BATEMAN ON MATHEMATICAL PHYSICS

Partial Differential Equations of Mathematical Physics. By H. Bateman. Cambridge, University Press; NewYork, The Macmillan Co., 1932. 522+xii pp.

The primary purpose of this book is the solution of the boundary-value problems of mathematical physics by means of definite analytical expressions, and the book is noteworthy in fulfilling this object. Some particular topics, such as integral equations, existence theorems of potential theory, Sturm-Liouville series, have been intentionally omitted. Nevertheless, a large number of topics are here treated, and in a unified way. Let us look over the table of contents.

The Introduction discusses briefly the relation of the differential equations to variational principles, and approximate solution of boundary-value problems, method of Ritz, orthogonal functions.

Chapter 1 is on the classical equations, and includes uniform motion, Fourier series, free and forced vibrations, Heaviside's expansion, wave motion, potentials, Laplace's equation, characteristics.

Chapter 2 consists primarily of applications of the theorems of Green and Stokes: Riemann's method, adjoint equations, difference equations as approximations to differential equations, variational principles, transformation of equations, elastic solids, fluid motion, torsion, membranes, electromagnetism, and so on.

Chapter 3 is on two-dimensional problems, Fourier inversion, vibration of a loaded string and of a shaft, Poisson's integral, logarithmic potentials with applications.

Chapter 4 is primarily theoretical, on conformal mapping, including the Riemann theorem, the distortion theorem, Green's function, mapping of polygons, orthogonal polynomials, approximation to the mapping function.

Chapter 5 deals with equations in three variables, wave motion, heat flow. Chapter 6 is on polar coordinates, Legendre polynomials, with generalizations and applications.

Chapter 7 discusses cylindrical coordinates, diffusion, vibration of a circular membrane, Bessel's functions, etc. Chapters 8 and 9 include elliptic and parabolic coordinates, with the corresponding boundary-value problems, including the study of Sonine's polynomials.

Chapter 10 is on toroidal coordinates and applications, Chapter 11 on diffraction problems, and Chapter 12 on non-linear equations, with particular reference to Riccati's equation and applications, minimal surfaces, and the motion of a compressible fluid.

It is clear from this incomplete list that an enormous amount of material is here gathered together and made available. Much of it comes from current (even the most recent) periodical literature, and includes results found by both theory and experiment. The magnitude of the undertaking may be appreciated from the fact that the author index contains 1198 references. The material as a whole is well selected, digested, and correlated. Many results which for one reason or another do not find place in the text are presented as problems to be solved by the reader; this is a most welcome feature. The ex-