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Uncertainty Estimation in Stereoscopic Particle Image Velocimetry SAYANTAN BHATTACHARYA, PAVLOS VLACHOS, Purdue University — In Stereoscopic Particle Image Velocimetry (Stereo-PIV) particle images are recorded using two viewing directions and the projected velocity components obtained in each view are combined to predict the three component velocity vector in the plane of measurement. The accuracy of the method depends on precise determination of viewing angles, measurement plane location and estimation of projected velocity components. However, the complex measurement chain with non-linear combination of errors make uncertainty estimation in Stereo-PIV challenging. Here we consider the overall uncertainty stemming from various error sources involved in the measurement process. The uncertainty in the absolute particle locations due to mismatch in the overlapping camera views are combined with the uncertainty in individual camera velocity components to predict the uncertainty in the reconstructed velocity field. The mapping function uncertainty and viewing angle uncertainty are also considered in the propagation equation. Present framework is tested with both simulated random field and experimental vortex ring image set. The RMS error and predicted uncertainties are compared for different viewing angle camera pairs. A sensitivity analysis of the individual uncertainty contributions to the overall uncertainty coverage is also presented.

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