

gration des équations hyperboliques à deux variables (méthode de Riemann); Chapitre III. Intégration de l'équation

$$\theta(u) = \frac{\partial^2 u}{\partial x_1^2} + \frac{\partial^2 u}{\partial x_2^2} - \frac{\partial^2 u}{\partial x_3^2} = f(x_1, x_2, x_3)$$

(méthode de Volterra); Chapitre IV. Quelques extensions de la méthode de Volterra; Chapitre V. Intégration, par la méthode des caractéristiques, de l'équation générale, linéaire, hyperbolique, du type normal; Bibliographie.

The exposition is restricted in general to the solution of second order partial differential equations of the hyperbolic type

$$\sum_{ij} A_{ij} \frac{\partial^2 u}{\partial x_i \partial x_j} + \sum B_i \frac{\partial u}{\partial x_i} + C - U = f,$$

in which case the *characteristics* used for generating the integral are real. In the general case these characteristic manifolds are *conoids*. When the A_{ij} are constants the characteristic conoid reduces to a cone, and in other more special cases to straight lines.

The pamphlet is the result of a course of lectures given by Mlle. Freda at the University of Rome, 1931. The treatment is classical following the researches of d'Adhémar, Tédoue and Coulon, Picard, and Volterra, with extensions and modifications by Mlle. Freda. Consideration is also given the applications to mechanics and physics.

The exposition is clear but very compact. One unfamiliar with the subject would profitably read a more elementary treatment. As Volterra points out in the preface and as the bibliography indicates, the preparation of this monograph was long and difficult, depending on the researches of many writers spread over a number of years.

Mlle. Freda is to be congratulated not only on her perseverance but also on the excellence of her accomplishment.

V. C. POOR

Elemente der Funktionentheorie. By K. Knopp. Berlin, de Gruyter, 1937. 144 pp.

This little book is Number 1109 in the well-known and highly regarded Sammlung Göschen. The author restricts himself to the treatment of only the simplest parts of the theory that are important for a more detailed and extensive study. The selection of material has been made with the discrimination of a scholar and is written with the clarity of style we have come to expect from the pen of the author.

The thirteen chapters are grouped in five parts: 1. Complex numbers and their geometric representation. 2. Linear functions and the circular transformation. 3. Aggregates and sequences. Power series. 4. Analytic functions and conformal representation. 5. The elementary functions.

To a reader already acquainted with the subject it may seem strange that the integral calculus of complex functions is omitted entirely. However, this enables the author to treat the topics included with amazing thoroughness in the small compass of 135 pages of text. One wishing to go further will find ex-

cellent material in the author's two volumes, *Funktionentheorie*, Erster Teil; Zweiter Teil. These are Numbers 668 and 703 in the Sammlung Göschen.

A student entering upon the study of a new subject needs many exercises to test his understanding. There are none in this book, but the author's two volumes, *Aufgabensammlung zur Funktionentheorie* (Nos. 877, 878) will provide ample material.

G. E. RAYNOR

Sur la Théorie Mathématique des Jeux de Hasard et de Réflexion. By René de Possel. (Actualités Scientifiques et Industrielles, No. 436; Conférences du Centre Universitaire Méditerranéen de Nice, publiés sous la direction de M. Paul Vallery, I.) Paris, Hermann, 1936. 41 pp.

Chapter I describes how the three factors, reflection, hasard, and wile, enter the "game of society," by use of several games.

The next chapter explains games of batons. Piles of batons or sticks are before the players who can remove, when their turn comes, a number of sticks less than or equal to a given number; the player who takes the last stick loses. More complicated cases of this game are analyzed by means of expressing the numbers involved in the system of notation with 2 as base.

The third chapter states a theorem concerning games of combinations in which one player wins or there is a draw.

Chapter IV contains the usual definitions of probability, mathematical expectation, and equitable games. Mathematical expectation is applied in detail to the roulette wheel.

In the last chapter the author defines the "game of society" and outlines how to study the influence of reflection, the influence of hasard, and the influence of wile, which enter into games. Maxima and minima of the mathematical expectations of the player have an important role in this part. Applications of these maxima and minima are made for several games.

W. D. BATEN

Biologie Mathématique. By V. A. Kostitzin. Paris, Librairie Armand Colin, 1937. 223 pp.

In an appreciative preface, Vito Volterra points out that while numerous books have been published in recent years on the applications of mathematics to biology, it remained for M. Kostitzin to produce a synthetic and didactic work drawing together the researches on this subject. As is stated by the author, this book is fundamentally different from the manuals of mathematics with similar titles that have been prepared for students of biology. While he recognizes the utility of such books for reference purposes, the author is not enthusiastic about selecting certain chapters of one science for the benefit of workers in another. He says that each science has its peculiar language and logic and that it is only by preserving these that the applications of science can have their full force. Carrying this thought further, the author says that if a biologist needs chemistry he had better study that science and not read a few chapters especially adapted for biologists. Similarly, to be able to apply the methods of mathematics it is necessary to study what constitutes the science of mathematics—its ideas—and not some of the processes of calculation.