challenges. The coupling between the unsteady fluid motion and the oscillation of the cylinder has long been of interest, and the author discusses the modelling of such phenomena.

The flow-induced vibration of an array of circular cylinders in cross-flow probably represents the most complex class of problems in the area of flow-structure interaction. Various types of correlations, and a review of attempts to explain the mechanisms occurring in such arrays, are presented in this section of the book. Very often, one encounters occurrence of acoustic resonance within such a tube array in engineering practice. As a consequence, the designer is confronted with the parallel to Wall Street's triple witching hour: triple coincidence of the natural frequencies of the unsteady flow, the cylindrical structures, and the resonant acoustic modes of the system. Again, creation of awareness that all of these aspects exist is indeed important.

The book concludes with interesting chapters addressing the somewhat simpler case of two cylinders in cross-flow, as well as a chapter entitled fluid-elastic instability that focusses on some of the important points that must be considered in describing vibrating cylinders and systems of them.

This book will be useful for both researchers and designers, especially those well versed in the mathematics describing this class of problems. Particularly welcome is a book from one who has himself contributed substantially to the development of a discipline; such is the case for this book.

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Turbulence in Fluids

Marcel Lesieur, Martinus Nijhoff Publishers, Boston, 1987, 286 pp., $68.50.

Some people think that turbulence is a tiny specialty within fluid mechanics, which is itself a small part of mechanics, an antique section of physics, which is just one of the sciences. There is a certain truth to this, which makes it nearly incomprehensible that the field could be so inhomogeneous, that a book on turbulence could have such a distinctive flavor, be so unmistakably identified with a particular world-view. This is a nice book, a useful book, and I like it. There is no escaping the fact, however, that it is certainly a physicist's book, maybe even a European physicist's book. That is even a good thing, but still inescapable.

This flavor results largely from the author's concentration on spectral methods and homogeneous flows, both isotropic and two-dimensional/quasi-geostrophic, and from the coverage of three- and two-dimensional EDQNM (Eddy Damped Quasi-Normal Markovian), DIA (Direct Interaction Approximation), the Test Field Model and other stochastic models, and such subjects as predictability theory and internal intermittency, and the Craya decomposition. Many people in the engineering community, and in the United States in particular (with less respect learned at Mother's knee for education and intellectual activity) were wearied long ago by these mathematically complex structures that seem to speak only to physical situations so pure as to have little relevance to real problems. Partly this is a failure on their part to recognize how difficult the turbulence problem really is; the strongly inhomogeneous and anisotropic flows that occur in technologically important situations are (for the most part) much too complicated to attack in any fundamental way at our present level of understanding. In these homogeneous flows we are attempting to understand energy transfer from large to small scales, something that happens in all turbulent flows. When we get that right, maybe we can move on. You can understand, however, the impatience with this point of view of a Program Monitor at an agency of the Department of Defense.

This book is fairly committed to the statistical approach. Lesieur returns from time to time to the question of coherent structures, although the opportunities for this are limited, since coherent structures are not much in evidence in homogeneous flows. Lesieur believes, as I do, that turbulent flows have varying amounts of structure, depending on boundary and initial conditions, but that even when considerable spatial organization is present there is a stochastic element, causing jitter in all the parameters of the structures, so that a statistical approach may still be the most sensible. Lesieur rightly makes no apology for the use of Reynolds averaging, and does not address the specious nonsense that such averaging obscures information.

In addition to the above, there is a nice introduction with a good selection of real and computer generated pictures of turbulence of all scales. There is a brief discussion of chaos. There is a section on direct numerical simulation and large eddy simulation of turbulence, as well as sections on absolute equilibrium ensembles and the diffusion of passive scalars. The book closes with a very brief discussion of stably stratified turbulence and the two-dimensional mixing layer.

All in all, this would be a useful text for a first course in turbulence for physicists, or as a second course for engineering students who have already had a more phenomenological introduction to the subject. It is a useful reference for the specialist who may not keep at his fingertips some of the details of the analytical theories and stochastic models.

As a final note, the manuscript was prepared by the author on a word processor, using TEX. The manuscript was thus delivered camera-ready. This makes it a little difficult to understand a price of roughly 24 cents a page, particularly when it is compared to *Annual Review of Fluid Mechanics*, which is typeset, and which breaks even at approximately 6 cents a page with a similar press run.

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