

## EVOLUTION OF THE THIRD BODY LAYER: DYNAMIC CAUSES AND CONSEQUENCES ON SQUEAL OCCURRENCE

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### KEYWORDS

*Load-bearing area; Third body; Friction induced vibrations; Brake Squeal*

### ABSTRACT

For brake industry, friction is a major problem as environmental and economic issues. Friction induced vibrations and noises contribute to both the noise pollution and the related increased costs for sound insulation. Amongst these vibrations, squeal is the most problematic because of its frequency (more than 1000 Hz) and sound pressure (above 80 dB). Its unstable vibratory nature is well understood. It results from the coupling modes between the parts in contact. These couplings are due to changes in mode frequencies and by the changing circumstances of the contact. However, many factors come into play when there are friction induced vibrations.

Thus, the origin of squeal occurrence remains misunderstood as there are many micro as well as macro scale factors (wear, behavior of the tribological triplet and dynamics of the whole brake system) involved in its mechanism [1,2,3]. This interdisciplinary issue of brake squeal should be resolved by the integration of tribological and dynamic analyses.

The objective of this work is to study the link between the evolution of load-bearing area at the interface and the squeal occurrence. A simplified and original tribological assembly was established. Experiments were performed under low load and low speed with an elementary pad-disc tribosystem composed of a pad mounted on a flexible leaf and rubbing on a disc. Mode couplings that can lead to squeal are well known and involve leaf bending, pad deformation and disc vibration modes.

The test configuration and the use of a glass disc allow observations of the evolution of the pad-disc interface during sliding. The introduction of an artificial third body and the adjustment of the pad-disc clearance generate the load-bearing areas.

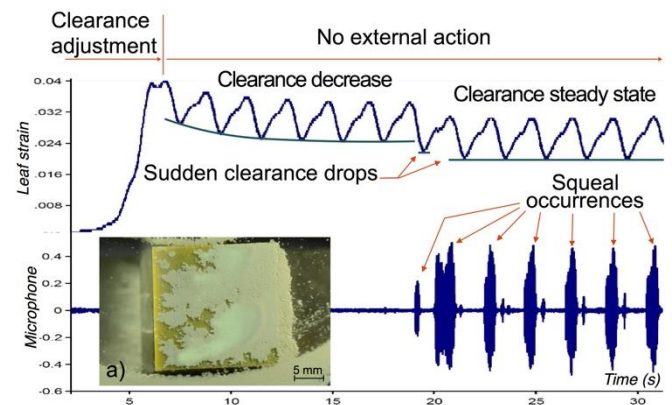


Fig.1 Noise occurrence vs. pad-disc clearance change during experiment. a) third-body layer and load-bearing area observed through the glass disc.

The study shows a wide influence of the third body on the occurrence of squeal, and experiments have good repeatability to obtain noise. The presence of a third body layer may be a condition to produce squeal. Disc runout along with third body also plays a role to obtain the periodic squeal occurrences. Experiments are analyzed in terms of contact location, extend and thickness of the third-body layer according to the opening and closure of the pad-disc clearance and time frequency spectrum of noise emission and related instable mode couplings.

### REFERENCES

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