the D-operator is left until very late in the book, in connection with linear systems, necessitating an elaborate explanation of the method of undetermined coefficients.

P. J. Ponzo, Waterloo

Stability of Motion, by A.M. Liapunov. Translated by F. Abramovici and M. Shimshoni. New York, Academic Press, 1966. xi + 203 pages.

In his 1892 Mémoire, Liapunov considered the stability of the equation

$$\underline{x}(t) = A\underline{x} + X(\underline{x})$$

where X, near $\underline{x} = 0$, vanishes to at least the second order. He there covered the cases where all eigenvalues of A are negative in real part, or where one vanished, or where two were pure imaginary.

Liapunov also studied the case where two eigenvalues vanished, the rest having negative real parts, in three papers not so well known as his Mémoire. This publication consists of a new translation of these, together with contributions by V.P. Basov and V.A. Pliss. They are out of order; a better discussion of sources could be given.

One should begin with the 1893 work, here beginning on p.128, in which Liapunov considers only the case $n = 2$. Thus in effect one has simply $x = y + 0(|x|^2)$, $y = 0(|x|^2)$. The work in which this is extended to general n remained incomplete, and unpublished; it was found by Smirnov in 1954 and published in Liapunov's Collected Works. Here it is published beginning on p.13. The final argument concerning the case when all the higher terms in $X(\underline{x})$ must be considered before stability can be decided, was fitted in by Pliss in 1964, in a short paper here starting on p.185. The short note beginning on p.123 is again out of place, and shows that only in the case that all eigenvalues of A have negative real parts is it possible to determine stability by examining A alone [without also studying $X(\underline{x})$].

D.R. Miller, Western Ontario

Introduction to Ordinary Differential Equations, by Albert L. Rabenstein. Academic Press, New York, London, 1966. xii + 431 pages. $9.95 (hard bound in gray buckram).

The title of this book is a little misleading. While primarily devoted to differential equations there is also a smattering of material that one usually associates with other courses. The whole treatment is aimed at undergraduate engineering and science students whose background need not include advanced calculus. The miscellaneous extra topics treated probably result mainly from this choice of target audience.

Topics treated include the usual items in any standard work on ordinary differential equations plus a chapter on complex variables, a chapter on Bessel functions, a chapter on orthogonal polynomials, one on Fourier series including the double series, a chapter on Laplace transforms and one each on partial differential equations and nonlinear differential equations. Numerous problems and references are given. In connection with the latter, however, one might suggest in future treatments that some of the very large tables of special functions and Laplace transforms be mentioned; Jahnke and Emde is a much overworked reference to Bessel functions and hardly a foremost source of such data nowadays!

For its intended purposes the book is doubtless quite satisfactory although some small improvements in style (such as printing theorems in italics) might be incorporated in a later edition. Printing is generally good. One misprint in the displayed expression at the top of page 102 was found.

R. L. Sternberg

Differential Equations of Applied Mathematics, by G.F.D. Duff and D. Naylor. J. Wiley, New York, 1966. xi + 423 pages. $11.65.

Chapter 1 begins with a discussion of vector spaces, providing a unifying concept for the book. The reader is led very early into the ideas of orthogonal expansions, linear transformations, the calculus of variations as applied to mechanical systems, distributions and Green's functions for ordinary differential equations.

The wave equation, diffusion equation and Laplace's equation are dealt with in the following three chapters. An interesting feature in each chapter is the discussion of numerical solutions by finite difference methods. Further, associated topics are introduced at an appropriate point in each chapter: a formal theory of distributions and Fourier series in chapter 2, Fourier integral transforms in chapter 3, complex variables and Laplace transforms in chapter 4.

Numerous physical applications are considered in chapter 5, including vibrations, fluid motion, electromagnetic theory and quantum mechanics. Chapter 6 deals with eigenvalues and eigen functions of differential operators and generalized Fourier series. Green's function techniques are applied to differential and integral equations in chapter 7, and chapters 8 and 9 deal with Bessel and Legendre functions including contour integral representations, asymptotic behaviour, generating functions and applications to specific physical problems. The concluding chapter discusses the three-dimensional wave equation and problems of reflection and refraction by corners.

The range of topics and excellent exercises make it ideally suited as a text at the advanced undergraduate level. The important ideas