

Consistent Simulation Environment with FMI based Tool Chain

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Abstract

Systems engineers face the ever increasing chase for reduced time to market, while the systems to develop ever increase in complexity. Software systems design and integration processes have therefore evolved along the well-known V-cycle.

This paper will focus on the software integration for mechatronic systems as they develop fast due to high demands and challenging requirements in the automotive industry.

The development order of model in the loop (MIL), software in the loop (SIL), processor in the loop (PIL) and hardware in the loop (HIL) can be seen as state of the art practised by many systems engineers. Driver in the loop (DIL) may be in its infancy, but rapidly growing.

The novelty presented in this paper is the consistency of the plant models used in the integration chain supporting consistent model data propagation: Functional Mock-up Units (FMU) defined by the open standard of the Functional Mock-up Interface¹ (FMI).

Keywords: FMI, FMU, MIL, SIL, PIL, HIL, plant models, Modelica

References

1. Blochwitz, T., Otter, M., Arnold, M., Bausch, C., Clauß, C., Elmqvist, H., Junghanns, A., Mauss, J., Monteiro M., Neidhold, T., Neumerkel, D., Olsson, H., Peetz, J.-V., Wolf, S., *The Functional Mockup Interface for Tool independent Exchange of Simulation Models*, 8th Modelica Conference, Dresden, Germany, 2011
2. Liebezeit, Bräuer, Serway, Junghanns: *Virtual ECUs for developing automotive transmission software*, 10th CTI Symposium Innovative Fahrzeug-Getriebe Hybrid- und Elektro-Antriebe, 5.-8.12.2011, Berlin, Germany
3. Junghanns, A., *Virtual integration of Automotive Hard- and Software with Silver*, Qtronic GmbH, Berlin
4. Andreasson, J., Andersson, D., Batteh, J., Gohl, J., Griffin, J., Krueger, I., *Integrated simulation of a e4WD vehicle using Modelica*, Advances in Automotive Control, Volume#7, Part#1, 2013
5. *FMI Toolbox User's Guide 1.7*, Modelon AB, Lund, Sweden, 2013
6. *Functional Mock-up Interface for Model Exchange, Version 1.0*
7. *Functional Mock-up Interface for Co-Simulation, Version 1.0*
8. <https://www.fmi-standard.org/>
9. *Measurement, ECU Calibration, and Diagnostics –Development Solutions for Automotive Embedded Systems*, ETAS GmbH, Stuttgart, Germany, 2010