MEXNEXT 풍력발전기 풍동 시험에 대한 풍동 영향 분석

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Wind tunnel effect analysis for MEXICO wind turbine model

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In this research, CFD calculation was implemented to analyze wind tunnel effect or rotor experiment in wind tunnel. One case included model wind turbine and all wind tunnel geometries. The other case include only rotor and nacelle system. Star-CCM+ was used for CFD analysis and rigid body motion around rotor area was applied to simulate rotating rotor. As for turbulence model, K-omega SST was used. The results were compared in 15m/s inflow condition. These results shows a good agreement with the measurement. Then, the result without wind tunnel was slightly different to the result with wind tunnel. Thus, in the case of Mexnex wind tunnel measurement, the wind tunnel don't affect the measurement result. Then, this wind tunnel and rotor size ratio can be reference for wind tunnel experiment of wind turbine rotor.

Key words : blade(블레이드), CFD(전산유체역학), MEXNEXT(멕스넥스트), wind tunnel effet(풍동효과)

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후류 영향을 고려한 풍력 발전 단지 성능 예측 연구

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Prediction of Aerodynamic Performance on Wind Turbines in the Far Wake

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Although there are many activities on the construction of wind farm to produce amount of power from the wind, in practice power productions are not as much as its expected capabilities. This is because a lack of both the prediction of wind resources and the aerodynamic analysis on turbines with far wake effects. In far wake region, there are velocity deficits and increases of the turbulence intensity which lead to the power losses of the next turbine and the increases of dynamic loadings which could reduce system's life. The analysis on power losses and the increases of fatigue loadings in the wind farm is needed to prevent these unwanted consequences. Therefore, in this study velocity deficits have been predicted and aerodynamic analysis on turbines in the far wake is carried out from these velocity profiles. Ainslie's eddy viscosity wake model is adopted to determine a wake velocity and aerodynamic analysis on wind turbines is predicted by the numerical methods such as blade element momentum theory(BEMT) and vortex lattice method(VLM). The results show that velocity recovery is more rapid in the wake region with higher turbulence intensity. Since the velocity deficit is larger when the turbine has higher thrust coefficient, there is a huge aerodynamic power loss at the downstream turbine.

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Key words : Wind turbine(풍력 발전기), Far wake(후류), Aerodynamic performance(공력 성능), Turbulence intensity (난류 강도), Wind farm(풍력단지)

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