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"COMO3#4 - Robust estimators of autocorrelation function in application to local damage detection for non-Gaussian signals"

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One of the most common approaches for local damage detection is the cyclostationary analysis. The indicators of cyclostationarity are based on the classical estimation of autocorrelation function (ACF), called sample ACF. It can be applied for the underlying signal in time, time-frequency or frequency-frequency domains. The indicators based on sample ACF are very efficient in case when the informative signal is disturbed by Gaussian- (or close to Gaussian)-distributed noise. However, in case when the background noise has strong non-Gaussian behavior, the sample ACF may fail as it is sensitive to large impulses related to the non-Gaussian characteristics of the noise. Thus, in this presentation we discuss the new approach based on the robust versions of sample ACF. By robust sample ACF we mean the algorithms less sensitive to large observations that estimate theoretical ACF. By relatively simple replacement of the classical statistic by its robust versions, one may decrease the influence the non-Gaussian distribution and identify the cyclostationary behavior also in this case. In the literature there are considered various statistics used as robust versions of sample ACF but they were never used in condition monitoring. In this presentation we demonstrate the general methodology of new cyclostationary indicators that, similar as the classical approach, can give the information in different domains. The results are demonstrated for three selected robust estimators of ACF and two different non-Gaussian distributions of the background noise. The simulation studies are supported by applications of the introduced methodology to real vibration signal.

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