COURANT AND HILBERT ON MATHEMATICAL PHYSICS

Methoden der mathematischen Physik. Bd. I. By R. Courant and D. Hilbert. Berlin, Julius Springer, 1924. xiii + 450 pp.

The book under review is the twelfth volume of the series *Die Grundlagen der mathematischen Wissenschaften in Einzeldarstellungen.* It is the second book of this series to be devoted to mathematical physics, it being preceded by volume IV, Madelung's *Die mathematischen Hilfsmittel des Physikers.** This earlier volume covers very extensive ground but, necessarily, in a rather cursory manner. The present volume, on the contrary, centers around one single physical problem, the oscillation problem, with its mathematical equivalents, the boundary value and expansion problems.

These are the main problems. Incidentally the reader will pick up a good deal about methods which are applicable to other problems of mathematical physics, but he will have to supply the applications himself. However, in these days of *Morbus relativitus* the information might be welcome that the word tensor appears on page 3 of the book and disappears on page 30, and it is not frequently used.

A few words regarding the joint authorship should be appropriate. The book is obviously and avowedly written by Courant. It is true that most of the subject matter originated directly or indirectly with Hilbert, whose spirit hovers over almost every page of the book. But the reader can easily verify, by looking up the several references, that a considerable portion of the book is based upon Courant's own investigations. This is especially the case with Chapter VI. Otherwise, the simple choice of methods, the fondness of heuristic considerations and a certain delicate touch of the pen, sometimes a bit vague but always elegant, betray the writer if nothing else does. All these qualities make the book easy and enjoyable reading.

We have already mentioned that the book deals with the oscillation problems of mathematical physics. This theory culminates in Chapters V and VI of the book, the former giving the equivalent boundary value and expansion problems, the latter the properties of the characteristic values and functions. The existence of the solutions is, occasionally postulated, many existence proofs being postponed to the second volume of the book which will appear later. The first four chapters lay a foundation for the theory; they deal with linear transformations and quadratic forms, expansions in terms of orthogonal functions, linear

* Review by B. O. Koopman, this BULLETIN, vol. 30, Nos. 5–6 (May–June, 1924), p. 272.