the cut-off wave number based on non-linear interactions. Such models appear therefore to be still at the limit between structural and functional modeling.

Chapters 7 to 10 highlight typical problems arising during applications of the LES method. The most important topics which should determine the research activities during the following decennium are related to the interaction between SGS model and numerical schemes on one hand, and the determination of exact and efficient boundary conditions (wall boundary and inflow conditions) on the other hand. Chapter 11 gives a few examples of realisations of three main flow families: homogeneous turbulence, wall bounded flows, free shear flows.

In summary, the book provides a broad and nearly complete picture of LES techniques for incompressible flows. Beginners in the field will enjoy its introductory character, while experts may discover ideas they thought of persuing themselves. The book can be strongly recommended to postgraduate students, researchers and engineers in all fields where statistical turbulence modeling fails.

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S0997-7546(01)01149-9/BRV

Turbulence Structure and Vortex Dynamics edited by J.C.R. Hunt and J.C. Vassilicos (Cambridge University Press, UK, 2001, 306 pp.) £55.00, US$ 80.00 hardcover. ISBN 0 521 78131 0

In turbulence, as in other subjects in physics, things can either be seen in terms of particles or in terms of waves, which in this particular case means that it is possible to describe the flow in terms of global modes, or in terms of structures. Also, as in other areas of physics, both points of views have their adherents who, on occasions, tend to see one of them as contradictory to the other. The synthesis of the statistical theories of the former with the structural descriptions of the latter has still not been done, and it is not absolutely clear that it will eventually succeed in a useful sense.

The title of this book, which is the proceedings of a workshop held at the Isaac Newton Institute in Cambridge, in the Spring of 1999, suggests that the participants subscribe to the structural approach, but a look at the index shows that the aim of the meeting was more an attempt to reconcile both points of view.

As it often happens with proceedings, the articles in the book are varied. About one third of them deal with vortex dynamics, with little or no reference to turbulence, and at least two papers are dedicated to statistical theories of turbulence with no apparent relation with vortices. The rest, however, make an attempt to link both points of view, and it is there perhaps that the interest of this book mostly lies.

As is unavoidable in these kinds of books, some of the articles have been superseded by newer, and in a few cases by older, published work by the same authors, but a substantial fraction of them seems to have been specially written for this meeting. Those include some welcome surveys of areas which may be unfamiliar to the readers of the book. There is for example an introduction by Barenghi to the description of superfluid turbulence in terms of vortex tangles which I read with pleasure, and a survey of vortices in rotating flows by Cambon which I could not find elsewhere in such a compact form.

The same is true of some of the articles on vortex dynamics. I think that the paper by Fukumoto and Moffatt on viscous vortex rings is not available outside this volume, and the surveys by Williamson et al. on the instabilities of wakes, and by Pradeep and Hussain on transition through core dynamics, although extensions of previous work by the same authors, are well written and informative.

This leaves the papers which actually attempt to explore the connection between turburence and its structural features. They can roughly be divided into two groups. The first one takes the view that, if a particular structure is observed or can be shown to exist, it is probably relevant. That is a dangerous argument in turbulence, which may result in confusion between what can easily be understood and what is important, but such avenues have to be explored. Gibbon et al. and Vassilicos, within this group, each look at particular classes of singularities or near-singularities, and to what their signatures in turbulent flows would be.

The second group of papers takes a more sceptical view, and either looks at the experiments for evidence of structures, or tries to estimate under which conditions they would form and be important. A primary example in this group is the paper by Hunt who, being one of the organizers of the workshop, probably had a clearer idea than most of what lie wanted the meeting to be. It contains a particularly nice discussion of the relation between the signature of individual structures and the statistics of groups of them. I was also interested by the paper by Warhaft on how isotropic the small scales of shear turbulence can be considered to be, although a newer published version of it exists. Tsinober, for his part, discusses the dynamics of the different velocity derivatives, and concludes that compact vortices may not be as important for the dynamics of the flow as they are often claimed to be. This point of view, although previously expressed by himself and by others, is perhaps a little surprising in a book with a title such as this one.

In summary, the idea I got from reading this book was that the workshop must have been a very interesting one. Whether it makes sense to buy these proceedings two years later, specially for individual readers, is more doubtful. Those interested in particular topics would probably be better off consulting the journal versions of the same papers. Libraries, on the other hand, or those who would like to have in a single place a survey of the many questions involved in the relation between statistics and structure in turbulence, will find in it relevant material that is not easily found elsewhere.

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