

## Simulating Microsystems in the Context of an Automotive Drive Application

G. Pelz, Ch. Decker, D. Metzner, Infineon Technologies AG  
L. Voßkaemper, D. Dammers, Dolphin Integration

### Abstract

The opportunities to integrate more and more functionality into a (micro)system-in-a-package (SiP) heavily call for advanced methodologies in modeling and simulation for complete systems. For a microelectronics company like Infineon Technologies, the top-level simulation of our products, i.e. the above microsystems, is not a nice-to-have feature – it is a must! Iterating on the fabrication runs for design debugging simply is not feasible. Extending these simulations to application level can be accomplished and this paper shows how. An automotive drive application will serve as a demonstrator for that.

### 1 Introduction

Let's first take a look at the microsystem: it may comprise microcontrollers and power electronics. Behavioral modeling provides for sufficient simulation speed, while not sacrificing precision. For all analog and mixed-signal parts of the system, it is carried out in VHDL-AMS. This holds for electronics as well as for thermal processes, which always have to be taken into account when power electronics comes into play. The microcontroller is modeled in SystemC, which provides for an extremely fast, but still cycle-correct treatment. It takes real-life programs on assembly level and executes them as it is simulated.

The application side is the electric motor with gear, load and a hall sensor for position feedback. Again, VHDL-AMS is adopted for behavioral modeling. This allows for the simulation of the complete application, comprising the microsystem as well as the surrounding electric motor and position using a commercially available simulator. This complete system typically simulates at a performance of 20 CPU-minutes per second real-time on a recent Linux workstation, which allows for thorough system verification, software development and even concept assessment (in case the abstract behavioral models can be provided in time, which should be no problem for a design with substantial legacy content).