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Depth of correlation reduction due to out-of-plane shear in microscopic PIV MICHAEL OLSEN, Iowa State University — The effects of out-of-plane shear on the depth of correlation in microscopic particle image velocimetry (microPIV) were analyzed by deriving an analytical model of microPIV interrogation for flowfields containing velocity gradients in the out-of-plane direction. The model is derived using a Taylor series approximation, and is therefore most accurate in the limit of small shear, but it does provide valuable insights. The model shows that out-of-plane velocity gradients reduce the depth of correlation compared to flowfields without gradients, but this decrease in depth of correlation is smaller than the increase in depth of correlation for a flowfield containing only in-plane velocity gradients. By combining the analysis for flows with in- plane gradients and with the analysis for flows with out-of-plane gradients, an equation for depth of correlation for a flowfield containing both in-plane and out-of-plane velocity gradients was derived. This equation suggests that unless the out-of-plane gradients are significantly larger than than the in-plane gradients, the effect on the depth of correlation due to the out-of-plane gradients is negligible, and the depth of correlation can be very closely approximated by calculating the depth of correlation using only the in-plane velocity gradients.

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