Atmospheric Turbulence. Models and Methods for Engineering Applications,
by Hans A. Panofsky and John A. Dutton,
John Wiley & Sons, New York, 1984, 389 pp. plus index, $49.95.

The authors state that their book has two purposes: 1) to serve as a summary of the current knowledge of the statistical characteristics of atmospheric turbulence, and 2) to serve as an introduction to methods required to apply these statistics to practical engineering problems.

The book is divided into three parts. Part One, Foundations of Turbulence Theory, contains chapters entitled The Wind and Atmospheric Turbulence, Fundamentals of Fluid Flow, and Statistical Descriptions. Part Two, Observed Properties of Atmospheric Turbulence, has eight chapters: Some Properties and Problems of Atmospheric Motions, General Characteristics of Atmospheric Turbulence, Profiles and Fluxes in the Surface Layer, Variances of Turbulence Characteristics, Spectral Statistics of Turbulent Fluctuations at Fixed Locations, Spatial Structure, Atmospheric Dispersion, and Clear-Air Turbulence. Part Three, Designing for Turbulence, contains Designing for the Effects of Wind and Turbulence, Linear Responses to Turbulence—The Spectral Design Method, and Aerodynamic Forces and Distributed Loads. There is an Appendix, Techniques for Estimating Wind and Turbulence Statistics near the Surface, about 200 references, and an index.

One suspects that Prof. Panofsky wrote the second part, and Prof. Dutton the first and third. Note only do their personal research interests break along these lines, but the book also reveals differences of style and approach that suggest this division of responsibility. These differences are less obvious than those in the 1964 Lumley-Panofsky monograph, *The Structure of Atmospheric Turbulence*, whose two parts (Part One, the theory, was Lumley's; Part Two, the observations, was Panofsky's) were quite independent, and had different notation!

The Lumley-Panofsky work is a personal favorite of mine. I remember well meeting most of Part One first in Prof. Lumley's class lectures in 1963 at Penn State, and to my taste, at least, his lucid, crisp, precise style wears very well. Prof. Panofsky is a pioneer in the scientific analysis of atmospheric turbulence data and in expressing his results through simple and useful parameterizations. His Part Two has become quite dated, as pointed out in the Preface of this new book, because of the knowledge gained from the field programs of the '60s and '70s.

One should not conlcude that this text is simply a revision of Lumley and Panofsky, although its Part Two is, to a large extent, an update of the old Part Two. Their intended audiences are different. Lumley and Panofsky addressed meteorologists and students of fluid mechanics and, I believe, strongly influenced an entire generation of atmospheric turbulence researchers. Panofsky and Dutton are writing for engineers, and I would expect their book to be useful primarily to the applications community.

Part One, Foundations of Turbulence Theory, begins from the perspective of dynamical meteorology, which is appropriate and understandable, if not traditional. The pace is brisk, however, and the author makes little attempt to relate his equations to those which describe turbulence in constant-density fluids, or to touch on the classical foundations of turbulence theory, as Lumley did so well. Thus, the first two chapters make it clear that that the book is slanted toward applications rather than research.

The author warms to his subject in Chapter Three, Statistical Descriptions, where the presentation is highly mathematical but very competently and thoughtfully done. I particularly noticed the careful demonstration of the change of variable in the double integral in the section on ergodicity, and a discussion of the consequences of isotropy which has some effective and apparently original touches.

No one completely understands turbulence, but if understanding it means the ability to describe it simply and effectively, then Prof. Panofsky comes as close as anyone. In Part Two he gives his view of the observed structure of the lowest few hundred meters of the atmosphere, covering those aspects most relevant to engineering applications. In the process he indirectly pays tribute to the experimentalists who have so greatly increased our data base on boundary-layer turbulence over the past 20 years. It is a thorough update of Part Two of Lumley and Panofsky, but with extensions to atmospheric disperison and clear-air turbulence.

Part Two is essentially self-contained. It uses simple correlations, interpolation formulas, and similarity expressions to represent the observed behavior of the lower atmosphere. The results are discussed and interpreted in the context of the physics of turbulence and the boundary layer, but not at such length to distract the reader seeking simple formulas for applications.

Part Three, Designing for Turbulence, is again quite mathematical. It deals principally with the effects of turbulence on structures, and includes discussions of gust simulation, exceedance statistics, and related topics. It seems to draw quite heavily on Prof. Dutton's research and applications experience in this area.

My only reservation about this book is its strong slant toward applications. I would have been delighted to see its first two sections integrated with the classical turbulence literature and current research. The physics of atmospheric turbulence is in some ways richer than that in laboratory shear flows, and its huge Reynolds numbers, all but impossible to find elsewhere, provide demanding tests of asymptotic turbulence theories. There are also exciting new developments in boundary-layer meteorology, including large-eddy simulation, laboratory simulation, and remote sensing; many workers today feel that these will be important tools for the next generation of researchers. None of these gets appreciable space. I think it would have been appropriate to recognize the broader needs of this next generation.

The noted wind engineer A. G. Davenport contributed a Foreword in which he writes "This book should find an important role at the interface between engineering and the atmosphere. It will significantly improve the mixing and exchange of momentum between these fields." Clearly, he is enthusiastic about the book, which is, I agree, a remarkable and overdue effort.

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Flexible Shells, edited by E. L. Axelrad and F. A. Emmerling, Springer-Verlag, New York, 1984, 282 pp., $23.00.

This is a collection of the seventeen papers presented at a Euromech Colloquium held in Munich in January 1984. The title of the book has technical significance. A "flexible shell" is one designed for large deflections and large rotations without large strains. In other words, a geometrically nonlinear theory applies. The subjects discussed fall principally into four categories: fundamental theory; numerical methods, especially finite element methods; buckling and postbuckling from a deflected shape; and applications to specific shell structures. A few papers include results of experiments, and many include results of calculations either to illustrate the use of theory or to present design information for specific applications.

The book is an excellent source for gauging the state of the art in the topic. Several papers are in the nature of progress reports on current work, while others are partly surveys of the current status of research on certain problems. Some authors have listed open questions and unsolved problems near the end of their papers. This is a lively collection of papers by experts on a subject that is actively under development.

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