TECHNISCHE UNIVERSITÄT DARMSTADT

Institut für Elektrische Energiewandlung

Master work:

Precise calculation of a bearing resistance and capacitance: FEM simulation and Experiment

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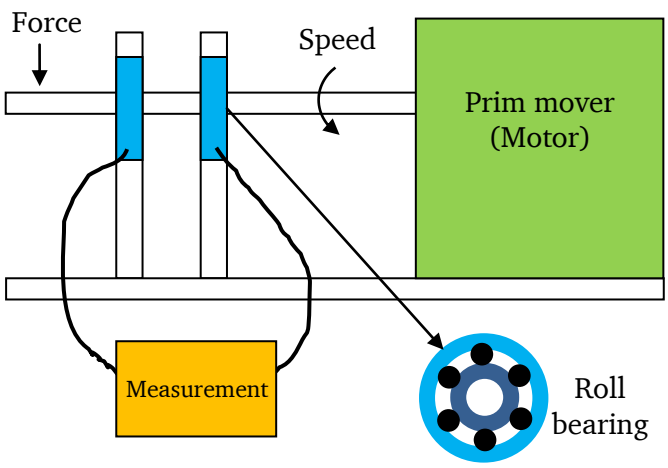
Motivation:

Bearings in the electrical machines could be exposed to electrical currents. The current could damage the bearing metallic surface. The metallic surface between the ball and raceway in a ball bearing called hertzian area is not perfectly flat but has some roughness. These roughness surrounded by lubrication are seen in forms of asperities. These asperities typically have a size of several micrometers. When a voltage is induced between outer and inner ring of a ball bearing, current flows in the most conducting paths exist between the two rings. The larger the conductance, the larger is the current amplitude. In the system of ball bearing the conductivity of the metal is about 10^{18} times bigger than of the lubrication. Therefore the conductivity of the lubrication (typically mineral oil) versus the metal (typically hardened steel) is negligible. It implies that the bottleneck for the current is on the contacting surface, because in the metallic parts the resistance is relatively very low.



Experimental Setup

Tasks:

- To have an overview on the mechanics of the roll bearings.
- To have an overview on the electrical circuit and modeling of the electrical bearing current
- To build up the setup test shown in the figure to measure the resistance of a bearing under different operating conditions:
  - with and without oil
  - under different force and speed
- To simulate the bearing surface in JMAG assigning the realistic material properties and dimensions.

Requirements:

- Being familiar with MATLAB and JMAG softwares