Int. J. Heat Mass Transfer. Vol. 6, p. 325. Pergamon Press 1963. Printed in Great Britain.

BOOK REVIEW

Unsteady Motion of Continuous Media: K. P. STANYUKOVICH, Pergamon Press, Oxford, 1960, 745 pp. + xiii, £5.

THIS is a translation of a very long text on the mathematical solution of problems involving unsteady flow of a compressible medium. By way of illustration the author has drawn on up-to-date questions in the fields of detonation and combustion, astrophysics, cosmogony and cosmology, and the theory of multiple particle production.

Since the war the standard work throughout the world has been the monograph by Courant and Friedrichs entitled *Supersonic Flow and Shock Waves* (New York, 1948). The present volume does not replace this, but supplements it with a very detailed account of Soviet contributions to the science. Since these have been both important and numerous in the newer branches of learning, the opportunity of reading of them in English is most welcome. Nevertheless it must be said that some of the mathematical work is pursued in rather great detail, so the book might well have been shorter. It is presumably on account of its length that the book has been produced by non-letterpress setting. The equations, which are difficult to read at times, appear to have been photographed from the original text, with the unfortunate result that the abundant mathematical misprints in the original have been copied in this new version. The publishers apologize for the standard of the production but remark that the book would otherwise have been delayed for several months and the price would have been higher. It seems to the reviewer that if a book is worth the great trouble of translation and reproduction from a foreign language, as this is, it should be produced in a form that is not one of mere utility, but pleasant to the eye and easy to read.

The book opens with an account of the basic equations of unsteady motion of a compressible fluid and of thermodynamic properties in general. At all stages the consequences of including heat emission or absorption terms and gravitational fields are considered. The third chapter is one dealing with self-similar solutions for flows with special symmetries (involving not more than two independent variables); these are mostly mathematical results obtained by the author. Chapters 4 and 5 consider one-dimensional isentropic motions. The first is a chapter of formal mathematics, dealing with simple waves and leading to the fact of breakdown of continuity in a wave of compression. The second gives details of flows out of one end of a tube with the other end closed or open, and wave motions resulting from the retraction of a piston in a closed tube. The next chapter (6) gives a comprehensive account of the known properties of normal and oblique shock waves in plane flow, including the regular and irregular (Mach) reflection of a shock wave at a rigid wall. Chapters 7 and 8 deal with detonations and deflagrations. These are very interesting. Soviet writers have considered mathematical models here in much detail and the book goes into problems involving release of energy by exothermic chemical reaction, mentioning also absorption resulting from radiation and endothermic reactions, the escape of detonation products when a detonation wave reaches the surface of a charge, and the wave motions resulting from the escape of these products into vacuum from a finite (one-dimensional) charge fired at some arbitrary internal point. In Chapter 7 there is a long and excellent discussion of the various approximations to the equation of state in condensed explosives and their conditions of applicability. There follows a description (Chapter 9) of the transmitted and reflected waves when shocks impinge upon another medium, with special reference to detonation waves. There is a long section on the escape of detonation products into air (one-dimensional motion). Chapter 10, entitled "Three dimensional motion of a gas", starts with cylindrical and spherical detonation waves, treated as a study in self-similar motions, and goes on to give an approximate solution for the expansion of a gaseous sphere into a vacuum. Then comes the theory of point explosions with finite energy and negligible mass (the model for atomic explosions), and the important problem of a converging spherical shock. The acoustic approximation, applicable to cylindrical and spherical waves after considerable attenuation, is next treated and then other approximate methods of integrating the equations for motions with these special symmetries are indicated. The chapter ends with a brief discussion of the dispersion of the products of detonation in air.

Chapter 11 deals with unsteady motion in condensed media. In these it is often possible to neglect the variation in entropy, with consequent simplification of the mathematics. Problems touched upon include cavitation of a dense medium at a free surface, the propagation of a spherical shock wave in water and of strong waves in solids. The last four chapters deal successively with the propulsion of bodies by a gas stream and, in particular, Lagrange's problem in internal ballistics; the motion of gas in a gravitational field, with special reference to the eruption of masses of gas from heavenly bodies; the limiting motion of rarefied and very dense media, again dealing mostly with cosmological and cosmonogical problems; and problems in the relativistic mechanics of solid media—a comparatively new subject with applications in the study of collisions of fast elementary particles and thus having some bearing on theories of the origin of cosmic rays, and more particularly, of mesons.

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