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Strategies for PIV Outlier Replacement using Gappy POD SAM RABEN, JOHN CHARONKO, Virginia Tech, PAVLOS VLACHOS, Virgnia Tech — This work presents methodologies for reconstructing erroneous measurements in gappy DPIV data using Proper Orthogonal Decomposition (POD). Current methods for data reconstruction using POD require a priori knowledge of the true solution [Venturi and Karniadakis, J. Fluid Mech. 2004]. This limitation renders the method ineffective for reconstructing experimental data. Here, strategies for optimizing Gappy POD reconstruction using different criteria for modal convergence as well as an iteratively reducing point selection algorithm are shown. Gappy flow fields were created using wall turbulence DNS data. Gappyness levels of 5%, 10%, 20%, 50% and, 80% were created with gap sizes of 1x1, 3x3, 5x5, and arbitrary NxM vector spacing. Noise, equivalent to that of DPIV error, was also added. Data reconstruction accuracy was compared against other currently used methodologies, including bootstrapping, kriging, and the universal outlier detection. The gappy POD method presented here is shown to accurately predict the optimum reconstruction with errors on the order of the error associated with basic DPIV velocity measurements.

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