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A COUPLING VOF/ LEVEL-SET EMBEDDED BOUNDARY METHOD TO MODEL TWO PHASE FLOWS ON ARBITRARY SOLID SURFACES: APPLICATION TO WETTING AND SOLIDIFICATION

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Multiphase flows interacting with complex solid geometries are challenging and difficult to tackle either experimentally or numerically because of the complexity of the flow coupled with generally heterogeneous solid structures. When phase change is involved, such as in solidification in ice formation, this can be even more complex.
A non trivial coupling of the Volume Of Fluid approach to model the liquid-gas interface and a level-set embedded boundary method to account for the moving solid ice is designed in this work. Following the one-fluid formulation, the dynamics of the two fluids is therefore governed by the incompressible Navier-Stokes equations while we consider non-deformable solid so that the coupling between the fluids and the solid intervenes only through the boundary conditions. Here, the hybrid VOF/level-set embedded boundary is presented in the case of wetting and solidification applications. The original coupling of method is designed to be accurate and second order. The validation examples show that our method is able to deal with various problems such as the wetting in the droplet impact on a fiber and the solidification with the freezing droplet test case.

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