Vibro- Acoustic Characterization of Small Geared Engines

Prof. Dr. Peter Blaschke
Audible Noise

Vibro-Acoustic Characterization
The small geared engine
Sound Radiation of the small geared engine

- Comparison of different engines

![Graph showing sound radiation comparison of different engines](image-url)
Sound Radiation of the small geared engine

Spectogramm of small geared engines
Sound Radiation of the the small geared engine

Vibro-Acoustic Characterization
Sound Radiation of the small geared engine

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Vibro-Acoustic Characterization
Structural analysis of the small geared engine
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ODS (Operational Deflaction Shape) Analysis

465 HZ

1022 HZ
Structural analysis of the small geared engine

ODS (Operational Deflaction Shape) Analysis

3718 HZ

5579 HZ
Structural analysis of the small geared engine
Structural analysis of the small geared engine

- 3238 Hz
- 1291 Hz
- 6397 Hz
Root Cause of the noise

- 1 Khz is the dominant frequency
- The 10th order is
- It is excited by the anker of the shaft and the rectangular slots
- The shaft itself has eigenfrequencies in the same area
- The body itself has as well eigenfrequencies in the same area

- The rectangular slots get excited by the anker
- The impulses of the anker will excite the structure at their eigenfrequencies
- Surface areas will radiate the sound
- The contact pins will pass the radiation as structure borne noise to the connected structure (seat, door, etc.)
How to avoid the noise

**Reduction of the exitation mechanism – Primary noise reduction**
- sloped anchor slots
- chamfered anchor slots
- optimized grease at the gears

**Optimization of the airborne sound radiation**
- design of the shaft at a different eigenfrequency
- optimized bearing localisation to tune the eigenfrequency
- sensitivity study of the shaft with bearings

**Optimization structure borne noise radiation**
- Sensitivity desing of the connection points out of the area of eigenmodes that match with the exitation frequencies