SUCCESS STORY

InTribology2
Excellence Centre of Tribology

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Operando characterisation techniques in tribology
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strategy

ON THE TRAIL OF VIBRATIONS

WITH CUTTING-EDGE MEASUREMENT TECHNOLOGY THE CAUSES OF VIBRATIONS ARE ANALYSED. IMPROVEMENT THROUGH TRIBLOGICAL MEASURES LEADS TO AN INCREASE IN SERVICE LIFE OF MACHINERY.

During the use of machines, oscillations and vibrations lead to significantly shorter service lives. The causes of these mechanical vibrations are often imbalance and eigen frequencies in the mechanical structure, external influences (e.g. uneven road surfaces or wind) or tribological wear processes that lead to material fatigue and even fatal failure. In many cases, the causes are not clearly identified, and premature machine failures lead to loss of productivity and unnecessary consumption of spare parts. Only precise knowledge of the underlying dynamic phenomena enables targeted remedial measures for system optimisation and measures to extend machines' service life.

The vibrations that occur are often characterised by very small amplitudes but can be amplified by their periodic occurrence and in the final stage entail catastrophic damage. In order to detect such "fast" and "small" deflections, AC2T research GmbH uses a high-precision 3D Doppler vibrometer, which is able to record vibrations with amplitudes of a few nanometres. This vibrometer is supplemented with a high-speed camera and high-speed thermography in order to visualise the movements and the resulting heat traces. All together this cutting-edge technology is used profitably for the optimisation of dynamic processes in machinery.

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In-depth knowledge of tribological test devices

To investigate tribological processes, test setups (so-called tribometers) are employed. These are used to simulate key factors in a model system and thus highlighting optimisation possibilities, e.g. of the lubricant. As in all mechanical set-ups, vibrations are also present here, which are visualised using the measuring equipment. This enables us to carry out investigations in optimum parameter ranges avoiding unwanted influences of machine dynamics.

Optimisation in paper production

The measurement technology is also used to support the manufacturing industry: The vibrometer usage made it possible to identify chatter marks in paper machines. Chatter marks – as periodic wear marks on the roll surface – lead to an early loss of quality in paper production. Tribological optimisation of the rolls, in particular the development of sustainable coatings, prevents the formation of such chatter marks, which will lead to significantly longer running times in the future.

Impact and effects

With the targeted use of the vibrometer, the high-speed camera and the high-speed thermography together with our expertise in machine dynamics and tribological interactions, we clarify the causes of undesirable vibrations in detail and develop targeted measures to avoid negative impacts, both in our laboratory set-ups and for industry.

Puhwein et al., Calander in the paper industry, IMAC-Conference 2024

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Project partner

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- Swansea University, United Kingdom
- AC2T research GmbH, Austria

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