

# Master work

## „Literature research on the fluting in the bearings due to the electrical bearing currents and simulating the fluting process in a multi-physics software like *COMSOL*<sup>®</sup>“

### Background

In electrical machines, electrical current may flow through the bearings. This bearing current may damage the bearing surface and lubricant of the bearing, leading to a bearing failure. The surface of the bearing is exposed to changes. The initially shiny metallic surface of the bearing raceway may show a grey raceway or even fluting patterns. The lubrication may also be degraded. Fluting causes mechanical vibrations in the bearing. Therefore the motor needs to be disassembled and the bearing replaced. It is relatively expensive and reduces the reliability of the drive.

There are factors influencing the bearing current. Rotor connection to the earth via the load provides a path for the common-mode current of the inverter-fed machine through the rotor. Switching in the inverter, type of the cable connections, the filters between the inverter and the motor, the motor configuration and motor earthing may influence the bearing current signals.

The bearing currents may wear out the bearing surface. The bearing surface can be investigated in microscopic scale to identify the bearing current damage on the surface asperities. One asperity exposed to the electrical current is modeled electrically and thermally to estimate the thermal burden on the material. The temperature rise affects the lubrication in the medium. The scanned real surface of the bearing is available using Confocal Microscopy and is analyzed electrically and thermally with *COMSOL*<sup>®</sup> in the Institute.

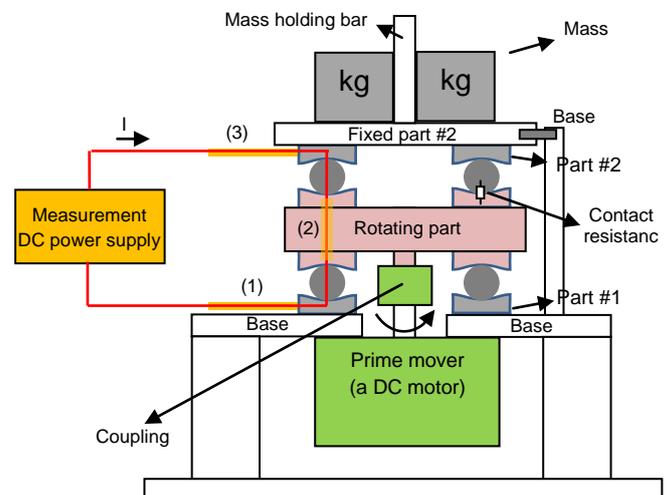


Fig. 1. Axial bearing test setup to measure the contact resistance between the ball and the ring

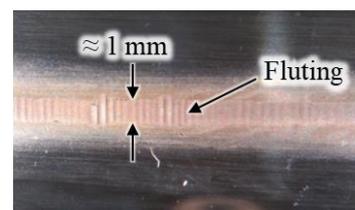


Fig. 2. Bearing surface damage (fluting), Rotor-to-earth bearing current, Apparent current density  $1 \text{ A/mm}^2$ , After 1000 hours operation

### Tasks

- To gain a knowledge in the electric contacts (constriction resistance, a-spots, fritting, arcing).
- Literature research on the fluting in the bearings due to the electrical bearing currents.
- To simulate the fluting process in a multi-physics software like *COMSOL*<sup>®</sup>.

### Advisor

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