On Integrating the MÖBIUS and MODEST Modeling Tools

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This tool paper presents the integration of the MODEST specification language into the MÖBIUS framework.

The MÖBIUS framework. The MÖBIUS framework [2] is an environment for supporting multiple modeling formalisms and solution techniques. Models expressed in formalisms that are compatible with the framework are translated into equivalent models using MÖBIUS framework components. This translation preserves the structure of the models, allowing efficient solutions. The framework is implemented in the tool by a well-defined Abstract Functional Interface (AFI). Models and solution techniques interact with one another through the use of the standard interface, allowing them to interact with MÖBIUS framework components, not formalism components. This permits novel combinations of modeling techniques. The AFI uses abstract classes to implement the framework components. The most basic model in the MÖBIUS framework is an atomic model, and is made up of state variables that hold information about the state of a model and actions that are used for changing model state. Stochastic activity networks (SANs) and the stochastic process algebra PEPA are example atomic models that have been successfully implemented in the MÖBIUS tool.

The MODEST modeling language. MODEST [1] is a modeling language that has a rigid formal basis and incorporates several ingredients from light-weight notations (e.g., SDL and the UML) such as exception handling and modularisation. The semantics enables formal reasoning and provides a solid basis for the development of tool support. MODEST is a modern stochastic process algebra and contains features such as simple data types, structuring mechanisms like composition and abstraction, atomic statements to control the granularity of transitions, non-deterministic and probabilistic branching and timing. Modeling and analysis of MODEST models is supported by a prototype tool-suite. The language parser and a simulator have been finalized. The simulator allows to traverse the (infinite) tree of possible behaviors of the MODEST specification under study. The simulator supports real-time, discrete probabilistic branching, and probabilistic timing. The underlying (finite) state space of a MODEST specification can be generated and be checked for functional correctness (like deadlock and livelock freedom) using e.g., the model-checking facilities of CADP [3].

Incorporating MODEST into the MÖBIUS framework. Recently, the MODEST modeling language has been integrated as an atomic model into the MÖBIUS framework. This complements the qualitative analysis of MODEST specifications using CADP with powerful solution techniques of MÖBIUS for quantitative assessment such as (distributed) discrete-event simulation (for models without non-determinism) and numerical analysis, e.g., for Markov models. Besides, it constitutes the basis for system specifications that are partly specified in MODEST and partly described by other formalisms such as SANs, and enlarges the classes of stochastic models in MÖBIUS.

The integration of MODEST into the MÖBIUS framework is established by a direct mapping from MODEST onto the MÖBIUS AFI. For each MODEST model C++-code is generated; this is compiled and the resulting object files (for all models) are packaged to form a library archive. MODEST actions are represented by actions in the MÖBIUS AFI, whereas the state variables in the AFI are representations of the local and global process variables in MODEST together with a vector of states for each process component in the MODEST specification.

References

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