Dense suspension rheology, normal stresses, and migration

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Dense or highly concentrated particulate systems are very common in several engineering fields such as civil engineering, food or pharmaceutical industry as well as in geophysical situations such as debris flows, sediment transport, and submarine avalanches. The major difficulty of dense particulate flows is that the grains interact both by hydrodynamics interactions through the liquid and by mechanical contact. These systems thus belong to an intermediate regime between pure suspensions and granular flows.

In this talk, we will first provide a simple review of dense suspension rheology and show that it exhibits a number of non-Newtonian behaviours. We will then focus on the appearance of normal stress differences in these systems and present two new experimental determinations of these differences using rotating-rod rheometry and tilted-trough flow. We will also discuss particle migration from regions of high to low shear-rate which can occur in these flow geometries.