The first chapter is on vectors and has been completely rewritten. Two definitions of vector are given, one in substantially the usual terms, the other as follows: A vector $\mathfrak{A}$ is a function which depends not only on a located point, but also has a value for every direction radiating from the point. These values are its *components*, and must be such that any three of them which form a trirectangular system, when added geometrically, produce that one of the components which has the maximum length. This particular component however has no precedence over the others in importance and no one of the components is the vector, but the entire system of values correlated to the directions. Geometrically, the vector is represented by a pair of spheres tangent at the point in question, with the ensemble of chords drawn through the point, which chords are positive in one sphere and negative in the other. Examples of these "physical vectors" are found in forces, displacements, velocities, accelerations, electric and magnetic fields. This conception of vector as a set of function values, rather than as a directed line segment, or as a hypercomplex number, seems to us more like an attempt at novelty than at usefulness. The gain is not evident. In the text following, the analysis goes back practically to the usual mode of development. A section is added on "Tensoren," a name introduced by Voigt, which are the dyadics of Gibbs and the linear vector operators of Hamilton. Examples are the pressure in a deformed elastic body, elasticity coefficients, conductivities of heat, dielectric constants, and other properties of crystals.

The chapter on geometrical optics covers the usual ground. That on plane waves leads up to the electromagnetic theory of light. These extensive additions are an improvement in the original.

Many small changes have been made throughout, but we need not dwell on them. The criticisms made in the first review, referred to above, still hold in large measure.

JAMES BYRNIE SHAW.

Über freie und erzwungene Schwingungen. Von Dr. ARTHUR KORN. Teubner, Leipzig und Berlin, 1910. 8vo. vi+136 pages. M 5.60.

THE title of this memoir is somewhat deceptive, as it does not deal directly with the theory of oscillations, which are mentioned only in a brief introduction of nine pages, where the solution of certain problems in oscillation is reduced to expansions in terms of normal functions (Eigenfunktionen) belonging to integral equations. The entire text is then taken up with the development of the theory of the solution of linear integral equations following the method of successive approximations. This method may, however, without too much strain on the sense of the terms, be called the method of development in series of oscillating functions, and possibly this idea may have suggested the title.

The treatment is divided into three sections, presenting respectively the theory of linear integral equations with continuous, symmetric kernel, with discontinuous symmetric kernel, and Fredholm's solution of linear integral equations with any continuous kernel. In an appendix some generalizations are given for kernels with discontinuities for many-dimensional problems, and for systems of linear integral equations. The book closes with a bibliography of memoirs by the author relating to the applications of the method of successive approximations. This method owes its development to C. Neumann, Poincaré, Picard, and Korn.*

In a sense the book is an introduction to the theory of developments in series of normal functions particularly when the kernel is unsymmetric. These are, up to the present time, special investigations which each extend the field a little. In many cases of particular forms of the kernel, it is possible to develop theorems analogous to those on which is based the solution of the case of a symmetric kernel. How far this method may lead one in such investigations remains for the future to show.

JAMES BYRNIE SHAW.

Etude sur l'Assurance complémentaire de l'Assurance sur la Vie. By P. J. RICHARD. Paris, A. Hermann et Fils, 1911. 118 pages.

THE appearance recently in this BULLETIN of the note that "at the University of Göttingen . . . candidates in applied mathematics must henceforth be prepared to be examined in the mathematics of insurance," the approval by the Italian Chamber of Deputies of the bill providing for a state monopoly

* H. Bateman, Report on the history and present state of the theory of integral equations, page 21.