Report on the XI. Conference Topical Problems of Fluid Mechanics 2004 Prague, February 25, 2004

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The XI. Conference "Topical Problems of Fluid Mechanics 2004" was held in the Institute of Thermomechanics AS CR in Prague on February 25, 2004. This conference organised up to now as a one-day seminar was connected with the winterschool "Environmental and Industrial CFD Simulations" prepared with the support of the ERCOFTAC. The purpose of this conference is to bring together people from academic institutions, research institutes and from industry with the aim to present the latest results of grant projects in the field of theoretical, numerical and experimental modelling of turbulent flows in various applications, especially in industrial and environmental flows.

The attendance of postgraduate students in this conference is continually encouraged. In this year, the conference was further utilised to presentation of posters prepared by participants of the winterschool. Both events were organised by the ERCOFTAC Czech Pilot Centre with the seat in the Institute of Thermomechanics AS CR. There were 78 participants from 6 European countries in the conference including 14 lecturers and 38 students of the winterschool. The part of the conference was organised in two parallel sessions focused to industrial and environmental flow problems respectively. Altogether, 17 oral presentations and 29 posters have been presented.

Theoretical, numerical and experimental contributions have been considered. In addition to contributions related to industrial and environmental flows, some contributions concerned flows in biomechanics, and hydromechanics. Among theoretical contributions, flow past and around rotating obstacles, a priori error estimates of FEM for mesh refinement near singularity in incompressible viscous flow, steady compressible jets, solution of Navier-Stokes equations with non-traditional boundary conditions, and asymptotic properties of the steady fall of a body in viscous fluids can be mentioned. Also a lecture on topological structures in rotating stratified flows was presented.

Numerical contributions can be divided into two groups - the first group contains presentations based on authors in-home codes and the second one includes contributions based on using of commercial software (CFX and FLUENT). Most contributions dealt with numerical simulation of flow in turbomachinery, especially in curved channels, diffusers and in blade cascades including transonic flow generally and transonic flow with condensation. Two contributions concerned numerical simulation of transonic flow in the turbine blade cascade SE1050 and were used for the database of the QNET-CFD Thematic Network project. Some contributions presented results of numerical simulation of pollution dispersion in the atmospheric boundary layer and a study of the vegetation influence on the atmospheric flow over complex topography. Another part of contributions dealt with modelling of flow and combustion in internal combustion engines. Besides, an attention was aimed to problems of synthetic jets, multiphase flows and flows in biomechanics. In the next future, the greater attention will be probably given to modelling of these problems, especially to biomechanical applications.

The contributions concerning experimental investigation of turbulent flow were concentrated on new facilities for investigation of transonic flow in radial turbine inflow cascades and for investigation of flow over a backward-facing step in 3D configuration. Interesting contributions were dealing with the experimental investigation of flow structure in the mixing chamber of a transonic ejector and with the analysis of intermittency in the boundary layer on the turbine blade.

In the closing discussion it was summarised that all presented numerical simulations were based on the solution of RANS equations though in several cases, especially where some unsteady phenomena can be expected, better results should be obtained using LES and/or DES approach, i.e. with a hybrid model based on RANS equations in shear layers and LES elsewhere.