

Preface

Vortex tubes and vortex sheets can be thought of as the fundamental building blocks of fluid flow at high Reynolds number, whether laminar or turbulent. It is therefore important to understand their structure, stability and evolution, and the various non-linear interactions that can occur among them. Similar problems in relation to magnetic flux tubes arise in magnetohydrodynamics (MHD) at high magnetic Reynolds numbers; and the analogies between MHD and vortex dynamics can be exploited in the development of insight in both fields.

The dynamics of vortex tubes, sheets and more complex structures plays a central rôle in the description of turbulent shear flows, whose ‘coherent structures’ can be most naturally interpreted as vortical structures subject to both self-induced evolution and the complex interactions with a random environment and with boundaries.

The interaction of skewed vortex tubes is a problem of acute current interest, because the intense stretching associated with the mutual interaction when such tubes are close to each other leads to rapid growth of vorticity. Whether this growth is or is not bounded within any finite time-interval is one of the famous open problems of fluid dynamics, and is the subject of much current analytical and numerical work.

The papers collected in this volume range over the above topics, and constitute the Proceedings of a NATO ARW and IUTAM Symposium held in Zakopane, Poland, 2-7 September 2001. They are grouped in six parts as follows:

- Part I Vortex structure, stability and evolution
- Part II Singular vortex filaments
- Part III Magnetic structure, topology and reconnection
- Part IV Vortex structures in turbulent flow
- Part V Finite-time singularity problems
- Part VI Stokes flow and singular behaviour near boundaries

The volume also contains two papers which were prepared for the Symposium, but whose authors (D. Poggi and B. Cantwell) were unfortunately unable to be present.

The fresh mountain air of Zakopane stimulated one of us [HKM] to compose a limerick as an ‘alternative abstract’ for each of the lectures that were presented. At the suggestion of many participants these are included (with the permission of the relevant authors!) on the title page of each paper. Two authors have written ‘response limericks’, also included; another has responded by composing his entire abstract in limerick format!

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Note added in proof

At a late stage in the production of this volume, we have learnt with great sadness of the sudden death of Richard Pelz on 24th September 2002. Richard’s contribution to this volume is contained on pp 269–283. His contributions to the finite-time singularity problem, some of which are described in this paper, have been at the cutting edge of research on this topic of central importance to fluid dynamics. He will be greatly missed throughout the extended worldwide family of fluid dynamics.
