two dimensions. The setting in most cases will appeal to the student as interesting and useful.

A fifty page résumé of the principles of mechanics is added. This facilitates references in the solutions which are given to some typical problems. Answers are given in practically all cases.

The book may be recommended to teachers who wish more problems than those found in the usual textbook in elementary applied mechanics.

PHILIP FRANKLIN

Elementary Matrices and some Applications to Dynamics and Differential Equations. By R. A. Frazer, W. J. Duncan, and A. R. Collar. Cambridge, University Press, 1938. 16+416 pp.

The authors are primarily interested in developing the theory of matrices as a tool, especially to be applied to aerodynamics. Consequently it is only the first four chapters which are concerned with matrices as such, while the remaining nine chapters are devoted to applications. Numerous examples occur throughout the work and much stress is put on the technique of numerical computation. An ele mentary knowledge of determinants is assumed at the outset.

In the first three chapters are found very satisfactory treatments of most of the standard theorems on matrices, including such topics as polynomials and power series of matrices, the Cayley-Hamilton theorem, Sylvester's theorem, and canonical forms for matrices. No treatment is given, however, of the reduction of a matrix to canonical form under collineatory transformations, although the fundamental results are stated and the reader is referred to a proper place in the literature. The fourth chapter is devoted to miscellaneous numerical methods for finding the reciprocal, high powers, and latent roots of a matrix, together with a few applications.

Chapters five and six treat systems of linear ordinary differential equations with constant coefficients. The fact that matrices can be used in treating systems of this kind is indubitably the reason that matrices are so important to the aeronautical engineer. The treatment given is unsatisfactory to the mathematician, because it is not shown that a complete set of solutions is given by the methods described (although this is indeed the fact); nor is there an adequate reference to fill the gap. Yet this very matter constitutes the most difficult part of the whole theory (cf. p. 168).

Chapter seven describes miscellaneous applications to linear differential equations with variable coefficients.

The rest of the book is primarily concerned with dynamics and becomes more and more technically involved in aeronautical problems as the book progresses to its close, the last chapter being entitled "pitching oscillations of a frictionally constrained aerofoil." It should be remembered, however, that much of this technicality is that of language only. On page 267, for example, we find a section entitled "the equations of motion of an aeroplane." The authors then go on to say that they are deriving the equations of motion for any rigid body, which merely for definiteness is supposed to be a (rigid) aeroplane in flight!

The book will probably prove invaluable to the student of aerodynamics. It should also be a stimulating reference book for the really good undergraduate who is assailed by doubts as to the practical applications of mathematics.

D. C. LEWIS