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Estimation of Measurement Errors in Supersonic Wall-Bounded Flows using CFD-Based Simulated PIV ROSS BURNS, NOEL CLEMENS, HEESEOK KOO, VENKAT RAMAN, The University of Texas at Austin — Particle-lag and resolution effects of PIV are being investigated by applying PIV processing techniques to synthetic CFD-based particle fields. Used previously by several investigators, this method aids in identifying sources of error in the flow and in the comparison of experimental and computational data. The technique utilizes time-resolved DNS or LES data and a modified Stokes flow model of particle motion to evolve a particle field and generate pairs of synthetic PIV images. A simulated Mach 5 inlet-isolator flow exhibiting multiple shock reflections and significant separation is used as a test application; simulated TiO_2 particles ranging in size from 0.1 μm to 2.0 μm are distributed uniformly within the model geometry and evolved in time. In agreement with previous experimental results, particle fields rapidly become inhomogeneous in high-gradient regions, with increased inhomogeneity occurring with greater particle size. A preliminary comparison of synthetic PIV-derived velocity fields with those from the LES data indicate significant errors in regions of high gradients, in particular shocks and regions of separated flow, with higher particle inertia yielding increasing errors.

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