

## **Jeffrey F Morris**

### Emergence of rigid structure and its influence on particle motion in dense suspensions

We investigate discontinuous shear-thickening (DST) and the approach to shear jamming (SJ) in dense, non-Brownian suspensions composed of monodisperse and bidisperse particles, with size ratios up to 4:1. Simulations are performed using the Lubrication Flow-Discrete Element Method (LF-DEM), a well-established framework that combines hydrodynamic lubrication interactions with discrete particle contacts, incorporating frictional contact forces that activate above a critical stress threshold. The analysis presented here focuses on evolution with stress and solid fraction of the frictional contact networks and their coupling to particle-scale dynamics, particularly translational and rotational fluctuations and their correlations. As jamming is approached, rotational motion becomes strongly correlated over long distance, signaling the emergence of collective dynamics linked to the formation of system-spanning contact structures. To probe the origins of this behavior, we examine the onset of contact percolation and the development of rigidity through geometric and topological measures of the network. The particle dynamics and mechanism of motion near jamming are explored by considering transient rigid clusters that appear in this regime; the cluster behavior follows critical behavior, with consequent large fluctuations in viscosity, and is shown to be a precursor to jamming.