

Lubrication of a truncated circular EHL contact

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KEYWORDS

EHL; Solid lubrication; Experiments in tribology, Modelling in tribology

ABSTRACT

Film thickness predictions in an elastohydrodynamic lubricated (EHL) contact are mainly based on the hypothesis of a semi-infinite equivalent solid to calculate elastic deformations. However, this assumption is not valid in a number of applications where the contact is close to an edge as in the case in roller-end flange contact in roller bearings (see Figure 1). Manufacturing tolerances on the roller and the flange, together with the specific operating conditions may lead the displacement of the contact zone on the flange. In some cases, the contact may operate very close to the edge or even on the edge of the flange. In the former case, the classical circular (or elliptical) contact will be truncated.

The literature review on free edge effects is really poor. Studies exist on the observation of free edge effects for circular dry contacts [2] and for EHL line contacts [3]. However, free edge effects on circular (truncated) lubricated contact have never been studied.

That is why a dual numerical-experimental approach is performed. The focus will be done on the impact of the distance between a free edge on film thickness of a lubricated circular contact. We focus here on contacts close or into the edge of the solid. To represent more realistic geometries, the analyse is performed in the case of a chamfer or a fillet at the edge of the solid.

The truncated lubricated circular contact is modelled by a finite element method. To validate the simulations, tests are performed on a dedicated test rig. Figure 2 presents a comparison of the maximal and minimal film thickness measured with both numerical and experimental approach. The results follow the same evolution in both numerical and experimental cases. A decrease of the film thickness when the contact approach the edge is observed, especially on minimum film thickness while reaches critical values.

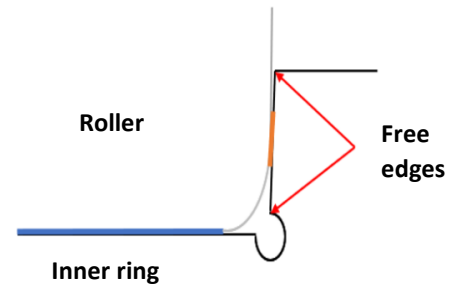


Figure 1- Roller-flange contact

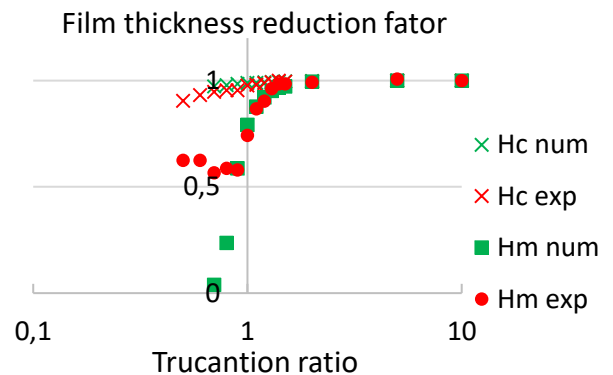


Figure 2 – Comparison of experimental and numerical film thickness results.

Truncation ratio smaller than 1 means that the edge enters into the Hertzian zone.

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