MECHANICAL ENGINEERING SEMINAR

Monday, November 18 2024 at 14:30, D. Dan and Betty Kahn Building , Room 217

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Particle – Turbulence Interactions: from Spheres to Fibers

René van Hout, Ph.D.
Associate Professor of Mechanical Engineering
Faculty of Mechanical Engineering, Technion - IIT
Email: rene@technion.ac.il ; Website: https://empfl.net.technion.ac.il

Hosted by: Prof. Alon Wolf

The study of fluid-solid multiphase flows, characterized by the suspension of small solid particles within turbulent carrier fluids, is of significant relevance in both industrial and environmental contexts. Such flows are commonly encountered in processes such as papermaking, fuel combustion, and cyclonic separations, as well as in natural phenomena like sandstorms and the dispersion of soot particles, to name only a few. The inherent complexity of these dispersed two-phase flows arises from the intricate interactions between the suspended particles and the surrounding fluid, making them substantially more complicated to understand and predict than single-phase flows. Furthermore, in real-world applications, flows are often spatially evolving and particle shapes deviate from perfect spheres, with irregular and non-spherical shapes being common. This introduces additional complexity, as the interactions between non-spherical particles and turbulent flows are highly dependent on particle shape and orientation. Understanding these interactions is crucial for improving predictions and optimizing industrial processes involving fluid-solid multiphase flows. In particular, the coupling between non-spherical particles and the surrounding fluid flow is challenging to measure or numerically simulate.
In this talk I will present experimental results obtained during the past decade on spherical and non-spherical particle-turbulence interactions, both in isotropic turbulence, non-homogeneous wall-bounded turbulent channel flow and spatially developing coaxial jet flows. Advanced measurement methods such as time-resolved (tomographic) particle image velocimetry, and digital holographic cinematography have enabled to measure three-dimensional particle movement (translation, rotation) while simultaneously resolving the fluid flow motion. In the first part of my talk, I will discuss results on sphere motion in turbulent boundary layers, their interaction with the wall and turbulent coherent structures. In the remainder of this talk, I will discuss results that were obtained on fiber rotational and translational motion in isotropic turbulence as well as in wall-bounded turbulence. Finally, I will present some recent results on of fiber motion in the near-field of a coaxial water jet.

Seminars Coordinator: Assoc. Prof. Shmuel Gal.