A New Approach in Hybrid Drivetrain Development and Optimisation

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Since the hybrid drivetrain technology is introduced to the market, the general capability for reduction of emissions and fuel consumption as well as for mass series production is proven. For further development and detailed optimisation of hybrid electric systems, a new approach in simulation technique offers a good capability to analyse and improve the drivetrain control algorithm and also to optimise the electric power requirements in predefined traffic situations, having a close link to every day system use. A co-simulation of the advanced traffic simulation program PELOPS and a detailed driveline simulation model presents that new type of development tool.

State of the art in today's simulation of hybrid electric vehicles is the optimisation of such drivetrains in predefined driving cycles like NEDC and HYZEM, giving a fixed vehicle speed as a function of time, Figure 1 (left). The advantage of those cycles is their standardisation effect on the simulation results, which helps to compare results for different vehicles. A big disadvantage is, that no vehicle or road specific data is included in the given vehicle speed request. For example, during a driving cycle simulation a sports car is performing the same accelerations as a transporter and the vehicles are always "driving" on plain ground. That could mean, that the load data given by the simulation is not matching the data representing a real life use of the same vehicle. To validate existing simulation results and in order to get new and more realistic data, a new co-simulation technique will be used. This advanced simulation tool gives a more detailed answer to the question of the optimal system lay-out and system load in real life driving conditions, Figure 1 (right). In this paper this new simulation tool is used to get information about the best size of the electric system in a hybrid driven compact class vehicle.

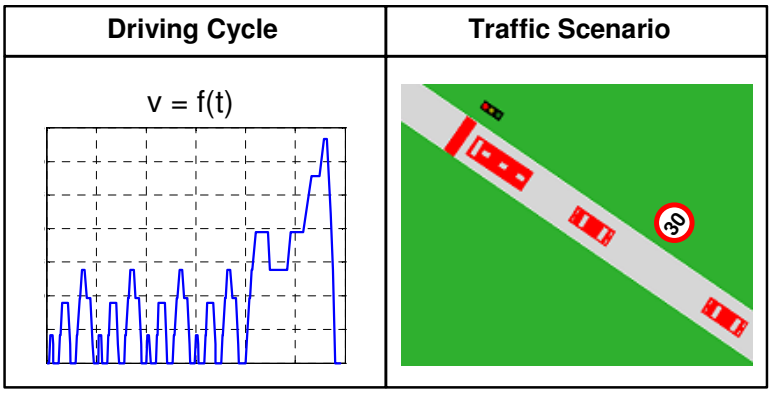

Figure 1: Simulation Environment - Driving Cycle (left) and Traffic Scenario (right)

According to the obtained simulation results of a propulsion and braking power analysis, a hybrid electric system in parallel configuration was implemented into the modular vehicle model. The electric system size was chosen to 12 kW, taking into account the different traffic scenarios and their individual importance. The achieved reduction of fuel consumption for this hybrid drive train set-up is 18-32 % in city traffic, 9-15 % in rural traffic and 0-3% on the highway.