Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Performance Enhancement of a Wind Turbine Blade using Synthetic Jets[1] KEITH TAYLOR, CHIA LEONG, MICHAEL AMITAY, Rensselaer Polytechnic Institute — Recent developments in flow control techniques, coupled with increased interest in green energy technologies, have led to interest in applying flow control techniques to wind turbines, in an effort to increase power output and reduce structural stress associated with widely varying loading. A reduction in structural stress could lead to reduced operational costs associated with maintenance. Presented is an investigation into the effect of active flow control on the aerodynamic and structural aspects of a finite-span S-809 airfoil. Synthetic jets are employed in an open loop control scheme to demonstrate the effect on lift, drag, and vibrations of the blade at Reynolds numbers of 110,000 and 220,000. Vibrometer measurements are presented to quantify vibration frequency, and time dependant fluctuations in lift and drag are correlated to tip deflection fluctuations. Static and dynamic pitch conditions are examined, with a sinusoidal pitch profile implemented for dynamic conditions. It is demonstrated that flow control can reduce tip deflection in static conditions, as well as reduce or eliminate hysteresis as the blade dynamically pitches into and out of separation.

[1]Supported by NSF.

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Date submitted: 03 Aug 2010 Electronic form version 1.4