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Experimental and computational studies of flexible membrane aerodynamics RODRIGO PADILLA, CONAL THIE, VIBHAV DURGESH, TAO XING, University of Idaho — Fluid-structure interaction (FSI) problems involve the interaction of flexible bodies or membranes like flexible airfoils, parachutes, and sails, with fluid flows. A detailed understanding of the flow dynamics and structure behavior is critical to resolving FSI problems. The objective of the current study is to quantify the impact of critical dimensionless parameters (Re, aspect ratio, dimensionless rigidity) on flow field, vortex shedding, surface pressure distribution, and membrane response, for a canonical rectangular flexible membrane with varying aspect ratios. A collaborative experimental and computational investigation was performed, and the membrane was fabricated using 3D printers. The experiments for this investigation were performed in a subsonic wind tunnel facility and the flow field was measured using Particle Image Velocimetry (PIV). Complementary computational fluid dynamics (CFD) studies were performed were first validated using the experimental data and then used to perform a parametric FSI. The results from this investigation showed that flow behavior is impacted by dimensionless parameters, this was reflected in a computational study that successfully captured the observed FSI behavior for the studied cases.

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