The wind can be stronger and steadier further from shore, but water depth is also deeper. Then bottom-mounted towers are not feasible, and floating turbines are more competitive. There are additional motions in an offshore floating wind turbine, which results in a more complex aerodynamics operating environment for the turbine rotor. Many aerodynamic analysis methods rely on blade element momentum theory to investigate aerodynamic load, which are not valid in vortex ring state that occurs in floating wind turbine operations. So, vortex lattice method, which is more physical, was used in this analysis. Floating platform's prescribed positions were calculated in the time domain by using floating system RAO and waves that are simulated using JONSWAP spectrum. The average value of in-plane aerodynamic force increase, but the value of out-of-plane force decrease. The maximum variation aerodynamic force abruptly increases in severe sea state. Especially, as the pitch motion of the barge platform is large, this motion should be avoided to decrease the aerodynamic load variation.

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