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”COMO3#3 - Identification of non-informative noise component in time-frequency representations. Application to vibration-based local damage detection”

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In this presentation we highlight the importance of the background noise properties in the context of the vibration-based local damage detection. We assume the model is a mixture of signal of interest (SOI) and the noise. In the case, when the background noise has Gaussian characteristics, the classical methods for local damage detection can be applied. In this case, the most common approaches are based on the measuring of impulsiveness of the vibration signal or cyclostationary analysis. In both cases, the used methods often are applied to the signal in time-frequency representation. However, for many cases in real environment the assumption of Gaussian distribution of the noise is not satisfied and one may expect the large impulses that influence the noise characteristics. It should be noted, the non-Gaussian distribution of the signal may occur for many machines. In that case the impulsiveness criteria fail and the cyclostationary analysis seems to be more useful approach. Since, most of the methods used in the cyclostationary analysis are based on the auto-covariance function, we indicate here the important role of the finite variance of the signal. In theory, if the variance is infinite, then the autocovariance is also not defined. We highlight, the problem considered here is much more general than the problem of testing the noise distribution. We present a new approach for the assessment of the noise probabilistic properties. The methodology is applied for the time-frequency representation of the signal. The problem is illustrated for the simulated signals from non-Gaussian distributions and real signals from various machines.

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