Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

An Immersed Boundary Formulation for Fluid-Structure-Interaction in Multiphase Flows ELIZABETH GREGORIO, AKASH DHRUV, MEGAN C. LEFTWICH, ELIAS BALARAS, George Washington University — Immersed boundary methods have been widely used to study single-phase flow problems involving complex geometries. However, the extension of existing techniques to multiphase flows is not trivial. When employing direct forcing schemes, the treatment of the level-set function near an immersed boundary is challenging and may result in non-physical mass gain or loss near the interface. In addition, most existing methods adopt a static contact line treatment, which is not suitable for many practical applications. In the present work, we propose a numerical formulation, which uses a moving least squared based forcing for the physical variables and a ghost-cell approach for the level-set function to satisfy a dynamic contact angle boundary condition at the immersed boundary. The method is well suited to model multiphase flow around moving immersed boundaries. A hydrodynamic stress model is also implemented to accurately compute the forces on the body from both the liquid and gas phases. We will establish that the proposed formulation does not introduce mass errors. Comparison with experimental and reference numerical simulations for falling droplets and entry-body problems will demonstrate accuracy and robustness.

Elizabeth Gregorio
George Washington University

Date submitted: 24 Jul 2019 Electronic form version 1.4