Università degli Studi di Udine

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Simulation of particle-laden turbulent flow

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Sala Verde (ex sala riunioni piccola DPIA)

Abstract In many applications in industry and in nature, particle or droplet transport in turbulent flow plays a role. Examples are combustion of fuel particles (biomass or metal) and cloud formation. In our group we study methods and models for accurate simulations of particle- and droplet-laden turbulent flow. For particle-laden homogeneous isotropic turbulence it is usually assumed that particle collisions are not important if the particle volume fraction is less than 10^{-3}. In inhomogeneous turbulent flow much higher particle volume fractions can occur locally due to turbophoresis and particle clustering. We investigated the effects of particle collisions for this flow and studied the particle collision rate in order to enable stochastic collision modeling. For particles larger than the smallest scale of turbulence, point-particle methods are inaccurate due to the use of correlations for the drag force which only hold if particles are sufficiently small. A way to improve these correlations is by particle-resolved DNS. We used this method in turbulent flow in a channel with an array of particles to determine optimal values for the coefficients in a correlation for the drag force. The use of this optimal correlation in point-particle DNS results in better agreement with the results for the particle-resolved simulation.

CV Prof. Hans Kuerten graduated with honors in Theoretical Physics at Utrecht University in 1983. He received his PhD in Physics in 1987 on thermodynamic and hydrodynamic properties of liquid Helium mixtures. After that he worked until 1998 as an assistant professor in the Department of Applied Mathematics at the University of Twente and subsequently as an associate professor at the Department of Mechanical Engineering at Eindhoven University of Technology, where he became full professor in Computational Multiphase Flow in 2014. Since 2010 he is also part-time professor at the University of Twente. His research interests are in fluid mechanics and numerical mathematics. The main topic of his research is a variety of multiscale problems in two-phase flows, in particular the different scales arising from the combination of turbulence and particles, droplets or bubbles in the flow. Relevant applications can be found in process technology, for instance in particle separation, steam injection and boilers, compressible turbulent flows around airplanes to evaporating micro-scale droplets on porous substrates and particle-laden turbulent flows. He uses various numerical methods with an emphasis on spectral methods and finite volume methods.
Prof. Kuerten is the director of the Dutch Research School for Fluid Mechanics J.M. Burgerscentrum in Eindhoven and a member of the organizing committee of the DLES workshop series. He was visitor of several universities, for example Politecnico di Torino, Helmut Schmidt University, Hamburg and ETH Zurich.