INFLOW AND THE FATIGUE OF THE LIST WIND TURBINE[*†]

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ABSTRACT

The Long-term Inflow and Structural Test (LIST) program is collecting long-term, continuous inflow and structural response data to characterize the spectrum of loads on wind turbines. A heavily instrumented Micon 65/13M turbine with SERI 8m blades is being used as the primary test turbine for this test. This turbine is located in Bushland, TX, a test site that exposes the turbine to a wind regime representative of a Great Plains commercial site. The turbine and inflow are being characterized with 60 measurements: 34 to characterize the inflow, 19 to characterize structural response, and 7 to characterize the time-varying state of the turbine. In this paper, the inflow and structural data from this measurement campaign are analyzed to determine the correlation of various inflow descriptors with fatigue loads. The inflow is described by various parameters, including the mean, standard deviation, skewness and kurtosis of the wind speed, turbulence intensity, turbulence length scales, Reynolds stresses, local friction velocity, Obukhov length and the gradient Richardson number. The fatigue load spectrum corresponding to these parameters is characterized as an equivalent fatigue load. A regression analysis is then used to determine which parameters are correlated to the fatigue loads. The results illustrate that the vertical component of the inflow is the most important of the secondary inflow parameters on fatigue loads. Long-term fatigue spectra illustrate that extrapolation of relatively short-term data to longer times is consistent for the data reported here.

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