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RESEARCH PROGRAM ON AN EMISSIONS TEST PROCEDURE FOR HEAVY DUTY HYBRIDS (HDH)

Development of Emissions and CO2 Test Procedure for Heavy Duty Hybrid Vehicles

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Outline

- Department of Signals and Systems
- Background
- Development of Emissions and CO2 Test Procedure for Heavy Duty Hybrid Vehicles
  - Workpackages
  - Timeplan
- Contact information

Department of Signals and Systems

- The Department of Signals and Systems is conducting research in biomedical engineering, antennas and signal processing, control, automation and mechatronics, and communication systems.
- The research deals to a large extent with the modeling and development of efficient systems for extracting and processing information.
- The Department of Signals and Systems consists of approximately 130 employees.
- For the Mechatronics research group, simulation and modeling are key components in all projects. The validity of simulation results and techniques for simulation and modeling are also key questions that are being considered.

Background

- Professor Jonas Sjöberg and Ass. Professor Jonas Fredriksson have been involved in research and teaching concerning hybrid vehicles during the last decade. They have a general strong background in modeling, simulation and control.
- Supervised several Ph.D. students on topics relating to design, sizing and control of electrical hybrids.
- Experience from developing model libraries and simulation tools useful for complete vehicle simulations as well as vehicle component studies for fuel cell and hybrid electric vehicles.
- Involved in the Swedish Hybrid Center (SHC), http://www.chalmers.se/shc.

- Recently been involved in a research project related certification of heavy-duty hybrid vehicles where the focus was verification and quality assessment of simulation evaluation (HILS and SILS).
  - Fredriksson, Jonas; Gelso, Esteban R.; Sjöberg, Jonas; Åsbogård, Mattias; Hygrell, Michael; Sponton, Ove; Vågstedt, Nils-Gunnar: *On emission certification of heavy-duty hybrid electric vehicles using hardware-in-the-loop simulation*. R009/2011,Department of Signals and Systems, Chalmers University of Technology, Sweden, 2011.

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3. Extension of HILS to non-electrical hybrids, which are currently not covered by Kokujikan No.281.

To May 2012 the following WP is to be carried out.

- Overview of possible other types of hybrids of interests and issues for HILS testing will be investigated. Information gathering. Proposal of which non-electric hybrids to include in the HILS method.
- Evaluate, using software models and simulation the possibilities of using HILS for assessment of quality factors of these hybrids.

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WP 3-1: Technology overview and selection of scope

- Detailed analysis on what non-electric hybrid systems/components to be included in the HILS method. Review of non-electric hybrid topologies proposed in the literature, by OEMs and others. Review of non-electric components, such as flywheels, accumulators etc, used in non-electric powertrains proposed in the literature, by OEM and others. Together with OEMs and other partners decide which topologies that should be covered. Meetings with OEMs, will be co-planned with TU Graz and TU Wien in relation to WP 1-4 (TU Graz and TU Wien offer).

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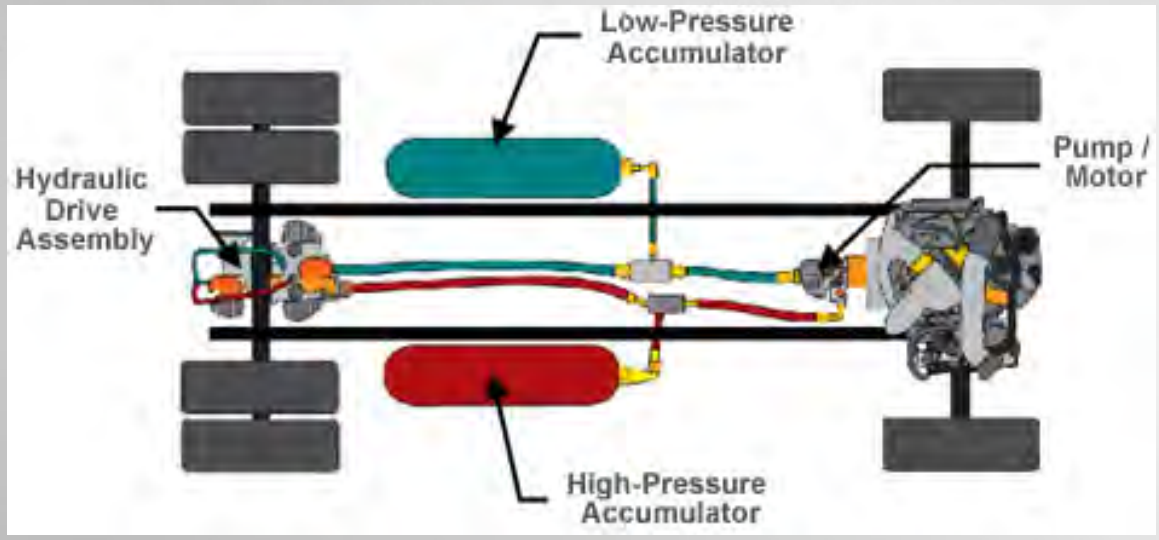
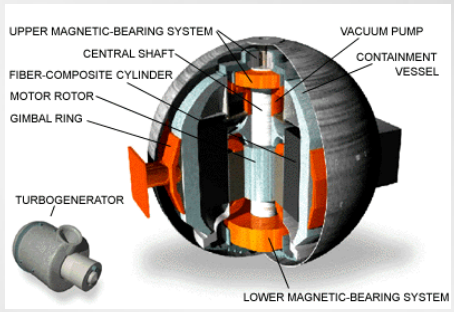
WP 3-1: Technology overview and selection of scope





- The preliminary result is a list of non-electric powertrain topologies and a list of components that needs to be modeled.

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WP 3-2: Development of HIL elements for non-electrical hybrid systems/components

- Based on the list of topologies and components in WP 3-1, develop simple, representative mathematical models of the different powertrain components, such as actuators and energy buffers. The models will be implemented in a simulation software. All models will be documented.

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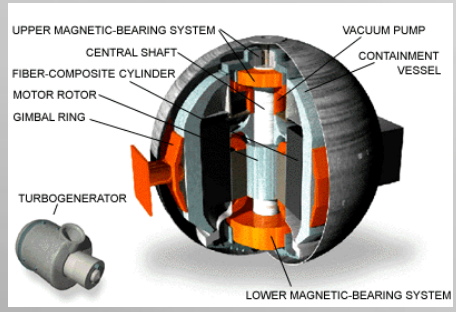
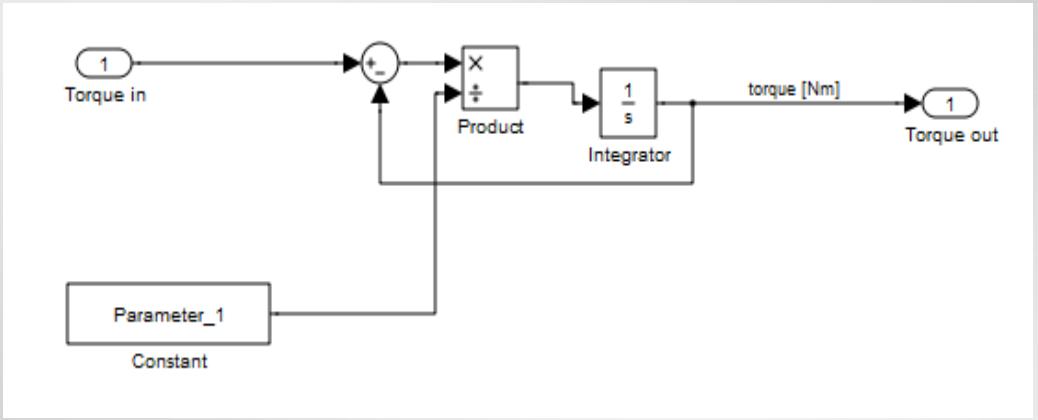
WP 3-2: Development of HIL elements for non-electrical hybrid systems/components





- The result is a set of simulation models of non-electric powertrain components, which are suitable to use in a HILS setup.

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WP 3-3: Test methods for input data to non-electric component models

- In this workpackage, specifications on parameters that need to be determined in order to use the components modeled in WP 3-2 will be written. A feasibility study on how or if the parameters can be determined from experiments will also be conducted. Depending on the feasibility study, modifications on the component modeling might be necessary.

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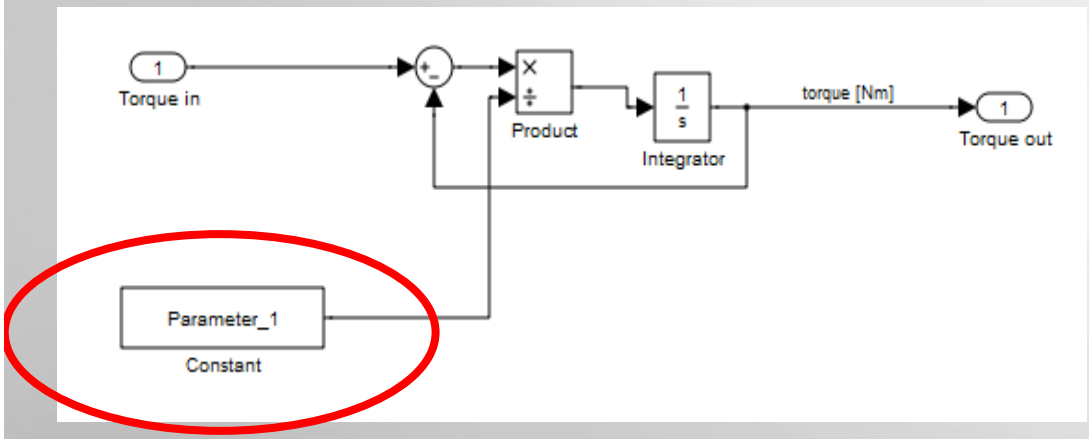
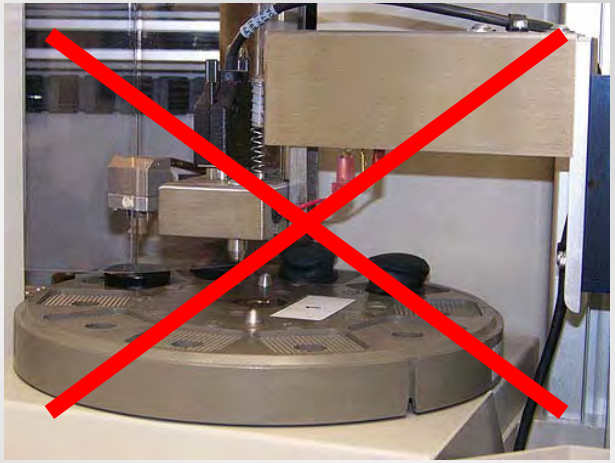
WP 3-3: Test methods for input data to non-electric component models





- The deliverable from this WP is the specifications of the component parameters.

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WP 3-4: Definition of control signals

- Based on the non-electric component models and also available components on the market today determine which control signals and sensor signals are necessary/available. Analysis for a standard interface connecting the hardware (HDH ECU) with the HILS software. Identifying the modifications needed to get non-electric hybrid components into the HILS method. This work will be in collaboration with WP 1, see TU Graz and TU Wien offer.

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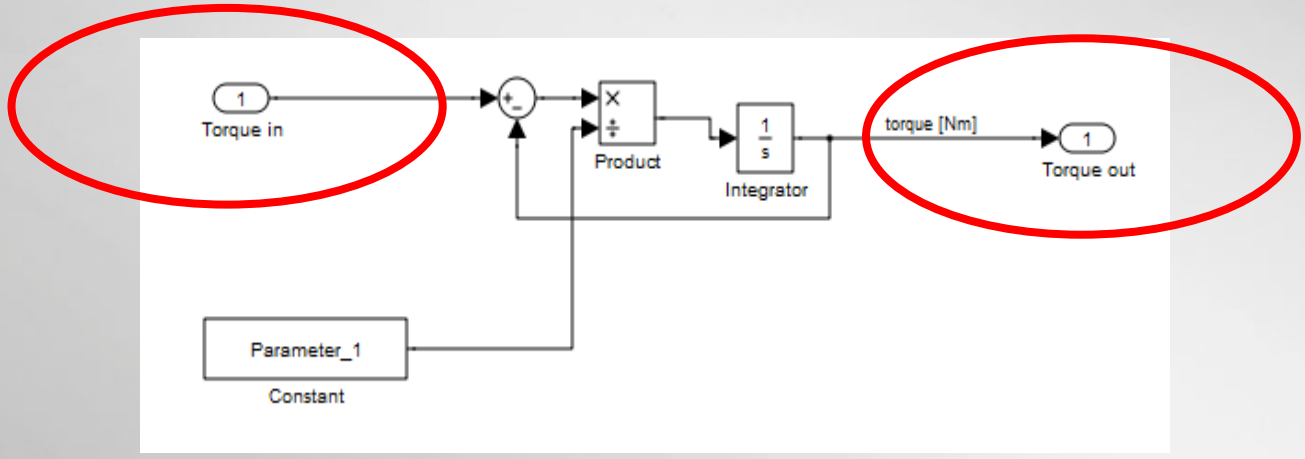
WP 3-4: Definition of control signals



- The result is a list of input and output signals to and from the non-electric components.

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WP 3-5: Alignment with HILS for HEV and verification

- Review of the HILS method to understand what modifications are needed to get the new components into the method. Hypothesis: No major modifications is needed, the non-electric components/subsystems have the same purpose as the electric components/subsystems. Verification of hypothesis.

- Result: Hypothesis is verified or suggestion on modification of method.

Timeplan

Work task	*Work task description*	*Hours*	*Period (Start-end)*
WP 1	Investigation and modification...		
WT 1.1	Review of Japanese method in collaboration with TU G-W consortium	40	06/11-11/11
WT 1.2	Simulated control systems instead of HW ECUs		
WP 2	HILS Component testing		
WT 2.1	General principles of component applied in collaboration with TU G-W consortium		
WP 3	Extension to non-electrical hybrids		
WT 3.1	Technology overview and selection of scope	104	06/11-10/11
WT 3.2	Development of HIL elements (models) for non-electrical hybrids	240	10/11-01/12
WT 3.3	Test methods for input data to non-electrical component models	60	01/12-02/12
WT 3.4	Definition of control signals	80	01/12-02/12
WT 3.5	Alignment with HILS for HEV and verification	40	03/12-04/12
WP 4	Inclusion of PTO operation		
WT 4.1	Discussions and review of results with TU G-W consortium	20	06/11-01/12
WT 4.2	Modifications of HILS method needed for vehicles with significant external electrical power (e.g. plug-in, full EV) and PTO demand.		
WP 5	Development of WHVC		
WT 5.1	Discussions and review of results with TU G-W consortium	40	06/11-01/12

Collaborations

- TU Graz
- TRL
- Ecorys
- TU Wien
- Chalmers University of Technology
- Linköping University (FluMeS)
- OEMs
  - …
- Suppliers
  - …

- Please send an e-mail if you would like to join!

Contact information

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