Journal of APPLIED MECHANICS Book Reviews

Transonic Flow

The Theory of Transonic Flow. By K. G. Guderley. Pergamon Press, New York, N. Y., 1962. Cloth, 6½ × 9½ in., xviii and 344 pp. $9.

REVIEWED BY E. V. LAITONE[1]

THIS book is an excellent translation of the original German text published as the "Theorie schallnaher Strömungen" by Springer-Verlag in 1957. Several minor errors have been corrected, but no new references have been added. The book should still be of great use, not only to fluid dynamicists, but also to applied mathematicians who are interested in nonlinear (quasilinear) partial differential equations with boundary-value problems containing interacting elliptic and hyperbolic domains.

[1] Professor, Department of Aeronautical Sciences, University of California, Berkeley, Calif.

The inviscid transonic flow problems treated by Dr. Guderley are characterized by the presence within the compressible flow field of interacting subsonic and supersonic flow domains. For example, the subsonic flow inside a Laval nozzle or over a closed body can contain a local supersonic region which is separated from the main subsonic flow by a sonic line whose shape is an unknown integral part of the boundary-value problem. On the other hand, the detached shock wave in front of a body moving at supersonic speeds produces a local subsonic region immediately behind the central portion of the shock wave. This local subsonic region is terminated by the sonic line, and now the shape and location of both the detached shock wave and the sonic line are unknown. Dr. Guderley presents many original attempts at obtaining analytical and numerical solutions for these interacting elliptic (subsonic) and hyperbolic (supersonic) domains. His work is very useful in presenting both physical insight and mathematical viewpoints in the solution of these and other transonic flow prob-

lems for two-dimensional and axisymmetric flow. He also discusses the known exact solutions and the particular solutions of the Tricomi equation. Various methods of series perturbation expansions, and the transonic similarity rules, are also applied to different types of transonic flow problems. This book, in conjunction with the "Mathematical Aspects of Subsonic and Transonic Gas Dynamics," by Lipman Bers (John Wiley & Sons, 1958), should provide anyone a complete background to the theory of inviscid transonic flow.

Gas Lubrication

Gas Film Lubrication. By W. A. Gross. John Wiley & Sons, Inc., New York, N. Y., 1962. Cloth, 6 × 9½ in., xiv and 413 pp. $14.

REVIEWED BY W. FRÖSSEL[2]

In principle, hydrodynamic lubrication can be achieved with the aid of any fluid or gas which adheres to a solid surface. In spite of this, the application of gases to lubrication has been achieved in practice only recently. For this reason, one should applaud the appearance of the above book, particularly because it treats the problem of compressible gas lubrication in a purely mathematical manner, and yet applies it to sensible shapes, sensible, that is, from the point of view of practical applications. It includes the plane wedge slider, the step slider, the taper-flat slider as well as curved slider bearings and treats them really comprehensively, taking into account the results contained in numerous papers by foreign authors.

Starting with the well-known Navier-Stokes equations and making the usual approximations by rejecting unimportant terms and introducing the other simplifications, the author manages to develop useful and usable final solutions. The properties of the solutions are brought to light with the aid of lucid diagrams drawn for infinitely long slider bearings as well as for those of finite length.

These are followed by results for journal, multiple-section journal, foil, and spherical bearings. The unsteady film is treated in addition to the steady film. A whole chapter contains a comprehensive mathematical treatment of the problems of steady, externally pressurized bearings.

The book imparts a theoretical grasp of the processes which occur in gas lubricated bearings and brings out particularly clearly the difference between incompressible and compressible lubrication. The practical application of these concepts requires further experimentation and the accumulation of actual experience with slider bearings.

A copious list of references concludes this very remarkable book.

[2] Max Planck Institut, Göttingen, Germany.

Boundary Layer and Flow Control

Boundary Layer and Flow Control. Vols. 1 and 2. Edited by G. V. Lachman. Pergamon Press, New York, N. Y., 1961. Cloth, 6½ × 9½ in.; vol. 1, xii and 600 pp.; vol. 2, vi and 760 pp. $35 for two volumes, $14.70 for one.

REVIEWED BY KLAUS GERSTEN[3]

On the instigation of Dr. Lachmann, 43 international authorities give in separate contributions a full coverage of the research on the subject of BLFC in its widest sense. Thus a terse but nevertheless complete review, reflecting fully the present situation in this extensive field, has been made available for the first time; it has been urgently needed since long ago.

It is not possible to give an account of the contents of both volumes in a short review, but it is emphasized that several articles contain new results (e.g., Coanda effect, trapped vortices) or unusually complete presentations (jet-flapped wing, laminar airfoils, shock-induced separation and its prevention, etc.).

Though the book naturally lacks homogeneity owing to the large number of authors (notation, figures, arrangement of the single articles), the appearance of this work is very welcome because it gives an almost complete survey of the subject. It is indispensable for anyone interested in questions of BLFC.

[3] Institute of Fluid Mechanics of the Technical University, Braunschweig, Germany.