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Particle drag history in a subcritical post-shock flow – data analysis method and uncertainty LIUYANG DING, Arizona State University, ANKUR BORDOLOI, Los Alamos National Laboratory, RONALD ADRIAN, Arizona State University, KATHY PRESTRIDGE, Los Alamos National Laboratory, ARIZONA STATE UNIVERSITY TEAM, LOS ALAMOS NATIONAL LABORATORY TEAM — A novel data analysis method for measuring particle drag in an 8-pulse particle tracking velocimetry-accelerometry (PTVA) experiment is described. We represented the particle drag history, $C_D(t)$, using polynomials up to the third order. An analytical model for continuous particle position history was derived by integrating an equation relating $C_D(t)$with particle velocity and acceleration. The coefficients of $C_D(t)$ were then calculated by fitting the position history model to eight measured particle locations in the sense of least squares. A preliminary test with experimental data showed that the new method yielded physically more reasonable particle velocity and acceleration history compared to conventionally adopted polynomial fitting. To fully assess and optimize the performance of the new method, we performed a PTVA simulation by assuming a ground truth of particle motion based on an ensemble of experimental data. The results indicated a significant reduction in the RMS error of C_D. We also found that for particle locating noise between 0.1 and 3 pixels, a range encountered in our experiment, the lowest RMS error was achieved by using the quadratic $C_D(t)$ model. Furthermore, we will also discuss the optimization of the pulse timing configuration.

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