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Incorporating contact angles in the surface tension force with the ACES interface curvature scheme MARK OWKES, Montana State University — In simulations of gas-liquid flows interacting with solid boundaries, the contact line dynamics effect the interface motion and flow field through the surface tension force. The surface tension force is directly proportional to the interface curvature and the problem of accurately imposing a contact angle must be incorporated into the interface curvature calculation. Many commonly used algorithms to compute interface curvatures (e.g., height function method) require extrapolating the interface, with defined contact angle, into the solid to allow for the calculation of a curvature near a wall. Extrapolating can be an ill-posed problem, especially in three-dimensions or when multiple contact lines are near each other. We have developed an accurate methodology to compute interface curvatures that allows for contact angles to be easily incorporated while avoiding extrapolation and the associated challenges. The method, known as Adjustable Curvature Evaluation Scale (ACES), leverages a least squares fit of a polynomial to points computed on the volume-of-fluid (VOF) representation of the gas-liquid interface. The method is tested by simulating canonical test cases and then applied to simulate the injection and motion of water droplets in a channel (relevant to PEM fuel cells).

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