Dr. Jeffrey F. Morris  
*Professor of the Department of Chemical Engineering  
Director of the Levich Institute  
Levich Institute and Department of Chemical Engineering  
CUNY City College of New York  

**Thursday, September 7, 2017**  
**4:30 pm, WALC 1055 (Wilmeth Active Learning Center)**  

**Dense Suspensions: Shear Thickening and Related Phenomena**

**Abstract:**
Suspensions of solid particles in liquids have a wide range of applications, from coatings to cement, and appear in nature as mud flows and sediment transport. Their properties vary widely, from low-viscosity liquids to wet granular materials or soft solids, depending on the solids loading. When the particles are very concentrated, these mixtures are often called “dense suspensions”. Dense suspensions often exhibit shear thickening, an increase in apparent viscosity as the shear rate is increased. When conditions are right, abrupt order of magnitude increases in viscosity over a narrow range in shear rate occur, and this is termed the discontinuous shear thickening (DST); this is seen in dispersions of particles from far below a micron in diameter to tens of microns, with corn starch in water the well-known example.

Using numerical simulations, we will establish a scenario in which the DST phenomenon, and the related large normal stress response, is explained by the transition from lubricated to frictional interactions between particles as the driving shear stress increases. This complex rheology results from the interplay of viscous lubrication, repulsive surface forces, and contact with frictional interactions between particle surfaces. The simulation method will be outlined, with results compared to efforts by other groups, including experimental studies and a theory incorporating the same basic elements as these simulations. As the model makes strong simplifying assumptions, some discussion of other possible scenarios and open questions will be presented. A point which is clear from the work is the need to characterize surface interactions between particles of micron scale or smaller, in order to understand the conditions resulting in, and to better describe contact interactions under flow.

**Bio:**
*Jeffrey F. Morris (City College of New York, CUNY; Levich Institute and Chemical Engineering):* BChE Georgia Tech 1989; Ph.D. Caltech, 1995. Postdoc: Shell Research BV (KSLA, Amsterdam), 1994-1995; Georgia Tech: Assistant Professor, 1996-2002; Senior Scientific Advisor, Halliburton 2002-2004; City College of New York, CUNY: Associate Professor (2005-2008), Professor (2008-Present), Chair of Chemical Engineering (1/2013-1/2016); Director, Levich Institute (2015-Present). Morris is an Associate Editor of the *Journal of Fluid Mechanics*, and holds a visiting Research Chair at the Université Paul Sabatier in Toulouse, France.

*Reception @ 4:00 p.m. – Faculty/Staff Lounge (ME 2052) in Mechanical Engineering Building*