A tutorial for wind farm intelligent prognostics and health management

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The emerging wind energy market has been growing exponentially during the past decade. As the number of wind turbines increases rapidly, there are fast-growing concerns for their maintenance and health management. Prognostics of turbine performance degradation and incipient faults in critical components can thus offer improvements in availability of wind turbines by enabling predictive maintenance. Supervisory control and data acquisition (SCADA) and condition monitoring system (CMS) have been widely adopted for such purpose. This paper provides a systematic framework for data-driven health prognostics of wind turbine, together with detailed analysis for different health modeling approaches adopted to various subsystems. Degradation assessment for turbine efficiency and incipient fault detection for drivetrain components will be highlighted. A cyber-physical system architecture is further proposed to integrate data analytics, decision support, and maintenance execution to adapt to big data environment of turbine fleets. Demonstration and implementation process of the proposed system on National Instruments LabVIEW platform and Watchdog Agent® Toolkit are also provided in the case study section.

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The role of STATCOM to power quality improvement in wind energy system integration

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The renewable energy plays an important role to provide electrical energy other than conventional sources. Wind power is one of the renewable energy sources used to minimize the environmental impact on conventional plant; it is one of the fastest growing sources of energy in the world. However, when the wind power is connected to an electric grid may cause problems important in terms of power quality. The effects of the power quality measurements are the active power, reactive power, variation of voltage, flicker, harmonics, and electrical behaviour of switching operations. This paper demonstrates the power quality problems due to installation of wind turbine with the grid. In this paper, we propose the importance of using STATCOM when it installed in a wind farm. Here, the STATCOM is connected at a point of common coupling to mitigate the power quality issues. Simulation studies were carried out in the MATLAB/Simulink environment to examine the performance of wind farm with and without STATCOM for improving power quality of wind farms connected to electrical network.

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