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Modeling and Numerical Challenges in Eulerian-Lagrangian Computations of Shock-driven Multiphase Flows[1] ANGELA DIGGS, Air Force Research Laboratory, SIVARAMAKRISHNAN BALACHANDAR, Department of Mechanical and Aerospace Engineering, University of Florida — The present work addresses the numerical methods required for particle-gas and particle-particle interactions in Eulerian-Lagrangian simulations of multiphase flow. Local volume fraction as seen by each particle is the quantity of foremost importance in modeling and evaluating such interactions. We consider a general multiphase flow with a distribution of particles inside a fluid flow discretized on an Eulerian grid. Particle volume fraction is needed both as a Lagrangian quantity associated with each particle and also as an Eulerian quantity associated with the flow. In Eulerian Projection (EP) methods, the volume fraction is first obtained within each cell as an Eulerian quantity and then interpolated to each particle. In Lagrangian Projection (LP) methods, the particle volume fraction is obtained at each particle and then projected onto the Eulerian grid. Traditionally, EP methods are used in multiphase flow, but sub-grid resolution can be obtained through use of LP methods. By evaluating the total error and its components we compare the performance of EP and LP methods. The standard von Neumann error analysis technique has been adapted for rigorous evaluation of rate of convergence. The methods presented can be extended to obtain accurate field representations of other Lagrangian quantities. Most importantly, we will show that such careful attention to numerical methodologies is needed in order to capture complex shock interaction with a bed of particles.

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