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Parasitic Currents in Diffuse-Interface Two-Phase Flow Simulations[1] PEDRO MILANI, SEYEDSHAHABADDIN MIRJALILI, ALI MANI, Stanford University — Two phase flow phenomena are important in a wide range of applications, such as bubble generation in ocean waves and droplet dynamics in fuel injectors. Several methods can be used to simulate such phenomena. The focus of this study is the diffuse-interface method, in which the interface is described via a mixing energy and spans a few computational cells, while surface tension is modeled as a force density term on the right-hand side of the momentum equation. The advantages of this method include the ability to easily simulate complex geometries since it does not require special treatment around the interface, and to conserve mass exactly. However, this method suffers from parasitic currents, an unphysical velocity field generated close to the interface due to numerical imprecisions in the surface tension term. This can be a serious problem in low speed flows, where the parasitic currents are significant compared to the velocity scale of the problem. In this study, we consider a wide range of diffuse-interface schemes for two-phase flows, including different options for discrete representation of the surface tension force. By presenting an assessment of each method's performance in scenarios involving parasitic currents, we develop accuracy estimates and guidelines for selection among these models.

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