The equation of state for the thermal-piezo-visous lubricant

D. Huang[1*], X. Yan[2], R. Larsson[1], A. Almqvist[1]

[1]Division of Machine Elements, Luleå University of Technology, Luleå, Sweden
[2]Saint-Gobain Performance Plastics, 386 Metacom Avenue, Bristol, RI, USA

The common approaches to investigate the lubricated film between two contacting surfaces are the Elastohydrodynamic Lubrication (EHL) and the Thermal Elastohydrodynamic Lubrication (TEHL) theories. Both EHL and TEHL involve solving the conservation laws for a fluid whose viscosity depends on its pressure and/or temperature. Experimental researches on the piezo-viscous behavior of the lubricants have resulted in multiple empirical equations. On the other hand, the temperature dependency of viscosity for a liquid lubricant can be acquired by the Andrade equation. In the current research, we show that the Barus equation for piezo-viscous fluid can be derived from the Andrade equation and vice versa, if the lubricant satisfies the modified stiffened-gas equation of state (EOS). Furthermore, we show that the Dowson-Higginson pressure-density relation can also be derived from the stiffened-gas EOS under isothermal conditions. a

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*Corresponding author: de.huang@ltu.se