



ICTS Fluid Dynamics Seminar

Title : A new characterization of small-scale dynamics in turbulent flows

Speaker: Rishita Das (Indian Institute of Science, Bengaluru)

Date : Friday, 16th February 2024

Time : 10:30 AM (IST)

Abstract : Turbulence small-scale dynamics is governed by velocity gradients, which reflect certain universality and self-similarity across different turbulent flows but also demonstrate small-scale intermittency. The multi-fractal and intermittent nature of velocity gradients renders characterization of its dynamics quite challenging. Inspired by Kolmogorov's 1962 refined similarity hypothesis, we propose a new framework to study small-scale dynamics by segregating a bounded normalized velocity-gradient tensor representing geometry of the local streamlines from an intermittent magnitude representing the scale of the streamlines. Analysis of direct numerical simulations (DNS) of isotropic turbulence and turbulent channel flow demonstrates that the normalized velocity-gradient geometry exhibits a distinct universality across Reynolds numbers, while the magnitude grows with Reynolds number. The evolution of small-scale structures in a turbulent flow is investigated within the state- space of the normalized velocity-gradient invariants, understanding the effects of different turbulence processes – inertial, pressure, viscous, and large-scale forcing. Finally, a new data-driven model of Lagrangian velocity-gradient dynamics is developed by modeling the bounded dynamics of the normalized velocity-gradient tensor and the dynamics of intermittent magnitude separately, showing improved agreement with the DNS results.

Venue : Offline: Feynman Lecture Hall

Online: Please click on the below link to join the seminar

<https://icts-res-in.zoom.us/j/94693102263?pwd=L2VxeTBXOGE2T05BRHlVbVNmL1lVZz09>

Meeting ID: 946 9310 2263

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