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Book Reviews

Injection and Mixing in Turbulent Flow, by Joseph A. Schetz, *Progress in Aeronautics and Astronautics*, Vol. 68, American Institute of Aeronautics and Astronautics, 1980, 200 pp., Price: $17 (AIAA Members), $27 (list).

REVIEWED BY PHILIP T. HARSHA

There is a long history of reviews of various aspects of turbulent flow phenomena. Most of these reviews have appeared as survey articles, and in fact this volume began as such a survey article. However, in describing the experimental and analytical aspects of the problems of injection and mixing in turbulent flow, Professor Schetz has gone far beyond the depth of material usually covered. Thus the importance of this work cannot be overstated: it belongs in the library of anyone interested in engineering problems which involve turbulent fluid flow.

Professor Schetz' intent is to review in depth the available experimental data for a variety of turbulent flows and the analytical techniques which have been used to predict them. This approach is necessary because the engineering solution of turbulent flow problems requires the use of both empirical and analytical techniques. An enormous variety of flows are covered in 200 pages: parallel jets, including constant-density flows and the effects of temperature and composition variations; flows with axial pressure gradients; zero net momentum defect cases; flows with swirl; two-phase flows; three-dimensional coaxial jets; transverse injection; buoyancy force effects; and viscous-inviscid interactions. In each case, experimental work is reviewed to establish the empirical data base and then the application of each of a hierarchy of turbulence models to prediction of the flowfield is examined. The experimental data include both mean flow and turbulence structure measurements, while the hierarchy of turbulence models ranges from algebraic eddy viscosity formulations through turbulent kinetic energy closures (both one-equation and two-equation) to Reynolds stress and direct turbulence models.

The amount of available data and the number of reported turbulence model applications varies widely for different flowfields, so that the depth of treatment in this volume varies with the subject considered. There are also, perhaps unavoidably, some gaps in the coverage of the various subjects: for example, while transverse injection into a supersonic stream is reviewed in detail, transverse injection into a subsonic stream is given only a brief mention. Nevertheless, Professor Schetz has succeeded admirably in what he sets out to do. The material covered in this volume provides an excellent introduction to turbulent mixing processes, while at the same time providing turbulence researchers with a complete overview of the current state-of-the-art. For the engineer concerned with examining a particular turbulent mixing process for a specific application, this volume provides the necessary review of the available experimental data and analytical techniques, while the 246 literature citations provide additional sources of information when further detail is required.

Wind Effects on Structures: An Introduction to Wind Engineering, Emil Simiu and Robert H. Scanlan, Wiley-Interscience, 1978, 458 pp. Price: $29.00

Wind Forces in Engineering (2nd Edition) Peter Sachs, Pergamon Press, 1978, 400 pp. Price: $40.00

REVIEWED BY OWEN M. GRIFFIN

Recent years have seen the growth of wind engineering as a technical discipline. Wind flow over buildings, cooling towers, bridges and other structures causes steady and unsteady loads and alters the atmospheric environment in the vicinity of the structure. For example, the need to know the effects of the wind on slender and flexible modern buildings has increased because most new high rise buildings have nonstructural curtain walls instead of massive masonry walls. The growth of wind engineering has been accompanied by an increased interest in the quadrennial International Conference on Wind Engineering, most recently held in 1979, which has evolved from earlier Conferences on Wind Effects on Buildings and Structures.

The two books reviewed here deal with the engineering aspects of wind forces and their effects on structures. Both were published in 1978, though the book by Sachs is a reissue of an earlier (1972) version. There is a definite distinction, however, between the two books and this can be seen from a comparison of the two Contents sections. The contents of the book by Simiu and Scanlan cover about two-thirds of a page and describe the book's eleven chapters by title. In contrast, the book by Sachs contains ten chapters but the Contents cover four pages; the book is arranged somewhat as a handbook (this is not meant in a particularly disparaging way) with the various topics discussed in each chapter listed in detail.

A chapter on wind tunnels is included by Sachs and is based largely upon the industrial aerodynamics program and experience at Great Britain's National Physical Laboratory. Chapters on Wind Data and Basic Shape Factors make up a large portion of the book. The latter is basically a compendium of drag and moment coefficients for almost every conceivable bluff body cross-section. Chapters 6,7,8 and 9 treat specialized applications to the wind engineering of Bridges, Buildings, Masts and Towers, and Special Structures. The latter include such things as cables, cooling towers, and radar and communication aerials. The final chapter of the book is a discussion of several representative Codes of Practice, the subjects each contains, and to which chapter of Sachs' book a particular subject is related. This feature is a definite advantage for the designer, for whom the material in the book primarily is presented. The addition of the chapter on Codes of Practice seems to be the major difference between the 1972 and 1978 editions of Sachs' book (as noted in his Preface).

The book by Simiu and Scanlan is intended as a text for graduate engineering students and for practicing structural engineers and architects. It is organized accordingly into two parts: Part A, The Atmosphere and Part B, Wind Loads And Their Effects On Structures. Part A contains chapters on Atmospheric Circulations, The Atmospheric Boundary Layer, and Wind Climatology and Its Application to Structural Design. Part B consists of two sections. One section includes interesting and well-written chapters on Bluff Body Aerodynamics, Structural Dynamics, and Aeroelastic Phenomena. A second section is titled Applications to Design and it contains chapters on Along-Wind Tall Building Response, Across-Wind Tall Building Response, Across-Wind and Torsional Response, The Wind Tunnel as a Design Tool, Wind Induced Discomfort In and Around Buildings, and Tornado Effects. The coverage of topics by Simiu and Scanlan is not nearly so broad as that of Sachs, but the depth of coverage by the former is correspondingly greater. Numerous worked examples are distributed through the book by Simiu and Scanlan, but there are no problems at the ends of the chapters. All in all, however, these authors have succeeded admirably in producing an up-to-date text for the relatively new and still expanding field of wind engineering.

In summary it should be noted that both books have considerable merit. *Wind Forces in Engineering* by Peter Sachs contains a wealth of data (though much of it dates from a pre-1970 time frame) that is made available to the designer and that is coordinated with up-to-date engineering Codes of Practice. *Wind Effects on Structures* by Emil Simiu and Robert Scanlan represents a well-written and appealing new text for introducing wind engineering to graduate students and practicioners alike.

Applied Fluid Flow Measurement Fundamentals & Technology, by Nicholas P. Cheremisinoff, Marcel Dekker, Inc., Price: $23.75

REVIEWED BY RODGER B. DOWDELL

After having specialized in the field of flow measurement for thirty years, it is not often that I pick up a publication and learn some new facts. This book by N. P. Cheremisinoff is refreshingly different. His first two introductory chapters are excellent: not too much theory, but enough to present the concepts of Newtonian versus non-Newtonian fluids and the difference between the laminar and turbulent equations of flow. He even derives the law of the wall from Prandtl's mixing length theory in a page and a half. With these two chapter ingested, the practicing engineer should be able to calculate the pressure drops and design fluid systems.

Chapter 3 is devoted to pressure differential devices: the venturi tube, orifice and flow nozzle. The descriptions are excellent, and the reader can design a Herschel type venturi tube from the data given. However, this is not true for the orifice nor flow nozzle where the reader is given references for the design information. This chapter also sheds light on installation effects. The next two chapters are on positive displacement meters and mechanical flowmeters. Again these are well done with excellent tables on the choice of materials to use with various corrosive fluids.

Magnetic meters are described next, and this description is excellent right down to what materials should be used for the flow tube and electrodes. However more information could have been included on installation effects.

The final chapter on mass flow meters has a large omission in that no mention is made of the angular momentum principle, and meters based on this principle are being manufactured. However, this is a minor shortcoming when the book is viewed in its entirety. The 82 references will lead the reader to whatever additional information is required.

I highly recommend this book for engineers anxious to learn more about flow measurement.