Openness and Connectivity a Challenge for System Simulation Tools - The Functional Mockup Interface -

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The application range of simulation tools has increased significantly in recent years. It is no longer sufficient to analyze and optimize isolated technical devices; instead, today analysis is done on systems made up of components from different physical domains and their interactions. Additionally, control software components are integrated within the system models. Such models are utilized in different ways throughout the development process. In early stages of the system design, behavioral models are built as executable specifications of the system behavior. Later on the behavioral sub-models are replaced by more and more detailed component models. Enriched by control software components, these models are then used for optimization of the holistic system.

Component and system testing of the control software is done using Software-in-the-Loop (SiL) simulation. The controller hardware is tested on Hardware-in-the-Loop (HiL) simulators against the simulation model, which runs in real time. This model based development process is state of the art, at least in the automotive industry. All of these specific tasks are of course not performed by one simulation specialist using one single tool. Rather, the component models run through several departments and simulation tools. The models are built with the tool which is most suited for the specific domain, or the tool which is just available. SiL simulations run in co-simulation platforms which integrate simulation models and controller code in a smooth and safe way. For HiL simulations, high performance hardware is used, which generates a virtual reality for the controllers on an electronic level.

This process leads to strong requirements with respect to openness and connectivity of simulation tools: models are to be exported from and imported into other tools. The simulation platform SimulationX from ITI grew up in this collaborative environment, and meets these challenges by means of several features. One of the key features is the complete support of the Functional Mockup Interface [1].

The Functional Mockup Interface (FMI) is a tool independent standard for the exchange of dynamic models and for co-simulation. The FMI was developed in close collaboration between simulation tool vendors, research institutes, and industrial users within the ITEA2 project MODELISAR. FMI for Model Exchange supports ordinary differential equations. It allows robust and efficient state and time event handling. Detailed dependency information between outputs and inputs is provided as well as Jacobian matrices. FMI for Co-Simulation supports master slave architectures. Distributed tool based and standalone scenarios are possible. Sophisticated co-simulation master algorithm with variable step size and repetition of communication steps can be applied.

Today, more than 30 tools support FMI. It has proven its usability not only in the automotive sector, but also in industrial and scientific projects.

References

[1] T. Blochwitz, M. Otter, M. Arnold, C. Bausch, C. Clau, H. Elmqvist, A. Junghanns, J. Mauss, M. Monteiro, T. Neidhold, D. Neumerkel, H. Olsson, J.-V. Peetz, S. Wolf *The Functional Mockup Interface for Tool independent Exchange of Simulation Models*. Proceedings 8th International Modelica Conference 2011, Dresden March 2011.