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Publishable Executive Summary

In the AEROFLEX work package 2, a framework for an efficient operation of distributed powertrains in long haul EMS vehicles is developed. This framework is referred to as Advanced Energy Management Powertrain (AEMPT). After presenting general requirements to such systems in D2.1, the present report D2.2 outlines a proposal for the technical solution.

A Global Energy and Torque Management System (GETMS) in the tractor unit receives acceleration or endurance brake requests from the driver, or driver assistance systems like cruise control. Endurance brake requests can also be issued by the EBS. Moreover, the GETMS receives the current capabilities from electric drives in the trailer units, in particular the battery state of charge and the available electric acceleration and brake force. In a braking scenario, a negative force request can be issued by the GETMS towards the trailer units, which results in recuperation of brake energy. In a propulsion scenario, the trailer units can be requested to supply positive force which results in a reduction of torque supplied by the combustion engine. Both ways lead to a reduction in fuel consumption. In contrast to the preceding Horizon 2020 project TRANSFORMERS, the electric drives are fully integrated in the tractor unit powertrain control strategy. Furthermore, the GETMS includes a stability guard which restricts electric drives in order to avoid negative influence to vehicle stability.

Each trailer unit comprises a Local System Management (LSM) which provides system information as available electric force to the GETMS. Electric force requests from the GETMS are translated into corresponding signals towards the electric drive control unit (EMG ECU). Service Brake requests issued from the truck EBS are received by the trailer EBS via the ISO11992 protocol. The trailer EBS includes a brake blending function which allows to shift brake force from the friction brakes to the electric drive. If the LSM receives an endurance brake request from the GETMS and simultaneously a service brake request from the trailer EBS, the requests are prioritized and handled in a consistent way.

The state of the art ISO11992 truck trailer communication is not sufficient for an efficient operation of a distributed drivetrain. Moreover, additional sensors in long vehicles such as rear cameras require a data rate which exceeds the limits of CAN technology. Therefore, an Automotive Ethernet communication protocol has been designed that overcomes the ISO11992 CAN restrictions. To make this new communication technology compatible to state of the art trucks and trailers, an Automotive Ethernet router has been designed which combines ISO11992 messages and additional data into one Automotive Ethernet protocol. This even enables to operate a conventional trailer together with an AEMPT tractor unit.