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Modeling Particle-Laden Compressible Flows Using Lattice-Boltzmann Simulation ORLANDO AYALA, University of Delaware, JOHN THOMAS, Johns Hopkins University, LIAN-PING WANG, University of Delaware — Combing the three-dimensional compressible Lattice-Boltzmann model with a fluid-particle interaction model, a robust computational framework for predicting fluid/solid momentum transfer within a particle-laden compressible flow field is developed. This tool is used to examine the effects of a moving shock front on the time-evolution of the displacement, velocity, and acceleration vectors of a single spherical particle initially at rest. These results are compared to analytical solutions obtained from the Navier-Stokes equations for compressible flows and a relationship between Mach number and drag coefficient is developed. Next, momentum transport through a system of particles is examined and the effects of particle-particle interactions on shock front propagation/attenuation are discussed. These results are used to understand fluid/solid momentum transfer within detonation shock waves.

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