wherever possible to frame estimates of reliability. In one case the author is led to an important conclusion, for he finds that in spite of its complication Simpson's three-eighths rule carries an inherent error more than twice as large as his one-third rule ; the comparison is between the actual errors that must occur in individual cases, not between upper limits to these errors in general, and it follows that the more elaborate rule has nothing whatever to recommend it.

Like the account of quadrature, the account of the numerical integration of differential equations is thorough ; four distinct methods are compared and illustrated, and the author's commentary is helpful. But the treatment of other topics is scantier. What are we to say, for example, when the last word on interpolation is with Stirling and Bessel and there is no mention of Everett ? There is an adequate chapter on the root-squaring method of solving an algebraic equation. For simultaneous equations, since the labour involved in the computation of a numerical determinant is not exposed, the tediousness of the Newton-Raphson process is not made evident, and while the iterative process is explained for sets of equations to which it is obviously applicable, nothing is said of the way in which sets of functional equations in general can be prepared for iterative solution. Although probability and statistics are outside the range of the volume, a discussion of normal and probable errors and of estimates of precision is included, to lead up to a chapter on the construction of empirical formulæ which is one of the most important in the book.

The explanations throughout are clear. The author attracts confidence by the honesty with which he applies the standard methods, sometimes to unfavourable cases, and teaches the computer to learn by experience.   E. H. N.

(1) *Les méthodes de solution approchée des problèmes de la physique mathématique.* Par Nicolas Kryloff. (*Mémorial des sciences mathématiques*, Fascicule 49.) Pp. 69. (Paris : Gauthier-Villars et Cie, 1931.) 15 francs.
(2) *Angenäherte und symbolische Lösung der Differentialgleichungen der mathematischen Physik und Technik.* Von Prof. Dr. N. M. Kryloff. Pp. 162. (Kharkov and Kiev : State Technical Publishers, 1931.) 3 Kps.

(1) ONE of the most valuable methods for the approximate solution of the differential equations of mathematical physics is that due to Lord Rayleigh and W. Ritz. This starts by applying the calculus of variations to a certain quadratic form and finally obtains a solution in terms of a convergent series of functions ; a limited number of terms of this series gives an approximation to the exact solution. However, the method as left by its authors was not fully developed, and a great deal of work has been done by Prof. Kryloff, who has written more than thirty papers on the subject. An essential part of his contributions is to show how to estimate the number of terms which must be taken to make the error less than an arbitrary assigned amount.

Great variety is possible in the treatment ; in fact, it might be said that each type of equation has its own appropriate method. The account given by Prof. Kryloff in this tract shows that the subject is far from exhausted and offers opportunities for further research.

(2) Another side of the subject is dealt with in the second of the above books of Prof. Kryloff. Unfortunately, this is in the Ukraine language, but there is a summary in German. This book makes considerable advances in the use of the Heaviside operational methods. In particular, it combines them with the methods of approximation on which Prof. Kryloff has worked so long.

H. T. H. P.

Leçons sur la théorie mathématique de la lutte pour la vie. Par Prof. Vito Volterra. Rédigées par Marcel Brelot. (*Cahiers scientifiques*, Fascicule 7.) Pp. vi + 214. (Paris : Gauthier-Villars et Cie, 1931.) 60 francs.

THIS book deals with one of the newest branches of applied mathematics, namely, the application of differential and integro-differential equations to biological problems of the survival of the fittest, such as the effect of a change in the rate of fishing upon the proportion of the different species of fish, some of which prey upon others.

The first part of the book assumes that the causes have immediate effects. This assumption, though probably far from the truth, has the advantage of allowing a fairly simple and complete mathematical treatment in terms of differential equations. Three fundamental laws are deduced, those of fluctuations, conservation of means, and perturbation of means, which seem of considerable practical importance. The second part of the book endeavours to extend the results of the first to the case where the causes produce delayed effects.

This work is connected with Prof. Volterra's researches on integro-differential equations and their applications to mechanics. In view of the simplifying hypotheses adopted, the results are not likely to be accepted by biologists until they have been confirmed experimentally, but this work has as yet scarcely begun.   H. T. H. P.

Miscellany.

Armadas of the Sky : the Problem of Armaments. By Paul Murphy. Pp 120. (London : The Houghton Publishing Co., 1931.) 5s. net.

THIS is a semi-philosophic discussion upon the possible methods of waging war in the future, bearing in mind the uses made of aircraft in the late War, and endeavouring to visualise their probable development by the time the next war breaks out. The reader is left, as it is suspected the author himself is, somewhat breathless, if not entirely drowned, in the sea of argument and counter-argument. The conclusion that appears to emerge from the welter of facts intermixed with visions is that the use of aircraft plus radio communication will so radically alter methods of war that it is impossible