

Preface

The ever-increasing complexity of electronic systems resulted in a strive for higher levels of abstraction in the corresponding design flows. This led to the rise of high-level programming languages in the design of software systems and the consideration of high abstraction levels such as the register-transfer level (RTL) or the electronic system level (ESL) in the design of hardware or embedded systems. Besides that, modeling languages such as the Unified Modeling Language (UML) or the Systems Modeling Language (SysML) find more and more interest. They allow for a formal description of the system to be implemented which can be checked for consistency and correctness before the actual implementation phase.

However, the gap between the initial textual specification and its desired implementation is still significantly large. Single models are often not sufficient. Instead, an iterative model development scheme is applied which, based on the given textual specification, starts with an abstract model which is subject to a refinement process. Two “directions” of refinement are thereby applied: Vertical refinement aims for adding detail and precision to single description means, e.g., simply provides more details for a given model. Horizontal refinement considers several views on one level of abstraction, e.g., refines the system specification by dedicated descriptions for structure or behavior. Unfortunately, vertical refinement and horizontal refinement are usually conducted manually thus far—making it an expensive and error-prone process.

In this book, an overview on automatic model refinement is provided—with a particular focus on verification. Several methods are introduced which support designers of electronic systems in the refinement process. This particularly includes a thorough consideration of verification, i.e., approaches allowing to automatically check whether a refinement has been conducted as intended.

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Models

From the Specification to the Implementation

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