Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

A Phase-Field Method for Simulating Fluid-Structure Interactions in Multi-Phase Flow XIAONING ZHENG, Massachusetts Institute of Technology, GEORGE KARNIADAKIS, Brown University — We investigate two-phase flow instabilities by numerical simulations of fluid structure interactions in two-phase flow. The first case is a flexible pipe conveying two fluids, which exhibits self-sustained oscillations at high Reynolds number and tension related parameter. Well-defined two-phase flow patterns, i.e., slug flow and bubbly flow, are observed. The second case is external two-phase cross flow past a circular cylinder, which induces a Kelvin-Helmholtz instability due to density stratification. We solve the Navier-Stokes equation coupled with the Cahn-Hilliard equation and the structure equation in an arbitrary Lagrangian Eulerian (ALE) framework. For the fluid solver, a spectral/hp element method is employed for spatial discretization and backward differentiation for time discretization. For the structure solver, a Galerkin method is used in Lagrangian coordinates for spatial discretization and the Newmark-β scheme for time discretization.

George Karniadakis
Brown University

Date submitted: 14 Jul 2015 Electronic form version 1.4