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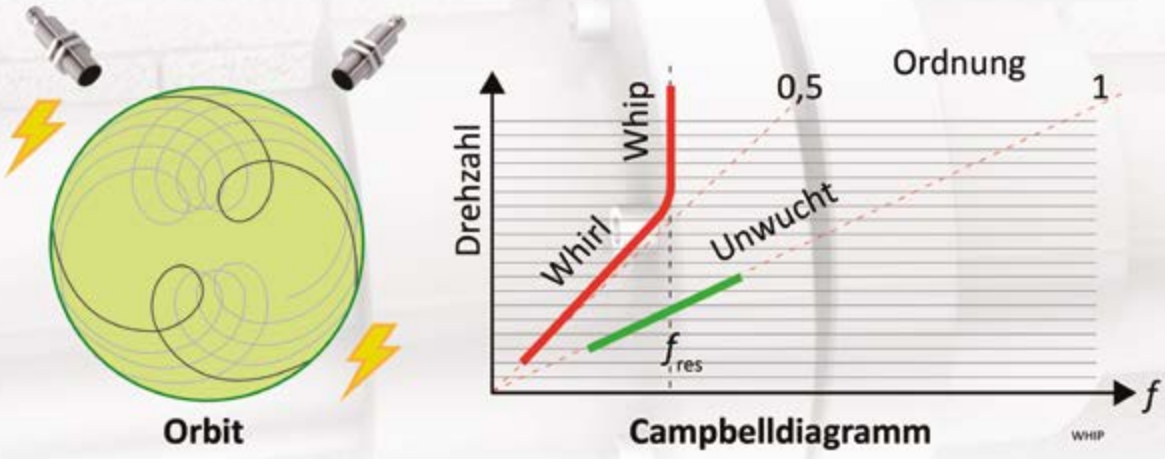
PRÜFTECHNIK ServiceCenter

Shaft vibration and Motion analysis on machines and plants

- Analyse and evaluate vibration according to standards
- Spectral Orbit analysis as a valuable tool
- Improve balancing condition in the machine
- Increase plant avaliability and reliability



VIB 4.1 – Shaft Vibration and Motion Analysis

In the new DIN ISO 20816 series of standards, it is recommended to record both the housing vibrations and the shaft vibrations during condition monitoring and to evaluate them in terms of amplitude. If values crosses thresholds, different levels of action are defined. The very first guideline e.g. for water turbines (Part 5) is to perform FFT analysis and Orbit analysis of the shaft vibrations. Too high shaft vibrations impair the vibration level of the housing, additionally burden the machine components and reduce the operational safety. The only prerequisite for such shaft vibration measurements is that shaft is accessible for mounting displacement sensors and the runout of the measurement tracks is small enough.

Fig. 1: Old BN rack where shaft vibration signals are easy to collect.

Orbit analysis is a very efficient tool for shaft vibration analysis

With **displacement analysis**, it is possible to check how high the bearing clearances are in terms of quantity, to track the shaft centerline and check they behave as intended under load changes.

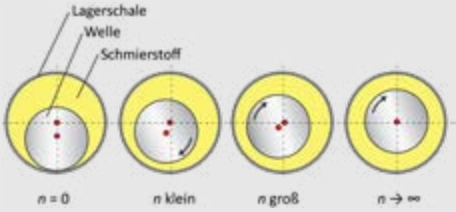


Fig. 2: Rotational speed dependent position

The aim of **high resolution time wave** analysis is to check whether the rotating shaft has no movement constrains or whether there are direction dependent constraints or start up phenomena.

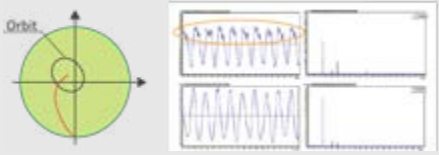


Fig. 5: High resolution time signals and FFTs with temporary constraints.

Orbit analysis makes it possible to record the vibration behavior of rotating shafts in their bearings. This can be used to identify imbalances, alignment errors, anisotropies, constraints, friction, oil whirl, oilwhip, etc.

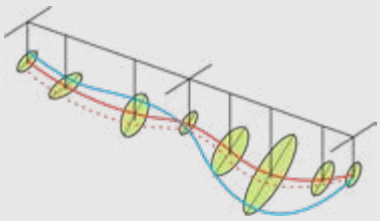


Fig. 3: Formation of the spatial shaft path (Mode shape of the Rotor)

Runup and costdown analysis with phase evaluation allow both critical frequency identification and the monitoring of signs for example for shaft cracks fault.

Fig. 6: Orbit when passing through a critical speed.

With **spectral analysis of shaft vibrations**, excitation and natural frequencies can be determined, assessed diagnostically and evaluated in terms of amplitude. Spectral orbit analysis allow depth diagnosis, e.g. to recognize the Morton effect.

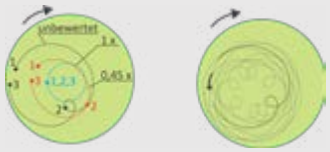


Fig. 4: Spectral orbit analysis (left: discrete orders, right: sum signal)

With the help of s**haft vibration based field balancing** the best balancing qualities can be achived, since measurement are made directly on the rotating cause of imbalances.

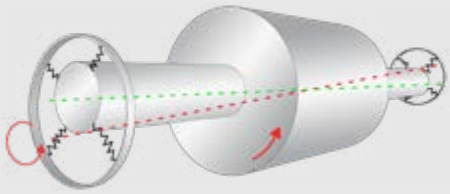


Fig. 7: Field balancing of an elastically mounted rotor based on shaft vibration.

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