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An Immersed Boundary Method for Shock-Particle Interaction[1]

IMAN BORAZJANI, J. Mike Walker 66 Department of Mechanical Engineering, Texas A&M University — A sharp-interface immersed boundary method is developed to simulate the interaction of solid particles with shocks. The inviscid and viscous fluxes of compressible flow equations in curvilinear coordinates are discretized with a third order weighted essentially non-oscillatory (WENO) and a central scheme, respectively. The equations are advanced in time using a third-order Runge-Kutta method. The sharp interface at the immersed boundaries is maintained by reconstructing the compressible flow variables along the normal direction to the boundary similar to the previous method for incompressible flows. The WENO discretization is reverted to a second order ENO scheme near the immersed boundaries to reduce the stencil size and avoid using the nodes inside the immersed boundary in the discretization. The method is validated against experimental measurements and shown to be second-order accurate in the presence of immersed boundaries. The numerical results capture all of the shock features observed in the experiments and show great agreement with the measurements.

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Iman Borazjani
J. Mike Walker 66 Department of Mechanical Engineering, Texas A&M Univ

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