Investigation of Unsteady Forces on a Particle in a Compressible Flow[1] M. PARMAR, A. HASELBACHER, University of Illinois at Urbana-Champaign, S. BALACHANDAR, University of Florida at Gainesville — The acceleration of a body immersed in a fluid gives rise to so-called added-mass and history forces because some of the surrounding fluid is accelerated due to no-penetration condition and due to the development of the boundary layer. These forces have been studied in detail, both theoretically and numerically, for incompressible flows and spherical particles. The purpose of the present investigation is to assess the effect of compressibility on these forces. Our primary interest is in strong accelerations of particles such as by impacting shock waves. To this end, we have modified an existing unstructured-grid fluids code to solve the Navier-Stokes equations in a moving frame of reference. The acceleration of the moving frame is determined from the instantaneous force on the particle and its mass. To improve the accuracy of the computations, non-reflecting boundary conditions are used at the outer boundary. Preliminary results in two dimensions will be presented for several acceleration rates.

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