P. BRADSHAW (Editor), **Turbulence. Topics in Applied Physics,** Vol. 12. Springer-Verlag, Berlin. 2nd Edition, 1978, 339 pp., 47 Figures. Price $24.50.

THIS BOOK is Volume 12 of the well presented *Topics in Applied Physics* series founded by Helmut K. V. Lotsch, and is intended to present an integrated treatment of Turbulence. The demand for a deeper understanding of turbulence is ever increasing because of its importance to many branches of Science and Technology; as a consequence the field is today in rapid development, and this book fulfils a useful purpose. The text is a handsome, well written account of contributions by different authors, which interact sufficiently to produce an integrated treatment of the subject.

This book gives, in a text of 339 pages, easy access to valuable information and is divided into 7 Chapters, each presenting different aspects of Turbulence.

Chapter 1 constitutes the "Introduction". What is termed Introduction is an excellent treatise by P. Bradshaw that outlines, in the most comprehensive way, the physical processes of Turbulence and the differential equations that govern them; and concludes with a presentation of sets of boundary conditions and flow geometries that occur frequently in practice. I found the 44 pages devoted to the Introduction very informative indeed.

Chapter 2 follows the Introduction and is the first of the chapters dealing with more specialised problems. This is by H. H. Fernholz and refers to turbulent regions which are significantly affected by only one wall (external flows). This chapter is mainly concerned with the discussion of steady 2- and 3- dim. turbulent boundary layers at low Mach numbers, and touches upon the subjects of: effects of freestream turbulence on a boundary layer, wall roughness, wavy walls, transition from linear to turbulent flow; and it finishes with 2-dim. boundary layers at high Mach numbers. The analysis is conventional but satisfying and is followed by a list of 447 references.

The next chapter, by J. P. Johnston, deals with internal flows in circular pipes, diffusers etc., and flows in and between blade rows of turbines and compressors. Full attention is focused on subjects like longitudinal curvature and system rotation, secondary flows, interactions in ducts, flow in diverging ducts and fully separated flows. Finally, an account of the current state of turbulence knowledge in the field of Turbomachinery is given. A list of 158 literature references closes the chapter.

The above three Chapters cover the most frequently occurring phenomena and the rest of the book is devoted to details of specialists problems, as Geophysical Turbulence by P. Bradshaw and J. D. Woods in Chapter 4, which covers the atmospheric boundary layer, the ocean surface layer, and laboratory scale buoyant flows. This is a brief Chapter not of direct help to the specialist in the field but certainly informative enough for those wishing to acquaint themselves with another branch of Turbulence.

The next two sections, 5 and 6, deal with the calculation of Turbulent Flows. Chapter 5 by W. C. Reynolds and T. Cebeci with the calculation of the velocity field and Ch. 6 by B. E. Launder with the calculation of heat and mass transfer. Chapter 5 written as early as 1976 is, understandably, out of date, given the rapid development of computational procedures, which renders the speculations of today the more-or-less standard methods of tomorrow. It is still an informative account of several levels of turbulence modelling.

Chapter 6 deals with heat- and pollutant-transfer turbulent problems, with the treatment of buoyancy effects fully integrated into the main discussion of heat transfer. It is an excellent treatment of the subject supplemented by 132 references; unfortunately none of which were published later than 1976.

The last chapter, by J. L. Lumley, is devoted to two-phase and non-Newtonian Flows. The general subject of turbulent flow of two-phase and non-Newtonian media is extremely broad and greatly unexplored. The author rightly restricts attention only to the simplest cases, that of spherical solid isolated particles and turbulence in dilute solutions of high molecular weight linear polymers (drag reduction by polymer additives). Although of limited applicability the article is adequate in introducing the reader to those very complicated fields, basically by reference to empirical laws.

On the whole, all chapters consist of high quality material with large bibliographies, to permit an efficient overview of the field. The publication itself is also very good. I look forward to a third edition, with a complete updating of the last three chapters to reflect the rapid recent developments (e.g. multiscale models of turbulence, multi-phase flow computations etc.).

The volume should be read by all serious teachers and researchers of turbulence. It will be a good starting point for research. I hope that it will be used by industrial workers as well; there are many industrial problems to which the modern turbulence principles have yet to be applied. The editor is to be congratulated on his choice of papers which has produced a book of good quality and reasonable length. There are also additional references with titles, updated to early 1978 and subject index. Last but not least the book is cheaper than it might have been. I strongly recommend it to the reader.

N. C. MARKATOS