Abstract Submitted
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Physics Based Compressive Sensing Approach Applied to Airfoil Data Collection and Analysis[1] ZHE BAI, THAKSHILA WIMALAJEEWA, ZACHARY BERGER, MARK GLAUSER, PRAMOD VARSHNEY, Syracuse University, DONALD LESKIW, Leskiw Associates, SYRACUSE UNIVERSITY TEAM, LESKIW ASSOCIATES TEAM — Compressive Sensing (CS), a newly developing method in signal processing, was used in physics to estimate a two-dimensional, high Reynolds number turbulence flow velocity field over a NACA-4412 airfoil. The facility and experimental setup in the wind tunnel were introduced, from which the velocity data was obtained. The principle of CS and its feasibility applied to the physical velocity field was demonstrated and Discrete Cosine Transform (DCT) was used to attain the sparsity. The reconstructed velocity field was provided to compare with the experimental measurement of the PIV setup and the normalized MSE between the original velocity filed and the reconstructed one was calculated for a number of snapshots, with the comparison of snapshot POD method. Also, a joint CS and POD technique was discussed, in which snapshot POD was used as a basis to find transformations that sparsify the data for CS to retrieve. The fusion of several snapshots was discussed by doing the before and after the CS process. The effectiveness of CS used for the approximation of large and distributed airfoil data sets through a small number of samples collection was demonstrated, which could also be expected to be readily applied to other types of datasets.

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