Development of an aeroelastic code based on three-dimensional viscous–inviscid method for wind turbine computations - DTU Orbit (21/10/2019)

Aerodynamic and structural dynamic performance analysis of modern wind turbines are routinely estimated in the wind energy field using computational tools known as aeroelastic codes. Most aeroelastic codes use the blade element momentum (BEM) technique to model the rotor aerodynamics and a modal, multi-body or the finite-element approach to model the turbine structural dynamics. The present work describes the development of a novel aeroelastic code that combines a three-dimensional viscous–inviscid interactive method, method for interactive rotor aerodynamic simulations (MIRAS), with the structural dynamics model used in the aeroelastic code FLEX5. The new code, called MIRAS-FLEX, is an improvement on standard aeroelastic codes because it uses a more advanced aerodynamic model than BEM. With the new aeroelastic code, more physical aerodynamic predictions than BEM can be obtained as BEM uses empirical relations, such as tip loss corrections, to determine the flow around a rotor. Although more costly than BEM, a small cluster is sufficient to run MIRAS-FLEX in a fast and easy way. MIRAS-FLEX is compared against the widely used FLEX5 and FAST, as well as the participant codes from the Offshore Code Comparison Collaboration Project. Simulation tests consist of steady wind inflow conditions with different combinations of yaw error, wind shear, tower shadow and turbine-elastic modeling. Turbulent inflow created by using a Mann box is also considered. MIRAS-FLEX results, such as blade tip deflections and root-bending moments, are generally in good agreement with the other codes.

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