Utilizing Object-Oriented Modeling Techniques for Composition of Operational Strategies for Electrified Vehicles

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The paper introduces a new concept of modeling the overall control unit of hybrid electric vehicles in *Modelica*. The work focuses on a structure which can simulate substantially different vehicle concepts without changing the structure of the control unit. Based on this universal implementation different scenarios can be simulated rapidly and consequently cheaply, including fundamentally different drive trains ranging from conventional to purely electrical including hybrid versions. The paper focuses on components that are responsible for the generation of traction force.

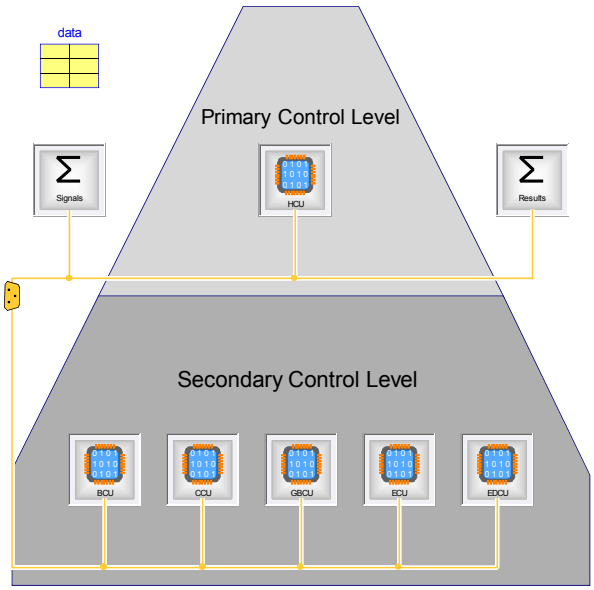

Figure 1: Template of the universal CU

The modeled control unit (Figure 1) is designed for one-dimensional simulations, therefore taking accelerator and brake pedal positions computed by a separated driver model as inputs. Based on these inputs and the vehicle's internal states the HCU's primary control level decides which one out of eight driving modes is activated. Based on the driving mode, the component controllers in the secondary control level compute input signals for the corresponding component.

The full paper demonstrates that simulations of purely electrical, conventional and hybrid vehicles can be carried out with minimal changes in the controller's parameters. The vehicles of choice include BMW's recent i-Series lineup, namely the purely electrical i3 (alternatively with range extender) and the through-the-road hybrid i8 representing a very complex drive-line structure.