Functional Development with Modelica: A Use-Case Analysis

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The paper deals about the development steps of an embedded controller. The activities of the role function developer are explained for the simple example traffic light controller. The method of virtual integration is explained to establish short feedback loops.

The behavior of a dynamic system is in general too complex to treat by theory or formulas. Several simulation methods have been established for analyzing such systems. The virtual integration method is conducted on a model to gain knowledge about the (intended) real system behavior. This abstraction typically allows to focus on the main properties of the studied multi-domain system and their effects. These components require specific domain solvers for mechanical, electrical, etc. components. In this context, the term co-simulation has been established. The virtual integration is based on co-simulation and described in [3, 4]. There is a rather huge literature on the Vee-Model and systems engineering, see e.g. [1]. For more general introduction see, e.g. [2]. In the following, we demonstrate how to develop a control algorithm for an embedded controller designing the entire system - both the plant and the control components - with the modeling language Modelica.

This approach allows us the modeling and simulation of the entire system, and thus the validation of the design decisions in an early phase of the development.
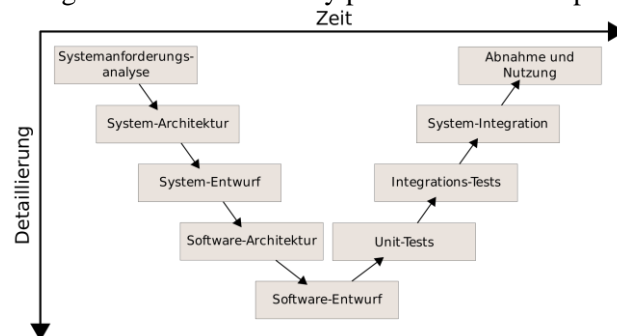

Figure 1: The development phases of the Vee-model that are considered in this paper are, see Figure 4, [17]: system level requirements, system design, module design, module implementation, module integration and test and finally system integration and test on an embedded controller.

Keywords: embedded systems; simulation; modeling; short feedback loops; co-simulation; virtual integration; Vee-Model; systems engineering

References

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