

Preface

Embedded systems take over complex control and data processing tasks in diverse application fields such as automotive, avionics, consumer products, and telecommunications. They are the primary driver for improving overall system safety, efficiency, and comfort. The demand for further improvement in these aspects can only be satisfied by designing embedded systems of increasing complexity, which in turn necessitates the development of new system design methodologies based on specification, design, and verification languages.

The objective of the book at hand is to provide researchers and designers with an overview of current research trends, results, and application experiences in computer languages for embedded systems. The book builds upon the most relevant contributions to the 2008 conference *Forum on Design Languages* (FDL), the premier international conference specializing in this field. These contributions have been selected based on the results of reviews provided by leading experts from research and industry. In many cases, the authors have improved their original work by adding breadth, depth, or explanation.

System development includes the tasks of defining an initial, high-level specification, designing system architecture and functional blocks, and verifying that architecture and functionality meet the specified properties and requirements. The designers working on these tasks, and the electronic design automation tools deployed in the design process, have to take into account software, digital logic, and analog system components and their complex interactions in heterogeneous, mixed discrete/continuous systems. This book therefore addresses related issues in four parts, dedicated to specification, heterogeneity, design, and verification.

Part I, *Model-Based System Specification Languages*, focuses on two high-level specification languages which are emerging as standards for embedded systems: the *Architecture Analysis and Design Language* (AADL), and the *Modeling and Analysis of Real-Time and Embedded Systems* (MARTE) profile for the Unified Modeling Language (UML). Beyond their syntax and semantics, the methods built upon these languages, and initial applications are presented in three chapters. Two further chapters are dedicated to competing approaches using an abstract state machine based language and Matlab/Simulink driven modeling, respectively.

Part II, *Languages for Heterogeneous System Design*, is devoted to two promising languages that provide the means to describe heterogeneous systems. The discrete-time and continuous-time worlds are brought together by SystemC-AMS on system level, whereas VHDL-AMS provides all it takes to describe mixed analog and digital circuits.

Part III, *Digital Systems Design Methodologies Based on C++*, is the largest part of this book, based on the substantial impact that the SystemC library and its methodology-specific additions continue to be making in the digital (hardware/software) design community. This part comprises eight chapters devoted to

the subjects of transaction-level modeling and its applications, architecture and performance evaluation, design and scheduling of functional blocks, as well as programming and modeling approaches for (run-time) reconfigurable FPGA architectures.

Part IV, Verification and Requirements Evaluation, features contributions addressing both functional and beyond-functional properties. Functional aspects include the verification of circuitry implementing arithmetic operations and the debugging of contradictory functional constraints specified with the SystemC Verification Library (SCV). Analysis of beyond-functional properties such as timing behavior, performance, area cost, and power dissipation, is covered for Multi Processor Systems-on-Chip (MPSoC) as well as on-chip interconnection networks.

The selection of the contributions to the before-mentioned parts has been guided by the reviews provided by FDL reviewers and programme committee members. I would like to thank everybody involved in these reviews, and in particular the FDL'08 chairpersons responsible for the conference tracks that relate to the four parts, namely Dominique Borriane (PDV track, *Property Driven Verification*), Pierre Boulet (UMES track, *UML and MDE for Embedded Systems*), Sorin Huss (DCS track, *Discrete and Continuous Systems*), and Frank Oppenheimer (CSD track, *C-Based System Design*). Moreover, I would like to acknowledge the extra effort made by the authors to layout, and in most cases revise and extend their original work as a contribution to this book.

Universität Stuttgart

Martin Radetzki
FDL'08 General Chair

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