Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Compressibility Effects on Particle-Fluid Interaction Force for Eulerian-Eulerian Simulations.[1] GEORGES AKIKI, MARIANNE FRANCOIS, DUAN ZHANG, Los Alamos National Laboratory — Particle-fluid interaction forces are essential in modeling multiphase flows. Several models can be found in the literature based on empirical, numerical, and experimental results from various simplified flow conditions. Some of these models also account for finite Mach number effects. Using these models is relatively straightforward with Eulerian-Lagrangian calculations if the model for the total force on particles is used. In Eulerian-Eulerian simulations, however, there is the pressure gradient terms in the momentum equation for particles. For low Mach number flows, the pressure gradient force is negligible if the particle density is much greater than that of the fluid. For supersonic flows where a standing shock is present, even for a steady and uniform flow, it is unclear whether the significant pressure-gradient force should to be separated out from the particle force model. To answer this conceptual question, we perform single-sphere fully-resolved DNS simulations for a wide range of Mach numbers. We then examine whether the total force obtained from the DNS can be categorized into well-established models, such as the quasi-steady, added-mass, pressure-gradient, and history forces.

[1]Work sponsored by Advanced Simulation and Computing (ASC) program of NNSA and LDRD-CNLS of LANL.

Georges Akiki
Los Alamos National Laboratory

Date submitted: 31 Jul 2017 Electronic form version 1.4