Integrated Engineering based on Modelica

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The academic society claims the use of virtual engineering (i.e. simulation) since many years. Nevertheless, it is de facto rarely ever used in the automation industry. This paper presents an approach and a toolchain for an integrated, digital engineering workflow including virtual commissioning, shown at a real industrial example. In particular, a new method for virtual commissioning that allows to drop all real-time requirements is presented.

Cyber-physical production systems rising with the concepts of industry 4.0 have a complexity that conventional engineering methods cannot bear. Therefore, the time has come to finally use model-based systems engineering methodologies that were proposed years ago, e.g. (VDI2206, 2004). Nevertheless, the automation industry acts very conservative towards new technology. This is mainly due to the distrust that model-based methods can be used in an economic manner. Within the development cycle in the automation industry CAD models are used, since they save costs compared to construction by hand. During other stages of the development cycle, virtual models are considered to be of little or no use, since the effort for modeling those images of real systems is assumed to excel the benefits. This prejudice can only be overcome by lowering the effort for modeling or increasing the value of generated models.

In this paper models generated in early development phases are re-utilized within later stages of the development cycle, like application engineering and commissioning. The re-use of models for virtual commissioning is in particular possible due to coupling of a Rexroth PLC and a (possibly non real-time) Modelica simulation using a new Modelica library. In order to obtain an development cycle that is as integrated as possible, transitions between different phases in the development cycle are tackled. First, starting with CAD data it is shown how to automatically generate a physical representation of a machinery in Modelica. Using the physical interfaces of Modelica the model can easily be extended by drive models from component manufacturers. In combination with Bosch Rexroth PLCs, a transition towards the commissioning phase without further adaptions (e.g. complexity reduction for real-time application) is possible employing a new Modelica library. To show the entire potential of an integrated engineering workflow based on Modelica, an approach for creating control code based on a Modelica model of the control algorithm is given. By demonstrating those methods in the industrial application example of a bottling machine, it is disclosed that the assumptions of a high effort for creating simulation models, as mentioned introductory, can be disproved.

References

VDI, *VDI2206: Entwicklungsmethodik für mechatronische Systeme*, 2004.