EVALUATION OF VARIABLE STIFFNESS OF WIND TURBINE TOWER WITH CONSIDERATION OF FLANGE - JOINT SEPARATION BY USING FEM ANALYSIS

EVALUATION OF VARIABLE STIFFNESS OF WIND TURBINE TOWER WITH CONSIDERATION OF FLANGE - JOINT SEPARATION BY USING FEM ANALYSIS

Tác giả: *Trường Đại học Bách Khoa**

Tóm tắt bằng tiếng Việt:

Development of clean renewable energies is necessary due to the global warming. Among them, because the development of wind power has been noticed, the number of wind turbines has been increasing. Since characteristic weather conditions and terrain conditions in Japan cause great damage to wind turbines, design guidelines (Japan Society of Civil Engineers 2007, 2010) were published. In the GL Wind 2003 (Europe), the maximum wind speed verifying the fatigue strength of high-strength bolts of wind turbines is set to 0.7 time of the design wind speed and the frequency of appearance of high wind speed is extremely low. Fatigue damages due to high wind speed can be ignored. On the other hand, the frequency of appearance of high wind speed in Japan is much higher. It is very important to understand the responses of wind turbines and the fatigue behaviors throughout the operation periods. In this study, we evaluate in two steps. Firstly, a model of a tower which uses high-strength bolts at flange joints is created and FEM analyses are performed. Then, stiffness of the flange joint is determined in order to model variable stiffness of the flange joints with considering the whole wind turbine tower.

Từ khóa: wind turbine; Flange - joint; bolt; separation; stiffness

Tóm tắt bằng tiếng Anh:

Development of clean renewable energies is necessary due to the global warming. Among them, the number of wind turbines is on the increase because the development of wind power has been noticed. Since characteristic weather conditions and terrain conditions in Japan cause great damage to wind turbines, design guidelines (Japan Society of Civil Engineers 2007, 2010) were published. In the GL Wind 2003 (Europe), the maximum wind speed verifying the fatigue strength of high-strength bolts of wind turbines is set to 0.7 time of the design wind speed and the frequency of appearance of high wind speed is extremely low. Fatigue damages due to high wind speed can be ignored. On the other hand, the frequency of appearance of high wind speed in Japan is much higher. It is very important to understand the responses of wind turbines and the fatigue behaviors throughout the operation periods. In this study, we evaluate variable stiffness of wind turbine tower in two steps. Firstly, a model of a tower using high-strength bolts at flange joints is created and FEM analyses are performed. Then, stiffness of the flange joint is determined in order to model variable stiffness of the flange joints with considering the whole wind turbine tower.

Key words: wind turbine; Flange - joint; bolt; separation; stiffness