J. Fluid Mech. (1998), *vol.* 371, *pp.* 379–381. Printed in the United Kingdom

BOOK REVIEWS

Fundamentals of Turbulence Modeling. By C.-J. CHEN & S.-Y. JAW. Taylor and Francis, 1998. xii + 292 pp. ISBN 1-56032-405-8. £34.95.

This book is a thorough and unbiased review of a notoriously controversial subject. It includes chapters on the general stress-transport ('second-moment') model, on algebraic stress models and two-equation eddy-viscosity models, on near-wall models, and on applications including buoyant flows. Unfortunately it is distinctly out of date and marred by eccentricities of terminology and presentation. Here one can only give a few examples of the latter.

The book originates in the first author's lecture notes, revised and updated by the second author. The number of references cited per year of publication rises to a peak about 1980, with a second peak about 1987 and a steady decline thereafter, except for a bumper crop of 13 references published in 1991. Only eight of the 192 references are dated 1992 or later. Fluid dynamics may be a mature subject but there have been considerable advances in turbulence modelling in the last six years or so, and it is disappointing to see little mention or discussion of them.

The Introduction is imprecise, to the point of being bewildering even to a reader with some background in turbulence. In the second sentence, the reader is told that "The irregularity of turbulent motion is due to the inherent nonlinear nature of the Navier–Stokes equations...". Not a good start: equations do not inspire phenomena; phenomena inspire the development of equations to describe them. Later on the same page, a list of the effects of the atmospheric wind includes "Trees and plants are bent, subject to large shearing forces near the ground", which at best leaves out several links in the chain of causes of large pressure drag on bluff bodies near the ground and at face value is simply wrong.

The notation is not listed, and some of it is oddly non-standard. The substantial derivative $\mathrm{D}/\mathrm{D}t$ is used indiscriminately for instantaneous and averaged equations. G_i instead of the usual f_i is used for a (positive) body force per unit mass in the x_i direction (g_i, again counted as positive in the positive x_i direction, is used later for gravitational acceleration). $B(u)$ is used for probability density function instead of the almost-universal $P(u)$, and after its first four moments are defined the reader is told that "From the measurements of these moments one may construct $B(u)$...". Granted that the p.d.f. can in principle be reconstructed from all its moments (up to indefinitely high order; the first four may not be good enough even for an engineering approximation) but neither an experimenter nor a theoretician would normally evaluate it that way. The next sentence is "A properly and accurately constructed [p.d.f.] should contain almost all turbulence information in the statistical sense". So much for spectra! and joint probability distributions have not even been mentioned.

Vortex stretching is, very properly, introduced early on, but with the misleading statement that "Turbulent eddies are always irregular...with the associated vortices always [sic] being stretched." So much for backscatter! The explanation of vortex stretching that follows is unclear and inaccurate. The diagram of a vortex being stretched, which traditionally accompanies first-principles arguments about conservation of angular momentum, is here presented but not used (throughout the book, the illustrative sketches tend to be misleading or useless). The Helmholtz equation is discussed as if $(\boldsymbol{\omega}\cdot\nabla)\boldsymbol{u}$ was entirely 'stretching', whereas two-thirds of its terms represent intercomponent transfers by 'tilting'. The size of the smallest eddies in an (unspecified) air flow is evaluated by equating to unity a Reynolds number based on a kinematic viscosity of $10^{-5}\ m^2\ s^{-1}$ (appropriate to a pressure of about 1.5 atm or a temperature of about $-30\ °C$!) and a velocity of $10\ m\ s^{-1}$ – in the context of laboratory experiments the latter is more likely to be a mean velocity than a typical fluctuation, and it is certainly far too large to be the required Kolmogorov velocity scale.

The above is a selection from the first seven pages of the Introduction. The main description and discussion of turbulence models in later chapters is clearer, but still marred by confusing or non-standard terminology. For example, models using PDEs are here called 'second-order' models, to distinguish them from what are commonly called 'algebraic' or 'zero-equation' models; but 'second order' normally refers to 'stress-transport' or 'second-moment' models using explicit transport equations for the Reynolds stresses. A doubly misleading error in terminology is to call the 'rapid' pressure–strain term in the stress-transport equations the 'rapid distortion or rapid return to isotropic state'. Among believers in the universality of turbulence models it is argued that models of the rapid pressure–strain term should be correct in the rapid-distortion limit, but this is not at all the same thing! Also, since the phrase 'return to isotropy' is commonly associated with the slow pressure–strain term, using it as a label for the rapid term is confusing.

These misapprehensions and misuse of terminology do not seem to be a consequence of poor English: in general the writing is quite acceptable. However they make it difficult to recommend this book to those who need a book with this title, and even newly published it is too out of date to be a useful reference for the specialist.

P. Bradshaw

SHORT NOTICES

Dams and Safety Management at Downstream Valleys. Edited by A. B. de Almeida & T. Viseu. Balkema, 1997. viii + 247 pp. ISBN 90 5410 916 5. £47, $80.

This collection of papers is the proceedings of a NATO workshop in Lisbon in 1996. The papers are grouped into four parts: dams, floods and safety; social sciences applied to valley safety management; advanced technology for valley safety management, and practical emergency and crisis planning. A considerable fraction of the book concerns risk and its management and those portions may be of value to those who have to deal with other examples of low probability severe events. Only a small number of the papers deal with the flow problems of dam collapse and downstream flooding.

Water Wells Implementation, Maintenance and Restoration. By M. Detay; translated by M. N. S. Carpenter. J. Wiley & Sons and Masson, 1997. xiii + 379 pp. ISBN 0 471 96695 9 (Wiley) and 2 225 85622 2 (Masson). $64.95.

This book is a practical treatise on wells, with methods described "not only based on the in-house expertise of Lyonnaise des Eaux (French group working in over 100 countries) but also derived to a large extent from bibliographic compilations and the practical experience of the author". The different skills and methods that may be needed in prospecting, developing, maintaining, restoring and closing water wells appear to be well treated, with many details. Aspects of groundwater hydraulics have a good coverage with description of specific examples and extending to catchment management. The fluid flow in boreholes and near water intakes is also a major topic impinging on problems of sediment transfer, corrosion and clogging by both mechanical means and biological growths. The translation from French is good.

Fourier Series and Integral Transforms. By A. PINKUS & S. ZAFRANY. Cambridge University Press, 1997. vii + 189 pp. ISBN 0 521 59209 7. £35.00 (hardback); and 0 521 59771 4. £12.95 (paperback).

This book is developed from a version used for a one-semester course for physics and engineering students. There is a background chapter on inner product spaces followed by chapters on Fourier series, Fourier transforms and Laplace transforms. There is an appreciable amount on convergence and statements of theorems in each chapter. There are only a few sections that use concepts from the theory of functions of a complex variable. The brevity of the book limits examples of applications. There is no discussion of practical evaluation of functions from a Fourier series, or of the numerical evaluation of Fourier integrals.

Classical Mechanics: Transformations, Flows, Integrable and Chaotic Dynamics. By J. L. MCCAULEY. Cambridge University Press, 1997. vii + 189 pp. ISBN 0 521 48132 5. £70.00 (hardback); and 0 521 57882 5. £24.95 (paperback).

This discursive account of classical mechanics is aimed at graduate students in physics and engineering. As much attention is given to the ideas of modern nonlinear dynamics as to mechanics itself, with a specific organising theme of integrability versus non-integrability. The subjects covered include the topics one might expect from the title, with some emphasis on the qualitative results that come from modern methods, for example as applied to the three-dimensional motion of a rigid body. Naturally, Lagrange's equations and Hamiltonian systems figure prominently. There are also brief introductions to Einstein's gravitational field equations and to the Dirac quantization rules. Many of the main topics are discussed in some detail, including examples, to aid appreciation of the results and to show the power of the methods. The book demands either a good level of previous mathematical development, or considerable industry in following up parallel texts. The book is more clearly oriented to physicists or applied mathematicians than to engineers. The latter might find it more interesting than directly useful.