

Abstract Submitted
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Application of photogrammetry to transforming PIV-acquired velocity fields to a moving-body coordinate system¹ POURYA NIKOUEEYAN, JONATHAN NAUGHTON, University of Wyoming — Particle Image Velocimetry is a common choice for qualitative and quantitative characterization of unsteady flows associated with moving bodies (e.g. pitching and plunging airfoils). Characterizing the separated flow behavior is of great importance in understanding the flow physics and developing predictive reduced-order models. In most studies, the model under investigation moves within a fixed camera field-of-view, and vector fields are calculated based on this fixed coordinate system. To better characterize the genesis and evolution of vortical structures in these unsteady flows, the velocity fields need to be transformed into the moving-body frame of reference. Data converted to this coordinate system allow for a more detailed analysis of the flow field using advanced statistical tools. In this work, a pitching NACA0015 airfoil has been used to demonstrate the capability of photogrammetry for such an analysis. Photogrammetry has been used first to locate the airfoil within the image and then to determine an appropriate mask for processing the PIV data. The photogrammetry results are then further used to determine the rotation matrix that transforms the velocity fields to airfoil coordinates. Examples of the important capabilities such a process enables are discussed.

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