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Time-Frequency Domain Vibration Signal Analysis to Determine the Failure Severity Level in a Spur Gearbox

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A gearbox is a critical component in a rotating machine; therefore, early detection of a failure or malfunction is indispensable to planning maintenance activities and reducing downtime costs.
The vibration signal is widely used to perform condition monitoring in a gearbox as it reflects the dynamic behavior in a non-invasive way. This work aimed to efficiently classify the severity level of a mechanical failure in a gearbox using the vibration signal in the time-frequency domain.
The vibration signal was acquired with six accelerometers located at different positions by modifying the load and rotational frequency conditions using a spur gearbox with different types and severity levels of simulated failure under laboratory conditions. First, the Wavelet transform with varying types of mother wavelet was used to analyze the vibration signal condition in the time-frequency domain. Subsequently, Random Forest (RF) and K nearest neighbor (KNN) classification models were used to determine the fault severity level.
In conclusion, RF was the most efficient classification model for classifying the severity level of a fault when analyzing the vibration signal in the time-frequency domain.

Keywords

Wavelet transform, Classification models, Vibration signal, Spur gearbox, Fault severity.

Classification

Both methodology and application

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