Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Eulerian-Lagrangian large eddy simulations of dense liquid-solid slurry flow through a horizontal pipe SUNIL AROLLA, JESSE CAPECELATRO, OLIVIER DESJARDINS, Cornell University — A high-fidelity large eddy simulation based Eulerian-Lagrangian methodology is used to investigate the detailed dynamics of liquid-solid slurries in a horizontal pipe. A dynamic Smagorinsky model based on Lagrangian averaging is employed to account for the sub-grid scale effects in the liquid phase. A fully conservative immersed boundary method is used to account for the pipe geometry on a uniform cartesian grid. The liquid and solid phases are coupled through volume fraction and the momentum exchange terms. Particle-particle and particle-wall collisions are modeled using a soft-sphere approach. Mean particle concentration and velocity profiles are computed, showing excellent agreement with experimental data. Covariance statistics are extracted and compared against multiphase turbulence models in the literature. When the bulk liquid velocity is below the critical deposition velocity, particles form a static bed at the bottom that exhibits strong size segregation. Based on our numerical simulations, a critical value for the Froude number is proposed below which the solid particles starts depositing.

Sunil Arolla
Cornell University

Date submitted: 29 Jul 2013 Electronic form version 1.4