TRANSFORMERS

DELIVERABLE REPORT

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Executive summary

The EU-funded project TRANSFORMERS aims at developing a modular Hybrid-on-Demand driveline (HoD-Driveline) concept, to investigate aerodynamic measures and to optimize load capacity to demonstrate highly efficient truck-trailer configurations. The main innovation is to integrate an electric driveline into trailers and to specify a slim communication interface between trucks and trailers based on commonly available signals. Using this communication interface the HoD-Trailers can be used by different truck brands and supports mission rightsizing of the truck-trailer configuration. On the other hand, the focus is on trailer design for improving aerodynamic and load capacity related measures. The planned improvements are very domain-specific engineering tasks and therefore, for interdisciplinary system development as well as system evaluation purposes, WP2 focusses on holistic truck-trailer system simulation.

In terms of system simulation exist different approaches: there are single-tool and multi-tool solutions. In the case of the TRANSFORMERs project already existing subsystem models shall be used as much as possible. Typically, these individual subsystem models were implemented and analyzed in domain-specific and tailored simulation tools, whereas the establishment of a single overall system simulation model (single-tool) is not possible in general. In contrast, within WP2 a modular simulation approach is used, where each subsystem is simulated in the specific simulation tool (multi-tool) and the inputs and outputs are exchanged between the different simulation tools for synchronization purposes: dynamic coupling of the interconnected subsystems is ensured. This approach is called co-simulation and is used for system simulation within TRANSFORMERs WP2.

Deliverable 2.1 describes the representation of the overall truck-trailer system for modular system simulation. The main outcomes are:

- the **specification of the interfaces** of the individual subsystems to ensure the assembling the available subsystem models via inputs and outputs thereof
- the **adaptation of existing subsystem models** regarding the specifications of the interfaces
- the **implementation of missing subsystems** behavior models

In terms of specification of the subsystem interfaces this Deliverable D2.1 specifies the input and output signals of the individual subsystems. In the first section the behavior of each subsystem is briefly described and the specified signals are listed including related limits and physical units. As a significant benefit, this specification of the subsystems interfaces enables a seamless exchange of specific subsystem models and thus the application of variant management approaches for subsystem optimization later on.

After specification of the interfaces of the individual subsystems the existing ones have to be adapted to confirm with the specifications done and the missing subsystem models have to be created. The behavior of the available set of subsystem models is describes in a separate section in this deliverable D2.1. In particular, a short explanation of the function of the subsystems is given and the most important and significant parameters are listed. This section gives an overview of the system variation possibilities for comprehensive overall system design.

List of Acronyms

Table 1-1: List of Acronyms

Acronym	Description
AC/DC	Alternating Current/Direct Current
CAD	Computer-aided Design
CFD	Computational Fluid Dynamics
DC/DC	Direct Current/Direct Current
EGR	Exhaust Gas Recirculation
EMG	Electric Motor/Generator
ESU	Energy Storage Unit
FeDS	Full ecoDriver System
ICE	Internal Combustion Engine
MBS	Multi-body System
RGS	Reference Signal Generator
SoC	State of Charge
SoE	State of Energy
TDMS	Trailer Driveline Management System
TEMS	Trailer Energy Management System
VCU	Vehicle Control Unit
VE³	Vehicle Energy and Environment Estimator
VEMS	Complete Vehicle Energy Management System
VGT	Variable Geometry Turbocharger

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