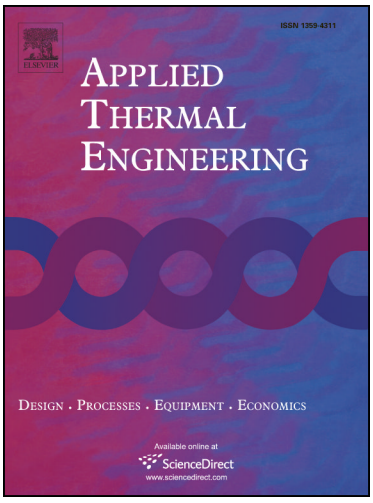

A study and comparison of frictional losses in free-piston engine and crankshaft engines

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A study and comparison of frictional losses in free-piston engine and crankshaft engines

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Abstract

Friction work in free-piston engines is expected to be lower than in crankshaft engines due to the elimination of the crank mechanism. In this paper, friction mechanisms were reviewed and compared between a free-piston and crankshaft engine of similar size. The main friction mechanisms were identified to be the piston assembly including piston rings and piston skirt, valve train system, the crank and bearing system for the CSE, and the linear electric generator for the FPE. The frictional loss of each friction mechanism was estimated and discussed. A Stribeck diagram was used to simulate the piston ring friction during hydrodynamic lubrication, mixed lubrication, and boundary condition. It is found that the FPE doesn't show advantage on piston ring friction force over the CSE, and the frictional loss from the piston ring is even higher. While the elimination of the crankshaft system reduces the frictional loss of the FPE, and the total friction loss of the FPE is nearly half of the CSE.

Keywords: Free-piston engine; piston assembly friction; friction force; skirt friction.

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