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Preface

This special issue consists of a selection presentations, delivered at the EUROMECH Colloquium No. 447 "Interaction Phenomena in Turbulent Particle-laden Flows" which took place in Tallinn on June 18–20, 2003. The researchers of this specific field gathered in Tallinn for the second time to sum up the research activities of the last decade. The first EUROMECH Colloquium No. 319 on the same topic, with participants from five countries, was held in Tallinn on May 17–20, 1994. Then the discussion was focused on the theoretical and experimental aspects of particle-laden flows. The development of particle-laden flows and their different implementation methods in technological processes and environmental protection has progressed significantly during the last ten years. At the EUROMECH Colloquium No. 447, 41 scientists from 11 countries participated. Universities, research organizations and companies from Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Russia, Switzerland, the United Kingdom and Estonia were represented. The Chairman of the Colloquium was Prof. Martin Sommerfeld from the Halle-Wittenberg Martin-Luther University. The Co-chairmen were Prof. Leonid Zaichik from the Institute of High Temperature of the Russian Academy of Sciences and Dr. Ylo Rudi from the Estonian Energy Research Institute at Tallinn University of Technology, who was the local organizer of the event under the auspices of EUROMECH and the Estonian National Committee for Mechanics.

The objective of the Colloquium was to bring together scientists working in the field of multiphase flows and to present ideas and results on the interaction phenomena in such flows with the focus on the physics of particle–turbulence interaction and turbulence modification, particle–wall and particle–particle interactions, particle coalescence and agglomeration, particle deposition, dispersion and clustering. Various approaches were presented to obtain either theoretical (numerical) or experimental results, including the Eulerian and Lagrangian methods, statistical kinetic PDF models with one-point and two-point turbulence closures, spectral analysis, direct and large eddy simulations as well as LDA, PIV and other measurement techniques.

Two invited lectures and 23 oral presentations were given in 3 technical sessions, devoted to fundamentals, numerical calculations and applications.

The first invited lecturer by Prof. B. Oesterle (University of Nancy, France) demonstrated the advantage of kinematic simulations for the prediction of the effect of preferential concentration in the homogeneous isotropic turbulent flow as well as turbulence modulation. In the presentations by Prof. M. Sommer-

feld and C.-A. Ho (Martin-Luther-University, Halle-Wittenberg, Germany) numerical simulations of the collision of small particles with a large collector particle, based on solving the 3D Navier–Stokes equations with the Lagrangian approach for the small particles, and experimental results on the behaviour of spherical and non-spherical particles at various loading ratios in a horizontal channel flow, were described. The clustering phenomena were reported by Dr. Portela (Delft University, The Netherlands) who calculated the formation of preferential concentration of particles in the near-wall region by using direct numerical simulations and Lagrangian tracking methods. Prof. L. Zaichik (Institute of High Temperature, Moscow, Russia) pointed out the significance of the turbophoretic force on the formation of particle clusters in the homogeneous as well as in the non-homogeneous turbulence using the PDF approach to model the dispersed phase. Dr. H. Soersen (Aalborg University, Denmark) reported numerical results on the motion of droplets of different size in a turbulent flow with zero mean velocity. In the presentation by Dr. A. Kartushinsky (Estonian Energy Research Institute, Tallinn) numerical simulations were validated for the gas–solid particle flow in a horizontal channel using experimental results on the turbulence modulation in a downward directed wind-tunnel flow. In the report by Dr. D. Graham (University of Plymouth, UK) a bootstrapping method, based on resampling the original data (particle statistics) was suggested to avoid repeated computations. The particles stabilizing behaviour in the swirling vortex flow, studied with an uncoupled Lagrangian approach, was described by Dr. F. Kaplanski (Estonian Energy Research Institute, Tallinn). A model for diesel fuel spray penetration with the consideration of the effects of droplet evaporation and break-up together with the air entrainment was presented by Prof. S. Sazhin (University of Brighton, UK). Finally, a new sampling method for the measurement of the concentration of pollutants in sewage water flows was presented by Dr. F. Larrarte (Laboratoire Central des Ponts et Chaussées, France).

The final discussion revealed the importance of detailed modelling of particle–turbulence, particle–particle and particle–wall interaction processes for a reliable numerical prediction of particle-laden turbulent flows using different approaches. Further direct numerical simulations as well as detailed experimental studies are needed to advance the basic understanding of these elementary processes and to improve the models. These developments will allow a more reliable application of numerical methods for the optimization of industrial processes.

The local Organizing Committee was recommended to continue the Tallinn Colloquiums under the auspices of EUROMECH.

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