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Towards Understanding of Leading-Edge Separation for Energy Harvesting with an Oscillating Foil VICKIE NGO, HOLLY MANJARREZ, JAMES LIBURDY, Oregon State University — The energy harvesting performance of an oscillating foil is studied by conducting a 2D turbulent model simulation in ANSYS FLUENT. The simulation objective is to identify the key flow physics associated with the leading-edge separation of an airfoil with variable leading-edge thickness undergoing a sinusoidal oscillating motion at low freestream Reynolds numbers. Of the key characteristics are the wall shear stress, vorticity, pressure field, and leading-edge flow separation. The leading-edge separation was detected from an abrupt drop in wall shear stress along the foil surface and is used as a primary indicator of vortex shed. These vortices have shown to be essential components of the oscillating foil's energy harvesting performance. The results of this study reveal a correlation that exists between leading-edge geometry and the reduced frequency that can predict flow separation. The time at which separation occurs is a function of the reduced frequency and the geometric parameters of the leading edge. The position on the foil at separation is independent of reduced frequency but is a function of geometric parameters of the leading edge. Further, the results of varying geometric and motion parameters were evaluated to inform a panel-based discrete vortex model to evaluate the overall energy harvesting potential.

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