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Composition du Jury

Civilité	Nom	Prénom	Grade / Qualité	Rôle
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Résumé

To fulfil customer demands, but also government regulations, the truck industry must decrease the fuel consumption and emissions of its vehicles. A key development is to improve the efficiency of the powertrain, which includes the axle. Until recently, optimisation of axle design has mainly concerned durability and noise aspects.
The aim of this study is then to characterise the efficiency of truck axles. As for most of the mechanical transmissions, power dissipation in axles is due to gear mesh, rolling element bearings, seals and oil churning. Formulae already exist to estimate these power losses at a global level, but they are not always adapted to axles. Indeed, the main component of axles is a spiral bevel or a hypoid gear set. The influence of these special gears on efficiency is investigated here: their shape drives oil churning losses, while their tooth geometry and their kinematics impact friction at gear mesh. Therefore, the meshing friction of the gear set is also evaluated thanks to a local approach. The influence of some gear parameters is studied.
However, power losses are influenced by temperature through oil viscosity. As previous experiments underline non-negligible temperature difference between components, it is necessary to consider local temperatures instead of a global oil temperature. Efficiency but also durability can be impacted by local hot spots. The thermal network method is used to model the thermal exchanges inside and outside the axle and to calculate temperature distribution. Usual efficiency tests on axles measure only global power loss and oil temperature: no evidence allows to confirm a power loss breakdown. Thus, a test campaign with temperature measurements is done and validates the model on local temperature calculation but also on estimation of component power losses. The model can be used at design stage for future development of axles.