Mach Effects on Particle-Wall Interactions: A Parametric Study

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ABSTRACT

This paper focuses on a parametric study of the effects of Reynolds, Mach and dimensionless gap height on particle drag/lift as it approaches a wall. Accurate modeling of drag and lift coefficients in this regime is needed where particle driven erosion is a concern. A 4^{th} order accurate finite difference scheme is used to discretize the compressible NS equations on a globally orthogonal mesh. Experiments are performed over Re(100 -1000), M(0.3-0.5) for a set of dimensionless gap heights - h(4, 2, 1, 0.75). These gap heights and Reynolds numbers are well documented in the incompressible regime, providing benchmarking for the methods used. Results for a free stream flow agree well with the values of St and C_D available in the literature for a range of Mach numbers. Preliminary, coarse grid results for a particle near a wall show an increase in the Strouhal number as predicted in the literature, the further effects of increasing Mach number will be reported in detail.

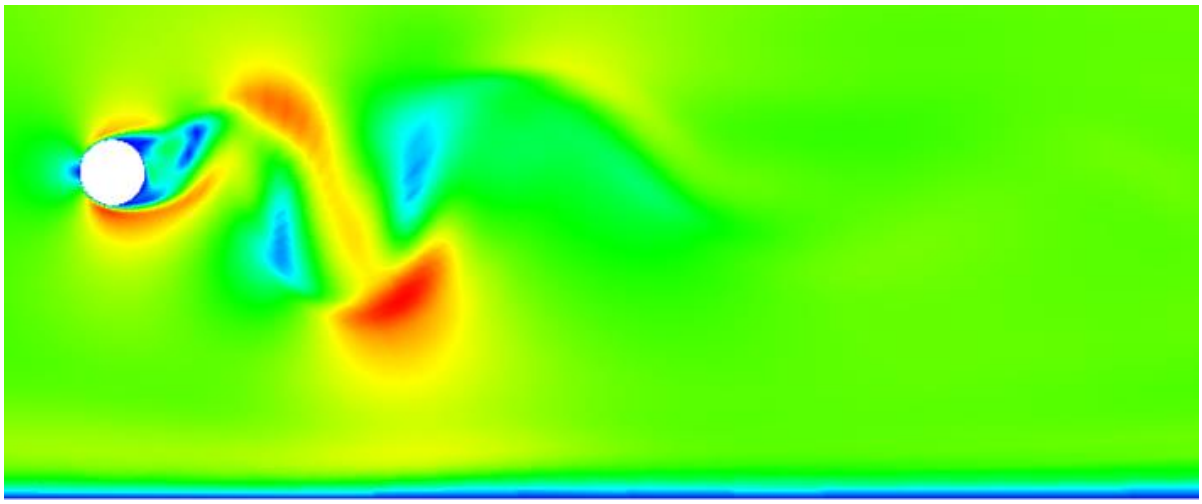

Figure 1 – Ma = 0.3 at Re = 500