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Uncertainty estimation for Stereo-Particle Image Velocimetry measurements SAYANTAN BHATTACHARYA, Purdue University, BRETT MEYERS, MATTHEW GIARRA, RODERICK LA FOY, Virginia Polytechnic Institute and State University, PAVLOS VLACJOS, Purdue University — Stereographic Particle Image Velocimetry (SPIV) is a standard method of estimating three-component fluid velocity fields from a two-dimensional field of view using two viewing angles. SPIV techniques involve a series of procedures such as camera calibration, image de-warping, velocity field reconstruction, etc., and the contribution of each step to the overall uncertainty of the measurement is not well understood. Previous efforts have been made to quantify errors involved at each stage of the 3D velocity reconstruction, but have fallen short of a rigorous analysis of the combination of errors for a range of parameters. Such analysis is performed herein. In the present work the Type A uncertainty is evaluated for each step of an SPIV method (involving self calibration and both 3D calibration-based reconstruction and geometric reconstruction) for a set of simulated images. A simulated vortex ring image set was used as a test case and the particle seeding density, light sheet thickness, image magnification, and viewing angles were varied parametrically. Propagation of systematic and random standard uncertainty using both Taylor series and Monte-Carlo method was performed. The results are also compared with prior 2D PIV uncertainty analysis.

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