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Modeling Subgrid Scale Droplet Deposition in Multiphase-CFD
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— The development of first-principle-based constitutive equations for the Eulerian-Eulerian CFD modeling of annular flow is a major priority to extend the applicability of multiphase CFD (M-CFD) across all two-phase flow regimes. Two key mechanisms need to be incorporated in the M-CFD framework, the entrainment of droplets from the liquid film, and their deposition. Here we focus first on the aspect of deposition leveraging a separate effects approach. Current two-field methods in M-CFD do not include appropriate local closures to describe the deposition of droplets in annular flow conditions. As many integral correlations for deposition have been proposed for lumped parameters methods applications, few attempts exist in literature to extend their applicability to CFD simulations. The integral nature of the approach limits its applicability to fully developed flow conditions, without geometrical or flow variations, therefore negating the scope of CFD application. A new approach is proposed here that leverages local quantities to predict the subgrid-scale deposition rate. The methodology is first tested into a three-field approach CFD model.

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