TRIBOLOGICAL EFFECTS OF THE COMBUSTION CHAMBER PRESSURE ALONG AN EXTENDED ELROD-ADAMS MODEL

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Piston rings; combustion chamber pressure; Elrod-Adams model

ABSTRACT

The Piston Ring/Cylinder Liner (PRCL) is a tribological mechanism that have received great deal of attention during the last decades. The source of this attention becomes from the important amount of energy losses due to friction in the PRCL [1]. During the compression stroke, the combustion chamber pressure (CCP) achieves values as high as 100atm. The compression ring is in direct contact with the combustion chamber gas through the gap present between the piston and the cylinder. Thus, when simulating the PRCL including the CCP (which depends on time), the value of the CCP must be imposed as a Dirichlet condition for the pressure on the hydrodynamical model considered.

As mass-conservation is essential when considering the texturization of lubricated mechanisms [2], in this work we extend the Elrod-Adams cavitation model (which is already an extension of the Reynolds Equation) to accommodate non-homogeneous boundary conditions. This is, in the side of the ring in touch with the combustion gas, the boundary condition for pressure is the CCP value, while on the other side we impose 1 atm.

In this work, we compare the friction losses predicted by the proposed extension of the Elrod-Adams model, with those friction losses predicted by a non-mass conservative model, which represents the state-of-the-art when including the CCP as a boundary condition [3].

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