

Model-based Development of Embedded Control Systems with Giotto and Simulink

Gerald Stieglbauer

The thesis delivers an innovation in the construction of embedded systems: Due to its roots in electrical and control engineering, the development of embedded systems has been focused on hardware platforms so far. In other words, software usually follows hardware. The thesis significantly contributes to a shift from a hardware-oriented towards a software-oriented, platform-independent development of composable embedded systems, by making the so-called Giotto methodology available under Simulink. Simulink is a tool that is commonly used by control engineers to craft embedded systems.

The spectrum of embedded systems ranges, for example, from mobile phones to satellite control systems. Today about 98% of the programmable CPUs run as embedded systems. The workload in the design of embedded systems is shifting continuously from hardware to software while the complexity is growing. Therefore the sound engineering of embedded systems is a relevant challenge, in particular in safety-critical systems.

The first part of the thesis presents the concepts how to accomplish the integration of Giotto and Simulink. In addition to a sound implementation of the necessary tool support, the second part of the thesis illustrates the feasibility of the approach by means of a Giotto-based electronic throttle control system. The thesis has succeeded to provide a significant portion of the visionary Giotto methodology in the realm of the Simulink tool set. The thesis thus contributes to the overall Giotto-based tool chain. The complete process from designing and testing such a Giotto-based controller in Simulink to the implementation on the embedded platform is presented. The automatic generation of timing code, as facilitated by Giotto, can contribute to ensuring the correctness of embedded systems.

The fact that Giotto semantics is systematically introduced into Simulink models delivers guidelines how to define deterministic models in Simulink.