truly excellent photographs of fleas deserve special mention. These are mostly the work of Arthur Barron and are quite the best and most useful photographs of fleas I have seen. It is to be hoped that the succeeding volumes will be similarly illustrated.

It is understood that Vol. 2, covering seven families (Coptopsyllidae, Vermipsyllidae, Stephanocircidae, Hypsophthalmidae, Ischnopsyllidae, Macropsyllidae and Xiphiopsyllidae) of the Ceratophylloidea is due for publication. The appearance of this and succeeding volumes will be eagerly awaited by all students of fleas. Meanwhile, the authors and publisher may be congratulated on the high quality and practical usefulness of the first volume of a work that will be the standard reference on fleas for many years to come.

G. P. Holland

MATHEMATICAL METHODS

Methods of Theoretical Physics

By Prof. Philip M. Morse and Prof. Herman Feshbach. (International Series in Pure and Applied Physics.) Part 1: Chapters 1 to 8. Pp. xxii+998+xl. Part 2: Chapters 9 to 13. Pp. xviii+999–1978. (London: McGraw-Hill Publishing Company, Ltd., 1953.) 120*s*. each volume.

THEORETICAL physics to-day has a vast content. To expound fully the mathematical methods which are necessary for the development of the major branches of the subject would be a great undertaking. Authors of text-books on the methods of theoretical physics must therefore choose between covering a very wide variety of methods in a superficial kind of way, and treating a restricted range of topics comprehensively. It is this latter course which Profs. Morse and Feshbach adopt. Despite its general title and its great length, their work consists almost entirely of an exposition of the methods of solving Laplace's equation, Schrödinger's equation, and the scalar wave equation. It is, however, an excellent account of these topics and will doubtless become a standard work.

The first three chapters of Part 1 consist of an account of various types of field (scalar, vector, tensor) occurring in theoretical physics, and of the differential equations and variational principles governing them. This is followed by three chapters on functions of a complex variable, ordinary differential equations and the theory of eigenfunctions, respectively. A great deal of the material in these first six chapters (covering nearly eight hundred pages) is familiar, but it is discussed in a manner particularly suited to the needs of the mathematical physicist. The treatment is always interesting, and sometimes novel—for example, the discussion of the 'Euler' transform in Chapter 5. The last two chapters of the first volume are devoted to the Green's function technique for the solution of partial differential equations, and to the theory of integral equations. The account of the method of Green's functions is particularly clear and attractive.

The second volume begins with an account of the three main approximate methods of solution of boundary value problems in physics: (1) the perturbation method, (2) the variational method, (3) the variation-iterational method. That this chapter is long (more than 170 pages), and difficult, is due largely to the fact that the authors have illustrated the methods they describe by applying them to difficult and worth-while problems of the kind which a theoretician will encounter in the course of his researches, rather than to the artificial kind of problem one encounters all too often in mathematical treatises. The remainder of the work is devoted to the application of the principles already established to the differential equations of mathematical physics —Laplace's and Poisson's equations, the wave equation, the diffusion equation, Schrödinger's equation. The partial differential equation approach (separable systems) is developed for exact solutions, the integral equation approach for approximate solutions.

From this brief description of the contents of the book it will be seen that it is, as the authors state in the preface, more a treatise on the boundary value problems of mathematical physics than a comprehensive account of mathematical methods. For example, it treats very sketchily, or omits entirely, the theory of characteristics, the flow of fluids, supersonic flow, and the equations governing the behaviour of solid continua. It does not develop either the theory of groups or the theory of matrices, both of which are of great use in theoretical physics. Nor is the use of dyadics rather than tensors a very happy choice. But within their limited field the authors have produced a work which, both on account of the amount of physics and the rigour of the mathematics, is very nearly complete and self-contained.

The striking feature of the whole work is the clarity of the exposition. Difficulties are not avoided or treated superficially. Little attempt has been made to compress the material; this may have led to a book of great length, but it has also produced one of great value. As has already been indicated, the physical problems which the authors discuss have been chosen for their current interest, and are seldom trivial. No attempt has been made to produce solutions from 'thin air'—the problems are tackled in a systematic way which not only illustrates the basic points of the theory, but also helps the young research worker to acquire a body of technique sufficient to enable him to grapple with the problems he encounters in the course of his researches. Running through the book is the view that very few problems in mathematical physics are capable of exact solution, so that the student must acquire facility in deriving approximate solutions. The approximate methods which the authors develop are analytical in nature. The fact that they do not discuss purely numerical techniques, such as 'relaxation', is not a serious drawback, since there are already in existence several admirable accounts of these methods.

The standard of book production is well up to the excellence of the authors' writing. The printing, the lay-out and the illustrations of the book are of an exceptionally high quality, and make it a pleasure to use. The book's one disadvantage is one which will not have escaped the publishers: its high price (£12 for two volumes) makes it impossible for all but a very few students to possess it. It is difficult to see how a book of this length could have been other than expensive; but it is a pity that it cannot be readily available to students. It should, of course, be in the library of every mathematical department. It will not lie undisturbed upon the shelves, for it contains a very great deal which will be of value to all who have to learn (or have to teach) mathematical physics.

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