APPLICATION OF THE U.S. HIGH CYCLE FATIGUE DATA BASE TO WIND TURBINE BLADE LIFETIME PREDICTIONS

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ABSTRACT

This paper demonstrates a methodology for predicting the service lifetime of wind turbine blades using the high-cycle fatigue data base for typical U.S. blade materials developed by Mandell, et al. (1995). The first step in the analysis is to normalize the data base (composed primarily of data obtained from specialized, relatively small coupons) with fatigue data from typical industrial laminates to obtain a Goodman Diagram that is suitable for analyzing wind turbine blades. The LIFE2 fatigue analysis code for wind turbines is then used for the fatigue analysis of a typical turbine blade with a known load spectrum. In the analysis, a linear damage model, Miner's Rule, is used to demonstrate the prediction of the service lifetime for a typical wind turbine blade under assumed operating strain ranges and stress concentration factors. In contrast to typical European data, the asymmetry in this data base predicts failures under typical loads to be compressive.