

# Pseudo Arc-Length Algorithm for Numerical Simulation of Immiscible Compressible Multi-Material Flows

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**Abstract:** We describe a pseudo arc-length algorithm for numerical resolution of immiscible compressible multi-material flows with the Mie-Grüneisen type equation of state (EOS) governed by the quasi-conservative five-equation model. The governing equation is discretized in space uses the finite volume approach with a second-order accurate Godunov scheme. Time discretization is achieved using the strong stability-preserving high-order Runge-Kutta time discretization scheme. The five-equation model with the Mie-Grüneisen EOS is general enough to model materials with different equations of state and physical states. However, for long simulations, the interface of materials is indistinct because of numerical dissipation. The interfacial compression method is used to keep the thickness of the diffusion interface within a few grid cells throughout the simulation. The THINC (Tangent of Hyperbola for Interface Capturing) scheme is used as a basis for the reconstruction of grids on the interface cells. Numerical simulation of underwater explosion shows that the pseudo arc-length algorithm can achieve that computational grid capture the detonation wave, five-equation model can be achieved on the material interface capturing by using macroscopic volume fraction, and the THINC scheme can keep the interface sharp and constrain the interface within two or three grids. The results of numerical tests verify the effectiveness of the present algorithm: capture the detonation front and interface-sharpened results are obtained.

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