Using physical based models for machinery RUL estimation

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ABSTRACT

Machinery prognosis is the process of forecasting the remaining operational life (RUL), future condition, or probability of failure based on the acquired condition monitoring data. RUL forecast becomes crucial since it allows planning of efficient maintenance actions.
In order to estimate the remaining usefull life it is needed, first, to estimate the damage severity or size, and then, to forecast the damage growth model.
Damage size estimation is not yet developed and needs additional research. **Classic theories** assume that energy dissipation is proportional to fault size. For small faults, it is not correct. In general the energy-fault size relation depends on the transmission path from the defect to the snsor which differs for every case of defect location, machine and sensor. Therefore the estimation of the fault size is crucial. State of the art algorithm for bearings size estimation will be presented. The algorithm approach is based on insights from a general dynamic bearing model and an analytical model for RE-spall interaction. The outline of these models will be presented.
Other machine components such as, gears and shafts will be discussed.
In the second stage, understanding of the damage progression process is needed. This stage is essential for estimation the RUL. The required steps towards damage progression tools will be discussed.
The models allow to examine the the algorithms sensitivity to different types of faults, geometric errors, misalignment, unbalance, system parameters etc.