

for the involved functions the existence and continuity of certain partial derivatives with respect to x ; (b) at various places in Chapters 3, 4, 5 there are statements to the effect that for a function $f(y_1, \dots, y_n, x)$ the existence and boundedness of partial derivatives $\partial f/\partial y_j$, ($j=1, \dots, n$), in an open set \mathfrak{A} of (y_1, \dots, y_n, x) space implies that in \mathfrak{A} the function f satisfies a Lipschitz condition in (y_1, \dots, y_n) , which is clearly not true without the added assumption of convexity of the intersections of \mathfrak{A} with hyperplanes $x=\text{constant}$.

W. T. REID

Analog methods in computation and simulation. By W. W. Soroka. New York, McGraw-Hill, 1954. 14+390 pp. \$7.50.

Modern technology must be based on a scientific analysis of the problems considered. At first glance this might seem to require a precise solution or at least a numerically valid solution to the mathematical formulation of the problem. However, this is not quite true. The basic information necessary for technical decisions may be available from the study of an analogous system under the control of the investigator. In these circumstances mathematics plays a somewhat different role. The basic problem is not the solution of the mathematical problem, but the establishment of the analogy, that is the similarity of the mathematical equations governing the two systems. The important question is the uniqueness of the solution rather than its construction.

The principle of analogy is well established in engineering. For many years, problems in power distribution, the vibrational response of elastic structures and their stress distribution, air vehicle stability, and a whole host of model studies have been based on analogy. Since the war, there has been a considerable development of electrical analog equipment which has considerable advantages in flexibility of set up, availability, and ease of operation over most other types. It is also true, however, that the many nonelectrical analogies have continued to advance. Each of these tends to have a field of optimum application where the results obtained by the specified method are the most appropriate available.

The present book is organized to survey the field relative to the various engineering applications. There is considerable introductory material relative to the realization of mathematical operations. The major analogies treated are those based on "lumped" electrical circuit theory including commercial electronic differential analyzers and the network analogies for elasticity and the theory of structures, those associated with the finite difference expressions for partial dif-

ferential equations and membrane and conducting sheet analogies.

The book begins with chapters on mechanical and electrical computing elements which are followed by a description of machines for simultaneous linear algebraic equations and a chapter on nonlinear equation solvers, harmonic analyzers, and the conduction sheet analogy for the complex plane. The mechanical and electrical differential analyzers are each treated in a chapter. The concluding chapters develop the analogies between dynamical and electrical systems, the analogies on which the finite difference solutions of partial differential equations are based, and the above mentioned analogies for the membrane and conducting sheets.

As an engineering text book this appears to be excellent. The derivations are specific to the application and at the mathematical level associated with college elective courses on differential equations. This book would also be a good introduction to analogies for the mathematician interested in the myriad mathematical problems associated with this field.

FRANCIS J. MURRAY

The kinematics of vorticity. By C. Truesdell. Bloomington, Indiana University Press, 1954. 20+232 pp. \$6.00.

This is a work packed with theorems of a general type concerning the vorticity of a fluid. The author uses freely the classical theory of vectors in three dimensions, the theory of dyadics and, to some extent, the tensor calculus. After various geometrical preliminaries, and the definitions of velocity, acceleration, expansion, deformation, etc., of a fluid motion, the vorticity is defined and its various interpretations are given. The vorticity field and the notions of vortex lines and tubes are next discussed, with their bearing on circulation. The measure of vorticity is given a chapter to itself and this is followed by one on vorticity averages. Bernoullian theorems are then investigated, by which are meant formulae for the squared speed of the fluid and the scalar potential of the flow. The two final chapters deal with the convection and diffusion of vorticity and with circulation-preserving motions.

I have attempted to estimate the number of theorems contained in the book and have concluded that there is probably an average of two per page, making a total of perhaps 400. Though they are expressed in the terminology of hydrodynamics, they are essentially theorems in pure mathematics, expressing relations between vectors and their integrals over volumes and surfaces. That the vectors are called velocity, acceleration, vorticity, etc., is not an essential feature