Abstract Submitted
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A volume-fraction model for the simulation of miscible and viscous compressible fluids[1] BEN THORNBER, MICHAEL GROOM, University of Sydney, DAVID YOUNGS, University of Strathclyde — Miscible multispecies compressible computations typically employ conservative equations for mass fraction transport. These equations, while simple, have a severe restriction in that they produce unphysical pressure oscillations at moving contact surfaces between gases of differing ratios of specific heats. These pressure oscillations dramatically increase the errors of the computations compared to stationary contact surfaces. Here, a new five equation model is presented which extends the volume fraction model of Allaire et al.[J. Comput. Phys. 181 (2002) 577-616] to include viscosity, diffusivity and heat conduction. It permits the computation of compressible mixing problems without producing spurious unphysical pressure oscillations. An algorithm is presented to solve the model equations at second order accuracy, demonstrating that it gives up to an order of magnitude lower errors than the mass fraction model for a given mesh resolution. Two and three-dimensional computations of the Richtmyer-Meshkov instability demonstrate that computational savings on the order of 50-100 is possible for an equivalent error. The proposed model is thus very suitable for Direct Numerical Simulation and Large Eddy Simulation of compressible mixing.

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