Enhancements of Statechart Modeling—
The KIEL Environment

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Introduction

Motivation:
• Statecharts possess high complexity (combinations of components, dependencies, system dynamics, concurrency)
• tools for modeling Statecharts provide restricted facilities to enter and understand complex system behavior

Purpose:
• formulation of improvements for easy modeling, analyzing and understanding complex Statecharts
• establishment of these improvements in a highly configurable tool for modeling and simulation
• validation of operativeness of the tool
Layouting Statecharts

Kiel Integrated Environment for Layout

- uses several layout heuristics to choose from
  - a simple horizontal/vertical layout scheme
  - more advanced schemes, provided by GraphViz
- provides generic wrapper to create hierarchical layout from flat layout schemes
- implemented in Java
- highly configurable
Creating Statecharts

Approaches:

1. quick-and-dirty graphical model (WYSIWYG)
   - import from Esterel Studio, Matlab/Simulink/Stateflow

2. structure-based editing
   - selection and manipulation (KIEL-Macro editor)
   - Statechart production rules

3. textual languages
   - KIT (Statechart description language)
   - Esterel
Creating Statecharts

- Different Representations of an SUD Example

(a) KIT—Textual Description Language

(b) Esterel

(c) Safe State Machine
Visualizing Statecharts

Idea: Views should hide in-active sub-states

- present dynamically changing views dependent on
  1. simulation state
  2. user requests

- a dynamic extension to semantic focus-and-context representation (Köth)

- Views:
  - associated with deepest hierarchy levels of macro states
  - all simple states of this level share one view
  - each view shows complete system
Checking Statechart Style

Statechart Style Guide:
- operational instructions for humans and configuration for automated analysis
- set of 41 wellformedness-, syntactic, and semantic rules
- defines a subset of the language Statechart

Statechart Style Checking:
- based on defined Style Guide
- allows to express new rules in OCL or in Java
- theorem prover for more advanced checks

Syntactic Rules

Semantic Rules
Summary and Outlook

The KIEL Prototype (Summary)

- automatic layout of Statecharts
- several layout heuristics
- interfaces to Esterel Studio and Stateflow
- supports dynamic Statecharts
- easy textual modeling
- transformation of Esterel to SSM
- checking of syntactical/semantical properties
- has been used successfully in teaching “System Modeling and Synchronous Languages”
- empirical experiment evaluation shows efficiency and practicability
- URL: http://rtsys.informatik.uni-kiel.de/~rt-kiel

Outlook on KIEL

- examine further layout schemes
- refine secondary notations for Statecharts (et al.)
- extensive explorative analysis of the empirical study
- layout, textual description with graphical model synthesis, and simultaneous display for data-flow languages (SCADE/LUSTRE)

thanks!
questions or comments?