Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Large-amplitude membrane dynamics in inviscid flow CHRISTIANA MAVROYIAKOUMOU, SILAS ALBEN, University of Michigan — We study the dynamics of thin membranes—extensible sheets with negligible bending stiffness—initially aligned with a uniform inviscid background flow. This is a benchmark fluid-structure interaction that has previously been studied mainly in the small-deflection limit, where the flat state may be unstable. Related work includes the shape-morphing of airfoils and bat wings. We study the initial instability and large-amplitude dynamics with respect to three key parameters: membrane mass density, stretching rigidity, and pretension. When both membrane ends are fixed, the membranes become unstable by a divergence instability and converge to steady deflected shapes. With the leading edge fixed and trailing edge free, divergence and/or flutter occurs, and a variety of periodic and aperiodic oscillations are found. With both edges free, the membrane may also translate transverse to the flow, with steady, periodic, or aperiodic trajectories.

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Date submitted: 11 Jul 2019 Electronic form version 1.4