Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

**Numerical study of interactions among air, water, and rigid/flexible solid bodies** SIDA HE, ZIXUAN YANG, LIAN SHEN, Univ of Minnesota - Twin Cities — We develop a numerical method for simulating the fluid-structure interactions (FSI) among air, water, and rigid/flexible solid bodies. The influence of solid bodies on fluid flows is captured by an immersed boundary method. The air and water are simulated as a coherent system, with a coupled level-set and volume-of-fluid method implemented to capture the interface between air and water. Six degrees of freedom are considered for the motion of rigid bodies. A finite element method based on thin-shell theory is utilized to simulate the arbitrarily large deformation of flexible plates. Both strong coupling and loose coupling have been applied based on the density ratio of structure and fluid. We validate our code using benchmark cases with one-phase fluids, including the vortex-induced vibration of a rigid circular cylinder and the vibration of cantilever mounted behind a square cylinder caused by vortex shedding. We also test the accuracy of the code for simulating FSI problems with two-phase fluids in the context of barge floating at fluid interface and violent breaking waves impinging onto rigid/flexible plates. It is found that our simulation results are in good agreement with laboratory and simulation results reported in literature.

Sida He
Univ of Minnesota - Twin Cities

Date submitted: 30 Jul 2017 Electronic form version 1.4