Abstract Submitted
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Leading edge vortex formation and detachment of a flapping foil energy harvester FIRAS SIALA, JAMES LIBURDY, Oregon State University — An experimental investigation is conducted to study the leading edge vortex (LEV) formation and detachment of a flapping foil operating in energy harvesting regime. Two dimensional particle image velocimetry measurements are conducted in the wind tunnel at reduced frequencies of $k = fc/U = 0.05$ - 0.20. The LEV characteristics such as the growth rate, size, strength, and trajectory are reported. It is shown that during the evolution process, the LEV characteristics are strongly dependent on the feeding shear layer velocity, where as the detachment process is dictated by the reduced frequency. Flow topology is used to discuss the detachment mechanism, and it is found that the transition from bluff body detachment to boundary layer eruption occurs at $k = 0.11$. In addition, vortex formation analysis is conducted to investigate the relationship between optimal energy harvesting efficiency and optimal LEV formation. We demonstrate that the optimal LEV formation number ($T = 4$) is achieved within the range of optimal reduced frequencies for energy harvesting applications ($k = 0.1$- 0.15).

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