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Acoustic Emission Detection of Early Stages of Cracks in Rotating Gearbox Components

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Many critical, highly loaded rotating gearbox components have fast crack propagation rates. Early detection of cracks in gearbox is critical to mitigating the risk of catastrophic failure. Acoustic Emission (AE) techniques have proven to be capable of continuously monitoring the crack initiation and propagation [1-3]. Due to the long distance of AE signal propagation from the AE sources to the sensors installed in the housing, the AE signal suffers from severe attenuation and noises. Accurate AE signal classification technology that is capable of extracting the true AE signal out of background noises generated by the surrounding environment of a gearbox is desired. In this paper, an innovative feature extraction and analysis based AE signal classification technology is developed to address this issue. Potential AE signals are first pulled out of the noisy background in real-time through a set of automated AE detection algorithms. Then features including count, energy, duration, amplitude, rise time, amplitude rise time ratio, etc. are extracted and analyzed. Through the comparison and correlation of features extracted from signals recorded by multiple AE sensors, respective feature thresholds are determined to distinguish noises from real AE signal. The classification results are experimentally validated through fatigue tests.

Acknowledgement:

This work is supported by the US Navy under contract N68335-12-C-0384.

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