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REVIEWS

Fluid Mechanics and Thermodynamics of our Environment. By S. Eskinazi. Academic, 1975. 422 pp. £12.50, $26.00.

This book is intended to introduce engineering students to problems in meteorology and oceanography, at the same time unifying these subjects "into a single environmental science". The author has written several other books on fluid mechanics for engineers, and his purpose in the present volume has been to carry the undergraduate without formal training in fluid mechanics and thermodynamics to the stage where he can deal with practical problems in the environment. This is a tall order, and in my view the author has not succeeded in his aim. There is too wide a range of subjects, and a general imbalance in the choice and emphasis of the various topics. The feature that would make the book most difficult from the students' point of view is the lack of coherence and the uneven level at which various subjects are discussed. It is never clear whether topics are being treated for their own sake or as background for later use; for example, surface tension is given an early chapter to itself, but it is barely referred to later. Inappropriate detail is included, with pages of calculation often taking the place of a clear statement of principles. It will certainly strike British readers as very strange that an author should add to such a book a long series of appendices on vector analysis.

There are chapters on the basic principles of fluid mechanics and heat transfer, developed with frequent reference to the ocean and atmosphere. These "environmental" references, however, are often rather superficial and inaccurate. For example, the troposphere is not identical with the mixed layer in the atmosphere, and it is misleading to refer to the troposphere and stratosphere in the ocean as if these were commonly accepted terms in that context. Statements like "noctilucent clouds appear to be light blue and resemble an inverted ocean with wave patterns" do not help anyone's understanding. Sometimes, more seriously, the author's quoting of results which he does not fully understand leads to nonsensical statements like that on page 69: "In comparison with conventional fuels the heat radiating from the sun is infinitesimally less, say, than that from coal." On the whole, however, the author does rather better with his descriptions of atmospheric than of oceanic phenomena. Let one quotation suffice as an example of a careless passing remark about the ocean: "Ocean currents, far from the shores which receive larger quantities of fresh water from run off due to precipitation, depend on the depth of the layers."

Examples of deficiencies and inaccuracies can be found in many sections, but let me take as an example the treatment of thermal convection, a subject of special interest to me. From the first detailed discussion of the phenomenon on page 122, the reader is given the impression that the cross-section of an ascending air column must decrease with altitude because of acceleration of the buoyant fluid. The next mention of the subject occurs as an illustration of "stream tubes", and in that section it is implied that the flow must be laminar.

Not till chapter 10 is any indication given that the flow can be turbulent, and even there the treatment is obscured by pages of a scale analysis which seem quite inappropriate in a book of this kind. Finally we are given the similarity solutions, but there is little reference to recent work or to the physics of the phenomenon, and the concept of turbulent entrainment is mentioned only in passing at the end of the section.

The last chapter is entitled "Certain applied problems in the environment", with sections on "The thermal plume", "The fully developed hurricane", "Dynamics of a balloon in a hurricane or a tornado", "Munk's generalized approach to wind-driven water circulation", and "Baroclinic secondary flow in estuaries". If the rest of the book had indeed been giving the background to enable students to discuss such problems intelligently, the result would have been very worthwhile. As it is, the treatment is so uneven, and the discussion of the problems themselves so superficial, that I do not recommend anyone to try to learn the principles here. The book may whet the appetite of engineers for knowledge about the environment, but I would still prefer to return to Prandtl's *Essentials of Fluid Mechanics* and learn from his deep understanding of the underlying physics of the phenomena he describes.

J. S. TURNER

Stability of Reaction and Transport Processes. By M. M. DENN. Prentice-Hall, 1975. 243 pp. $18.50.

This book is intended to unify the aspects of stability theory as applied to reaction and transport processes. The level of the book is designed to provide an introduction for nonspecialists and students whose background includes elementary matrix operations and solution techniques for homogeneous partial differential equations. The author developes the fundamental theory and then analyses models of certain selected physical systems to illustrate the utility of the methods and concomitantly to amplify the theory. The choice of examples as well as the style of the presentation compliment each other to produce a very readable and useful introductory text. Moreover, the annotated bibliography at the end of each chapter provides a useful stepping stone to a more in-depth coverage of the field.

The first chapter provides a physical description of some typical chemical and flow systems which are subsequently used in numerical examples and the remaining portion of the text is organized into two basic parts. The first part, chapters 2–6, treats systems which are characterized by an autonomous system of ordinary differential equations, i.e. lumped parameter systems; the second part, chapters 7–17, treats systems which are characterized by a system of partial differential equations, i.e. distributed parameter systems.

Chapters 2 and 7 deal with the notion of uniqueness and treat the interesting counter-examples of a continuous stirred tank chemical reactor and an anisotropic fluid which exhibit non-uniqueness in the form of multiple steady states. A sufficient condition for uniqueness is generated by bounding techniques and is illustrated by applying it to the above systems as well as a catalyst particle.

The quantitative description of various types of stability and the method of small disturbances are described and illustrated in chapter 3. Chapters 4 and 9–14 cover linear stability theory and examples, such as a continuous stirred tank reactor, feedback control system, catalytic reaction, rotational Couette flow, plane Poiseuille flow, polymer processing, convective transport, and a surface tension driven flow, are detailed. Chapters 5, 6 and 15–17 deal with nonlinear stability theory and develop and illustrate the use of: Liapunov's direct method: the energy method; the Stuart–Watson technique; the method of averaging; the Poincaré–Lindstedt method; and Eckhaus' method.

The text throughout is well presented and is complemented by a reasonable number of informative figures. The depth and style of presentation make the text very suitable for an introductory course.

R. L. SANI

CORRIGENDUM

'An experimental investigation of the detention of airborne smoke in the wake bubble behind a disk'

by W. HUMPHRIES and J. H. VINCENT,

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In this paper we described measurements of the residence time of airborne smoke particles in the turbulent wake of flat disks for Reynolds numbers in the range $2\times10^3 < Re < 4\times10^4$. We have recently been made aware of some previously published related studies which deserve mention in the context of our own paper. The most relevant were by Bovina (1959) and Winterfield (1965) in connexion with turbulent exchange processes behind axisymmetric flame holders for the range $4\times10^4 < Re < 3\times10^5$, and by Kalra & Ulherr (1973) in connexion with mass transfer processes behind bluff bodies in the range $50 < Re < 200$. Indeed, the measurements of Winterfield for disks are in excellent agreement with our own for the case of smooth approaching flow.

We should like to thank Dr P. H. T. Ulherr of the Department of Chemical Engineering, Monash University, Australia for bringing this body of published work to our attention.

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