Chapter 10

VERIFICATION OF AUTOSAR SOFTWARE
BY SYSTEMC-BASED VIRTUAL PROTOTYPING

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Abstract
This chapter focuses on simulation-based verification of AUTOSAR software. It introduces the methodology and technical aspects behind AUTOSAR and outlines the affinities of the concepts of AUTOSAR and SystemC. It discusses in detail how SystemC supports the implementation of AUTOSAR and how SystemC can be applied with respect to the different AUTOSAR layers. Furthermore, it illustrates the different views of car makers and tier 1 suppliers onto the system and discuss how SystemC can support them. Therefore, the different layers of abstraction within TLM (Transaction-Level Modeling) space are introduced and different ways of integrating timing behavior into the entire system are shown. The article is attended by a case study of a traffic sign recognition system, which demonstrates the functional and timing evaluation of the entire system.

Keywords: Design Methodology, Embedded Software, Virtual Prototyping
10.1 Introduction

In recent years, the raising complexity of electronic systems has become a new challenge within the automotive industry. This is particularly true for software since most innovations in a car are made in the area of software. In future, this trend will continue and the part of software will steadily increase in the next years. Additionally, automotive electronic is a highly distributed electronic systems resulting in a further growing degree of interconnection and interaction. An increasing number of subsystems are involved in providing a specific system function and more system functions are sharing a heterogeneous network architecture. In this context, interaction becomes one of the most critical challenges of the design process. Another very automotive-specific problem is the differing view of OEM and tier 1 onto the system. Until recently, an ECU (Electronic Control Unit) is a single unit for the supplier. But the growing degree of interaction makes it necessary to consider the entire system. This is particularly true for the manufacturer who is responsible for the entire system and the integration of the several components. On the other hand, he considers the suppliers components as black box units. In terms of interaction, the black box consideration makes it difficult to focus the entire system.

Right now, a paradigm shift is proceeding from a ECU-centric view to an entire system view. Also well-known requirements like quality and development time are still important and result in the need of modularity, reuse and scalability of the software. It is difficult to reconcile this with highly hardware-dependent software of today’s automotive systems that causes significant software modifications if changing the underlying hardware architecture. In summary, the likewise increased complexity of the systems caused many problems also in terms of stability, error-proneness, performance, reusability, modularity, processes and the like.

10.1.1 The AUTOSAR Initiative

Currently, AUTOSAR (AUTomotive Open System ARchitecture) [AS] tackles the problems. AUTOSAR is an international development partnership consisting of a multitude of car manufacturers, suppliers and tool vendors, defining concepts and workflows, how electronic automotive software-related systems can be formally specified and processed. AUTOSAR focuses on a software architecture that decouples software and hardware by offering a hardware abstraction layer and a basic software. The application software is implemented within modules. These software components communicate via well-defined interfaces. The goal is to make the application software completely independent from the underlying hardware architecture to allow an arbitrary distribution onto different ECUs. Configuration and generation processes built the final ECU software.