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Informal Group on Heavy Duty Hybrids
Attention: Juergen Stein, HDH Secretary
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RESEARCH PROGRAM ON AN EMISSIONS TEST PROCEDURE FOR HEAVY DUTY HYBRIDS (HDH)

Experience on Hybrid Electric Vehicles

Responsible for this proposal are professor Jonas Sjöberg (JS) and associate professor Jonas Fredriksson (JF). JS and JF 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. Together with the Swedish automotive industry and other Swedish universities they have been involved in national projects targeting research and education on hybrid vehicles. They have supervised several Ph.D. students on topics relating to design, sizing and control of electrical hybrids.

The projects include, building model libraries and a simulation tool useful for complete vehicle simulations as well as vehicle component studies for fuel cell and hybrid electric vehicles, developing control strategies for energy management of the on-board energy, including using pre-view information of the route of driving. Recently they have 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).

The department is largely involved in the Swedish Hybrid Center (SHC) <http://www.chalmers.se/shc>, which is hosted by Chalmers University. Except JS and JF, there are some 5 more senior researchers with competence of modeling and simulating hybrid vehicles.

Further descriptions of ongoing projects and publications can be found on the department web: <http://www.chalmers.se/s2/>

JS and JF are not experts in certification. However, they are very interested to be part of projects concerning certification where they can contribute with their experience of modeling, simulation and validation of hybrid vehicles. Hence, in the quotes below, emphasis has been

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given on these tasks where interesting results can be obtained using simulations. Since these do not cover all aspects asked for, JS and JF are open for, and interested of, working together with some other institute which can complement their shortcomings.

Quote on the called tasks

Here follows quotes on the tasks called for.

1. Investigation and modification, if applicable, of the HILS model and interface (chapter 1); this should include a proposal for a verification method (chapter 5) w/o vehicle testing.

To November 2011 the following WP could be carried out.

- Review of the Japanese HILS method. This is partly done in an earlier project.
- Investigation of possible shortcomings of the Japanese method in regards to the needs of OEM's on different markets, and possible changes of the method to meet the needs. For example, distributed control system, need of thermal models.
- Develop a generic control architecture for evaluating the Japanese method in simulation.
- Meeting with the involved companies, possibly organizing it, to describe preliminary results, and to make it possible for the companies to give input to the work.

2. Investigation and modification, if applicable, of the HILS component testing (ch. 2)

To November 2011 the following WP could be carried out.

- Review of the Japanese procedure for component testing.
- Given input from participating companies, investigate how well the Japanese testing comply with the needs internationally.
- Meeting with the involved companies, possibly organizing it, to describe preliminary results, and to make it possible for the companies to give input to the work (in connection with the meeting on task 1).
- With help of simulation tests, investigate the sensitivity of the over-all HILS's result with respect to the uncertainty of the components. This helps to decide upon how accurately the components need to be, to obtain a valid result. Suggest possible changes in the test procedure based on the simulation result.



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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 could be carried out.

- Overview of possible other types of hybrids of interests and issues for HILS testing will be investigated. Information gathering.
- Evaluate, using software models and simulation the possibilities of using HILS for assessment of quality factors of these hybrids.

4. Inclusion of PTO operation, which normally takes place outside the test cycle,

To January 2012 the following WP could be carried out.

- An overview of possible and relevant power demands from PTO's will be put together. Literature information search.
- Suggestion and investigation of possible ways to handle out-of-cycle power consumer, of which PTO is only one of them.
- Evaluate, using software models and simulation the influence of the PTO's on the result of the HILS test. Special (named) auxiliary systems can also be investigated if it is of interest.

5. Development of WHVC weighting/scaling factors to represent real world vehicle operation,

To January 2012 the following WP could be carried out.

- Given different operation of vehicles, for example city bus, and long haul truck, subsets and weighting factors of WHVC will be suggested based on simulation.
- Sensitivity of the result with respect to design parameters will be investigated.
- Several, comparable drive cycles will be produced so that one can test for cycle beating.
- It will be investigated how the result depends on the level of hybridization.

Cost

The suggested tasks are offered to the following prices.

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Task	Price (thousand Euro)
1	15
2	30
3	30
4	20
5	30

To this comes an estimated cost on 20.000 Euro for travel costs. There is the possibility to reduce the contribution on some tasks to make the contribution smaller. However, the given prices build on synergies between the tasks, so the prices need to be adjusted if only part of the offer is accepted.

Sincerely yours



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