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Consistent and conservative framework for incompressible multiphase flow simulations MARK OWKES, Montana State University, OLIVIER DESJARDINS, Cornell University — We present a computational methodology for convection that handles discontinuities with second order accuracy and maintains conservation to machine precision. We use this method in the context of an incompressible gas-liquid flow to transport the phase interface, momentum, and scalars. Using the same methodology for all the variables ensures discretely consistent transport, which is necessary for robust and accurate simulations of turbulent atomizing flows with high-density ratios. The method achieves conservative transport by computing consistent fluxes on a refined mesh, which ensures all conserved quantities are fluxed with the same discretization. Additionally, the method seamlessly couples semi-Lagrangian fluxes used near the interface with finite difference fluxes used away from the interface. The semi-Lagrangian fluxes are three-dimensional, un-split, and conservatively handle discontinuities. Careful construction of the fluxes ensures they are divergence-free and no gaps or overlaps form between neighbors. We have tested and used the scheme for many cases and demonstrate a simulation of an atomizing liquid jet.

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