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Synthetic-jet-based dynamic stall control on a scaled finite span wind turbine S817 blade THOMAS RICE, KEITH TAYLOR, MICHAEL AMITAY, Rensselaer Polytechnic Institute — As wind turbines increase in size, so do many of the adverse effects associated with unsteady flow fields. Yawed flow, unsteady gusts, atmospheric boundary layers, and even free stream turbulence can cause unsteady loading, which are detrimental to the blades' structure. In order to decrease unsteady loading, synthetic jet actuators were installed on a scaled finite span cantilevered wind turbine blade having an S817 airfoil shape. The S817 airfoil shape is of the blade tips on the NREL CART3, which will be used next year on full scale field testing of active flow control. The model has been tested in the wind tunnel with and without active flow control, using load, surface pressure, and PIV measurements to characterize the airfoil's stall behavior during static and dynamic conditions, and the effect of flow control on its aerodynamic performance. Surface-mounted microphones were also used to detect dominant frequencies in the flow field. Dynamic stall was also simulated by pitching the airfoil through stall in a sinusoidal pitching motion. Synthetic jets, placed near the leading edge, were shown to increase lift both in the static and dynamic cases, in addition to attaching the flow and reducing hysteresis during dynamic pitching, showing a decrease in structural loading.

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