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Comparison of Blade Element Momentum Theory to Experimental Data Using Experimental Lift, Drag, and Power Data TARA NEALON, MARK MILLER, JANIK KIEFER, MARCUS HULTMARK, Princeton Univ — Blade Element Momentum (BEM) codes have often been used to simulate the power output and loads on wind turbine blades without performing CFD. When computing the lift and drag forces on the blades, the coefficients of lift and drag are normally calculated by interpolating values from standard airfoil data based on the angle of attack. However, there are several empirical corrections that are needed. Due to a lack of empirical data to compare against, the accuracy of these corrections and BEM in general is still not well known. For this presentation, results from an in-house written BEM code computed using experimental lift and drag coefficient data for the airfoils of the V27 wind turbine will be presented. The data is gathered in Princeton University's High Reynolds Number Testing Facility (HRTF) at full scale Reynolds numbers and over a large range of angles of attack. The BEM results are compared to experimental data of the same wind turbine, conducted at full scale Reynolds number and TSR, also in the HRTF. Conclusions will be drawn about the accuracy of the BEM code, and the corrections, regarding the usage of standard airfoil data versus the experimental data, as well as future applications to potentially improve large-eddy simulations of wind turbines in a similar manner.

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