



## Measurement of Lubricant Film Thickness and Optimisation of Surface Texture in a Gearbox Journal Bearing with Ultrasonic Reflection

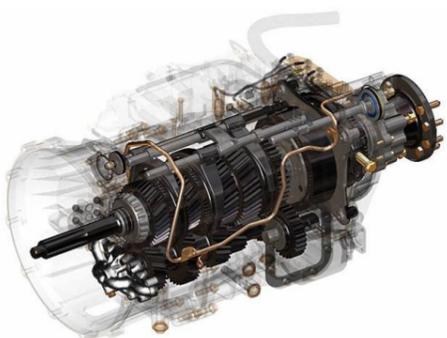
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### MOTIVATION

**Longer operating life** – lubricant film collapse can cause tribological failures in automotive gearbox bearing, however, it is hard to quantify bearing lubrication in situ. This study aims to find out effect of **surface texture** for lubricant film collapse by **ultrasonic reflection** in journal bearing of a **production automotive gearbox**.

### FOR WHOM?

**For all industries** which concern tribological failure on journal bearing, particularly for journal bearing with feed force lubrication system. Yet few studies in measurement of lubricant film thickness and effect of surface texture have been experimentally presented for journal bearing under **practical operational conditions** in automotive gearbox.



A production gearbox for heavy duty truck

### KEY POINTS

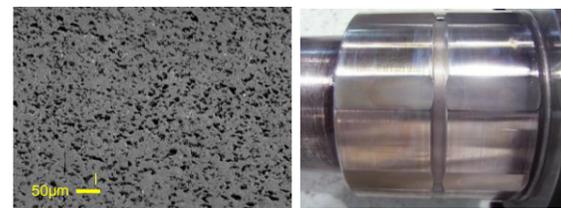
**Film thickness measurement with ultrasonic reflection** - the reflection of the ultrasonic wave at the oil film is used to determine the layer stiffness, and hence oil film thickness, using a simple mathematical relationship. An array of ultrasonic transducers is positioned to determine the lubricant film thickness distribution.

**A production gearbox** – the bearings are exposed to severe conditions in the start-up regime because of the high viscosity of the lubricant and the low speed of the rotation. The tests have been carried out on apparatus that uses the journal bearing and the oil circulation system from a production automotive gearbox.

**Bespoke surface texture** – previous studies showed two effects of bespoke surface textures i.e. **hydrodynamic effect** which gives additional load carrying capacity because of cavitation and **secondary lubrication effect** since the textures work as oil reservoir. Micro and macro surface textures are embedded on by **shot peening** and by **vibration assisted machining**.



Test rig taken from a production gearbox



A micro texture [1]

A macro texture

### BENEFITS

- ❖ **Product reliability** - collapse of lubricant film may cause fatal damage to bearing. Technique to control and maintain lubrication film would be obtained through understanding film formation mechanism in this study.
- ❖ **Alternative evaluation** - determination of an optimum bearing surface texture usually requires expensive endurance tests. This study would give an alternative way of the evaluation to replace the conventional method.
- ❖ **Energy Efficiency** – technique to quantify lubricant film enable to set more optimised design criterion. This would help the journal bearing get more efficient, compact and lighter.

#### Reference

[1] Yoshizaki, M., "Improvement in tooth surface strength of carburized transmission gears by fine particle bombarding process", Proc, The 10th International Conference on Shot Peening, 2008.

