though any 'random' mechanism would cause it to flow the other way, down its gradient). Prandtl noted, in this context, that any loss of energy in the high-altitude west–east circulation (due to large-scale disturbances) would reduce the Coriolis force balancing the poleward pressure gradient, and so permit poleward movement down that pressure gradient until the energy had been restored; and he noted also that the geostrophic relation between poleward pressure gradient and west–east momentum implies that energy-restoring motions must also make the west–east momentum flow polewards. Other illuminations in this field include work on the structure of fronts, and, remarkably enough, an original paper dated 1950 on the dynamics of the jet stream.

The volumes close with a section covering many of Prandtl's significant contributions to experimental technique, which laid the foundations of modern low-speed and high-speed wind-tunnel practice (and, as a curiosity, included experimental studies in a rotating room), followed by a group of miscellaneous papers, among which stand out a beautiful piece of work on bearing lubrication and some eloquent advocacy of the use of vector analysis.

Those who love theoretical and applied mechanics can be recommended, if necessary, to curtail some future holiday in order to be able to afford these absorbingly interesting volumes. Such a drastic measure might also enable them peacefully to enjoy the pleasures of their first perusal!

M. JAMES LIGHTHILL

THEORY OF BOUNDARY LAYERS

Boundary Layer Theory

By Dr. Hermann Schlichting. Fourth edition. Translated by Dr. J. Kestin. (McGraw-Hill Series in Mechanical Engineering.) Pp. xx+647. (New York: McGraw-Hill Book Company, Inc.; London: McGraw-Hill Publishing Company, Ltd., 1960.) 128*s*.

New Methods in Laminar Boundary-Layer Theory

By Dr. D. Meksyn. Pp. xxiv+294. (London and New York: Pergamon Press, 1961.) 70*s*. net.

THE concept of the boundary layer was discovered by Prandtl in the first years of the present century, and since then it has occupied a central position in fluid mechanics. The boundary layer is essentially a skin effect, which occurs in the flow of a fluid with small viscosity, but the behaviour of the layer may have a profound influence on the general character of the whole flow. For this reason, the mechanics of the boundary layer is of great importance to engineers and mathematicians interested in the problems of fluid flow. In recent years the study of boundary-layer flow has attracted increasing attention, both theoretically and experimentally, and a great number of papers have appeared on this subject.

Prof. Schlichting has been one of the leading contributors in this field, and his book, which was originally published in German ten years ago, has now appeared in its fourth English edition. This follows the same general plan as the first German edition, but the accretion of new material has made it considerably bigger. The first part provides the basic physical ideas and the fundamental equations for the flow of viscous fluids. Some of the exact solutions of these equations are discussed, and there is a chapter on the approximate solutions which are valid when the viscous forces are dominant over the inertia of the fluid. Laminar boundary layers are treated in the second, and longest, part of the book. This side of the subject is the most fully understood, and has received extensive mathematical treatment. A full account of two-dimensional flow is given, including chapters on heat transfer and compressibility. Axisymmetric and three-dimensional boundary layers are treated more briefly, and there is a chapter on boundary layer control.

The third part is on the transition from laminar to turbulent flow. It contains a description of the theory of hydrodynamic stability, its experimental verification and its relation to the formation of turbulence. The factors influencing stability are considered, with applications to the flow over aerofoils. The last section of the book deals with fully developed turbulent flow. Here the treatment is of necessity largely empirical, and based on the analysis of experimental results. Separate chapters deal with flow in pipes, over flat plates, with the calculation of turbulent boundary layers, and with free turbulence in jets and wakes.

Schlichting's book is written for engineers, and emphasis is placed on those methods and results which are likely to prove most useful. Topics which are not yet amenable to routine calculation, such as the flow over a general three-dimensional surface, are dealt with only briefly. Each chapter has an extensive list of references, and there are many figures illustrating theoretical results and experimental observations. In a book on such a quickly growing subject there is inevitably scope for improvement and addition in detail, but it is likely to remain a standard work for several years. The legend of Fig. 5.15, on page 90, has an error, and a corresponding one is made in the description, on page 91, of the effect of Reynolds number on the flow in a divergent channel. The book is well produced and clearly printed.

The scope of Dr. Meksyn's book is more limited, as its title indicates. It is concerned with mathematical methods, and deals mainly with steady laminar flow and with stability theory. The author has written several papers on these subjects since the War, and his book presents a systematic account of his work. Other aspects of laminar boundary layers are mentioned rather cursorily. The reader who is already familiar with boundary-layer theory may find Meksyn's methods of interest, but he would be well advised to check the formulæ carefully. The original papers contained several errors, of which most have been corrected, but some still survive. There are a number of minor slips.

E. J. WATSON

MEASUREMENT OF WATER-FLOW

Hydrometry

Theory and Practice of Hydraulic Measurements. By Prof. Adam T. Troskolanski. Pp. xix+684. (London and New York: Pergamon Press; Warszawa: Panstwowe Wydawnictwa Techniczne, 1960.) 120*s*. net.

WHEREAS in most other countries 'hydrometry' means the science of water-flow measurement, in Britain it has been connected with measuring the density of liquids. The title of this book is therefore yet another example of a distinguished foreigner teaching us our own language.