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Abstract :

Worked on optimal filtering and analysis of gear signals for early damage detection based on the spectral kurtosis.The authors have proposed a methodology for enhancement of small vibration signals for finding local gear tooth faults such as pitting in its early stage.They compared their work with inverse filtering approach.The proposed method can be used for the early detection of pitting formation in gear teeth.The following are the various conclusions drawn by the authors.

- The application to an industrial case showed the possibility of detection of relatively small tooth surface pitting (less than 10%) in a two-stage helical reduction gearbox.The adjustment of the resolution for the SK estimation appeared to be optimal when the length of the analysis window is approximately matched with the mesh period of the gear.
- The use of the classical residual signal showed better diagnostic potential than the AR-residual based on an autoregressive model.Also,no sign of the pitting faults could be detected when using either the raw vibration signal or its residual part obtained after removing all deterministic spectral components.This may suggest that the faults in this case mainly induced periodic rather than cyclostationary effects as observed .
- The SK-based denoising approach has also been compared to a blind deconvolution (inverse filtering) approach.However, the latter turns out to be more unstable and sensitive to noise,resulting in a lower value of the fisher criterion,less separation between the estimated diagnostic features in the pitted/unpitted cases.
- Based on this work,several directions may be investigated.The local power of the SK-residual may be used in order to trend the level of damage for individual teeth separately,provided that a phase reference is available.Some improvements can also be addressed such as the robust estimation of the constant of proportionality between the SK and the Wiener filter or the use of the wavelvet transform for the SK estimation.