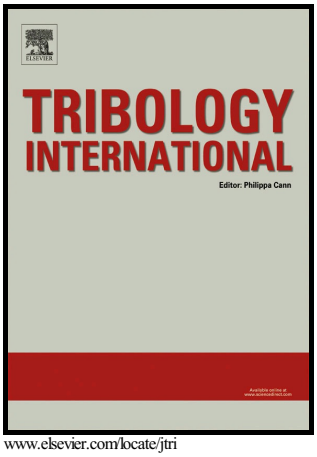


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# The Effect of Surface Grooves on Transition to Mixed Lubrication

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**ABSTRACT**

The purpose of this study is to describe the influence of artificially produced surface grooves longer than a diameter of the contact area on the transition from a full EHL regime to mixed lubrication in the point contact using optical interferometry. This article focuses on the influences of grooves orientation, length in the contact area, elastic modulus of contact surfaces, and different types of lubricants defined by pressure-viscosity coefficient. An empirical prediction model of groove influence on film thickness was established based on experimental data. The groove influence was incorporated into lubrication parameter. This modified definition was compared with the classic one. It showed that avoiding the groove influence leads to a significant underestimation.

**KEY WORDS**

elastohydrodynamic lubrication, mixed lubrication, lubrication parameter, surface roughness, groove

**6. NOMENGLATURE**

| | |
|---|---|
| $A$ | parameter characterizing the effect of pressure-viscosity coefficient, $A = 4.57\alpha^{-0.499}$ (-) |
| $B$ | parameter characterizing the effect of elastic properties, $B = 0.0027E' + 0.0238$ (-) |
| $D$ | groove depth (μm) |
| $D_1$, $D_2$ | depth of groove measured in the contact at leading and trailing edge (μm) |
| $D_{def}$ | deformed groove depth, $D_{def} = (D_1+D_2)/2$ (μm) |
| $E$ | modulus of elasticity (GPa) |
| $E'$ | reduced elastic modulus, $2/[(1-\mu_B^2)/E_B+(1-\mu_D^2)/E_D]$ (GPa) |
| $E_D$, $E_B$ | modulus of elasticity of disc and ball (GPa) |
| $h_0$ | central film thickness evaluated by Hamrock-Dowsons formula (nm) |
| $h_{GImin}$ | minimum film thickness influenced by the groove (nm) |
| $h_{inf}$ | film thickens influenced by groove, $h_{inf} = h_0 \cdot R_{GI}$ (nm) |
| $h_{smooth}$ | film thickness in the central area for smooth surface (nm) |