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FAST TRACTION PREDICTION IN ROLLING/SLIDING EHL CONTACTS

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KEYWORDS

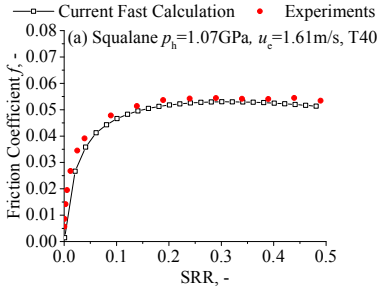
EHL; Fluid lubrication; Rheology; Traction

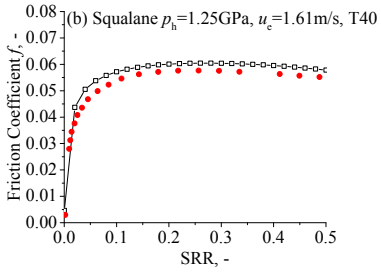
ABSTRACT

There are several non-Newtonian fluid models in EHL area describing the film behavior under high pressure, high shear, and possible high temperature conditions. However, traction prediction in EHL lubricated rolling/sliding contacts is still challenging. Solving EHL problems with measured fluid rheological properties and appropriate non-Newtonian fluid models is thus of great importance for the quantitative understanding of EHL traction behavior.

Numerical methods, including FDM (e.g. multigrid [1]) and FEM (e.g. with Comsol Multiphysics [2]), could solve EHL problems accurately. However, full numerical methods are usually time consuming for practical applications and may fail to converge under high pressure and some extreme conditions. In this work, a simplified fast traction prediction approach was built for highly loaded point/elliptical EHL contacts based on measured fluid properties (free-volume viscosity model and Carreau shear thinning model). Thermal effects were also included by solving both the oil and solid energy equations considering temperature and pressure influences on the thermal properties of the lubricant.

The proposed fast traction approach is validated by the experimental results of Squalane (a well-characterized reference liquid, see Ref.[3]). The predicted traction curves show agreements and reasonable accuracy with the experimental results over a wide range of running conditions.





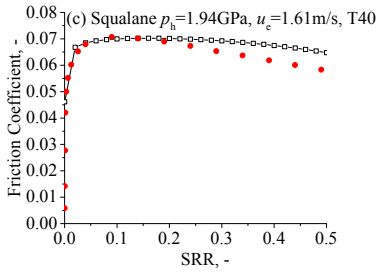


Fig.1 Comparison of the traction curves between calculations and measurements for three Hertzian contact pressures (Squalane, $u_e = 1.61$ m/s, $T = 40$°C)

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