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Feasibility Study of Using Gurney Flaps for Flow Control of Wind Turbine Blades[1] POURYA NIKOUEEYAN, ANDREW MAGSTADT, JOHN STRIKE, JONATHAN NAUGHTON, University of Wyoming — Unsteady wind turbine aerodynamics due to atmospheric unsteadiness and rotation of the blade through a shear layer are phenomena that exceed the rate at which conventional blade pitch control mechanisms operate. Depending on the location on the blade, these rapidly varying effects can cause reduced aerodynamic efficiency, stall, unwanted oscillatory loads, and accompanying deflections. In this study, actively controlled Gurney flaps are investigated as a practical solution for alleviating these effects. Because of recent growth of the use of flatback airfoils in the root section of wind turbine blades, a DU97-W-300 derived flatback airfoil has been used in this study. The effect of flap height on lift and moment in static and dynamic conditions has been investigated by means of time-resolved pressure measurements. Static results show $\pm 30\%$ changes in the section lift coefficient C_l with the Gurney flap, indicating sufficient authority for active control. An aeroelastic model based on the flatback airfoil geometry and correlations derived from the experimental Gurney flap results has been developed. Using a feedback control algorithm, the model indicates that a step disturbance can be quickly damped using closed-loop control of the Gurney flap.

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