MACHINE CONDITION DIAGNOSIS BASED ON ACOUSTIC EMISSIONS

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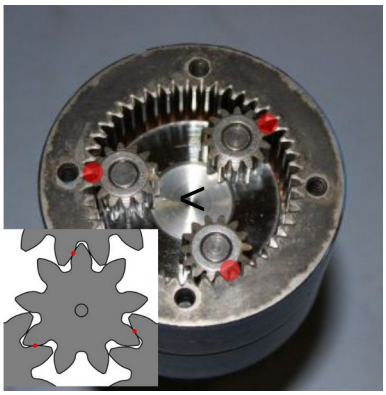
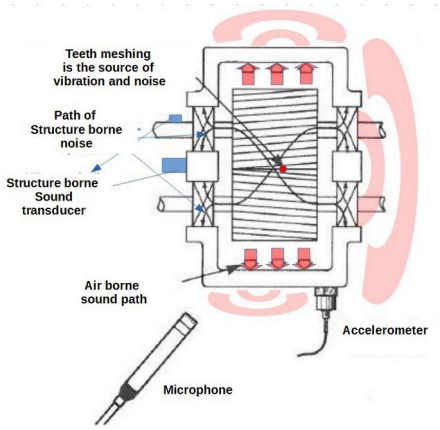


CONDITION DIAGNOSIS BASED ON ACOUSTIC EMISSIONS

Acoustic emissions (AE) are vibrations in the range from 20 kHz to 10 MHz. These are transient waves that arise from the release of elastic energy as a result of structural rearrangement at the solid contacts.

AE occur in lubricated tribocontacts (e.g. in bearings and tooth flanks) or due to cavitation in pumps and turbines.

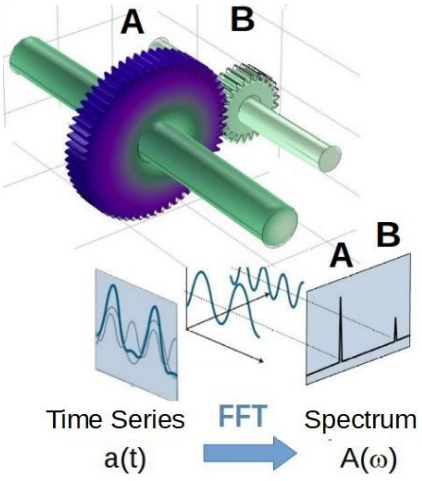
The detection of AE enables the diagnosis of wear processes in machines at a very early stage of development. This offers the opportunity to develop concepts for **condition monitoring** and **predictive maintenance**.



VIBRATION PATHWAYS

AE propagate from the source of origin such as the meshing of tooth flanks or the rolling over of rolling bearing bodies via stationary and rotating machine elements (bearing rings, shafts) to the machine housing surface.

This enables the non-invasive detection of AE signals by mounting structure-borne noise sensors at the outside of the machine housing. The closer the sensor is mounted to the source, the more precise the diagnosis can be. For large machines in particular, it is advisable to mount AE sensors as close as possible to the component of interest.

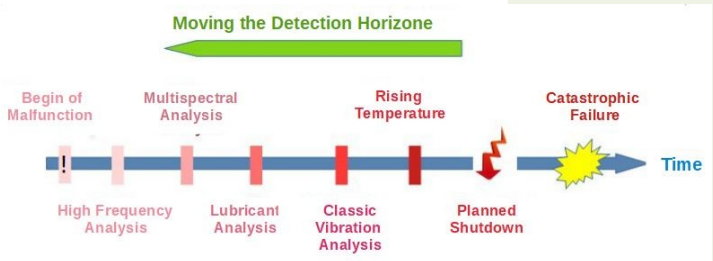


SIGNAL ANALYSIS IN REAL WORLD APPLICATIONS

The basis for the signal evaluation (FFT) is the broadband recording of the vibration time series of signals (Hz to MHz) and the analysis in spectrograms. Based on the rotational frequency tooth meshing and the rollover frequencies can support feature extraction .

The analysing of the signal modulations at high frequencies (MHz) provides information on the collaps of lubricating films or the implosion of cavitation bubble clouds closed to the rotating pump and turbine blades. Both events are strongly related to severe erosion faults.

FROM CONDITION DIAGNOSIS TO PREDICTIVE MAINTENANCE



The high-frequency AE analysis extends the established methods of classic vibration analysis. The sensitive method shifts the temporal detection threshold for the occurrence of the first error-relevant signals far forward. This is a major advantage over classic vibration analysis (accelerometer).

AE analysis therefore offers the option of monitoring the development of damage at the earliest possible stage.

With the development of powerful AE sensors, the transition from condition diagnosis to condition prognosis and thus to predictive maintenance based on AE signals is becoming tangible.

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