MODERN ELECTROMAGNETIC THEORY.

Outlines of the Theory of Electromagnetism: a Series of Lectures delivered before the Calcutta University. By Dr. G. T. Walker, F.R.S. Pp. viii + 52. (Cambridge: University Press, 1910.) Price 3s. net.

THESE lectures were intended to present some of the more important developments of electromagnetic theory in a connected and convenient form for the use of advanced students in the University of Calcutta and of the lecturers in outlying colleges. Following the example of Abraham and Föppl's excellent treatise, the author prefixes a chapter on the notation and methods of vector analysis, employing clarendon type for vector quantities. These are adhered to closely throughout the book, with the slight excursions into Cartesian method which seem to be inevitable. The second chapter consists of some illustrations of the application of these methods to the magnetostatic field. This is followed by an account of the Hertzian form of the equations of the electromagnetic field both for stationary and for moving bodies, with an indication of instances in which they fail to agree with experiment, and, finally, the electron theory of Lorentz is expounded so far as the general equations of the field are concerned.

The book is welcome as partly supplying the great need of an English text-book setting forth clearly the present state of electromagnetic theory, which seems in the last few years to have emerged a little from the purely tentative stage. The accumulated evidence against the possibility of the determination of a unique velocity of matter relative to the æther is giving physicists a prepossession in favour of the Lorentz field-equations. The present work seems to be directed mainly towards familiarising a larger public with the theory on which these equations are based, as contrasted with the earlier theory of Hertz. The account given is concise and free from digressions, and well adapted to the author's purpose.

In one respect the book might have been improved, and have assisted more materially than it does in establishing a uniform usage among English writers on electromagnetism. The author speaks of the *polarisation of the aether, polarisation of the matter, and of total polarisation.* Now that the theory of the stagnant æther is generally accepted, the time would seem ripe for confining the term *polarisation* to the second of these quantities, even if the unsatisfactory term *displacement* has to be retained for the last, as is done by Lorentz in his "Theory of Electrons" (Leipzig, 1909). It would be a great advantage to students beginning to read the subject if English-speaking physicists would adopt a terminology analogous to that used in recent German accounts of the subject (*e.g.* Lorentz, "Enzyk der Math. Wiss."; Abraham, "Theorie der Elektrizität," Bd. 2), where the term *Erregung* is used for both displacement (electric) and induction (magnetic).

The author is slightly confusing in his use of symbols, making an otherwise very clear exposition more difficult to follow. Without warning, the notation for the magnetic induction is changed from **B** to **H**, a new symbol, $\mathbf{H}_1$, being introduced for the magnetic force, and an equally novel one, $\mathbf{G}^1$, for the magnetisation. Closely following one another we find the three equations, $\text{div}\, e = \rho$, $\text{div}\, \mathbf{D}^1 = -\rho$, $\text{div}(\mathbf{E} + \mathbf{D}^1) = \rho$, in each of which ρ has a different significance. An apparent desire for brevity has caused the omission of explanation which was probably present in the spoken lectures and would make the book much easier to read for one to whom the subject was unfamiliar. The process of finding the average electric force over a small element of volume, so fundamental to the Lorentz theory, would with advantage have received fuller explanation, if only by a bare definition of the averaged vectors.

Save for the few exceptions referred to, the book marks a distinct advance towards a text-book which shall give its readers a clear outline of modern theory as it is at present developed.

ELEMENTARY PRINCIPLES OF AVIATION.

(1) *Elementary Aëronautics, or the Science and Practice of Aërial Machines.* By A. P. Thurston. Pp. vii + 126. (London: Whittaker and Co., 1911.) Price 3s. 6d. net.
(2) *The Principles of Aëroplane Construction.* With Calculations, Formulæ, and 51 Diagrams. By R. Kennedy. Pp. vii + 137. (London: J. and A. Churchill, 1911.) Price 5s. net.

(1) "ELEMENTARY AËRONAUTICS" is a careful collection of available information, together with some elementary theorems in aërodynamics which are, on the whole, good. It is necessary in considering early theories in aëronautics, that the reader should be carefully informed as to the limitations imposed by the initial assumptions, and also of departures from usual practice. This feature is not always sufficiently emphasised in the present work.

Generally speaking, frictional resistances are ignored without mention, and on p. 20 a new definition of stream lines is given which is quite foreign to the more usual definition adopted in mathematical aërodynamics. Further, the equation used in this case is only applicable to an incompressible fluid, and it is possible that for propellers such an assumption may not be justifiable.

A small point of printing is worth noting. Suffixes are not always clearly indicated, and might easily be misread for factors. An obvious case occurs at the bottom of p. 5, where $P\alpha \cos \alpha$ is written for $P_{\dot{a}} \cos \alpha$.

The first thirty-one pages provide a sound *résumé* of current data, accompanied by illustrations of the motion of air round obstacles. The advantage of aërocurves as compared with planes is clearly and correctly indicated. The work then proceeds immediately to less certain ground in the discussion of stability. The formula for damping of oscillations deduced on p. 37 appears to be wrong, as the damping effect of a plane is largely dependent on the forward speed—an effect which is ignored.

The chapter on propellers and helicopters is good only if it be clearly borne in mind that ideal conditions are assumed for most of the theoretical de-