ICTS Fluid Dynamics Seminar

Title : Thin-Film Reduced Models: What Works, What Breaks, and What's Next

Speaker : Sanghasri Mukhopadhyay (International Institute of Information Technology, Bangalore)

Date : Friday, 10 April 2026

Time : 11:30 AM (IST)

Abstract : Thin liquid films arise in contexts ranging from tear films to coating and condensation processes. Their slender geometry enables a systematic reduction of the Navier–Stokes equations to effective low-dimensional evolution while preserving rich nonlinear wave dynamics. Classical approaches include long-wave asymptotic theory, depth-averaged (integral) models and weighted-residual formulations, centre-manifold reductions, and more recent adjustable formulations (Mukhopadhyay et al., JFM 2022). Although these models originate from distinct theoretical perspectives, they share a common objective: approximating the emergent low-dimensional dynamics associated with geometric anisotropy. Long-wave theory directly exploits this scale separation to derive asymptotic reductions, while depth-averaged models introduce closure assumptions to represent transverse structure, and centre-manifold analysis provides a systematic local reduction near the flat-film state. Despite their effectiveness, classical reductions may lose robustness at moderate inertia, exhibiting finite-time blow-up in long-wave formulations and sensitivity to the chosen transverse structure in integral models. This talk revisits thin-film modelling from this unified perspective, presents an adjustable formulation, and outlines directions for advancing reduced modelling.

Venue : Emmy Noether Seminar Room
Zoom Link: https://icts-res-in.zoom.us/j/98040128075?pwd=b9nFbvsNBU8nHylaU2hXJpBeptf9LY.1
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