

**FILM THICKNESS EQUATION FOR ELASTOHYDRODYNAMIC LUBRICATION OF  
ISOTHERMAL SMOOTH LINE CONTACTS UNDER HEAVY LOADS FOR  
NEWTONIAN FLUIDS**

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**ABSTRACT**

A new equation is proposed for predicting the film thickness at the Hertzian contact center in elastohydrodynamic lubrication (EHL) of isothermal smooth line contacts under heavy loads when the fluid is Newtonian. Results show that this film thickness equation has a satisfactory prediction precision for the dimensionless load to film thickness ratio  $W/H_c$  ranging from 0.01 to 200, especially when the load is heavy. In the heavy load condition, it has a much higher prediction precision than the Grubin formula and the Dowson-Higginson formula, both of which much overestimates the central EHL film thickness even in the magnitude of 1 to 2 orders. The maximum prediction error of the present film thickness equation is examined to be about 40% in the investigated wide range of the parameter value  $W/H_c$ . It gives that the present film thickness equation reaches application value for heavy loads, which is unable to be accommodated by the previous EHL film thickness formula.

**KEYWORDS:** Elastohydrodynamic Lubrication; Film Thickness; Line Contacts; Heavy Loads; Newtonian Fluids.