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Interaction of an Artificially Thickened Boundary Layer with a Vertically Mounted Pitching Airfoil[1] TRISTEN HOHMAN, ALEXANDER SMITS, LUIGI MARTINELLI, Princeton University — Wind energy represents a large portion of the growing market in alternative energy technologies and the current landscape has been dominated by the more prevalent horizontal axis wind turbine. However, there are several advantages to the vertical axis wind turbine (VAWT) or Darrieus type design and yet there is much to be understood about how the atmospheric boundary layer (ABL) affects their performance. In this study the ABL was simulated in a wind tunnel through the use of elliptical shaped vortex generators, a castellated wall, and floor roughness elements as described in the method of Counihan (1967) and then verified its validity by hot wire measurement of the mean velocity profile as well as the turbulence intensity. The motion of an blade element around a vertical axis is approximated through the use of a pitching airfoil. The wake of the airfoil is investigated through hot wire anemometry in both uniform flow and in the simulated boundary layer both at $Re = 1.37 \times 10^5$ based on the chord of the airfoil.

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