TURBULENCE AND INTERACTIONS - TI2006

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CONTEXT

The first Turbulence and Interactions conference (TI2006), which took place at the IGeSA Centre from 29th May to 2nd June 2006, was a unique event. Never before have so many organisations concerned with turbulence works come together in one conference. As the title "Turbulence and Interactions" anticipated, the workshop was not run with parallel sessions but instead of one united gathering where people had strong interactions and sharings. Many of the 85 or so attendants were veterans of ERCOFTAC conferences but the list of organisations represented also included IUTAM, Euromech and there were a number of researchers for whom this was their first turbulence conference.

PROGRAM/LECTURERS

The organisers were fortunate in obtaining invited speakers of top quality. Among them, Professor Yukio Kaneda (Department of Computational Science and Engineering, Nagoya University) in his opening keynote lecture gave a review on results of data-analysis based on recent high-resolution direct numerical simulations (DNS) of incompressible turbulence in a periodic box with the number grid points up to 4096^3. Emphasis was put on the universality of the small-scale statistics in turbulence at high Reynolds number, as well as on the dependence of the statistics on the Reynolds number and the length scale. Insights from strongly anisotropy turbulence were also at the heart of Dr. Claude Cambon (École Centrale de Lyon) closing keynote lecture, in which he told the statistical theory and DNS. To the question "what remains to do in turbulence - from the viewpoint of physical understanding (not only modelling and simulating)" - he responded that more investigations of intermittence, anisotropy, and non homogeneity, are necessary. He took issue with a useful description of a complete anisotropy of second-order statistics, parameterised in Fourier space, in terms of directional and polarisation dependence, to analyse homogeneous anisotropy turbulence, interacting with various body forces and/or in the presence of large scale mean gradients. He mentioned that, as far as possible, both statistical theory, ranging from Rapid Distortion Theory to nonlinear theories including it, and recent, often original, DNS data are investigated. He insisted in applications to strongly anisotropy turbulence in a rotating flow and in a stable stratified fluid. The cases of a homogeneous flow, a simple MHD flow (with an external magnetic field), and a weakly compressible quasi-isentropic flow, are touched upon using the same theoretical approach.

Throughout the conference, dazzling sessions were offered each day, particularly the two-day ERCOFTAC/SIG4 - AFM/GST13, and the attending was assiduous. In a very different session, M. P. Martin (Princeton University), M. Tsubokura (University of Electro-Communications, Tokyo) and T. Weller (Technische Universität Darmstadt) presented some fascinating findings from their impressive DNS and LES results on the outer large-scale motions of wall turbulence and their interaction with near-wall structures, Mach number and wall temperature effects on turbulent boundary layers and turbulent channel flow with streamwise rotation at different Reynolds numbers, respectively. Substantial video animations of turbulence flow fields produced in France, Germany, Slovenia, UK and USA gave a helpful insight into very different interaction phenomena and challenged some preconceived ideas about unsteadiness taken place along such a flow.

Three of the highlights of the conference were the keynote lectures of Y. Zhou (Lawrence Livermore National Laboratory), F. Waleffe (University of Wisconsin) and G. Tryggvason (Worcester Polytechnic Institute). Zhou asked what would be the minimum resolution requirement (minimum) model) for a faithful model calculation of the large-scale turbulent flow (for engineering applications at high Reynolds numbers)? Waleffe pointed to the discovery of exact coherent structures in turbulent shear flows that opens up new avenues for turbulence research and forces a fundamental rethinking of the true nature of turbulence. Tryggvason addressed DNS computations of bubbly channel flows, encountered in a wide variety of industrial systems. The computational studies discussed allow exploring the detailed dynamics in a very well-controlled and characterised situation.

SUMMARY

The overall evaluation of the meeting was excellent, the high quality of the audience and the presented research activities suggest that a future conference with similar topics should be organised again within three years. In the meanwhile, industrial partners will be more and more interested in taking account the finest turbulence aspects in their CFD tools to design future vehicle projects or systems.

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