Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad - 500107

Students' Annual Seminar

Rashmi Ramaadugu

Topic I: Buoyancy driven 2D-bubbly flows

Bubbly flows are observed in many natural phenomena and also in process industries. Wakes formed by bubble motion interact with each other and form complex flow structures [1,2]. In this talk I will present a numerical study to unravel the role of density contrast and Reynolds number on flow dynamics. At high Reynolds number, the flow resembles conventional turbulence. The energy spectrum shows a power-law behaviour and we find negative energy flux similar to inverse cascade of 2D turbulence. I will also discuss about the bubble size distributions in different parameter ranges.

Topic II: Mixing in immiscible fluids because of cellular flows

Vortices are central to mixing processes in both laminar and turbulent flows. In fluids with large density contrast, I show that baroclinic torque is crucial to effective mixing. We conduct high-resolution numerical simulations to study the interplay of baroclinic torque and surface tension in a Lamb-Oseen vortex flow. I show that stringy structures of high density fluid are formed at the vortex core. This is in stark contrast to flows with small density difference where a blob like region of high density is formed. I show that this has dramatic consequence on the mixing in cellular flows.

References:

[1] Bouche, E. and Roig, V. and Risso, F. and Billet, A. M. Homogeneous swarm of high-Reynolds-number bubbles rising within a thin gap. Part 2.liquid dynamics Journal of Fluid Mech., 544:508-521, (2014).
[2] Esmaeeli, A., Tryggvason, G. An inverse energy cascade in two-dimensional low Reynolds number bubbly flows. Journal of Fluid Mechanics, 314, 315-330, (1996).

Monday, Jul 9th 2018

4:00 PM (Tea/Coffee at 3:30 PM)

Seminar Hall, TIFR-H