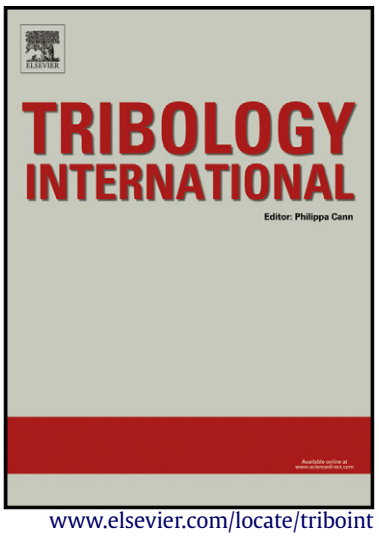

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Starved lubrication of a spur gear pair

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Abstract: A thermal starved elastohydrodynamic lubrication (EHL) model is proposed to study effect of starved lubrication on the contact performance of a spur gear pair. Minimum film thickness, maximum temperature, and the coefficient of friction at interfaces are predicted from the gear tip to the root. Three characteristic meshing locations along the line of action are chosen to represent different slide-to-roll ratios the gear pair endures. The inlet oil supply is utilized to represent the degree of the starvation. Effect of the load and speed are studied under the starved lubrication conditions, which is compared to the results of the fully flooded cases.

Keywords: Starved lubrication; spur gears; film thickness, friction

Abbreviations:

EHL: elastohydrodynamic lubrication

HPSTC: the highest point of single tooth contact along the line of action

LOA: the line of action

LPSTC: the lowest point of single tooth contact along the line of action

1 INTRODUCTION

Lubrication plays an important role at the gear tooth interface, and the breaking of the lubrication film would lead to the gear tooth surface failure issues [1]. Since the requirement of the power density of the gear drives is getting higher in the current gear industry, the tooth interface lubrication should be guaranteed to avoid any potential surface roughness collide and form a complete full film within the contact region at tooth interfaces. However, during the operation of gear drives, the starved lubrication situations may occur due to the leakage of the lubricant. The loss-of-lubrication performances of the gears are quite vital for the reliability and safety of the gear-driven devices such as helicopters [2].

Gear lubrication problems have been studied since the development of the first numerical EHL model [3]. Further Larsson considered the transient squeeze effect in the spur gear lubrication model [4] and Wang et al. took the thermal effect into account [5]. Recently the influence of the non-Newtonian fluids and the tooth surface