A frequently recurring difficulty permeates phases of our undergraduate teaching. Even our better students are puzzled and annoyed by a situation which could easily be improved. We are at fault in that we do not formally classify the distinct domains (types of function or types of numbers) in which we operate. Thus we state successively that $1/\log x$ cannot be integrated; that the differential equation $y'-1/\log x=0$ can be solved whereas others more complicated cannot; finally that all differential equations can be solved by series. Likewise, in the equation $y+\log y=x$ it is impossible to solve for y; yet the equation defines y as a function of x and hence we may compute dy/dx with the help of standard theorems on differentiation. The worst paradox of all is that since $x^2+1=0$ has no root, we must use a special symbol to represent it. It would seem that our students would thrive better if we gave less attention to the introduction of ϵ and δ and devoted a little time to the discussion of these questions. One ventures the prediction that future texts in the calculus will carry out such a program explicitly. The publication of *Integration in finite terms* may accelerate this very desirable end by making the Liouville theory current coin in mathematical circles.

E. R. LORCH

Matrix and tensor calculus with applications to mechanics, elasticity and aeronautics. By A. D. Michal. (Galcit Aeronautical series.) New York, Wiley; London, Chapman and Hall, 1947. 13+132 pp. $3.00.

The author states in the preface that the purpose of his book is "to give the reader a working knowledge of matrix calculus and tensor calculus, which he may apply to his own field." To accomplish that much in 130 pages is a difficult problem. Professor Michal attempts to solve it by omitting many proofs and by restricting severely the material presented. Thus several basic notions (for example, characteristic vectors of a matrix) are not mentioned. These omissions are partly compensated for by numerous *Notes* collected at the end of the volume and by an extensive bibliography. On the other hand, this book contains information on some non-standard topics. These include the theory of "multiple-point tensor fields" (originated by the author two decades ago), and a tensor treatment of the boundary layer theory (due to Lin).

The book consists of two largely independent parts, one dealing with matrices, the other with tensors. Each part begins with the fundamental definitions and theorems. Further mathematical concepts are introduced in connection with concrete applications which range over various fields of mechanics. While no problem is pursued very far the author succeeds in convincing the reader of the advantage resulting from attacking a problem in mechanics by appropriate mathematical tools.

Matrix theory occupies about one third of the book. A brief account of matrix algebra (including the Cayley-Hamilton theorem) is followed by a discussion of power series in matrices and of the calculus of matrix-valued functions. Applications are given to the theory of small oscillations around a point of stable equilibrium, to the theory of aircraft flutter and to elastic deformation theory.

Tensor calculus is developed primarily for the Euclidean three-space. The discussion centers around curvilinear coordinates, the metric tensor and covariant differentiation. As a first application the fundamental equations of mathematical physics are written in general curvilinear coordinates. A brief chapter on fluid dynamics is followed by a comparatively extensive treatment of tensor methods in the theory of elasticity. A distinctive feature of these chapters is the author's determination not to limit himself to infinitesimal deformations. The last two chapters are devoted to tensor calculus in Riemannian spaces with applications to classical mechanics and boundary layer theory.

The volume is based on a series of lectures given to a group of research engineers. It could be well used in a graduate or senior undergraduate course for engineering students. The exercises are not numerous but are selected skillfully. A few awkward expressions and slips of the pen (for instance on p. 32, l. 27, p. 34, l. 11, p. 41, l. 10, p. 88, l. 20) do not detract materially from the value of this enthusiastically written and useful book.

LIPMAN BERS

Theory and application of Mathieu functions. By N. W. McLachlan. New York, Oxford University Press, 1947. 9+401 pp. $12.50.

Part I of this book contains a comprehensive treatment of analytical and numerical methods which have been successfully used to obtain solutions of the various forms of Mathieu's differential equation, satisfying various conditions, and for complex as well as real values of the independent variable. It discusses also the theoretical background underlying these methods. A large part, estimated by the author as one third, of this material is new, filling gaps by extending over the whole field methods which had proved useful in part of it; the book will therefore be very useful to a reader who wants to make a new application without having to extend the theory.

The subjects covered include the integral equations and relations satisfied by the solutions; the distribution of their zeros; the periodic