Effects of normal and extreme turbulence spectral parameters on wind turbine loads - DTU Orbit (19/08/2019)

**Effects of normal and extreme turbulence spectral parameters on wind turbine loads**

Loads simulations as performed to obtain design loads on wind turbines, requires wind turbulence as an input, characterized by parameters associated with the turbulence length scale, dissipation and anisotropy. The effect of variation in these turbulence spectral parameters on the magnitude of design loads is investigated with a focus on the commonly used Mann turbulence model. Quantification of the Mann model parameters is made through wind measurements acquired from the Høvsøre site. The parameters of the Mann model fitted to site specific observations can differ significantly from the recommended values in the IEC 61400-1 Ed.3 that is used for wind turbine design. The present paper investigates the impact of Mann turbulence model parameter variations on the design loads envelope for 5 MW and 10 MW reference wind turbines. Specific focus is made on the blade root loads, tower top moments and tower base loads under normal turbulence and extreme turbulence, whereby the change in operating extreme and fatigue design loads obtained through turbulence model parameter variations is compared with corresponding variations obtained from random seeds of turbulence. The investigations quantify the effects of turbulent length scale and anisotropy on the major wind turbine component extreme and fatigue loads.

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