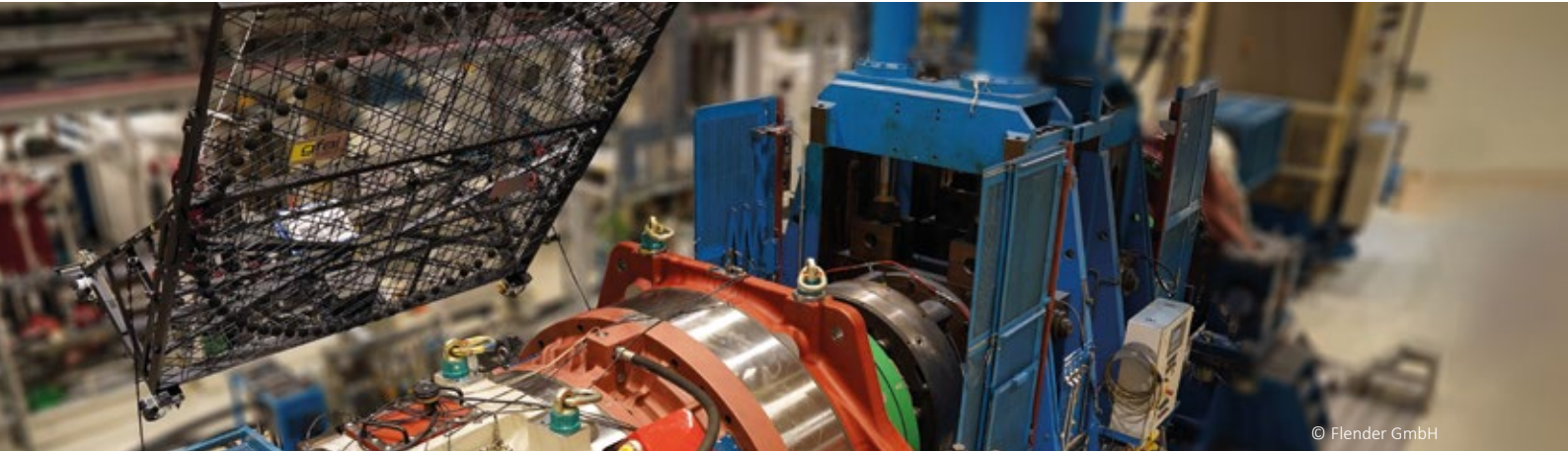




Order Analysis on Gearboxes

The Acoustic Camera as a Solution for Rotating Machinery



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CHALLENGE

Facing the need for an energy revolution to mitigate climate change and increasing prices for steel there are huge incentives to drive innovation on large scale gearboxes to increase power density. The requirement to handle more power using less resources, increases the importance of understanding the dynamic behavior of the plant. When analyzing rotating machinery, it can be a complex task to pinpoint different excitation frequency components to specific parts in an assembly. The signal is a superposition of mainly multiples of the rotational frequency the so called first order. A typical component exhibiting this behavior is a gearbox where every gear stage adds prominent orders with its gear mesh frequency.

SOLUTION

Some distinction can be made interpreting data in a spectrogram. An easier and quicker way to distinguish such orders and qualify the acoustic emissions is an analysis based on orders (order analysis). NoiseImage 4 and the Order Analysis module allow to calculate acoustic maps via ordergram, order line selection in the spectrogram (Figure 1) or order spectrum (Figure 2). This will allow a fast analysis for machinery at all sizes ranging from large scale infrastructure as shown to small items in the range of centimeters.

MEASUREMENT

Measurement object	Flender GmbH Gearbox wind turbine
Microphone array	Customized Evo array 72 microphones ring distribution diameter: 2.3 m
Software NoiseImage 4	Acoustic Photo 2D Acoustic Photo 3D Recorder Interface Spectral Analysis Order Analysis Project Manager
Data acquisition	Data recorder mcdRec

BENEFITS

- Fast and easy measurement set-up and analysis
- Analyze data based on multiple different rotational speeds
- Detailed and meaningful results
- Test bench integration, complement vibration testing
- Add additional accelerometers etc. as required
- Large choice of arrays for different requirements



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RESULTS

Based on the results of the conducted analysis, the client is enabled to quickly localize noise emissions and e. g. compare prototype iterations. The results also allow to narrow down regions of interest for more detailed testing including vibration analysis and trouble-shooting of resonance effects.

The array displayed can be used for testing on ground level as well as for suspended operation using a crane e. g. to cover the top view. It is foldable for transport.

The powerful data recorder collects data at 192 kS/s for up to hundreds of channels including individual microphones, accelerometers and rotational speed sensors. The analysis is automated using the project manager allowing the user to transfer analysis configurations to complete measurement campaigns.

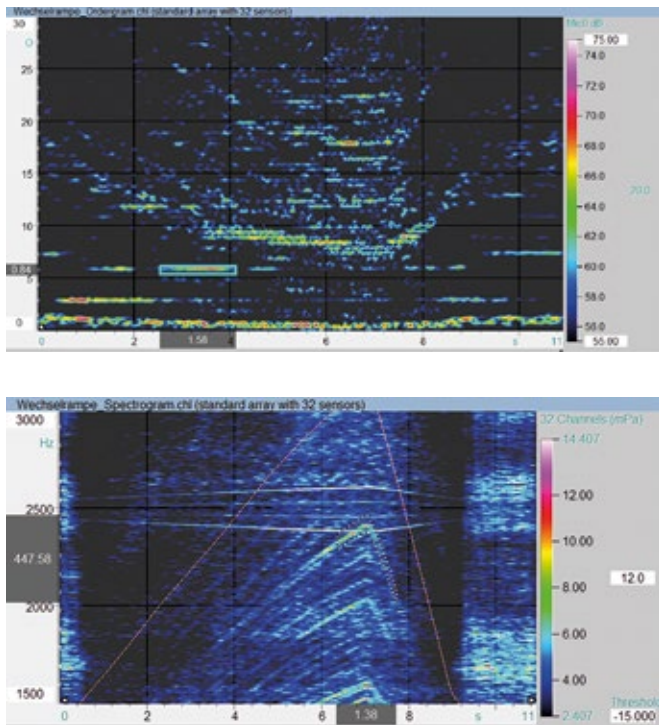


Fig. 1: Ordergram showing orders over time during rotational speed variation (top) and spectrogram showing an order line selection.

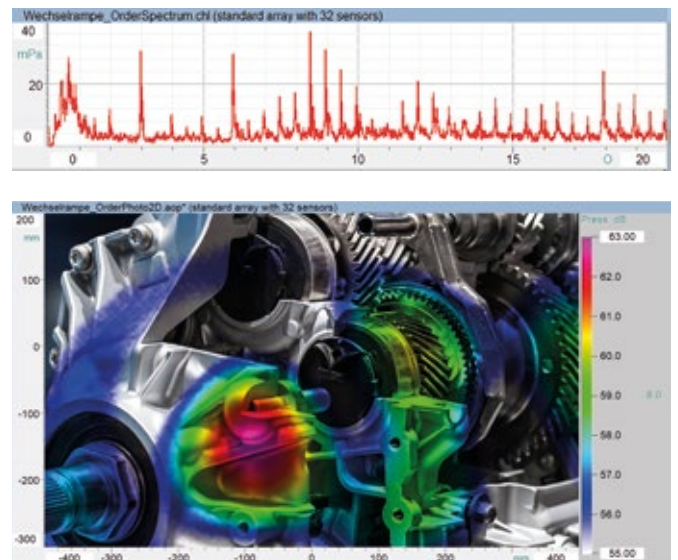


Fig. 2: Order spectrum of the first 20 orders (top) and an acoustic map based on NoiseImage order analysis (order 63).

