Abstract Submitted
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Effects of Dynamic Pitching on Wind Turbine Blade Performance[1] JONATHAN NAUGHTON, ASHLI BABBITT, JOHN STRIKE, MICHAEL HIND, ANDREW MAGSTADT, POURYA NIKOUEEYAN, University of Wyoming — Due to turbulence in the wind and the rotation of the blade through a shear layer, wind turbine blade flows are inherently unsteady. Over the past five years, a number of wind turbine blade sections used for inboard, mid-span, and tip regions of the blade (including flatback airfoils) have been tested at a Reynolds number of 225,000. The airfoils have been tested at reduced frequencies $c\omega/2U$, where c is the chord length, ω is the oscillation frequency (radians/sec), and U is the air velocity ahead of the blade, relevant to commercial wind turbines. Unsteady pressure measurements and Particle Image Velocimetry (PIV) have provided information about the surface properties and surrounding flow field and their relationship. The results have shown that, depending on the reduced frequency, a lag in pressure and flow-field structures is experienced by the blade. When the blade is operating at angles above the static stall angle, delayed separation is experience as expected. The reattachment of the flow is also delayed, and, at higher reduced frequencies, the flow can remain separated throughout the entire downward pitching movement. Such dynamic data result in a better understanding of the unsteady flow physics necessary for improved designs.

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