MODELING COMPRESSIBLE MULTIPHASE FLOWS WITH DISPERSED PARTICLES

T. McGrath[1], J. St. Clair[1], S. Balachandar[2]

[1]Naval Surface Warfare Center Indian Head Explosive Ordnance Disposal Technology Division., 4103 Fowler Rd, Indian Head, MD, 20640, USA;
[2]University of Florida, 231 MAE-A P.O. Box 116250, Gainesville, FL, 32611, USA

ABSTRACT

Many important explosives and energetics applications involve multiphase formulations employing dispersed particles. While considerable progress has been made towards developing mathematical models and computational methodologies for these flows, significant challenges remain. In this work, we preset a mathematical model for compressible multiphase flows with dispersed particles and demonstrate its application to shock-induced dispersion problems. The model is cast in an Eulerian framework, treats all phases as compressible, is hyperbolic and satisfies the 2nd Law of Thermodynamics. However, it also retains relaxed characteristics for the dispersed particle phase that remove the constituent material sound velocity from the eigenvalues. This is consistent with the expected characteristics of dispersed particle phases and can significantly improve the stable time-step size for explicit methods. The model is applied to test cases involving the shock and explosive dispersal of solid particles and compared to data from the literature. Computed results compare well with the experimental findings providing confidence in the model and computational methods applied.