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Wind turbine prognostics and maintenance management based on a hybrid approach of neural networks and proportional hazards model

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Abstract-

This paper proposes an approach for stress condition monitoring and maintenance assessment in wind turbines (WT) through large amounts of collected data from supervisory control and data acquisition (SCADA) system. The objectives of the proposed approach are: to provide a stress condition model for health monitoring, to assess the WT’s maintenance strategies, and to provide recommendations on current maintenance schemes for future operations of the wind farm. At first, several statistical techniques, namely Principal component analysis, Pearson, Spearman and Kendall correlations, mutual information, regressional ReliefF and decision trees are used and compared to assess the data for dimensionality reduction and parameter selection. Next, a normal behavior model is constructed by an artificial neural network which performs condition monitoring analysis. Then, a model based on mathematical form of Proportional hazards model is developed where it represents stress condition of the WT. Finally, those two models are jointly employed in order to analyze the overall performance of the WT over the study period. Several cases are analyzed with a five-year SCADA data and maintenance information is utilized to develop and validate the proposed approach.

Index Terms- Wind Turbine, Condition Monitoring, Prognostics, Maintenance Management, Neural Networks

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