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Analysis of the Flow Over a Sphere Using Direct Simulation Monte Carlo Method in OpenFOAM TADD YEAGER, DOUGLAS FONTES, MICHAEL KINZEL, University of Central Florida — Continuum assumptions are not valid for some flows such those found in cases involving atmospheric reentry. For these kinds of problems, the flow field cannot be solved considering the average physical properties (usually used to describe the effects of molecular interaction). Thus, these molecule-molecule interactions must be solved directly. Rarefied flow is often characterized by the Knudsen number, which is related to the ratio of the flow's Mach and Reynolds numbers. Aiming to study of the effects of these relevant dimensionless parameters as they pertain to flow over a blunt body, this paper presents an analysis of rarefied flow over a stationary sphere modeled using the Direct Simulation Monte Carlo (DSMC) method. In these simulations, high subsonic and supersonic flows of air are to be considered and discussed. These cases are simulated using the dsmcFoam solver from OpenFOAM. The preliminary average results of the surface force density and pressure distribution around the sphere surface are consistent with known physics, as are the velocity and momentum fields. Different particle velocities and particle number density should be evaluated to provide a better understanding of interactions between rarefied free stream flow and blunt solid bodies.

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