

# LavA: Model-Driven Development of Configurable MPSoC Hardware Structures for Robots

Matthias Meier and Olaf Spinczyk

*Technische Universität Dortmund  
Embedded System Software — Computer Science 12  
Dortmund, Germany*

`{matthias2.meier, olaf.spinczyk}@tu-dortmund.de`

**Abstract:** Deploying multicore or multiprocessor hardware for robotics applications is highly beneficial. Parallel hardware structures can be utilized to improve the performance, real-time characteristics, or fault tolerance. Special accelerator components can boost the performance and energy efficiency even more. However, the optimal hardware design is application-specific. This is a dilemma especially for modular general purpose robots, because the application scenario is unknown at design time. Therefore, more and more robots are being equipped with configurable hardware such as FPGAs. In this paper we describe the LavA framework, which facilitates the development of *application-specific* MPSoC hardware structures. Our prototype can interact with Lego Mindstorms NXT sensors and actuators. A DSL is used to describe the hardware structure. Syntactic and semantic checks are performed on the high-level hardware model and a resource model quickly provides an estimate of the required FPGA resources. The hardware synthesis itself is fully automated and requires no special know how. Optionally, the framework can even statically analyze the C/C++ application code. Based on the hardware access patterns found in the code, a suitable hardware description is derived automatically.