

Creating a benchmark of vertical axis wind turbines in dynamic stall for validating numerical models - DTU Orbit (08/11/2017)

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An experimental campaign using Particle Image Velocimetry (2C-PIV) technique has been conducted on a H-type Vertical Axis Wind Turbine (VAWT) to create a benchmark for validating and comparing numerical models. The turbine is operated at tip speed ratios (TSR) of 4.5 and 2, at an average chord-based Reynolds number of 1.6×10^5 and 0.8×10^5 . At both TSR, the velocity fields are presented in the mid (symmetry) plane of the blade for eight azimuthal positions. The velocity fields are directly derived from PIV, while the loads are obtained through an integral approach presented by Noca et al. The experimental data of the velocity fields around the airfoil and the loads on the blade are used for numerical validation. The aim of evaluating the two different TSR is identifying the effect of Dynamic Stall (DS), which is not present at the higher TSR, while dominant at the lower. The DS phenomenon is numerically very hard to model, so a solid benchmark for a VAWT in DS is of great interest. The aim of the paper is to present the experimental flow fields, and the validated loads on the blades for both TSR.

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