Impact Velocity Modeling of Gear Vibration to Estimate Defect Width

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ABSTRACT

Gears are one of the most common elements in any rotating machinery. Unexpected breakdown of gears are cause of major concern in machinery. If gear defect can be assessed, gearbox maintenance schedule can be planned at optimum. Machinery failures are not unpredictable; they often occur long after the condition of the machine begins to deteriorate in some form or other. In the case of rotating machinery like gears such deterioration almost always manifests itself in terms of changes in levels of vibration. To establish the relationship between defect size and vibration level, better understanding of the basic physics involved in the generation of the sensor signal at the presence of a gear defect is necessary. This paper presents a rigid body dynamic model to relate measurable vibration signal to the rotating speed of the gear and the defect width on the gear tooth flank. With the use of impact dynamic principles, the relationship is shown to be a function of the rotation speeds of gear pair. The analytical model has been verified by comparing results with experiments using accelerometer to measure impulse vibration signal. The RMS measurement on gear sets without defect and with defect shows that the vibration level increases as the defect width increases The experimental results support the effectiveness of the analytical model in interpreting the gear vibration level for defect width prediction. This model doesn't provide the relationship between defect depth and defect length across the face width.