

Abstract Submitted
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Load estimation from planar PIV measurement in vortex dominated flows. JEFFREY MCCLURE, SERHIY YARUSEVYCH, University of Waterloo — Control volume-based loading estimates are employed on experimental and synthetic numerical planar Particle Image Velocimetry (PIV) data of a stationary cylinder and a cylinder undergoing one degree-of-freedom (1DOF) Vortex Induced Vibration (VIV). The results reveal the necessity of including out of plane terms, identified from a general formulation of the control volume momentum balance, when evaluating loads from planar measurements in three-dimensional flows. Reynolds stresses from out of plane fluctuations are shown to be significant for both instantaneous and mean force estimates when the control volume encompasses vortex dominated regions. For planar measurement, invoking a divergence-free assumption allows accurate estimation of half the identified terms. Towards evaluating the fidelity of PIV-based loading estimates for obtaining the forcing function unobtrusively in VIV experiments, the accuracy of the control volume-based loading methodology is evaluated using the numerical data with synthetically generated experimental PIV error, and a comparison is made between experimental PIV-based estimates and simultaneous force balance measurements.

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