2011 Special Program: Two-Phase Flow, Interface Flow and Related Phenomena

Soft particle acrobatics and migration in microflow

2011 - 10 - 26 (Wed.)
15:00 - 17:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

We are surrounded by, and made of "soft" particles that deform upon the application of a "small" force. Muscle tissue, blood cells, biopolymers, plastics are examples of "soft" particles for which deformations plays necessary and important roles in their functions. By numerical modeling, we study the dynamics of soft particles in microfluidic flow, which can perform tumbling, trembling, and tank-treading under the competition of shear forces and particle elasticity. In addition, "soft" particles in microfluidic flow preferentially migrate away from the walls due to the coupling of particle deformation and fluid-mediated hydrodynamic forces, characterized by the Weissenberg number (Wi). For micron-sized particles, the competition between the shear forces and particle diffusion, characterized by the Peclet number Pe, affect whether the particles concentrate in the channel center of in an off-center position. The migration effect is also found to be enhanced for softer particles with longer elastic relaxation time. This variation allows separation of soft particles by their mechanical stiffness.