A Simple SIS for Research

Reactive!
Real-time!
Distributed!
Embedded!
Heterogeneous!

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Process Modelling for MPM


Sadaf Mustafiz, Joachim Denil, Levi Lucio, and Hans Vangheluwe; "The FTG+PM Framework for Multi-Paradigm Modelling: An Automotive Case Study"; Accepted @ MPM2012 of Models2012, 2012

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Hybrid Simulation

InterfaceBlock::update

Data-In

Data-Update-In

Control-rules

Model::update

Data-Update-Out

Data-Out

no

yes

InterfaceBlock::Data-In

InterfaceBlock::Control-Rules

Data-In::data-InRule

ControlRules::store

TriggeredRule
data-InRule
data-InRule2
...

ControlRules::onPeriodicRule

storeTriggeredRule

onPeriodicRule
...

OR

AND

Condition

Expr

Condition

Period

Offset

engine with ECU

gearbox with ECU

thermal systems

automated cargo door

chassis components, roadway, ECU (e.g. ESP)

etc.

functional mockup interface for model exchange and tool coupling

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Process Modelling for MPM

Design-Space Exploration

Joachim Denil, Antonio Cicchetti, Matthias Biehl, Paul De Meulenaere, Romina Eramo and Serge Demeyer; Automatic Deployment Space Exploration Using Refinement Transformations; Accepted @ MPM Workshop of Models 2011
Explosion

Joachim Denil, Han Gang, Magnus Persson, Xue Liu, Haibo Zeng, Hans Vangheluwe, "Model-Driven Engineering Approaches to Design Space Exploration", School of Computer Science, McGill University, January 2013, SOCS-TR-2013.1
Give Engineers the tools

Models?
### Real-Time Preserving Instrumentation

**Normal Execution (no rate transition block):**

<table>
<thead>
<tr>
<th>Sine Wave</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sine Wave</td>
<td></td>
</tr>
</tbody>
</table>

**Rate Decreased (two times):**

<table>
<thead>
<tr>
<th>Sine Wave</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sine Wave</td>
<td></td>
</tr>
</tbody>
</table>

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![Diagram](image)
Working on:

- Heterogeneous modelling and co-simulation:
  - Work with Bart Meyers: Hybrid to FMI co-sim
  - Work with Bert Van Acker and Claudio Gomes (see presentation)

- Extra-functional aware instrumentation of models:
  - Work with Sebastian Fishmeister (U of Waterloo)

- Consistency during mechatronic design:
  - Work with Istvan (see presentation)

- Control – Deployment Co-Design:
  - Work with Ken on RTE (see presentation)
  - Design-space Exploration techniques for MDE