

A Review Report on PhD Dissertation entitled

Effect of Surface Texturing on Friction and Film Thickness under Starved Lubrication Conditions

by Mr. Ing. Fadi Ali

Improvement of lubrication characteristics due to surface texturing is one of most attractive and update topics in the field of tribology. Based on a wide range of literature survey the author judged that the effect of micro-textures on tribo-characteristics in starved and extreme EHL contacts should be revealed by detail experiments.

Firstly, the author finds using brilliant methods that the degree of starvation in EHL contacts can be estimated by measuring the relative coefficient of friction. Furthermore, the author proposes, through experiments using artificially-induced replenishment device, a simple method to prevent the occurrence of oil starvation in radial and thrust rolling bearings. The author also points out that the tribological performance in sliding point contact surfaces under oil starvation can be improved by introducing shallow micro-dents on the surface of ball, and such a beneficial effect of micro-textures is lost under fully flooded conditions. The study on the behavior of transverse shallow micro-grooves in rolling-sliding EHL contacts is the highlight of this thesis. The author reveals through reciprocating experiments that the limited transverse groove protects the side-leakage and produces thick local film and brings about the reduction of friction. The results are proved by the numerical simulation.

These results obtained by the author are very important and will contribute very much to the improvement of tribo-characteristics in machine elements with non-conformal contacts.

The linguistic level is high enough. It is to be regretted that although the thesis consists of the main part and the appendix, the main part is simplification of the appendix, i.e. published papers or appended papers, except for Chapter 2. However, such a construction of the PhD thesis may be a way in Brno University of Technology. The reviewer therefore would like to judge this thesis including the appended papers. That is, the aim of the author has been sufficiently established.

In summary, Mr. Ing. Fadi Ali should be awarded the PhD academic degree.

Questions:

1. From the last sentence of page 51 to page 52, and Friction dependence on starvation in EHL contacts of Conclusions: Such descriptions may lead readers to confusion. Because the rheological property of oil is, for example, controlled by Deborah number $D = (\eta/G)/(L/u_e)$, where η is the viscosity, G is the shear modulus of elasticity, L is the contact width along the rolling direction, and u_e is the entrainment velocity. When $D < 1$, the lubricant behaves as a viscous fluid. In general, $D > 1$ in the region of EHL. That is, when $D > 1$, the rheological properties of lubricants do not depend on the slide-roll ratio. As SRR increases, the oil viscosity decreases due to the increase in the oil film temperature and the shear thinning, and consequently the value of D may decrease less than 1. Could the author give some comments on the oil film behaviour?
2. Edges of artificially produced dents and grooves may produce high pressures. Such high pressures may produce surface damages. Could the author give some comments on this matter?

On shortened version of PhD Thesis

1. 6.1 and 6.2 of the PhD dissertation should be described.
2. The sizes of artificially produced dent and groove are connected with the Hertzian diameter. Hence, the Hertzian diameter and the maximum Hertzian pressure should be given for every load.
3. Page 15, line 10: (N2400)
4. Page 15, line 10: Fig.6.10 and Fig.6.1 ?

Motohiro Kaneta (Professor)

Dne 18.6.2015 v Brne