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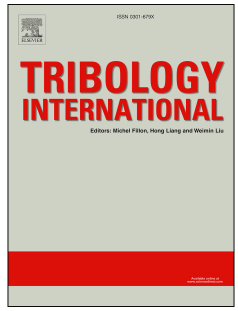

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Effect of Cylinder Deactivation on tribological performance of piston compression ring and connecting rod bearing

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Abstract

Thermo-mixed-hydrodynamics of compression rings and big-end bearings are presented. Frictional losses under normal engine operating conditions for a gasoline engine and those with cylinder deactivation (CDA) are predicted. With CDA, the combustion chamber pressure increases in the active cylinders, whilst some residual pressure remains in the deactivated ones. For the former, the increased in-cylinder temperatures reduce viscous friction, whilst reducing the load carrying capacity, promoting increased boundary interactions. In deactivated cylinders, lower contact temperatures yield increased viscous friction. Overall, a 5% improvement in expended fuel is expected with the application of CDA. However, 10% of these gains are expended due to increased friction. The study demonstrates the need to consider total system effects when introducing new technologies such as CDA.

Keywords: Cylinder Deactivation; Piston Compression Ring; Big-end bearing; Friction; Power loss

1. Introduction

Recent years have witnessed the emergence of new technologies for improved fuel efficiency of internal combustion engines. These include, but are not confined to, variable valve actuation (VVA), cylinder deactivation (CDA) and stop-start in congested traffic. CDA is one of the most widely adopted of these energy saving technologies. It varies the number of active cylinders to match the required engine capacity for a desired output power. Therefore, it is most suited to congested traffic or those instances where full engine power is not required. For example, in steady state highway driving when most of the parasitic losses can be attributed to pumping typically only 30-40% of the peak engine power would suffice.