Abstract Submitted
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The Role of Turbulent Scales in a Rough and Smooth Surface Wind Turbine Blade[1] V. MALDONADO, S. TORRES-NIEVES, L. CASTILLO, Rensselaer Polytechnic Institute, C. MENEVEAU, Johns Hopkins University — In the present research, a 2-D (constant chord) wind turbine blade section based on an S809 airfoil was manufactured and tested at Johns Hopkins University in the closed return subsonic Corrsin wind tunnel. The blade was covered with a 24-grit aluminum oxide abrasive sheet for the rough surface measurements. Smooth-wall blade measurements were also performed. Turbulence was generated using an active grid placed 5.5 m upstream of the blade. A free stream velocity of 10 m/s corresponding to a Reynolds number of 1.68×10^5 and angles of attack of 0 and 16 degrees (before and after flow separation) were selected, in order to study the effects of free stream turbulence on the aerodynamics and development of turbulent scales on the wind turbine. Global flow measurements such as mean velocity and Reynolds stresses were taken using Particle Image Velocimetry (PIV) and the pressure distribution around the suction and pressure surfaces of the 2-D blade with and without turbulence was acquired for angles of attack of 0 and 16 degrees. Initial results suggest that for the smooth surface blade at an angle of attack of 0 degrees, turbulence decreases lift production from a lift coefficient of 0.067 to 0.018, while at 16 degrees, turbulence enhances lift from 0.82 to 0.92.

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Victor Maldonado
Rensselaer Polytechnic Institute

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