

notes and bibliographical references make the book an excellent starting point for research in the field.

A long time will pass before a realistic assessment can be made of the scientific legacy of von Neumann, since it consisted not only of new and important results, but also, and perhaps mainly, of new domains of science opened up to investigation. And there is enough in these to keep researchers busy for many years ahead. Moreover, implicit in all investigations, such as those described in Prof. Karlin's two volumes, is the idea that somewhere there is an electronic digital computer to carry out the work. And here too our debt is plain.

Introduction to Theoretical Meteorology. By Seymour L. Hess. 362 pp. Henry Holt and Co., Inc., New York, 1959. \$8.50. *Reviewed by Ferguson Hall, Federal Aviation Agency.*

PROFESSOR Hess has been highly successful in meeting his stated objective of writing a book on theoretical or "dynamic" meteorology which is rigorous but not "difficult", in the sense of being bound up in advanced mathematics. Of importance also is the clarity with which each topic is presented and discussed, as well as the engaging style which makes the book readable and interesting.

The topics covered are those which underlie all atmospheric properties and motions, including solar and terrestrial radiation, the vertical state and motions of the air (convection), the thermodynamics of the atmosphere, horizontal motions (the winds), the character of fronts, the turbulent layer near the ground, and the theories of the large-scale or general circulation of the atmosphere. In addition the reader is introduced to the recent developments in "numerical weather prediction" which make use of high-speed electronic computers.

For the student of meteorology, as well as for the practicing meteorologist desiring a review of basic meteorological theory, this book seems an excellent choice. This is true also for teachers and others who wish to go a step beyond the purely descriptive aspects of weather and gain an insight into the physical laws which in concert produce each day's complex weather map.

Applications of the Theory of Matrices. By F. R. Gantmacher. Translated from Russian and revised by J. L. Brenner, D. W. Bushaw, S. Evanusa. 317 pp. Interscience Publishers, Inc., New York, 1959. \$9.00. *Reviewed by Philip M. Morse, Massachusetts Institute of Technology.*

MATRICES may be of declining interest to mathematicians but they are of increasing interest to physicists, systems engineers, and operations research workers. In perturbation calculations, in programming for digital computers, in working out a Markov chain or a queuing problem, one often needs to diagonalize a matrix or compute a matrix function or solve a

matrix equation. It has been pretty hard to learn these things; most of the literature on the subject is scattered and not very "solution-oriented". Consequently, the present volume, a translation of the second half of a two-volume work on matrices, is a welcome addition. In this reviewer's opinion, the first half is just as valuable. Luckily, Chelsea has now published a translation of both volumes (at a somewhat smaller price!).

The volume here reviewed includes chapters on complex symmetric, antisymmetric, and orthogonal matrices, on pencils of matrices, on matrices with non-negative elements (important for Markov and other stochastic processes), on the application of matrix theory to the study of differential equations (important in queuing theory, for example), and on the application of matrix theory to the study of the stability of solutions of such equations (basic to control system theory). In these latter subjects the book is unique in the depth and unification of treatment of material previously nearly inaccessible. Bellman's recent volume, *Introduction to Matrix Analysis*, treats some of this material in a much more readable way, and beginners in the field are advised to start with Bellman. But if they want the real dope, they should dig through Gantmacher's Volumes 1 and 2.

Quantum Chemistry: Methods and Applications. By R. Daudel, R. Lefebvre, C. Moser. 572 pp. Interscience Publishers, Inc., New York, 1959. \$14.50. *Reviewed by Stuart A. Rice, Institute for the Study of Metals, The University of Chicago.*

THERE are undoubtedly many different approaches to the teaching of quantum chemistry. Most of the books I am familiar with start with some exposition of the historical origins of quantum theory, continue with an abbreviated discussion of classical mechanics, vibrating strings, and eigenvalue problems and then with this background proceed to study the hydrogen atom and so forth. Daudel, Lefebvre, and Moser have abandoned the cited ordering of topics. Instead, they first discuss extensively empirical methods for the computation of approximate stationary states of molecules. The necessary physical concepts are introduced qualitatively and then used in the general framework of the independent electron model to treat interatomic distances; bond angles; dissociation, ionization, and resonance energies; excited states; dipole moments; as well as chemical reactivity, reaction rates, and biochemical applications. A brief discussion of the nature of the approximations in the independent electron model precedes the study of more sophisticated molecular calculations. In the second half of the book the student is introduced to the problem of electron-electron interactions as studied by a variety of methods. The hydrogen molecule and ethylene and benzene are used extensively as examples.

There is, in my opinion, a great deal to recommend in this book. In particular I find the "illogical" ordering of the subject matter very pleasing because the