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Institute of Fluid Dynamics
Institute of Energy and Process Engineering

Colloquium Thermo- and Fluid Dynamics

Unveiling the transition to turbulence in particle-laden flows

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The transition from laminar to turbulent flow in single-phase pipe flows is familiar knowledge: for low Reynolds number the flow will be laminar, around a Reynolds number of 2000 we see an intermittent flow, and for higher Reynolds number the flow is usually turbulent. This situation changes when (neutrally-buoyant) particles are added. Depending on the particle size (expressed as the particle-to-pipe diameter ratio, d/D) and volume fraction, we may see an earlier or later onset of the transition. For instance, the onset may occur at a Reynolds number as low as 1350 (for d/D = 1/19, volume fractions= 8%), even after correcting for the increased effective suspension viscosity. At higher volume fractions (>14%), a completely new transition mechanism has been observed: instead of an intermittent flow, the entire flow gradually becomes turbulent with increasing Reynolds number (Hogendoorn et al., 2018; 2022). Turbulent 'puffs' appear to be absent during this transition scenario.

In this seminar, I summarise our recent efforts to investigate the role of particle size and volume fraction during the transition to turbulence. Special attention is given to the measurement techniques that are required in this pursuit.

Christian Poelma is Professor Multiphase Systems at Delft University of Technology. He gained his PhD at the same university in 2004. After a postdoc position at Caltech, he returned to Delft to set up a research line in multiphase flow, with a focus on cardiovascular flows. He was promoted to full professor in 2017. His group currently investigates fundamental and applied multiphase flows, using state-of-the-art measurement techniques and numerical simulations. Since 2021 he is also Head of the Process & Energy department.

Date: Wednesday, 19 April 2023
Time: 16:15 - 17:15h
Place: ETH Zurich, ML H 44
Host: Prof. Filippo Coletti, IFD

Further information: https://ifd.ethz.ch/events/ktf.html

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