Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Active Vibration Control of an S809 Wind Turbine Blade Using Synthetic Jet Actuators[1] VICTOR MALDONADO, MATTHEW BOUCHER, REBECCA OSTMAN, MICHAEL AMITAY, Rensselaer Polytechnic Institute — Active flow control via synthetic jet actuators was implemented to improve the aeroelastic performance of a small scale S809 airfoil wind turbine blade model in a wind tunnel. Blade vibration performance was explored for a range of steady post-stall angles of attack, as well as various unsteady pitching motions for a chord based Reynolds number range of $1.29\text{x}10^5$ to $3.69\text{x}10^5$. Blade tip deflection was measured using a pair of calibrated strain gauges mounted at the root of the model. Using flow control, significant vibration reduction was observed for some steady post-stall angles of attack, while for dynamic pitching motions, vibration reduction was more pronounced (for a given angle of attack) on the pitch up motion compared to the pitch down motion of the blade cycle. This effect was attributed to the phenomenon known as dynamic stall, where the shedding of a leading edge vortex during the pitch up motion contributes to elevated values of lift (compared to static angles of attack) and lower values of lift when the blade is pitched down. This effect was also quantified through the use of Particle Image Velocimetry.

[1]Funding provided by the New York State Energy Research and Development Authority (NYSERDA).

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Date submitted: 05 Aug 2009 Electronic form version 1.4