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RANKING SUBASSEMBLIES OF WIND ENERGY CONVERSION SYSTEMS CONCERNING THEIR IMPACT ON THE OVERALL RELIABILITY

ABSTRACT

In this Project, an extensive reliability analysis of wind energy conversion systems (WECS) is presented. Elaborate the analysis is presented starting from the subassembly level to the subsystem level, then the system or the overall WECS. The fault tree method with a Weibull probability distribution function is introduced as a complete model for estimating the wind turbine subassemblies' reliability. The model was tested using a massive dataset of failure rates of various wind turbine subassemblies derived from relevant literature, comprising various operating concepts and the different climate conditions. In addition, ranking for various subassemblies of wind energy conversion systems concerning their impact on the overall system reliability is also presented in this Project to identify the weak items and subsystems. This identification guides the designers and planners in setting the appropriate maintenance strategies to increase the overall reliability of the considered systems and achieve a desired level of reliability. The results indicate that the model has practical applications for managing wind turbines, and the implementation demonstrates the proposed approach's effectiveness and efficiency, which may significantly enhance the WECS reliability.