Helicopter transmission gearbox fault detection using an enhanced minimum entropy deconvolution adjusted method

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Abstract

Blind deconvolution (BD) has a very successful application on impulse extracting from amplitude anomalies in vibration recordings for machinery health monitoring and diagnostics. In this paper, we investigate the effect of an exponential transformation on the improvement of the performance of the minimum entropy deconvolution adjusted (MEDA) method for the extracting of periodic fault impulse trains. Meanwhile, based on the exponential transformation, a new varimax norm is defined as criterion for BD. The modified MEDA method is compared to the classical minimum entropy deconvolution (MED), the MEDA, the optimal minimum entropy deconvolution adjusted (OMEDA) on both simulated and experimental signals. The experimental data is from the seeded fault test of H-60 helicopter transmission gearbox. The results show that the modified MEDA performs considerably better than other comparison methods in the extracting of periodic fault impulse trains especially for incipient faults.

Keywords: Fault detection; helicopter gearbox; blind deconvolution; minimum entropy deconvolution adjusted; exponential transformation

References:

Buzzoni, Marco, Jérôme Antoni, and Gianluca D'Elia. "Blind deconvolution based on cyclostationarity maximization and its application to fault identification." Journal of Sound and Vibration 432 (2018): 569-601.

McDonald, Geoff L., Qing Zhao, and Ming J. Zuo. "Maximum correlated Kurtosis deconvolution and application on gear tooth chip fault detection." Mechanical Systems and Signal Processing 33 (2012): 237-255.

Ooe, M., and T. J. Ulrych. "Minimum entropy deconvolution with an exponential transformation." Geophysical Prospecting 27.2 (1979): 458-473.

McDonald, Geoff L., and Qing Zhao. "Multipoint optimal minimum entropy deconvolution and convolution fix: Application to vibration fault detection." Mechanical Systems and Signal Processing 82 (2017): 461-477.

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