Detection of icing on wind turbine blades by means of vibration and power curve analysis

Ice accretion on wind turbines' blades is one of the main challenges of systems installed in cold climate locations, resulting in power performance deterioration and excessive nacelle oscillation. In this work, consistent detection of icing events is achieved utilizing indications from the nacelle accelerometers and power performance analysis. Features extracted from these two techniques serve as inputs in a decision-making scheme, allowing early activation of de-icing systems or shut down of the wind turbine. An additional parameter is the month of operation, assuring consistent outcomes in both winter and summer seasons. The amplitude of lateral nacelle vibration at rotor speed is the used condition indicator from vibration standpoint, which is verified by the presence of sinusoidal shape in high-resolution time waveforms. Employment of k-nearest neighbour on wind speed - power production data sets leads to successful recognition of power performance deterioration. Results from one wind park consisting of 13 turbines operating under icing are presented, where similar patterns on both vibration and power curve data validate the effectiveness of the proposed approach on the reliable detection of icing formation.

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