear networks, inertial parameters, synthesis of nonlinear systems, subharmonics, magnetic amplifiers, and intentional non-linearization of servomechanisms.

The format of the Proceedings is good and, while many minor errors were found, none of them would be a hindrance to the serious reader. This volume is a desirable addition for those working in nonlinear mechanics and is even recommended to those who would like to familiarize themselves with the field.

SHELDON LEVY

Transactions of the symposium on fluid mechanics and computing held at New York University, April 23-24, 1953. Edited by G. Birkhoff, K. O. Friedrichs, and T. E. Sterne. Interscience Publishers, Inc., New York, 1954. iv + 243 pp. \$5.00.

The volume contains the papers presented at a symposium that was sponsored by the American Mathematical Society and the Office of Ordnance Research, U. S. Army. The contributors to the volume are M. J. Lighthill, G. F. Carrier, G. Birkhoff, G. S. S. Ludford and M. H. Martin, J. H. Giese, L. Bers, A. Weinstein, P. Germain, R. v. Mises, M. Lotkin, P. D. Lax, L. H. Thomas, G. E. Hudson, and H. Schardin.

W. PRAGER

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Then (1) and (5) imply

$$u = \operatorname{Re} \frac{1}{2} \int (V - V^{-1}) df, \quad = \operatorname{Re} - \frac{1}{2} i \int (V + V^{-1}) df, \quad w = \operatorname{Re} f(\zeta),$$

$$\varphi = \frac{1}{2} \operatorname{Re} \left[X \int (V - V^{-1}) df - iY \int (V + V^{-1}) df + 2f \right],$$

for some analytic $f(\zeta)$. These comprise the desired results in the form exhibited by Poritsky, from which u, v, w' can easily be obtained as functions of x, y, z' . It is customary to choose isothermal parameters such that $V = \zeta$, so that in the supersonic case the interior of the Mach cone of the origin will map onto $|\zeta| \leq 1$.

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3. R. Courant and D. Hilbert, *Methoden der mathematischen Physik*, vol. II, Berlin, 1937 pp. 133-135
4. H. Poritsky, *Homogeneous harmonic functions*, Quart. Appl. Math. 6, 379-388 (1949)
5. H. Poritsky, *Linearized compressible flow*, Quart. Appl. Math. 6, 389-404 (1949)

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Introduction to aeronautical dynamics. By Manfred Rauscher. John Wiley & Sons, Inc., New York, and Chapman & Hall, Ltd., London. xv + 664 pp. \$12.00.

This book, as its unusual title indicates, has an unusual aim. It includes particle dynamics and rigid-body dynamics as well as the theory of fluid motion. The author obviously wishes to give a very detailed and thorough grounding in the fundamental ideas and notions in these fields. To this purpose, he provides detailed derivations of the basic laws; figures and graphs usually omitted in more concise presentations are generously included; basic examples are worked out in full detail; many original and stimulating examples and discussions are included, to help the beginning student overcome the usual basic difficulties. Thus, this book apparently has a higher aim than to be just a textbook; namely, to replace the teacher as well. Its features, described above, make it truly suitable for self-study, although there is no doubt that it will also be valuable in the classroom.

As the various chapters proceed into more detailed and advanced matters, the author shows a certain preference for those special domains in which elegant solutions along classical lines can be obtained. For example, thin-airfoil theory is omitted in favor of an unusually complete presentation of airfoil generation by conformal mapping. Perhaps this is because otherwise the attempt to provide a book going into such detail would have led to a volume of unwieldy size and expense. At any rate, the result is a textbook of unusual character, reflecting, perhaps more than most books do, the special interests and predilections of its author.

N. ROTT
W. R. SEARS

Einführung in die Determinantentheorie einschliesslich der Fredhomschen Determinanten.
By Gerhard Kowalewski. Walter de Gruyter & Co., Berlin, 1954. \$7.16.

The first edition of this well-known book was published in 1909. This fourth revised edition was prepared by the author, although publication was delayed due to his death in 1950.

G. NEWELL