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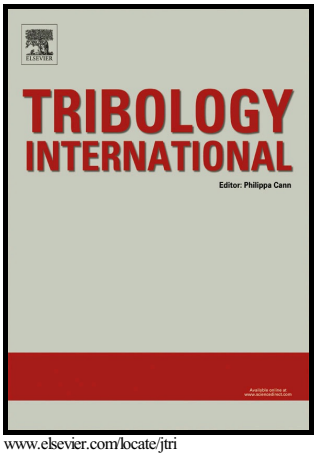

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ABSTRACT

A number of inevitable factors distort the liner circular bore, resulting in asymmetry of piston ring–liner (PRL) contact in the circumferential direction. The limited conformability of a piston ring causes a gap in PRL contact, which has significant effect on the tribological performance of the interface. Recent developments in ring surface modification through laser surface texturing have shown promising results in improving tribological characteristics. Analyses of a textured piston ring are often based on ideal circular liner bore, which is contrary to actual engine operating conditions. In this study, asymmetric PRL contact of a textured piston ring in a distorted bore is considered, and the 2D Reynolds equation is solved with a mass-conserving cavitation algorithm. In addition, asperity interaction in mixed lubrication, axial ring dynamics, variable ring conformability, and realistic engine oil rheology are considered in the investigation of tribological performance of a non-axisymmetric textured PRL interface. Results show that optimized surface textures improve the tribological performance of a PRL interface, whereas textures with large lateral aspect ratios have a detrimental effect. The surface texturing-induced increase in oil transport to the combustion chamber remains minimal.