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Gear system lubrication with OpenFOAM

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Abstract

A modeling technique using OpenFOAM is presented for the analysis of load independent power losses of gear system caused by oil churning and windage.

In the automotive field the reduction of transmission power loss has gained a significant importance related to fuel economy and CO_2 emission reduction, in this paper the effect of oil churning and windage is addressed because they are responsible for a large part of the total loss.

Free surface flow analysis of oil splash into transmission gear system is still a challenging task with standard experimental methodologies, the availability of free source high performance CFD solvers like OpenFOAM has provided a new tool for the virtual simulation of such complex phenomena providing a complete in-depth analysis of the flow field inside the gear housing.

In our application we use interFoam capabilities to predict the free surface of the lubricating oil into the gearbox; we monitor the torque loss due to oil splash and by studying the air aerodynamics into the gearbox cavity we predict the amount of oil particles that are spread around.

By optimally placing adequate baffles it is possible to drive the oil spray on the bearings thus providing correct lubrication with the additional benefit of reducing the oil quantity.

Key words: interFoam, churning, windage