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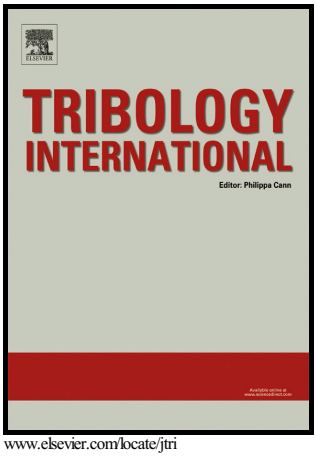

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Normal and tangential oil film stiffness of modified spur gear with non-Newtonian elastohydrodynamic lubrication

Changjiang Zhou[a,*], **Zeliang Xiao**[a], **Siyu Chen**[b], **Xu Han**[a]

[a] *State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, Hunan University, Changsha, 410082, PR China*

[b] *State Key Laboratory of High Performance Complex Manufacturing, Central South University, Changsha, 410083, PR China*

*Corresponding author. E-mail address: yangtsezhou@hnu.edu.cn

Abstract:

A new normal stiffness model of the oil film is established by the viscous-elastic fluid between a spur gear drive being equivalent to a massless spring element, and the tangential stiffness model is proposed according to the hypothesis of equal shear stress on laminar element surfaces. Effects of operating parameters (contact force and rotation speed) and geometry parameters (module, tooth number，pressure angle and modification) on the oil film stiffness from the root to the tip are investigated. The results show that the amplitude and fluctuation of the stiffness are closely related to the shear rate, effective viscosity and curvature radii. It is indicated that the rational parameter match is valid in mesh impact reduction and stationarity enhancement.

Keywords:

normal and tangential stiffness; oil film; non-Newtonian EHL; modified spur gear.

Nomenclature

b	half-width of Hertzian contact (m)
B	face width (m)
h	oil film thickness (m)
h_0	rigid central film thickness (m)
p	oil film pressure (Pa)
n	number of nodes along rolling direction
R	equivalent curvature radius (m)
u_1	velocity of driving pinion 1 (m/s)
u_2	velocity of driven gear 2 (m/s)
u_e	entrainment velocity (m/s)
$\overline{U}$	dimensionless velocity parameter

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