MECHANICAL ENGINEERING STUDENT SEMINAR

Wednesday, February 14, 2024, at 13:00, D. Dan and Betty Kahn Building, Room 217.

Fiber Kinematics in the Near field of Coaxial Jets

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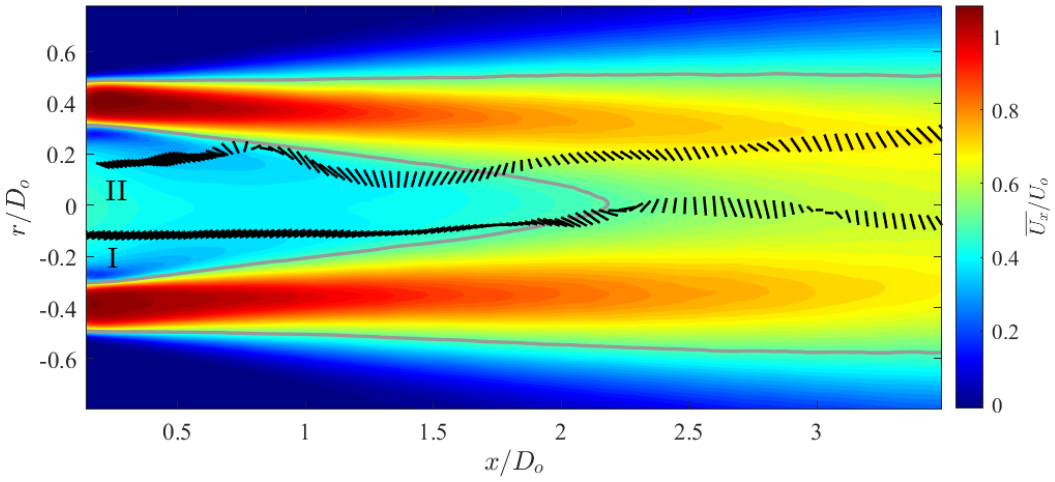
Adviser: Assoc. Prof. René van Hout

Particle-laden jets occur in many practical applications, for example in the fabrication of composite materials, pollution dispersion and drug delivery devices. In this seminar, I will discuss a fiber-laden coaxial jet that is characterized by multiple shear layers that generate large scale toroidal vortices as a result of Kelvin-Helmholtz instabilities. The underlying hypothesis is that by manipulating vortex generation by either changing the velocity ratio or the absolute value of the jet exit velocities, one can "control" fiber orientation. Here, nylon fiber kinematics (orientation, translation, tumbling rates) were measured in the near-field flow of a round coaxial, water jet (one-way coupling) using time-resolved, planar particle image velocimetry (PIV). The fibers (length 1.6mm, diameter 52μm) were introduced in the center jet. Measurements were performed at several velocity ratios and Reynolds numbers and in this seminar I will focus on a velocity ratio of 2.5. The PIV data enabled to resolve the instantaneous fiber-flow coupling. Results indicate that strong fiber rotation is the result of large vortical structures having a similar size as the fiber's length. The change in fiber orientation is especially pronounced at the point where the fiber interacts with the inner shear layer. I will discuss both single fiber kinematics and fiber statistics in different regions downstream of the jet nozzle. In addition, fiber-flow interaction and associated local Stokes numbers will be presented and discussed.



Note: the seminar will be given in Hebrew

Seminars Coordinator: Assoc. Prof. Gal Shmuel.