Enhanced Prediction of Rotor Blade Aerodynamics with OpenFOAM

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1. Abstract

Predicting the aerodynamic behaviour of rotor blades with a high level of accuracy is of great importance for designing reliable and cost-effective wind turbines.

Most wind turbine designers still rely very strongly on BEM and other engineering methods for load calculation. Those methods are reasonably reliable in many cases and present the advantage of their low computational cost. Still, the use of CFD simulations promises to boost a better understanding of the physics related to wind turbine aerodynamics. The knowledge gained from CFD simulations can then be used e.g. to improve the correction models implemented in BEM-codes.

In this contribution we would like to summarise the experience we have gained with the simulation of several wind turbine rotors, which were measured under controlled conditions. Both steady-state and transient results are presented. The comparison between simulations and experimental data reveals the great potential of CFD. Special emphasis is put in the prediction of aerodynamic loads, where our CFD-simulations outperform over the calculations based on BEM. Furthermore, they give a deep insight into complex aerodynamic phenomena like rotational augmentation and dynamic stall.