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A sharp interface in-cell-reconstruction method for volume tracking phase interfaces in compressible flows[1] DOMINIC KEDELTY, CARLOS BALLESTEROS, Arizona State University, RONALD CHAN, Stanford University, MARCUS HERRMANN, Arizona State University — To accurately predict the interaction of the interface with shocks and rarefaction waves, sharp interface methods maintaining the interface as a discontinuity are preferable to capturing methods that tend to smear the interface. We present a hybrid capturing/tracking method (Smiljanovski et al., 1997) that couples an unsplit geometric volume tracking method (Owkes & Desjardins, 2014) to a finite volume wave propagation scheme (LeVeque, 2010). In cells containing the phase interface, states on either side are reconstructed using the jump conditions across the interface, the geometric information of the volume tracking method, and the cell averages of the finite volume method. Cell face Riemann problems are then solved within each phase separately, resulting in area fraction weighted fluxes that update the cell averages directly. This, together with a linearization of the wave interaction across cell faces avoids the small cut-cell time step limitation of typical tracking methods. However, the interaction of waves with the phase interface cannot be linearized and is solved using either exact or approximate two-phase Riemann solvers with arbitrary jumps in the equation of state. Several test cases highlight the capabilities of the new method.

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