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”COMO3#1 - Experimental study on condition indicators for severity estimation of growing spall in bearings.”

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Rolling element bearings are essential components for the proper functioning of many types of rotating equipment. Diagnosing faults in bearings has traditionally been done using signal processing techniques inspired by physics, where acceleration signals are analyzed using time-frequency analysis methods. One of the key challenges in classifying the spall severity in practical applications is that changes in acceleration signatures, which are related to the size of the spall, are hard to detect due to low signal-to-noise ratios (SNRs). The objective of this research is to study and characterize the effect of spall propagation on acceleration signatures to classify and identify the spall severity. To overcome the challenge of low SNRs, we focus on changes in signal trends rather than events in single measurements. Experiments were conducted to gather data from endurance tests with growing faults on the outer ring of cylindrical roller bearings. The data collected includes measurements of acceleration and load at various rotational speeds. One benefit of conducting endurance tests is that they allow for the natural propagation of spall, however, the extent of spall severity during the test remains uncertain. To overcome this, a spall size estimate is used derived from the load-cell signals, which is validated by means of visual inspections. Although a load-cell is not available in practical applications it is used in our research as the €œground truth€ to validate the acceleration-based algorithms. A new condition indicator (CI) for classifying spall severity is proposed. This CI was derived through analysis of CIs trends, extracted from order domain signatures. The new CIs enable the identification of several stages of spall propagation prior to reaching the critical size, where beyond asset operation is no longer acceptable. The effectiveness of this new CI was demonstrated using four different endurance tests.

Presenter(s) : BUBLIL TAL

Classification par session : Survishno 12 / Condition monitoring 3