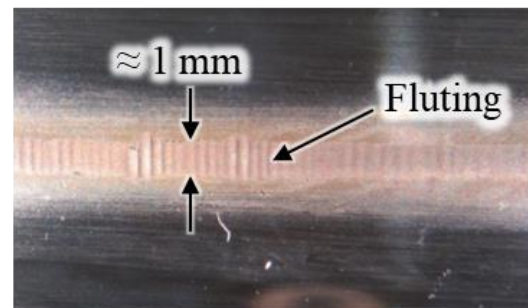# Master work

„Investigation of fluting on six 1.5 kW induction machines under parasitic and injected bearing currents and improving a LabVIEW program for measuring the bearing currents "

Background

In inverter-fed electrical machines, parasitic electrical currents may flow through the bearings. This bearing current may damage the bearing surface e.g. fluting. Fluting causes mechanical vibrations in the bearing. Hence, the motor needs to be disassembled to replace the bearing, which is relatively expensive and reduces the reliability of the drive. Therefore, it is of interest to know, which factors influence the fluting.

In typical application, as an example, a rotor connection to the ground via a mechanical load provides a path for the common-mode current of the inverter-fed machine. This type of bearing currents lead to fluting for enough big apparent bearing current densities i.e. $J_b > 1$ A/mm^2.

Bearing surface damage (fluting), Rotor-to-ground bearing current, Apparent current density 1 A/mm^2, After 1000 hours operation

Tasks

1) In this work the effect of bearing current type on the fluting is investigated on six 1.5 kW induction machines at rotational speed $n = 1500$ /min. For comparison, the assigned bearing current stress for all the cases is the same. The bearing current stress is the integral of the apparent bearing current density over the operating time.

Table I. the conditions for the Investigation of fluting on the six 1.5 kW induction machines under parasitic and injected bearing currents

No.	Driven via	Bearing current type	How induced	Preparation
Motor 1	Grid	DC current	Injected between the rotor and stator via a silver graphite brush	N.A.
Motor 2	Grid	Square AC Current	Like Motor 1	A full-bridge converter via a Micro-controller
Motor 3	Grid	DC pulse with a specified duty cycle e.g. 1%	Like Motor 1	A half-bridge converter via a Micro-controller
Motor 4	Inverter	High rotor-ground bearing current	It is a parasitic effect from the inverter. Rotor is grounded via a cable.	N.A.
Motor 5	Inverter	Low rotor-ground bearing current	Like Motor 4	N.A.
Motor 6	Inverter	EDM bearing current	It is a parasitic effect from the inverter.	N.A.

2) There is a LabVIEW program written for measuring the parasitic bearing currents. At each measurement, 250 current events are captured based on the set trigger and stored. The program has some shortages. The improved version must able to calculate the bearing stress and to store the trigger and the time distance between the measured signals. A search trigger must be implemented to capture the 250 events within the specified time.

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