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A super-resolution approach for uncertainty estimation of PIV measurements BERNHARD WIENEKE, LaVision GmbH, ANDREA SCIACCHITANO, FULVIO SCARANO, TU-Delft — A super-resolution approach is proposed for the a posteriori uncertainty estimation of PIV measurements. The measured velocity field is employed to determine the displacement of individual particle images. A disparity set is built from the residual distance between paired particle images of successive recordings. Within each interrogation window, the disparity set is treated with a statistical analysis to infer the measurement uncertainty: the mean disparity is ascribed to bias errors due to poor particle image sampling or spatial modulation effect; the dispersion of the set is related to precision errors, mainly due to random noise in the recordings and to errors in the PIV interrogation. The performance of the estimator is assessed on a synthetic uniform flow field with varying out-of-plane displacement. The uncertainty is accurately estimated in optimal imaging condition, but underestimated for very small particle images. Experiments are conducted on a water jet experiment, where the actual measurement error is computed as the difference between measured and a reference displacement field estimated from the time redundancy of highly oversampled data. The uncertainty is quantified accurately within 0.1 px.

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