Fachbereich 4
Produktionstechnik
Maschinenbau &
Verfahrenstechnik

CENTER OF
APPLIED SPACE TECHNOLOGY
AND MICROGRAVITY
ZARM

Fluids and Space Engineering Seminar

Date: Wednesday, April 3, 2019 at 13:00
Location: ZARM, Room 1730

Direct numerical simulation of particulate flows: investigating finite-size effects

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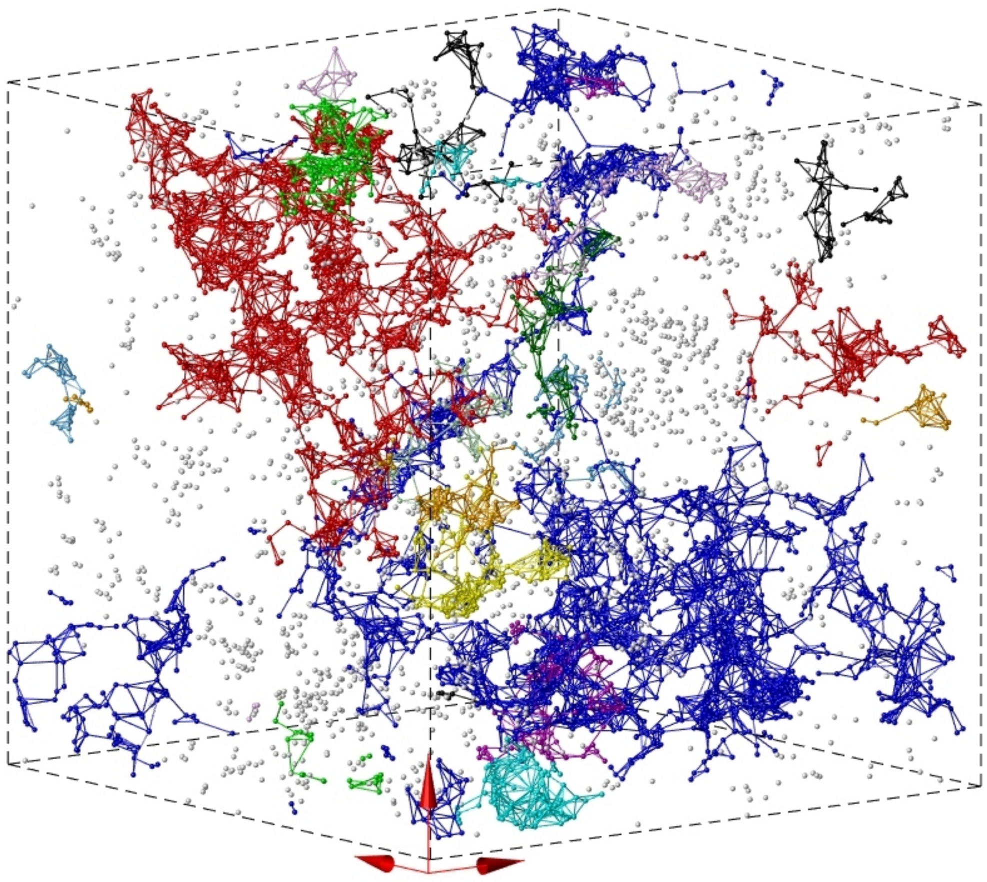

"The ten largest particle clusters in a snapshot of homogeneous-isotropic turbulence (Taylor micro-scale Reynolds number of 115), shown in like colors and connected with rods. The particle size is equivalent to approximately 5 Kolmogorov length scales, and their density measures 6 times the fluid density; gravity is zero. Out of the total 20000 particles, only those are shown which are part of a cluster."

Although fluid-particle systems are technologically relevant in many contexts, our understanding of their dynamics is still incomplete. Phenomena such as particle clustering are therefore still difficult to predict with the aid of engineering-type approaches. The situation is even more intricate when the particles are not small compared to the smallest flow scales, and/or the Reynolds number on the particle scale is not negligibly small. In this situation it becomes necessary to resolve the flow around the individual particles up to a precision which yields the correct hydrodynamic forces. This fully-resolved approach, although computationally demanding, is becoming increasingly feasible for investigating said dynamics in idealized configurations.

Here I will report on numerical studies on dilute suspensions of particles in homogeneous flows, with and without gravity. In the former case particles are on average settling through the fluid, which leads to the formation of wakes. The specific wake structure in turn induces various regimes of particle motion which are further modified by collective (multi-particle) effects. In the latter case we are interested in the interaction between a turbulent background flow and the suspended particles, investigating such questions as: where are particles preferentially located with respect to turbulent flow structures? The final aim is to understand the dynamics of settling particles with turbulent background flow, in which case turbulence counteracts the gravity-induced wake attraction mechanism.