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Three-dimensional advected normals method for calculating interfacial normals and curvatures in two-phase flows ASHISH PATHAK, MEHDI RAESSI, University of Massachusetts Dartmouth — We present an extension of the advected normals method to three-dimensional two-phase flows, including contact line problems. In this method, a mass-conserving volume-of-fluid method is used to track fluid volumes, while the unit vectors normal to the fluid interfaces are advected by solving an additional transport equation. Interface curvature is computed directly from the advected normals. RK3 scheme is used for discretizing the temporal gradient of the normals transport PDE, and spatial gradients are calculated using Lax-Friedrichs flux splitting scheme with WENO-5, which provides a more robust solution, especially in cases where the velocity field may contain spurious currents. Efficacy of the method in accurate evolution of normals is demonstrated in 3D test cases with prescribed velocity, where the normals and curvatures are shown to converge with second and first order accuracy, respectively. Furthermore, the method was extended to handle contact line problems in 3D. Normal vectors around the contact line and along the contact surface are used as boundary conditions to impose the contact angle. Additionally, to solve the normals evolution PDE, an extension of the normals field below the contact surface is required, which is obtained using natural neighbor interpolation.

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