Different Signal Processing Techniques for Predicting the Condition of Journal Bearings

ABSTRACT

- Journal bearings are used to support shafts.
- Vibration condition monitoring is to detect, diagnose and prognoses faults [1].
- Show the differences between the time domain, frequency domain and time-frequency analysis (STFT) of Journal bearing vibration signal.

THEORETICAL BACKGROUND

- Time domain analysis gives the behaviour of the signal over time which allows predictions and regression models for the signal [2].
- Frequency-domain data are obtained by converting time-domain data using a mathematical technique referred to as Fast Fourier Transform (FFT) [2].
- Time-frequency analysis is short-time Fourier Transform (STFT) investigates waveform signals in both time and frequency domain at same time [2].
  \[ STFT(t', u) = \int f(t)W(t-t')e^{-2\pi i u t} \, dt \]
  Window should be narrow enough to make sure that the portion of the signal falling within the window is stationary.

Test Rig Facility

- The time domain and frequency domain of journal bearings at high speed, high radial load and low viscosity oil

Results and Discussion

- Time-frequency STFT presentation

Conclusion

- Time-frequency not only presents the frequency content of the signal but also shows when it occurs.
- STFT Narrow window means good time resolution, poor frequency resolution.
- STFT wide window means good frequency resolution, poor time resolution.

References