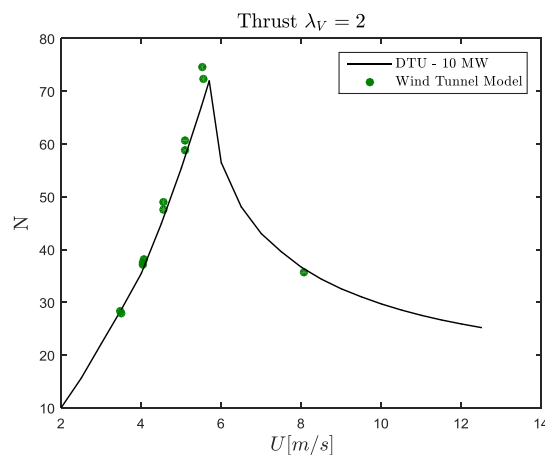


D3.1 AeroDyn validated model

This document contains the wind tunnel tests methodology and procedures applied to the experimental campaign done to validate AeroDyn. In particular, it details the design process of the wind turbine scaled model and the results achieved.

The wind tunnel test methodology and metrological qualification for the adopted experimental set-up are described, as well as the procedure to analyse the imposed motion data. AeroDyn simulation parameters are reported and the entire test matrix has been numerically simulated to check the AeroDyn capability to predict the wind turbine thrust for different imposed motion conditions.

Concerning the design of the wind turbine model, the scaled thrust was the target of the aerodynamic optimization. Due to the difference on Reynolds number between full scale and model, a set of Low-Reynolds blades were realized, adopting an innovative methodology based on numerical simulation and experimental measurements performed on a wing sectional model.



Thrust force for velocity scale factor 2 as function of wind speed

After a performance verification of the scaled model (see figure above), surge and pitch imposed motion were carried out at different wind speeds. The tests were done in the low and wave frequency ranges at different amplitudes. The dynamic test results represent a reference database for AeroDyn validation. These results are herein reported extensively in terms of aerodynamic forces as function of relative wind velocity. All the time histories are available for the Consortium. All the experimental tests were simulated in FAST 8.10/AeroDyn 14. A quite good agreement is evident between experiments and computations. Some non-dimensional parameters are proposed to support the imposed motion data analysis. As a first observation, two different behaviours can be seen: below-rated and above-rated wind velocity imply different hysteretic aerodynamic responses. AeroDyn is able to properly identify them. These hysteresis, due to unsteady aerodynamics, should be investigated more thoroughly accounting for the variation of the angle of attack as well as the wake characteristics.