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Identification of Vortex Breakdown in Bio-Inspired Wakes Using Proper Orthogonal Decomposition[1] ZACHARY BERGER, JUSTIN KING, MELISSA GREEN, Syracuse University — In this investigation, the flow field of a bio-inspired wake is studied using stereoscopic PIV at the mid-span and quarter-span of a trapezoidal pitching panel in a water channel. Three-component planar velocity fields are generated immediately downstream of the panel. Standard (4 Hz) PIV measurements require phase-averaging to extract relevant flow features with respect to the time scales of the flow. In order to gain more insight into the energy content of the flow field as well as quantitatively identify the vortex breakdown, reduced-order modeling in the form of proper orthogonal decomposition (POD) is applied to the data. Two component vector POD allows for the extraction of the most energetic, large scale structures which can be used to reconstruct a low-dimensional representation of the flow field. This can then be compared to phase-averaged data to readily quantify vortex breakdown as a function of spanwise location in order to construct a model of the three-dimensional wake structure.

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