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Cost and accuracy comparison between the diffuse interface method and the geometric volume of fluid method for simulating two-phase flows[1] SHAHAB MIRJALILI, Stanford University, CHRISTOPHER BLAKE IVEY, Lawrence Livermore National Laboratory, ALI MANI, Stanford University — The diffuse interface(DI) and volume of fluid(VOF) methods are mass conserving front capturing schemes which can handle large interfacial topology changes in realistic two phase flows. The DI method is a conservative phase field method that tracks an interface with finite thickness spread over a few cells and does not require reinitialization. In addition to having the desirable properties of level set methods for naturally capturing curvature and surface tension forces, the model conserves mass continuously and discretely. The VOF method, which tracks the fractional tagged volume in a cell, is discretely conservative by requiring costly geometric reconstructions of the interface and the fluxes. Both methods however, suffer from inaccuracies in calculation of curvature and surface tension forces. We present a quantitative comparison of these methods in terms of their accuracy, convergence rate, memory, and computational cost using canonical 2D two-phase test cases: damped surface wave, oscillating drop, equilibrium static drop, and dense moving drop. We further compared the models in their ability to handle thin films by looking at the impact of a water drop onto a deep water pool. Considering these results, we suggest qualitative guidelines for using the DI and VOF methods.

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