Project: Damage and Failure in Wind Turbine Pitch Bearings

Key focus: pitch bearing, damage characterisation, improvement of wind turbine reliability

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Background

Pitch bearings of modern large-scale wind turbines operate under unfavourable conditions. These bearings are subjected to high axial forces and bending moments while they are standing still or oscillating at low speeds. No established international standard exists to determine pitch bearing service life accurately. This inaccuracy is mainly due to insufficient understanding of the key damage mechanisms observed when operating under small amplitude oscillations at low speed. These mechanisms are false Brinelling and fretting corrosion.

Figure 1- a) Pitch bearing (image: schaeffler-fairs.de) b) Typical double-rowed four-point contact ball pitch bearing.

Pitch bearing failures due to false Brinelling and fretting corrosion became predominant after the implementation of individual pitch controller (IPC), which allows each blade to oscillate independently. This has resulted in a significant increment of small amplitude oscillations, the operating condition under which these wear mechanisms prevail. A worn pitch bearing can result in the faulty operation of the pitch control, which can cause an inefficient power optimisation, and unexpected loads in other components.

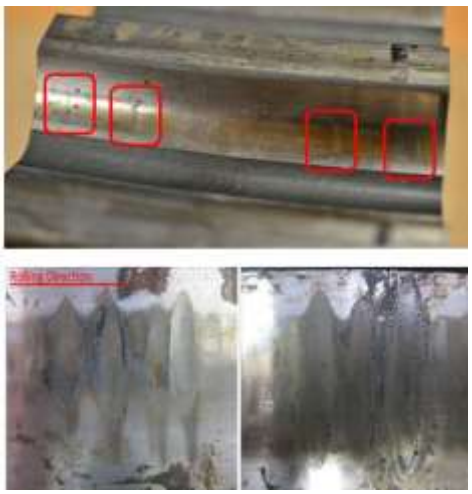

Figure 2- Examples of worn pitch bearing.

Project description

This research project aims to investigate and understand the failure mechanisms observed in wind turbine pitch bearings due to small oscillatory movements. A clearer understanding of false Brinelling and fretting corrosion development in pitch bearings will contribute to predict their service life more accurately.

Research outcomes/impact

An in-depth comprehension of the factors affecting false Brinelling and fretting corrosion in pitch bearings will lead to an improvement of pitch bearing designs, particularly for larger scale wind turbines using larger bearings.

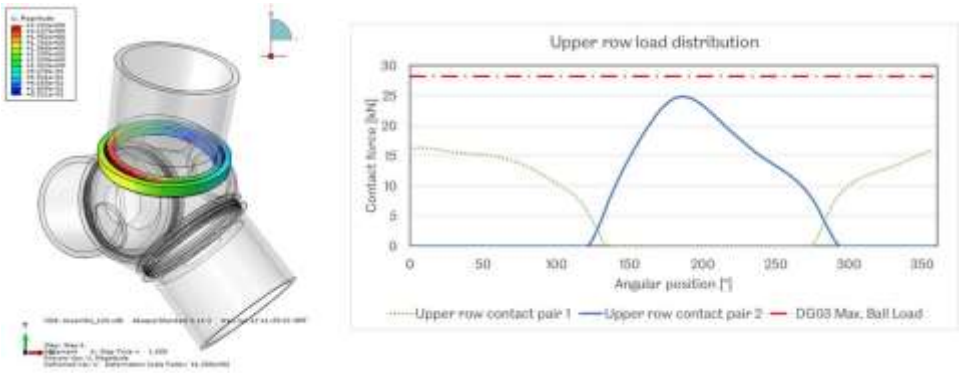

Figure 3- Pitch bearing FE model to study load distribution.

Project Sponsorship:

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