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Numerical Investigation of the Accuracy of Particle Image Velocimetry Technique in Gas-Phase Detonations[1] SAI SANDEEP DAMMATI, YORAM KOZAK, Texas A&M University, KAREEM AHMED, University of Central Florida, ALEXEI POLUDNENKO, Texas A&M University — In this study, we numerically investigate the accuracy of the Particle Image Velocimetry (PIV) technique for the flow characterization in high-speed, compressible regimes, and in particular in gas-phase detonations. A two-dimensional, planar detonation at atmospheric conditions is modeled using a simplified single-step Arrhenius kinetics. The upstream flow is uniformly seeded with particles representing the Al_2O_3 PIV particles used in experiments, along with initially co-located massless Lagrangian tracers used to recover the correct particle trajectories in the flow field. Massless Lagrangian particles are integrated using both 2nd order and 4th order time integrators to further assess the errors in the reconstructed Lagrangian trajectories. By comparing the trajectories of massive particles with those of the tracer particles, we address the following questions: a) How do PIV particles affect the detonation wave, in particular its velocity and cellular structure? b) How closely do massive PIV particles follow the flow pathlines? c) What is the accuracy of the flow field reconstructed using the PIV particles? Finally, we discuss the implications for the use of the PIV technique as a diagnostic tool for high-speed reacting flows such as detonations in detonation-based engines

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