DARwind – predicting dynamic responses of floating wind turbine and the validation with basin model test

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In the pursuit of abundant and steady wind energy resources, wind power industry is moving its way from onshore to offshore sites. In recent years, floating offshore wind turbines (FOWT) has been attracting great attention accompanied by its fast commercialization steps. But it is still a relatively new technique and many challenges still exist with respect to its dynamic characteristics. Among of these challenges, coupling effects, prediction of dynamic behaviors, development of numerical simulation programs, and model testing technology are the hot spots in academic research and engineering practice fields. In this study, an aero-hydro-elastic-mooring-servo coupling numerical program, named *DARwind*, was developed. In this program, a multi-body kinematics model for a FOWT based on Cardan angle and the floating frame of reference formulation was built; a high-order structural model was proposed to bring the rigid-flexible coupling effect of FOWT blades into consideration; the Newton-Euler approach and the Kane's dynamical equations were used to establish the dynamic equation of the multi-body dynamic model. Subsequently, the program *DARwind* was validated by using the model testing results of a semi-submersible type FOWT. The model test was conducted in Deepwater Offshore Basin at Shanghai Jiao Tong University in 2014. It was shown that good agreements have been achieved between the results of basin model test and those of numerical simulation, and it proved the feasibility of the code *DARwind*.