INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The flow of suspensions in simple geometries has complex nature due to several parameters like particle-particle interactions, fluid viscosity, etc. An intriguing property of particle laden fluids is to form radial and axial patterns when rotated inside a horizontal cylinder.

Simulations of positively buoyant suspension in a horizontally rotating cylinder were performed to study the formation of radial and axial patterns. Axial density profiles show sinusoidal behavior for the drag-dominant phase and oscillating sinusoidal behavior for the centrifugal-force-dominant phase. Results indicate that the traveling bands are formed as a consequence of the inhomogeneous distribution of particles arising from an imbalance among drag, buoyancy, and centrifugal forces. The particle distribution patterns obtained from the simulations are found to be in good agreement with the experiments. A similar kind of analysis is also performed for a bi-density system. We have studied the phase space, radial and axial patterns in settling as well as floating sys- tems. Each system comprised of particle mixtures of two different densities. As many as eight unique phases are identified for each system along the radial plane. Characteristic behaviour of the bi-density systems is identical at low rotation rates and contrasting when centrifugal force dominates. Location of the axial bands remains the same for heavy and light particles in both systems. The Suspension Balance Model (SBM) is also implemented to study the possibility of the formation of axial bands for concentrated suspensions. These numerical simulations include the effect of the end-walls which are neglected in the discrete particle simulations indicate that the formation of axial bands might start because of interaction of the suspended particles with the end-walls.