הטכניון TECHNION
מכון טכנולוגי לישראל Israel Institute of Technology

Faculty of Mechanical Engineering הפקולטה להנדסת מכונות

MECHANICAL ENGINEERING MSc SEMINAR (30 min.)

Monday, May 18 2026 at 14:00-14:30, Lady Davis Building, Auditorium 250

Turbulent flow across axisymmetric contraction in round pipe and its relevance to transport of inertial solids

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This study presents an experimental investigation of a turbulent flow through an abrupt axisymmetric area contraction in a pipe, focusing on a comparison between two different Reynolds numbers. The experiments were conducted in a refractive index–matched closed-loop flow tunnel, enabling optical access for high-resolution stereo particle image velocimetry (PIV). The fully developed incoming flow, with mean inlet velocities of 2.5 and 1.5 m/s was measured as it transitioned from a pipe of diameter 40mm to a pipe of diameter 25mm corresponding to an area ratio of 2.56, at step-height Reynolds numbers of 54,000 and 91,000. The results indicate comparable flow redevelopment lengths and similar mean velocity profiles for both cases. Nevertheless, notable differences arise in the turbulence structure. The contraction induces strong acceleration and pronounced shear layer formation, with variations observed in the interaction between near-wall and core flow regions as Reynolds number increases. These differences manifest in elevated out-of-plane velocity fluctuations near the contraction corner, influencing shear layer evolution and leading to changes in turbulent kinetic energy (TKE) production and Reynolds stress distributions. Further insight is obtained through analysis of Reynolds stress anisotropy maps, which reveal variations in the spatial extent and intensity of anisotropic turbulence regions between the two Reynolds numbers. In particular, differences in the prevalence of uniaxial stress states highlight the sensitivity of turbulence structure and anisotropy to Reynolds number under strong geometric constraints. Complementary Lagrangian coherent structure (LCS) analysis provides additional perspective on the organization of the flow, indicating Reynolds-number-dependent variations in the size, coherence, and persistence of dominant vortical structures. In addition to the planar measurements, tomographic imaging data were collected in the contraction region to capture three-dimensional flow features. The combination of refractive index matching and high-resolution imaging yields an unusually detailed characterization of turbulent flow through a non-uniform pipe cross-section, allowing the complex dynamics and coherent structures associated with axisymmetric contractions to be resolved and interpreted.

Seminars Coordinator: Prof. Sefi Givli

Note: the seminar will be given in English