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”FLEET#1 - Fleet Condition Monitoring in non-stationary conditions”

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Machine condition monitoring is a challenging task. This paper presents a technique on the domain of rotating machine fleet condition monitoring for non-stationary operating with emphasis on gears and bearings as the most critical mechanical components. The machines are working on non-stationary conditions, on factual applications. This condition is causing an effect on the vibration signal as the operating frequencies are varying. As a result, the signal cannot be used as a condition estimator on its raw form. Additionally, the signal could contain more than one mechanical part interference, as well as casing or other resonances. While we present the factor of non-stationary conditions and signal decomposing, current studies do not follow this path. Most researchers require a large historical data as they use artificial intelligence on their try to be less unproductive. More than that, on this study a comparison between the whole fleet and a single machine will be presented, compared to cluster methods or machine to machine comparison. The proposed solution contains the decomposition of the vibration signals, received from the main mechanical components of each individual, in order to separate the internal forces that contain information on kinematic parts and are therefore potentially symptomatic of faults in gears and bearings, to be used for Machine Health Monitoring. This decomposed signal of each individual defines a stochastic process in the fleet provide different realizations. The deviating machine is spotted within a monitoring framework by controlling if any new measurement can be accepted as a realization of this stochastic process. The originality of this method stands on the equalization scheme which is able to remove the effect of speed-varying transfer functions, so as to normalize the signal with respect to the structural fingerprint of each individual part of the fleet. All the above, were applied in parallel with the experimental procedure, on a set of machines, acting as a fleet. Vibration signals were taken from three points of each mechanism. On the paper, the experimental procedure is presented in depth as well as the evaluation of signals and the complete methodology of the condition monitoring.

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