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MACHINERY HEALTH MONITORING USING ACOUSTIC PHASED ARRAYS: AN EXPERIMENTAL DEMONSTRATION

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Abstract

Machinery condition monitoring is an important tool in the industry to help reduce operation costs by predicting developing faults and thus reducing machinery down-time. A common technique to evaluate the status of a machine is the so-called Condition-Based Monitoring (CBM) using vibration data from several accelerometers or proximity sensors located on a machine. For CBM, vibration data of a current configuration is compared with a healthy configuration at certain frequencies of interest to determine the presence of a fault and its severity. In this paper, a novel approach using a microphone phased array and the array integrated spectrums is implemented to show that phased arrays can be used to monitor rotating machinery for faults in a way similar to current industry standard methods such as the vibration based CBM. The results found using the phased array technology closely matched the trends found from the vibration analysis at the frequencies of interest commonly used for fault analysis. Measurements were performed using an experimental setup consisting of small-scale machinery fault simulators and a 121-element microphone phased array in a “non-anechoic” environment. Results showed that microphone phased array technologies can be successfully used to monitor rotating machinery for faults in typical industrial environments.