TIME-DEPENDENT RELIABILITY ANALYSIS FOR TURBINE BLADE IN EXTREME WIND LOADING

Zhen Hu, Dr. Xiaoping Du

ABSTRACT

In order to evaluate the reliability of turbine blades over a certain time period, a time-dependent reliability analysis model is developed in this paper for turbine blades in extreme wind loading. The extreme wind loading over a certain return period and the deterioration of the blade material are considered to investigate the time influence on the reliability of turbine blades. Only failure in flapwise bending is taken into account. The concept of upcrossing rate, which is based on the Poisson approximation for first-passage problems, is employed to address the time-dependent reliability analysis. By integrating the first order reliability method with the upcrossing rate, the reliability of a site-specific turbine blade over a certain time period is computed. The results show that the MVFP (mean value first passage) method applied in this paper is efficient and flexible. It can quantify the degradation of reliability over time period accurately.