

THE INFLUENCE OF MULTIPLE OIL TRACKS ON STARVED ELASTOHYDRODYNAMIC LUBRICATION

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KEYWORDS

EHL; Experiments in tribology; Fluid lubrication; Starved lubrication

ABSTRACT

EHL oil film thickness and rolling viscous resistance can be expressed as a function of the inlet meniscus length [1]. Nogi et al. suggested a formula for the inlet meniscus length derived from the results of a numerical analysis. [2]. Their method considered re-flow from the sidebands, thus oil distribution including the inlet meniscus length around the contact area could be calculated. Although Nogi et al. presented the results of a single point contact analysis, rolling bearings had many contact points between the rolling elements and the inner/outer rings. Furthermore, when a contact angle is present, the center positions of the Hertz tracks on a ball at each side of the inner and outer rings may shift [3]. In this study, the shapes of meniscus under two contact areas on a disc were investigated using balls on disc type tribometer where the positions of balls could be adjusted. Experimental setup consisted of two steel balls, one sapphire disc and observation system. The shape of the meniscus was calculated by Nogi's analytical model. In this paper, the results for the case where two contacts exist on the same circumference and for the case where the center of two Hertz tracks were offset by the contact radius are shown.

The dashed line in Fig. 1 shows the sideband shape calculated by Nogi's method. The solid line in Fig. 1 shows the sideband shape considering that the sidebands are shifted by the contact radius. Each sideband shape was used as inlet boundary condition for the numerical calculation. Figure 2 shows the observed and analyzed shapes of meniscuses around the contact areas. The left image shows the case where two contacts exist on the same circumference, while the right image shows the case where the center of two Hertz tracks were offset. White line in Fig. 2 indicated the analyzed results. It was found that the inlet meniscus length was longer when the center of two Hertz tracks were offset.

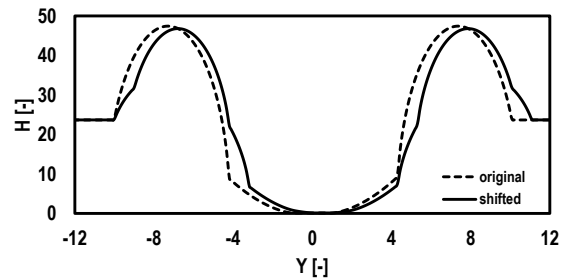


Fig. 1 The sidebands of original shape and shifted shape.

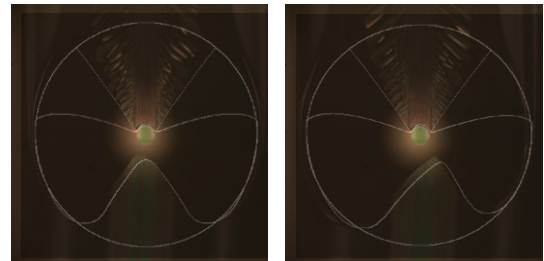


Fig. 2 The observed and analyzed meniscus shapes around the contact area. The left image shows the case where two contacts exist on the same circumference. The right image shows the case where the center of two Hertz tracks were offset by the contact radius are shown.

REFERENCES

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