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ACCEPTED MANUSCRIPT

Effect of Waviness and Roughness on Cylinder Liner Friction

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KEYWORDS

Topography; Waviness; Piston Rings; Friction

ABSTRACT

The tribological performance of piston ring-cylinder bore was investigated through deterministic mixed-lubrication modeling. Bore topographies measured from regular honed Grey Cast Iron (GCI) to “Mirror-Like” coated bore surfaces were used in the investigation. In contrast with typical honed GCI bores composed of relatively well-distributed peaks and valleys, coated bores are composed of a much smoother plateau and localized deep pores. Simulation results indicated that coated bore surfaces generate significantly higher hydrodynamic pressure and lower asperity contacts when compared with regular GCI topographies. The influence of roughness filtering and the associated cut-offs values were also considered in the analysis, showing that the choice of cut-off affects both the predicted hydrodynamic and asperity contact pressures. Furthermore, the simulation results also revealed that most of the fluid pressure was generated by the honing grooves rather than by the localized pores present on coated bore surfaces.

1. Introduction

Optimization of surface topography is one of the main paths to improve tribological performance of internal combustion engines (ICEs). Although smoother surfaces are usually associated with low friction and wear, the presence of a controlled amount of roughness on the contact surfaces is in general necessary to prevent adhesion, work as lubricant micro-reservoirs and debris trap, as well as allow contact shape adjustments. For combustion engines, special attention has been given to the finish of cylinder bores. Being the piston system responsible for approximately 50% of the total engine friction losses [1, 2], improvements on the cylinder bore

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