Modeling Viscous Flows with Suspended Particles Passing through a Channel Branch

K. Wei[a], **J. Feng**[a], **J. Zhu**[b], and **X. Wang**[b]

[a]Department of Mechanical Engineering
City College of New York
New York, NY 10031
feng@ccny.cuny.edu

[b]Department of Mechanical Engineering
Polytechnic University
Brooklyn, NY 11201
xwang@poly.edu

In this paper, we present two numerical methods for the simulation of the motion of particles suspended in a viscous fluid. In the immersed boundary method, the fluid-solid interaction is embedded in the distribution of the nodal forces of the submerged points and the interpolation of the nodal velocities via an attached discretized delta function with a finite support domain. Therefore, if uniform grids are used for the background fluid domain, the coupled fluid-solid system can be directly solved with a Fast Fourier Transform. The arbitrary Lagrangian-Eulerian method, on the other hand, tracks the moving internal boundaries with a deforming mesh. A Galerkin finite element formulation for both fluid and solid phases then leads to a nonlinear system of equations which are solved iteratively. We compare these two distinct computational procedures using the model problem of a particulate flow passing a channel branch. The distribution of solid particles in this geometry is relevant to biomedical applications such as drug delivery in air and blood circulations as well as cell mobility in biological tissues.