pedagogy. The book requires more maturity than is usually assumed for a first course, but it could be used for this purpose with sufficiently able students.

The chapter headings are: First order differential equations, Second order linear equations, Power series solutions, Linear equations with constant coefficients, Existence and uniqueness theorems, Plane autonomous systems, Approximate solutions, Efficient numerical integration, Regular singular points, Sturm-Liouville systems, and Expansions in eigenfunctions.

The authors have achieved a distinctive and valuable contribution to the text-book literature of this subject.

Turning to the text by Bear, we find two chapters on First order equations, two on linear equations, one on each of the Laplace transform, Picard's existence theorem, and systems of equations. There are innumerable examples and particular cases, and the explanations are very detailed. The book would be suitable for a short introductory course with students of intermediate ability, or as a supplement to a more ambitious and less detailed text.

The book of Leininger contains three introductory chapters on calculus and series, two chapters on first order equations, and single chapters on second order equations, existence of solutions, Laplace transform, series solutions, and applications. The author has taken some trouble to state clearly certain elementary points of difficulty, and has not always succeeded in simplifying matters. However, the book does, on the whole, achieve its stated object. Many minor theorems are stated in detail (unfortunately not in italicized print), and there are many worked examples. There is much emphasis upon the Laplace transform. Most engineering students in Canadian universities are given more training in calculus than is assumed in this book.

G. F. D. Duff, University of Toronto

Ordinary Differential Equations, by L. S. Pontryagin. Translated from the Russian by Leonas Kacinskas and Walter B. Counts. Addison-Wesley, 1962.

There are many people, both students and working scientists, who have learned calculus, linear algebra and an introduction to differential equations, but who have found that they need a deeper understanding of differential equations. This book by Pontryagin will make excellent reading for these people, particularly if their main interest is in non-linear equations and stability. Some topics, such as solutions in series, numerical methods, and boundary value

problems, are omitted completely, but the material which is covered is done superbly. This includes a thorough study of linear equations and systems (using results from linear algebra), existence and uniqueness theorems, including dependence on initial conditions and parameters, and a great deal of material on stability. The chapter on stability contains many topics seldom treated on this level, such as limit cycles, states of equilibrium of two-dimensional autonomous systems, and stability of periodic solutions. Many physical applications are given to illustrate the results. They are integrated with the theoretical material, rather than being collected in one place where a lazy reader can avoid them. The most interesting physical applications are the discussions of electrical circuits, vacuum tube oscillators, and centrifugal governors.

Because of the omission of several topics and because of the absence of problems and trivial examples, this book is probably not ideal as a text for an intermediate course in differential equations. This is not intended as a criticism, because presumably the author was not attempting to write a text for use in Canadian and American universities. He has, however, succeeded in writing a book which should be read by everyone who teaches differential equations or uses them in physical applications.

Fred Brauer, University of Wisconsin

Introduction to Nonlinear Differential and Integral Equations, by Harold T. Davis. Dover Publications, New York, 1962. ix + 566 pages. Paperbound $2.00.

This volume is an unaltered version of the work first published in 1960 by the United States Atomic Energy Commission. It appears to be directed toward engineers, physicists, and applied mathematicians who know little about the subject, but who are actually confronted with nonlinear problems. That is, the book consists largely of an attempt to define the field and a presentation of some of the methods and techniques which have proved useful in attacking certain nonlinear problems. In addition, the author usually tries to provide the reader with some of the background required for an understanding of the methods and techniques. For example, Chapter 6 is a 50 page digression on elliptic integrals, elliptic functions and theta functions (with short tables!), these being essential for a later discussion of the second order differential equation of polynomial class,

$$A(y)\,y'' + B(y)\,y' + C(y)\,(y')^2 + D(y) = 0$$

(where A, B, C, D are polynomials in y whose coefficients are functions of x).