Fluid Mechanics

Prof.dr.ir. J Westerweel

Prof.dr.ir. BJ Boersma

Prof.dr. JCR Hunt

Prof.dr.ir. G Ooms

The group of prof. J Westerweel in the section fluid mechanics consist of the following collaborators: prof.dr.ir. BJ Boersma, dr. R Delfos, prof.dr. JCR Hunt, prof,dr.ir. G Ooms, dr. R Lindken, dr.ir. C Poelma, and dr.ir. MJBM Pourquie. The common theme of the research in this group is turbulence and complex flows, such as multiphase flows, microfluidics and biological flows. The research is aimed at fundamental aspects of flows, but always with a clear connection to a practical application or process in industry. This research is carried out by modern experimental methods, such as particle image velocimetry, and by modern numerical methods, such as direct numerical simulation and large-eddy simulation. In most research experimental and numerical methods are combined.

The turbulence research aims at the interaction of turbulence with other processes, such as mixing and chemical reactions, dispersion of small particles, entrainment, aeroacoustics, and polymer drag reduction. A purely fundamental investigation is the transition to turbulence in a pipe flow. Multiphase flows include liquid/liquid dispersions, the interaction between particles and bubbles in a turbulent liquid , and drag reduction in bubbly flow. An example of a three-phase flow is to investigate the use of gas bubbles to capture small particles in a turbulent liquid. This fundamental investigation is related to a mixing and purification process in steel production. About half of the group is active in the area of (multiphase) microscale flows, i.e. microfluidics. This includes investigation of separation methods and (rapid) mixing in microfluidic devices. Mixing is investigated using various geometries, external forces (e.g., electroosmotic flow and acoustic forcing) and actuators. Recently a new stereoscopic micro-PIV system was developed and applied to the investigation of three-dimensional microfluidic flows. Other activities include the development of liquid/liquid microreactors for sample treatment and detection of DNA.

More recent we began to investigate microscale cardiovascular flows. The aim is to investigate the relation between differentiation and adaptation of tissues to fluid mechanical forces. This provides fundamental knowledge to understand the mechanisms of certain diseases, such as atherosclerosis. This research is carried out in close collaboration with medical groups at the universities of Leiden and Rotterdam.