JOHNS HOPKINS
Center for Environmental & Applied Fluid Mechanics

SPRING 2022 CEAFM VIRTUAL SEMINAR

"Flow near Jamming: Discontinuous Shear-thickening in Suspensions"

Presented by Prof. Jeffrey Morris
Levich Institute and Chemical Engineering
The City College of New York (CUNY)
Hosted by Rui Ni (MechE)

Abstract: There is a developing consensus that highly-concentrated (or "dense") suspensions in liquid share many features with dense granular flows, as both are close to jamming. However, suspensions can be tailored to have little difference in density, so that the concentration may be varied more readily and the interparticle forces are relatively tunable. This flexibility allows us insight to how the suspended solids change the material from a simple liquid at dilute solids to a highly complex non-Newtonian fluid or soft solid in the dense-packed limit. This same flexibility is of significant utility in applications.

The closeness to jamming results in the potential for strong and even discontinuous shear thickening (DST) when a repulsive force maintaining particle surface lubrication at low stress is involved. A key element is that at sufficiently large stresses, this force is overcome to allow surface contact with frictional interactions. The cornstarch-water suspension is an example showing DST and shear jamming (SJ). Using discrete-particle simulations, the behavior of spherical particle suspensions of both nearly monodisperse and significantly bidisperse suspensions displaying the lubricated to frictional transition will be considered. The rheological behavior will be outlined and then recent work relating the properties to the contact and force networks induced by shear stress will be considered using percolation, k-core, and persistent homology methods.

Friday, March 4, 2022 at 3:00 PM

Zoom Meeting

https://wse.zoom.us/j/93762992307