동작점 변화 조건에서의 풍력터빈 선형 피치제어기 설계

*천 종민, 김 춘경, 이 주훈, 홍 지태, **권 순만

Design of Linear Pitch Controller in Wind Turbine under the condition of Varying Operating Points

*Jongmin Cheon, Choonkyoung Kim, Joohoon Lee, Jitae Hong, **Soonman Kwon

This paper presents a pitch controller which can hold output power constant at the rated value. Although wind turbine contains complicated nonlinearities, its behaviour within a certain operating range of a point can be approximated by that of a linear model. By doing so, we can apply rather simple and systematic linear control techniques such as PID and LQR(Linear Quadratic Regulator) to design a linear pitch controller. Because these linear controllers are valid only in a sufficiently small range around an operating point, linearized wind turbine model under the condition of varying wind speed needs a linear pitch controller can achieve the aims of tracking the rated rotor rotational speed. We propose an improved linear pitch controller taking each merit of LQR and PI controller under the condition of varying operating points in this paper.

Key words : 풍력터빈, 피치제어, 선형제어기, LQR 제어기, PI 제어기

E-mail : *jmcheon@keri.re.kr, **smk@keri.re.kr

와류격자기법을 이용한 Counter-Rotating 풍력 발전기의 성능 및 후류 해석 연구

*이 승민, 손 은국, **이 수갑

Prediction for the Performance and Wakes of a Counter-Rotating Wind Turbine Using the Vortex Lattice Method

*Seungmin Lee, Eunkuk Son, **Soogab Lee

A Counter-rotating wind turbine is one of the new concepts that are proposed to increase the performance of a wind turbine. It has two rotors rotating in the same axis, and it is known that its power coefficient can reach to 0.64 in the ideal case. While the BEMT is widely used to analyze the aerodynamic performance of wind turbines, the analysis of the counter-rotating wind turbine by using it is limited due to the aerodynamic interaction between the two rotors. In this study, the vortex lattice method is used to consider the effect of the front rotor on the rear rotor of the counter-rotating wind turbine and calculate the aerodynamic performance of it. The power and thrust sharing in the two rotors of the counter-rotating wind turbine are predicted and the total power and thrust are compared with that of a single rotor. Moreover, the wake convection and expansion rate is also compared with that of a single rotor.

Key words : Counter-rotating wind turbine(상호역회전 풍력발전기), Vortex lattice method(와류격자기법), Aerodynamic performance(공력성능), Wake geometry(후류 형상)

E-mail : *vitamin1@snu.ac.kr, **solee@snu.ac.kr