Abstract Submitted
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Level set immersed boundary method for gas-liquid-solid interactions[1] SHIZHAO WANG, ELIAS BALARAS, The George Washington University — We will discuss an approach to simulate the interaction between free surface flows and deformable structures. In our formulation the Navier-Stokes equations are solved on a block-structured grid with adaptive mesh refinement, and the pressure jumps across the interface between different phases, which is tracked using a level set approach, are sharply defined. Deformable structures are simulated with a solid mechanics solver utilizing a finite element method. The overall approach is tailored to problems with large displacement/deformations. The boundary conditions on a solid body are imposed using a direct forcing, immersed boundary method (Vanella & Balaras, J. Comput. Physics, 228(18), 6617-6628, 2009). The flow and structural solvers are coupled by a predictor-corrector, strong-coupling scheme. The consistency between the Eulerian field based level set method for fluid-fluid interface and Lagrangian marker based immersed boundary method for fluid-structure interface is ensured by reconstructing the flow field around the three phase intersections. A variety of 2D and 3D problems ranging from water impact of wedges, entry and exit of cylinders and flexible plates interacting with a free surfaces, are presented to demonstrate the accuracy of the proposed approach.

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