POLITECNICO DI TORINO

Dipartimento di Ingegneria Meccanica e Aerospaziale

Seminar Announcement

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DIMEAS Sala Ferrari (2nd floor)

Particle-resolved DNS of turbulent channel flow with a fixed array of particles

Prof. J.G.M. Kuerten
Eindhoven University of Technology
Department of Mechanical Engineering

Abstract. For particles larger than the Kolmogorov scale point-particle DNS becomes inaccurate due to the use of correlations for the drag force which only hold if particles are small compared to the Kolmogorov scale. A way to improve these correlations is by particle-resolved DNS. We developed an overset grid method for particle-laden channel flow. In this method a global rectangular grid is used for the complete domain and each particle has its own spherical grid. Especially in case of dilute flows the computational effort is far less than in the immersed boundary method, since the global rectangular grid does not need to resolve the flow around a particle.

We used this method for turbulent flow in a channel with an array of particles that move with constant velocity with respect to the wall and used this to calculate the force on a particle and its dependence on the fluid velocity field around the particle. In this way we determined optimal values for the coefficients in the Schiller-Naumann 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 than the standard Chiller-Naumann correlation.

Biography. Hans Kuerten started his research on numerical simulation of turbulent flows in 1987 when he became assistant professor at the University of Twente, where he studied numerical methods and models for large-eddy simulation of compressible turbulent flows. In 1998 he became associate professor at the Department of Mechanical Engineering of Eindhoven University of Technology. In 2010 he was appointed part-time professor at the University of Twente and since 2014 he is full professor at Eindhoven University of Technology.

The focus of his present research is on two-phase flow, in particular particle-laden flows and flows with phase transition. His most important research topics are: subgrid modelling in LES of particle-laden flow, DNS of particle-laden flows with additional physical phenomena, such as evaporation and condensation of droplets and pyrolysis and combustion of biomass particles, the diffuse interface model for phase-transitional flow and evaporation of sessile droplets on porous and non-porous substrates.