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THERMOMECANICAL STUDY OF HIGH SPEED ROLLING ELEMENT BEARING: A SIMPLIFIED APROACH

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ABSTRACT

Rolling element bearing (REB) is an essential component in mechanical transmission because it reduces friction between two rotating parts. Two main approaches to evaluate power losses are proposed in literature: i) global engineering models using few input data[1], [2]; ii) local models which are more accurate but need much more information on REB geometry[3].

In this study, an intermediate model which uses a thermal network method is developed. The main idea is to obtain lumped information (temperature of REB's components and power losses) with a minimum of input data (external geometry only). The power losses are not calculated for each contact but by using global power losses models. Influences of geometrical estimation and power loss models used on the REB thermal behavior are studied. The research work is divided into parts:

In the **first part** the simplified thermal network[4] developed by Neurouth et al[5] is adapted for an angular contact ball bearing under oil-jet lubrication in high speed application. This thermal network allows an estimation of REB rings' temperatures. Figure 1 shows the power losses calculated in the thermal network. It underlines that Harris' model underestimates the power losses. Nevertheless, Harris' model combined with drag loss estimation provides accurate results. It can be noted that these values are calculated at the ring temperature estimated through the thermal network.

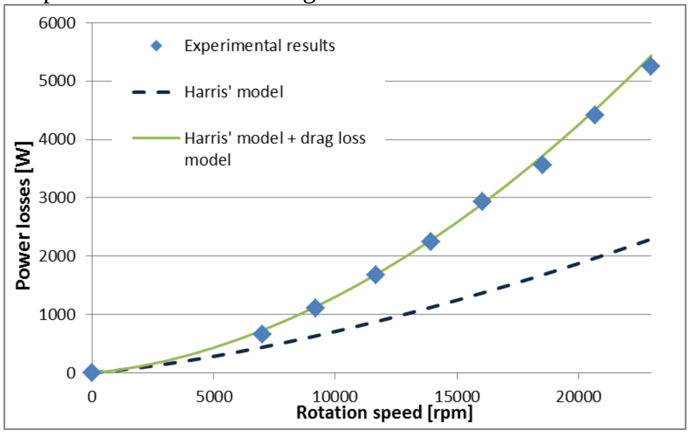

Figure 1: comparison between power losses models and experimental

In the second part, the thermal network developed in the first part is used with a limited input data. It means that the input parameters provide only from REB manufacturers' catalogues. Therefore the REB's internal geometry (ball diameter, Raceway groove curvature etc.) have to be estimated.

Internal geometry estimation leads to a slightly modification of temperatures calculated (Figure 2) and power losses.

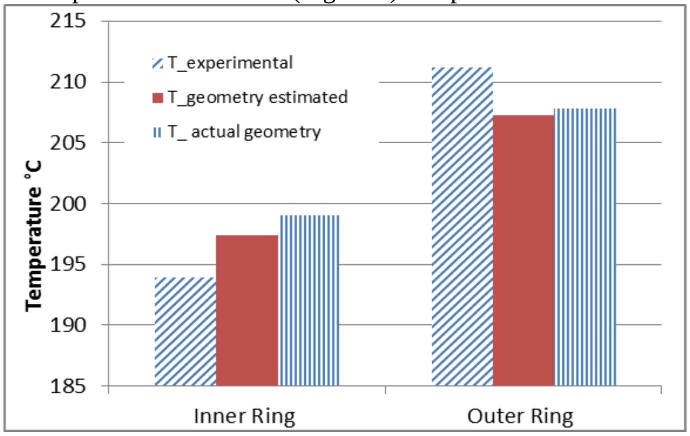

Figure 2: evolution of temperature depends on the geometrical estimation

To conclude, this new approach estimates the REB's thermomechanical behavior with a limited number of input data and by using global power losses models.

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