STROKE-AVERAGED LOAD CARRYING CAPACITY AND FRICTION OF A ROTATED PARABOLIC-FLAT PISTON RING

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ABSTRACT
Over the last two decades, the fuel consumption reduction of combustion engines has become an important environmental issue. Engine friction has to be reduced and the piston ring - cylinder liner contact is a major source of friction [1]. The current work analyses the friction and load carrying capacity of a rotated parabolic - flat piston ring. This friction and load carrying capacity are averaged over the operating conditions occurring over the entire stroke. The resulting friction and load carrying capacity are given as functions of twist angle, ratio of flat width and total width and the total width.

RESULTS
The current work is an extension of [2] introducing an exact rotation of the piston ring. The Couette friction W_C is given by the following expression:

$$W_C = \frac{SRR}{12}\left(\left(\alpha \ln\left(\frac{\left(M^2+1\right)J^2}{2Q\alpha^2}\right)+\frac{2\alpha Q^2}{J}\left(\arctan\left(\frac{\alpha^2}{J}\right)\right.\right.\right.$$
$$\left.\left.\left.-\arctan(M)\right)\frac{\ln(R)}{\alpha}\right)\right)$$

where α is the angle; *SRR* is the side-roll ratio and *M*, *Q*, *J* and *R* are expressions defined in [2] that allow a concise description

Similar expressions are obtained for the Poiseuille friction and the load carrying capacity. All these expressions are analytical and can be calculated very rapidly. As such, one can calculate the values for each crank angle and obtain a stroke-averaged result.

The figure below shows how the stroke-averaged coefficient of friction depends on the three parameters.

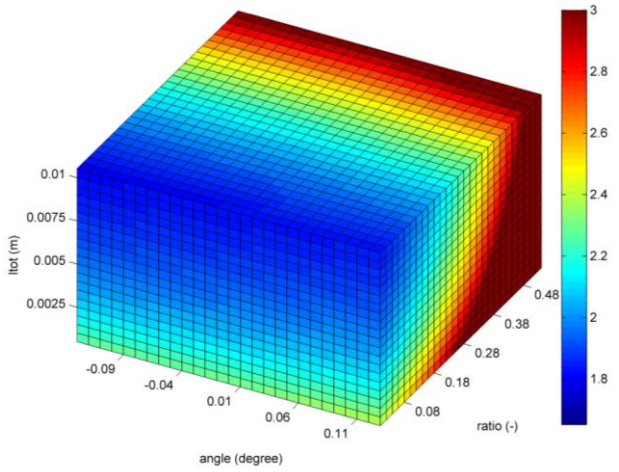

Fig.1 Stroke-averaged coefficient of friction

REFERENCES
[1] Jeng, Y.-R., "Theoretical Analysis of Piston-Ring Lubrication Part I - Fully Flooded Lubrication," STLE Tribology Transactions, 1992, 35, 696-706.
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