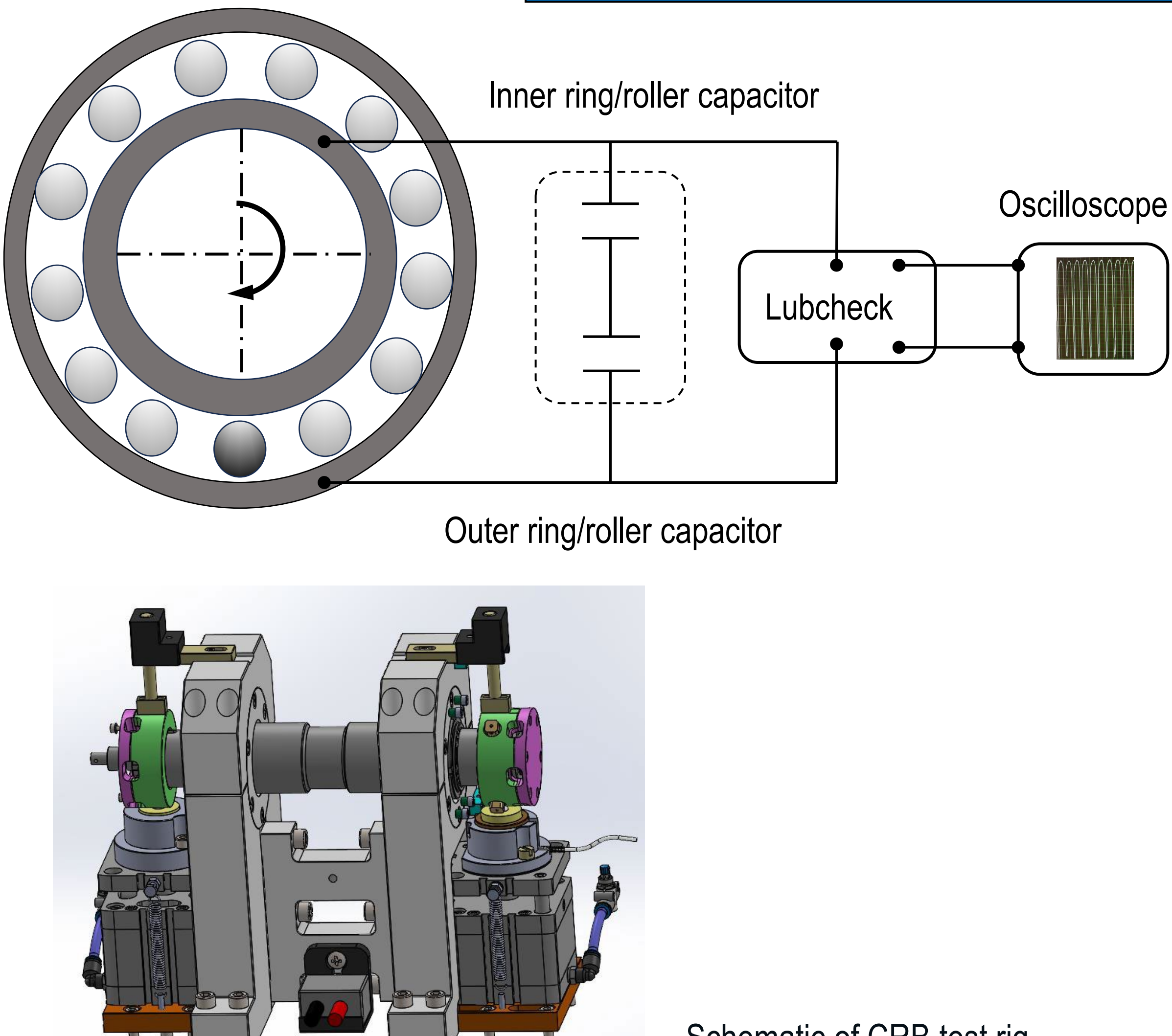


CRB test rig

Film thickness measurement in grease lubricated cylindrical roller bearings

Min Gao*, Jude Osara, Marco van Zoelen, Rihard Pasaribu, Piet Lugt

Working principle and schematic



The schematic diagram illustrates the electrical measurement setup for a CRB test rig. It shows a cross-section of a bearing with an inner ring/roller capacitor and an outer ring/roller capacitor. The inner ring is connected to a circuit that includes a battery, a switch, and an oscilloscope. The outer ring is connected to the other terminal of the capacitor. The physical setup shows a bearing mounted on a shaft, supported by two cylindrical bearings at each end. The shaft is driven by a motor, and the load is applied to the inner ring. The Lubcheck signal is measured and displayed on an oscilloscope.

The CRB test rig is designed to measure the film thickness in grease lubricated cylindrical roller bearings (CRBs) via an electrical capacitance method with *Lubcheck*.

The speed range is 0—7500rpm, and the load range is 0—3500N.

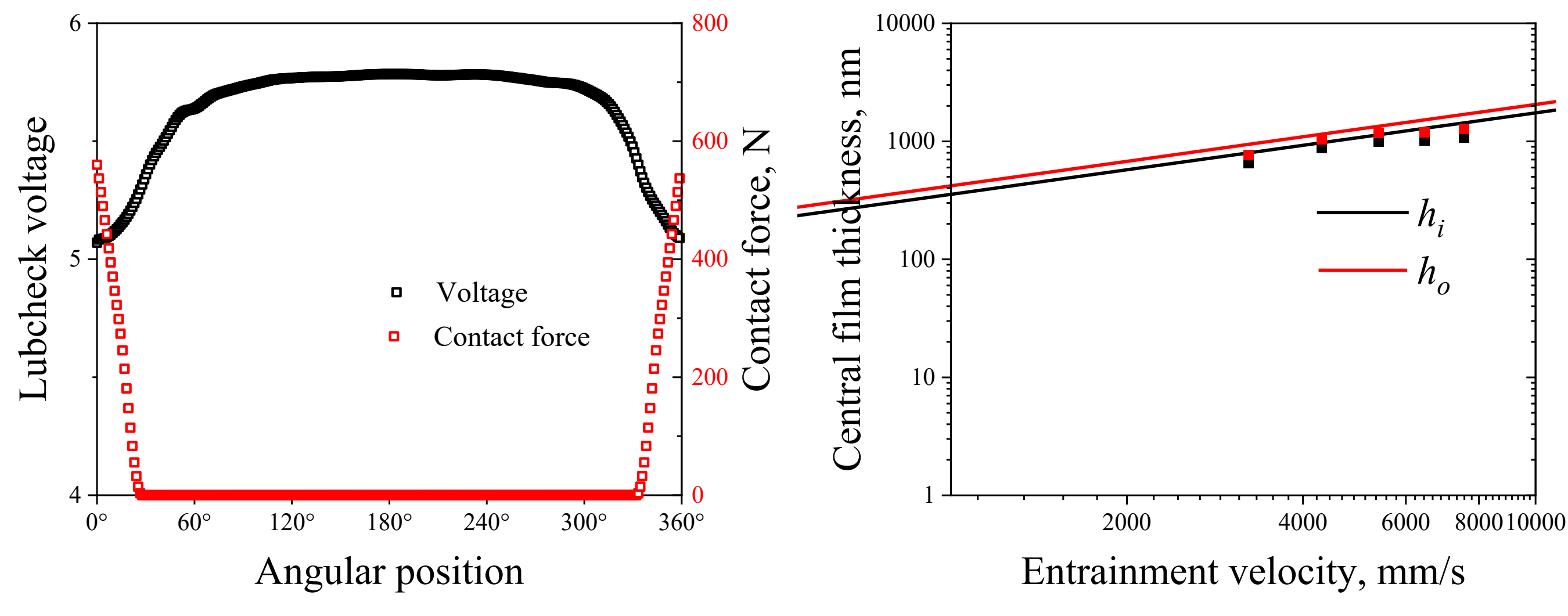
The shaft is supported by two cylindrical bearings at each end to minimize shaft bending which causes misalignment of the roller inside the CRB.

The inner ring of the test bearing is isolated from the rest of the bearing using ceramic rollers.

Bearing temperature is controlled using heated/cooled air flow.

Schematic of CRB test rig

Results and discussion



The first graph shows the Lubcheck voltage (black squares) and contact force (red squares) distribution at different angular positions. The voltage is high (around 5.5V) at 0° and 360° and drops to around 4.5V at 180°. The contact force is high (around 800N) at 0° and 360° and drops to around 400N at 180°.

The second graph shows the comparison between measured and calculated film thickness at the highest loaded point. The measured film thickness (black line) and calculated film thickness (red line) are plotted against entrainment velocity (mm/s). The measured film thickness is slightly higher than the calculated film thickness.

Lubcheck voltage and contact force distribution at different angular position

Comparison between measured and calculated film thickness at highest loaded point

A cylindrical roller bearing can only bear radial loads, which leads to different contact loads on the rollers.

As such, the film thickness along the bearing circumference is different.

To study the film thickness at the roller-ring interface of the test bearing, one of the ceramic rollers is replaced with a steel roller.

Then the *Lubcheck* signal (depicting film thickness) corresponding to the circumferential location of the steel roller helps achieve this goal.

The contact force distribution due to the radial load is symmetric in the bearing.

The film thickness is also symmetric assuming the same entrainment velocity at different angular positions.

UNIVERSITY
OF TWENTE.

Surface Technology
and Tribology

M. Gao
m.gao@utwente.nl