

Fault diagnosis of variable-speed bearings based on non-stationary signal analysis

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ABSTRACT:

An accurate extraction of instantaneous frequencies (IF) corresponding to a defect component from a condition monitoring (CM) signal is fundamental for fault diagnosis of rotating machines operating under varying speed condition. However, the coupling of strong amplitude-modulation and frequency-modulation (AM-FM) in the non-stationary signal caused by sudden speed/load changes of a machine can complicate the IF extraction using traditional time-frequency analysis techniques. This talk discusses some of the recently emerged time-frequency analysis techniques developed in addressing this challenge. Particular attention is paid to the development of a so-called demodulated multi-synchrosqueezing transform (DMSST) technique. In this approach, a decoupling of the AM-FM of the signal is performed first to lessen the frequency deviation caused by amplitude fluctuations, and then, a multi-synchrosqueezing operator is employed to iteratively reassign time-frequency energy coefficients to the corresponding IFs. The proposed technique is examined by using both simulated and experimental bearing defect data, and the results demonstrate that the proposed technique can effectively extract energy concentrated IFs for an accurate bearing fault diagnosis under complex operating condition.