

A Process Model for Distributed Development of Networked Mechatronic Components in Motor Vehicles

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Abstract

Increasing demands concerning safety, economic impact, fuel consumption and comfort result in growing utilization of mechatronic components and networking of up to now widely independent systems in vehicles. The development of such a complex and networked system requires a coordinated, systematic development process. In this contribution a suitable process model will be presented. It supports the verification of a domain model considering functional requirements in an early stage of development. The process model takes two different types of modeling into account. Object oriented modeling is used to describe domain models and particularly supports aspects like re-use, exchangeability, scalability and distributed development. Data flow oriented modeling especially focuses on dynamic aspects and is employed to create a simulation model. Coupling points will be identified allowing an automated mapping of these two types of models.

1. Overview

Increasing demands concerning safety, economic impact, fuel consumption and comfort result in advanced functionality and networking of up to now widely independent mechatronic systems in vehicles. The integration of these extensive individual functions into one complex system requires a clear structuring of the functions and a clean specification of component interfaces. Additionally, aspects like re-use, exchangeability, and distributed development have to be considered to meet quality demand and decreasing development intervals. To cope with these demands Robert Bosch GmbH is developing a structuring concept for control systems in vehicles called CARTRONIC using object based modeling, which is suitable to describe the structure of domain models with defined logical units based on functional requirements and the encapsulation of their functionality [1].

In addition to such an object based structural description the behavior of time-driven mechatronic systems has to be specified. Usually a data flow oriented behavioral description is used. Regarding the dynamic aspects of the mechatronic components this behavioral description, mostly given in form of simulation models, is essential for a consistent system development. By using simulation in an early stage of development, possible errors and risks can be discovered, reduced or even eliminated. On the one hand these two modeling approaches lead to a much better understanding of the structure and behavior of such complex mechatronic systems. On the other hand a de-coupled modeling results in additional expenditure caused by partial double modeling and the danger of losing information by changing the modeling view. Therefore, the interface to exchange information between the two different types of modeling has to be specified precisely and the exchange itself has to be automated as far as possible. In this contribution a systematic and coordinated development process is defined by combining the V-Model [2], which is well established for automotive applications, with the incremental model [3] tailored to the development needs of mechatronic systems in vehicles. Coupling points for an object and a data flow based description in different phases of the development process are identified and clearly specified. An automatic mapping between both modeling types via the standardized XML exchange format is currently under development.

2. References

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