The DAN-AERO MW Experiments - DTU Orbit (03/05/2019)

The DAN-AERO MW Experiments: Final report

This report describes the DAN-AERO MW experiments carried out within a collaborative, three years research project between Risø DTU and the industrial partners LM Glasfiber, Siemens Wind Power, Vestas Wind Systems A/S and the utility company DONG Energy. The main objective of the project was to establish an experimental data base which can provide new insight into a number of fundamental aerodynamic and aero-acoustic issues, important for the design and operation of MW size turbines. The most important issue is the difference between airfoil characteristics measured under 2D, steady conditions in a wind tunnel and the unsteady 3D flow conditions on a rotor. The different transition characteristics might explain some of the differences between the 2D and 3D airfoil data and the experiments have been set up to provide data on this subject. The overall experimental approach has been to carry out a number of coordinated, innovative measurements on full scale MW size rotors as well as on airfoils for MW size turbines in wind tunnels. Shear and turbulence inflow characteristics were measured on a Siemens 3.6 MW turbine with a five hole pitot tube. Pressure and turbulent inflow characteristics were measured on a 2MW NM80 turbine with an 80 m rotor. One of the LM38.8 m blades on the rotor was replaced with a new LM38.8 m blade where instruments for surface pressure measurements at four radial sections were build into the blade during the blade production process. Additionally, the outmost section on the blade was further instrumented with around 50 microphones for high frequency surface pressure measurements. The surface pressure measurements have been correlated with inflow measurements from four five hole pitot tubes and two sensors for measuring the high frequency (50 Hz to 10 kHz) contents of the inflow turbulence. In parallel, 2D wind tunnel measurements on common airfoils for wind turbine applications have been conducted in three different wind tunnels at Delft University (NL), at LM Glasfiber (DK) and at VELUX (DK). Initial results from the different measurement set-ups are presented in order to show the application areas for the total data set.

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