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Uncertainty in Velocity Fluctuations for Two-Component PIV Measurements[1] BRANDON WILSON, JEFF HARRIS, BARTON SMITH, Utah State University Mechanical and Aerospace Engineering — The subpixel displacement estimator in PIV generates random fluctuations, in the velocity measurement. This noise causes velocity fluctuations to be overestimated. We quantify this overestimate of the fluctuation level due to four error sources: particle displacement, particle image size, particle density and flow gradients. A jet experiment that is designed to segregate error sources and demonstrate their effects by comparison of PIV and hot wire measurements is used. While the influence of the error sources studied on the mean velocity is negligible, increases in velocity fluctuation levels are observed for all error sources when compared to hot wire results, particularly particle displacement and flow gradients. Uncertainties in the velocity fluctuation levels are one-directional because the error sources considered can only increase the measured fluctuations. Sources that attenuate the fluctuation level (i.e. particle lag or volumetric averaging) are not studied. The amount by which the velocity fluctuation level is overestimated is consistent with previous theoretical studies and with recent studies using synthetic images.

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