Book Reviews

Tubes, Sheets and Singularities in Fluid Dynamics
Edited by K. Bajer and H. K. Moffatt, Kluwer, Dordrecht, The Netherlands, 2002, 379 pp., $105.00

This is a volume in Kluwer's series on Fluid Mechanics and Its Applications, devoted to books in which fluid mechanics plays a fundamental role. Consistent with this purpose nothing could be more fitting than to publish, as Volume 71 of this series, the proceedings of the jointly sponsored NATO-Workshop/IUTAM Symposium on Tubes, Sheets and Singularities in Fluid Dynamics, Zakopane, Poland, 2–7 September 2001, because vortex tubes and sheets can be considered as fundamental building blocks of flows at large Reynolds numbers. Their structure, stability, evolution, and nonlinear interactions are among the most intellectually challenging and important problems of modern fluid dynamics. The analogy between magnetic flux tubes, characteristic of high-magnetic-Reynolds-number magnetohydrodynamics (MHD) problems, and vortex tubes allows mutually beneficial insight into MHD and vortex dynamics and extends the applicability of such research to this domain as well.

Vortex dynamics plays a key role in the description and simulation of high-Reynolds-number turbulent shear flows, the coherent structures of which can be regarded as vortical structures evolving due to both self-induction and complex interaction with boundaries and random environments. The marked stretching by mutual interaction of nearby skewed vortex tubes can lead to very rapid growth of vorticity. The question of the development of finite-time singularities is the subject of much current analytical and computational work, and, like the other topics mentioned in the preceding paragraphs, is treated in the papers in this volume.

Specifically, the papers are grouped in the following six parts: vortex structure, stability, and evolution; singular vortex filaments; magnetic structure, topology, and reconnection; vortex structures in turbulent flow; finite-time singularity problems; and Stokes flow and singular behavior near boundaries.

The location of the meeting allowed for more papers from Eastern European contributors than might otherwise have been the case. The 40 or so papers in the volume are typically 6 pages long, the longest ones generally at most 10 or so pages. The papers are mainly theoretical, analytical, and numerical simulations, with some experimental or observational papers. Some address very specific problems, whereas others address general issues or provide concise reviews of the literature. Collectively, the authors merit considerable credit for so succinctly and effectively presenting and summarizing their contributions. An abstract at the beginning of each paper makes it easy for the reader to quickly decide which papers to read in depth. Finally, the editors, K. Bajer and H. K. Moffatt, and the publisher deserve praise for the typography of the papers, their uniformity of style and being easy on the eyes, and the brief time that was allowed to elapse between the oral presentations at the meeting and their appearance in print. This volume is an invaluable guide to the state of research in some of the most important areas of vortex dynamics at the commencement of this decade.