Abstract Submitted
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Passive control of a dynamically pitching wind turbine airfoil under aeroelastic conditions using a Gurney flap[1] POURYA NIKOUEEYAN, ANDREW MAGSTADT, JOHN STRIKE, MICHAEL HIND, JONATHAN NAUGHTON, University of Wyoming — To reduce the cost of energy, wind turbine design has moved towards larger blades that are heavier and have lower relative structural stiffness compared to shorter blades. To address the lower blade stiffness, different flow control techniques have been considered. The Gurney flap, a small, low-cost and effective control method, is a promising control actuator. Wind tunnel testing has been performed on a DU97-W-300 10% flatback airfoil undergoing dynamic pitching relevant to flow conditions encountered by wind turbine blades. To mimic blade compliance, the airfoil is actively driven through a torsionally elastic element. Time-resolved surface pressure measurements have been acquired from which lift C_l and moment C_m coefficients were calculated. Changes in C_l and C_m in moderate and deep dynamic stall regimes for different Gurney flap heights were studied for different pitch drive conditions (amplitude and frequency). The results show the significant impact of compliance on the angle of attack (α) range experienced by the airfoil. Shifts in α range result in different hysteresis behavior in both C_l and C_m and demonstrate the effectiveness of the Gurney flap in modifying the aerodynamics of wind turbine blades experiencing dynamic pitching.

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Jonathan Naughton
University of Wyoming

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