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A health condition model for wind turbine monitoring through neural networks and proportional hazard models

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Abstract— In this paper, a parametric model for health condition monitoring of wind turbines (HCWT) is developed. The study is based on the assumption that a wind turbine's (WT) health condition can be modeled through three features: rotor speed, gearbox temperature and generator winding temperature. At first, three neural network models are created to simulate normal behavior of each feature. Deviation signals are then defined and calculated as accumulated timeseries of differences between neural network predictions and actual measurements. These cumulative signals carry health condition related information. Next, through nonlinear regression technique, the signals are used to produce individual models for considered features, which mathematically have the form of proportional hazard models. Finally, they are combined to construct an overall parametric health condition model which partially represents health condition of the WT. In addition, a dynamic threshold for the model is developed to facilitate and add more insight in performance monitoring aspect. The HCWT model has capability of evaluating real-time and overall health condition of a WT which can also be used with regard to maintenance in electricity generation in electric power systems. The model also has flexibility to overcome current challenges such as scalability and adaptability. The model is verified in illustrating changes in real-time and overall health condition with respect to considered anomalies by testing through actual and artificial data.

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

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