TOPCASED Days

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Using TOPCASED for Model-Based Testing

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Outline

- Model-Based Testing
- VETESS project
- UML4MBT plug’ in
- SysML4MBT plug’ in
- Experimentations
- Demonstration
Model-Based Testing (MBT)

1. Modeling
2. Generation
3. Concretization
4. Analysis

Specification → Test case generation tool → Test cases → Test Runner Interface → Test Bench

Simulation Mode
VETESS project

VETESS: verification of vehicle embedded system by automatic test generation from specifications.


Project members:
• Smartesting: editor of tooled MBT solution (Test Designer).
• Clemessy: testing bench provider (Test In View).
• PSA Peugeot Citroën: car manufacturer.
• LIFC: Model-Based Testing expertise (MBT).
• MIPS: Model Driven Engineering expertise (MDE).
VETESS project
UML4MBT plug‘ in
UML4MBT plug’ in: UML4MBT

Class Diagram:
- Static view of the system.
- Classes, associations, enumerations, class attributes and operations.

Object Diagram:
- Concrete objects used to compute test cases.
- Define the initial state of the system.
- Must be an instantiation of the class Diagram.
Dynamic view:

- One Statemachine Diagram (annotated with OCL constraint).
  - parallel states
  - historic states
  - fork and join states
- OCL expressions to precise behaviors of operations and transitions.

Several restrictions on OCL.
UML4MBT plug’ in: OCL editor

OCL editor:

- Syntactic coloring.
- Auto-completion:
  - Transitions guards and effects.
  - Operations preconditions and postconditions.
  - States onEntry and onExit.

```
---@REQ:HIGH_LOW_MODE_MNGT, AUTOMATIC_FW_SPEED_REDUCE
---@AIM:WIPERS_SPEED_AUTOMATIC_DECREASE
if (self.frontWiperSw=FRONT_WIPER_SW_BY_DRIVER::LOW) then
  ---@AIM:LOW_CHANGES_TO_STOP, SEND_FW_STOP_CMD
  self.sentCmds.frontWipingRequest = 0
else
  ---@AIM:HIGH_CHANGES_TO_LOW, SEND_FW_LOW_CMD
  self.sentCmds.frontWipingRequest = 6
endif
```
UML4MBT plug’ in: verification part 1

Syntactic verification:

• UML model satisfies UML4MBT restrictions.

• Checking syntactic errors:
  – Same name for an association and a class.
  – Multiplicities violations (object diagram).
  – OCL errors…
Functional validation:
- Simulation of the model.
- Checking the correctness of modeled behaviors.
UML4MBT plug’ in: scenario manager

Scenario manager:
- Creating and checking of scenarios.
- Sequences of operation calls.
- New test cases.
Test suites:

- Splitting test targets.
UML4MBT plug’ in: export

Export:
- Exporting model to a metamodel based file. (.uml4mbt)
SysML4MBT plug’ in: SysML4MBT

Block Definition Diagram (BDD):
- Static view of the system and its environment.
- Blocks, associations, compositions, enumerations, blocks attributes and operations, ports and signals.

Internal Block Diagram (IBD):
- Interconnection between blocks.
- Represents electrical or mechanical communications.
SysML4MBT plug’ in: SysML4MBT

Dynamic view:

- One or more Statemachine Diagrams (annotated with OCL constraints).
  - parallel states
  - historic states
  - fork and join states
- OCL expressions to precise behaviors of operations and transitions.
- Triggers: signal reception.
SysML4MBT plug’ in: SysML4MBT

OCL:
- Same restrictions than in UML4MBT.
- Addition of OCL ^ operator (signal sending).

Requirements Diagram:
- Represents system requirements.
- Links requirements with model elements that satisfy them.
SysML4MBT plug’ in

Adapted from UML4MBT plug’ in:
- OCL editor.
- Syntactic verification.
- Definition of test suites.

New dedicated export:
- Exporting the model to a SysML4MBT file.
- Transforming the SysML4MBT file to a UML4MBT file. [LBL+10]

Experimentations

- **Wiper:**
  - Specification of the front wiper system of a car.
  - The modeled functionalities are slow speed drying up, high speed drying up, intermittently speed drying up and cleaning with drying up.
    - 133 behaviors covered with 115 tests.
    - Tests executed with simulation mode.

- **Steering:**
  - Representation of the steering column of a car.
  - Reaction of the steering column in regard of road.
    - 154 behaviors covered with 154 tests.
    - Tests executed on physical test bench.
Demonstration

Video:

• English version:
  http://lifc.univ-fcomte.fr/vetess/video_en/

• French version:
  http://lifc.univ-fcomte.fr/vetess/video_fr/
The End

Any questions?

http://lifc.univ-fcomte.fr/vetess/