An Overview of Signal Processing Techniques for Fault Detection in Mechanical Systems using Motor Current and Vibration Signature Analysis

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Motor current signature analysis is a non-intrusive and direct method for fault detection in Motors or Generators. However, there have been very few instances where it is used to detect faults in mechanical systems such as gearbox, pumps or compressor driven by the motor due to the following challenges:

1. The transmission path of mechanical system and motor may cause loss of information of the defects
2. The flexible coupling between the mechanical system and motor may reduce the effect of mechanical faults at the motor
3. The dominant line frequency (of 50/60Hz) may mask the fault frequencies of mechanical systems
4. Noise in the overall system as well as the sensor signals may hamper the tracking of the fault frequencies etc.

In this presentation, application of various signal processing techniques such as FFT analysis, amplitude and frequency demodulation, wavelet transform and Multi-resolution Fourier Transform will be discussed in order to overcome the above challenges. The mechanical system considered in the presentation will be a multi-stage synchro-meshed helical gearbox. The motor current signature analysis will be compared with the corresponding vibration signature analysis in order to detect faults in the gearbox.