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Indicator sets construction for wind turbine bearings early fault detection based on Instantaneous Angular Speed monitoring

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Abstract. Among the most sensitive rotating machines suffering from non-stationary conditions, wind turbines are standing out, with a very complex gearbox and a high number of bearings to be monitored. Maintenance tasks should be scheduled properly to satisfy an optimal power supply within the machine life cycle. In order to effectively plan maintenance interventions, early detecting defects appearance and tracking their evolution are two key challenges to be considered in the construction of an effective condition-monitoring tool. Instantaneous Angular Speed appeared those last years as a reliable source of information for condition monitoring of rotating machines, specially fitted to non-stationary conditions. IAS signals can contain an important amount of information on the dynamic of the whole machine. This information can be treated and then used in different ways to monitor health state of machine components. This work seeks the construction of different kind of fault indicators from IAS Measurements. In this purpose, the following approach proposed and is carried out in several stages. First, IAS measurements are recorded from different operating wind turbines in healthy and defective conditions. Signals are then, processed with adapted tools and a high number of indicators extracted. Indicator transformation and selection based on pattern recognition are finally applied on original information and allowed the construction of different kind of indicators: early detection indicators and sure alarm indicators. The constructed indicators could be used of optimizing maintenance tasks schedule.

Keywords: instantaneous angular speed, fault diagnosis, pattern recognition, early detection.