INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON « LUBRICATED INTERFACES FOR THE FUTURE » SKF

Call for Candidature for a Research Project

Energy Loss modeling in high speed rolling element bearings

Context

To reduce energy consumption in mechanical systems such as flying machines (helicopters, planes), friction and heat dissipation between the rotating parts should be controlled.

In the context of high-speed rolling element bearings, the cage (silver coated steel or carbon reinforced PEEK) is a very important element as a cage failure leads to the ruin of the bearing. Simulations at the bearing scale show that most of the heat is due to the contact between the cage and the ring (in the case of inner or outer ring guided cage).

Surprisingly the heat-generated by this cage-ring contact also very depends on the nature of the rolling element (i.e.: steel or ceramic). This contact (purely sliding contact, with conform surfaces) is yet poorly studied in the literature and the design of cages in rolling bearings is not optimized to this respect.

Steps of the project

The aim of this study is to understand the role of the cage-ring contact on friction and heat generation in a rolling bearing. A numerical modeling approach is proposed.

<u>Step 1: At the rolling element bearing scale.</u>
The first step of this project is to estimate the cage deformation at the rolling bearing scale, with the computational code BEAST provided by SKF (A training period will be necessary to get familiarized with BEAST). Both materials (Polymer VS Steel) will be considered for the cage deformation. At this step, friction between the different parts of the bearing should be estimated.

<u>Step 2: At the elementary contact scale.</u>
The calculated cage geometry computed in step 1 will be an input for numerical modeling at the elementary cage-ring contact scale. At this scale, the mechanisms leading to heat dissipation will be explored, depending on the contact geometry.
Centrifugal force field may have to be included in the model to represent specific power gearbox and helicopter transmission applications, as well as the effect of oil supply holes in the vicinity of the contact.

<u>Step 3: final rolling bearing scale.</u>
The last step consists in correcting the input friction coefficient in BEAST thanks to the elementary contact scale study (step 2) to predict both friction and heat generation at the rolling bearing scale. Key phenomena to be integrated in a "bearing scale" simulation will be identified.

Numerical results will finally be compared to existing experimental measurements of temperature and torque performed on an instrumented rolling element bearing at various rotational speeds.

Profile of application

The selected applicant, a graduated engineer, ideally owns a PhD in tribology (lubrication) and should have a strong background in numerical modeling.
He/She will benefit from a 1 or 2 year(s) research position, supported by the INSA Lyon – SKF Research Chair "Lubricated interfaces for the Futur". Work will mainly take place at INSA Lyon, LaMCoS (http://lamcos.insa-lyon.fr), but training periods may take place at SKF.
The selected applicant should show an interest in research. He/She has to work independently and with rigor. A decent English level is required to communicate both throughout the SKF group in Europ and with the scientific community.

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