풍력발전기 소음의 진폭변조에 대한 예측 및 인지 가능성 고찰

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Perception of amplitude-modulated noise from wind turbines

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Wind turbine noise is generally lower than that from other environmental noise sources such as road and railway noise. Nevertheless, some residents living more than 1km away from wind turbines have claimed that they suffer sleep disturbance due to wind turbine noise. Several researchers have maintained that residents near a wind farm may perceive large amplitude modulation of wind turbine noise at night, and this amplitude modulation is the main cause of the noise annoyance. However, to date only few studies exist on the prediction of the amplitude modulation of wind turbine noise. Thus, this study predicts amplitude modulated noise generated from a generic 2.5MW wind turbine. Semi-empirical noise models are employed to predict the modulation depth and the overall sound pressure level of the wind turbine noise. The result shows that the amplitude modulation is observed regardless of atmospheric stability, but the modulation depth in a stable atmosphere is 1~3dB higher than that in an unstable atmosphere near the plane of rotation where the blades move downward. Moreover, using the result of the noise prediction, this study estimates the maximum perceptible distance of the wind turbine noise cause by amplitude modulation. The result indicates that the wind turbine noise can be perceived at a distance of up to 1600m in the range of about 30~60 degree from the on axis in a extremely low background noise environment.

Key words : Wind turbine(풍력 발전기), Wind turbine noise(풍력발전기 소음), Noise perception(소음 인지), Amplitude modulation(진폭 변조), Noise prediction(소음 예측)

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다물체 동력학 해석 프로그램을 이용한 풍력발전기 공력해석 기술개발

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Development of Aerodynamic Analysis Technology for Wind Turbines using a Multibody Dynamic Analysis Software

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Simulation technology for dynamic analysis of wind turbine is developed. The Aerodyn and the DAFUL are chosen for aerodynamic analysis and multi-body and flexible body dynamics respectively. Subroutines and variables of Aerodyn developed by NREL are analyzed with hub-height wind data, full field turbulent wind data and Airfoil data. The interface to perform coupled analysis between AeroDyn and DAFUL, GUI for modeling several parts of wind turbines are developed. The program will be extended to analyze the coupled analysis of aerodynamic and hydrodynamic behavior for floating offshore wind turbines.

Key words : Floating Offshore Wind Turbine(부유식 해상 풍력발전기), DAFUL(다풀), AeroDyn(에어로다인), Aerodynamic Force(공력하중), Dynamic Analysis(동적 거동 해석)

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