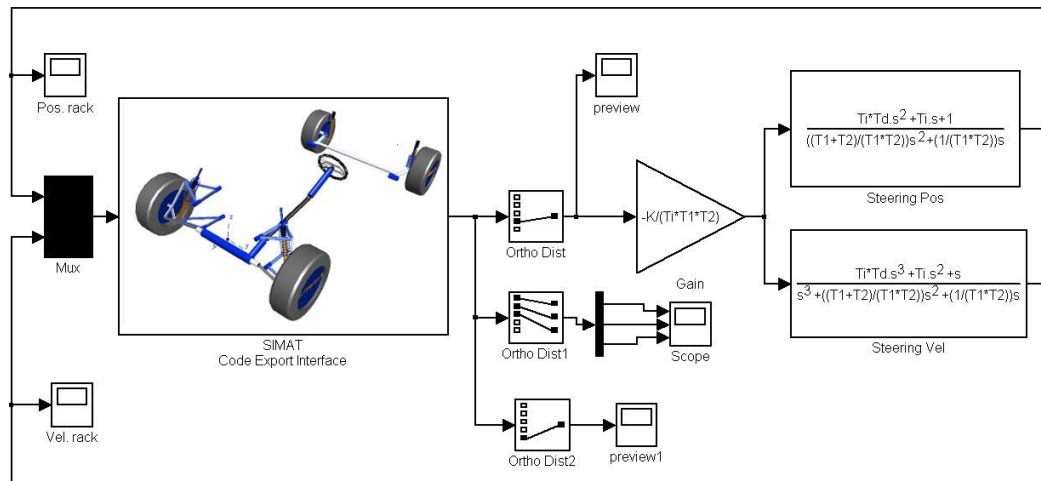


SIMPACK Code Export

The Basis for Mechatronic Simulation



Contents



SIMPACK User Meeting 04, SIMPACK Code Export, 09.11.04, Frank Kohlschmied

 SIMPACK
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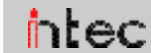
- **Functionality**
- **Fields of Application**
- **What's new since last User Meeting**
- **Parameterisation**
- **Access to ETAS Environment**
- **Current Implementations - Outview**

Code Export Functionality



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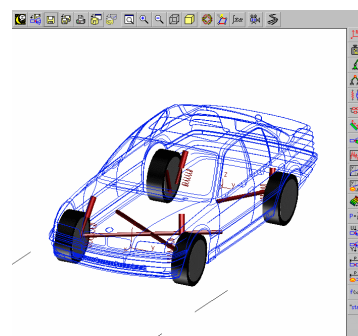


3

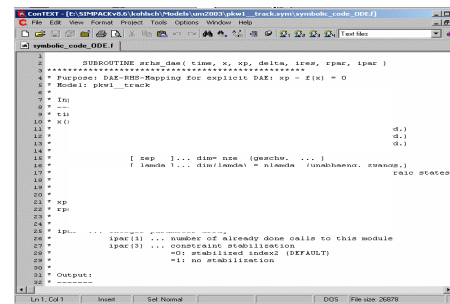
Overview



Automatic generation of dynamic equation of (nearly) arbitrary SIMPACK models as source code

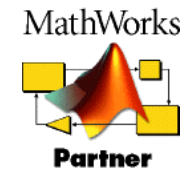


Code Export



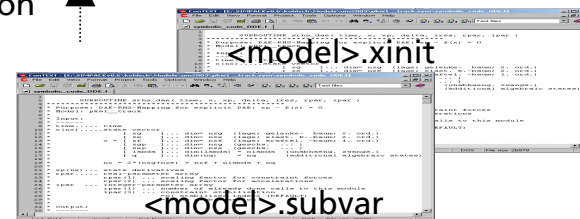
Reads at initialisation

$$\int x dt$$



USER

<model>.data_base



Code Export Functionality



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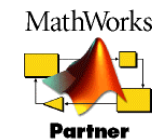
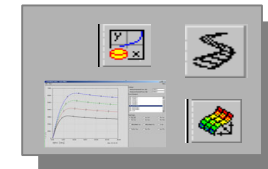
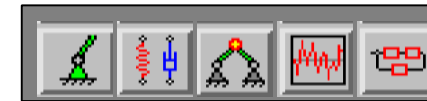
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Features

- minimized model specific pre-processing
- code optimised for simulation time
- huge subset of SIMPACK functionality and elements supported
- usage of SIMPACK elements in licensed library
- usage of user routines
- usage of model specific data base
- pre-defined main functions for ODE and DAE solver, test call and calculation of jacobi matrix
- to be linked to arbitrary solver systems with supported connection to external SIMPACK solver and MATLAB
- state results are written in SIMPACK and MATLAB format
- (nearly) completely parameterisable



Overview

- **acceleration, for**
 - models with long simulation time
 - models with short simulation time, but long initialisation

- **provide non-MBS user with complex MBS systems**

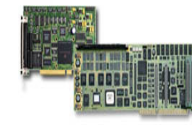


- SIL control design development
- automatic integration to SIMULINK as continuous or discrete system
- full SIMPACK parameterisation without application know-how

- **implementation in HIL simulation**

- supported access to ETAS HIL environment (RTPC)
- support of further HIL environments (xPC, dSPACE)
in development

- ...



Fields of Application



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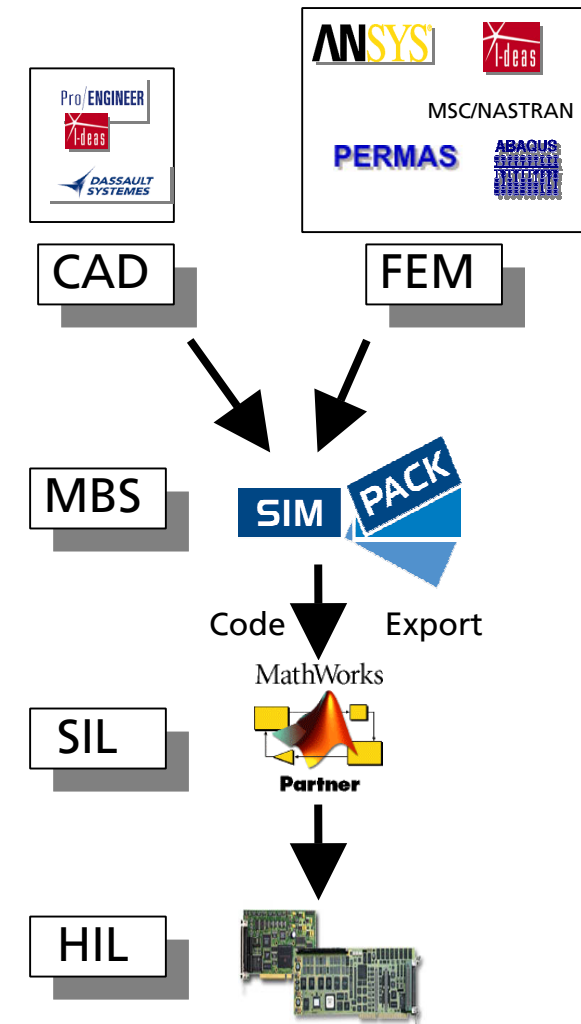
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Advantages

- **closed CAE chain**
 - usage of CAD and FEM data in SIL or HIL environment
 - unique data in MBS, SIL or HIL simulation
- **graphic MBS programming**
 - no programming errors like in manual coding
 - easy model modifications by SIMPACK process
 - realisation of complex model in code
- **quality assurance by SIMPACK**
 - quality of mechanical model verified by commercial MBS Tool
- **methodical further development by Intec**
 - new MBS elements
 - e.g macro joint



What's new since last User Meeting?



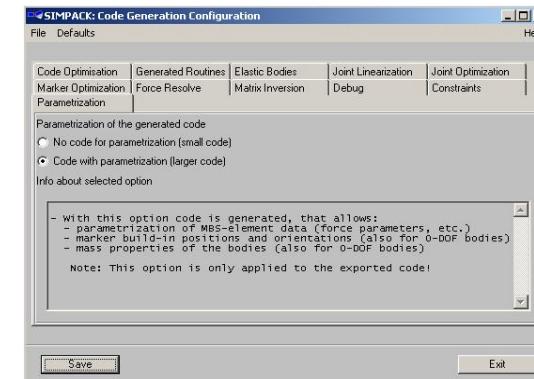
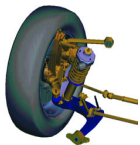
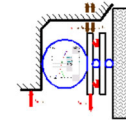
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- virtual suspension
- user routines (forces, joints, timex) and selected access functions supported
- tyre elements (standard / SIMPACK user + Tidex / Delft Tyre (MF, MC, Swift))
- tyre- and track related excitations
- flexible bodies
- configuration menu
- parameterisation
- ready-to-use vehicle model on SIMULINK basis for real-time simulation
- access to **ETAS** real-time environment



Parameterisation



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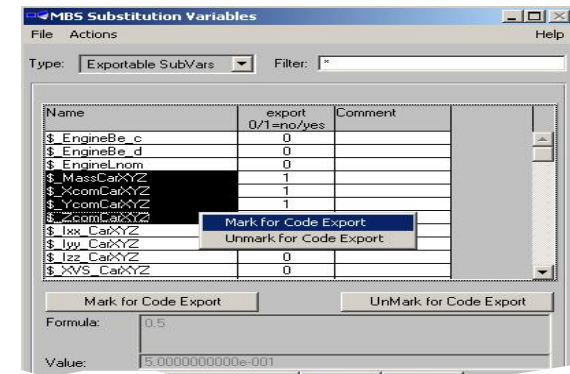
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What's parameterisation

Modification of a model parameters without new export or recompile

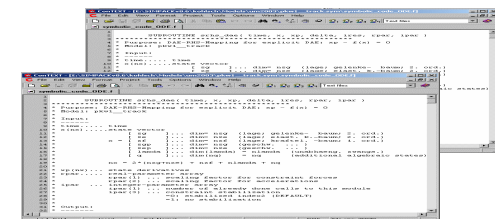
Conception: SIMPACK expert provides end-users with Exported model

- selects free-parameters for variation
- "graphic programming": no structural modification



Default Parameterisation

- model parameters to be modified in exported model must be defined as substitution variables to be selected in new Code Export GUI
- supported elements:
 - rigid body parameter
 - marker parameter
 - library element parameter (force, joint, timex, marker)
- created files (read at initialisation):
 - <model>.subvar: selected substitution variables
 - <model>.xinit: all initial states



<model>.xinit

<model>.subvar

Access to ETAS – HIL Environment



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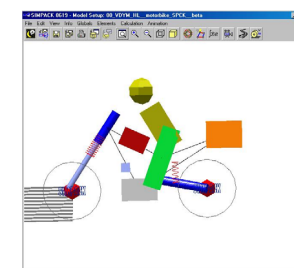
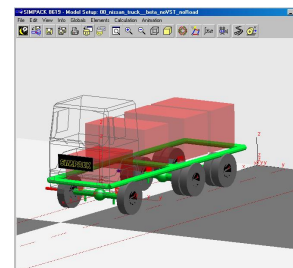
VDYM Ready-to-Use Vehicle Model for Real-time Simulation

- based on C-code
- fully parameterised
- suspension by semi-trailing arm
- (elasto-) kinematic suspension by lookup table
- (elasto-) kinematic suspension by macro joint
- fully integrated in ETAS environment
- ...



Process: SIMPACK MBS to ETAS Real-Time Environment for General Models, e.g.

- trucks
- motorbike
- trailer
- engine
- landing gear
- general mechanism
- ...



Access to ETAS – HIL Environment

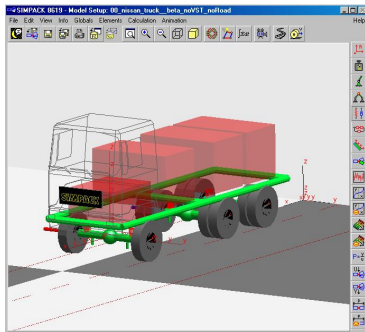


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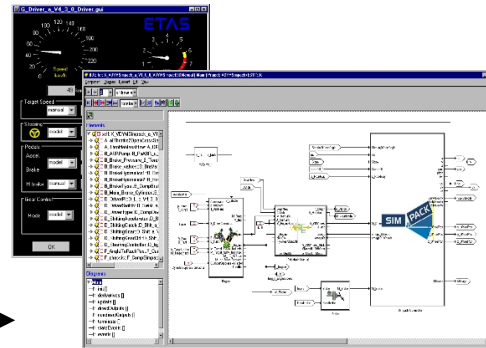
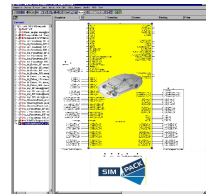
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SIMULINK model



ETAS

SIMPACK Element library for RTPC (Linux)



ETAS RTPC

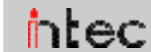


Access to ETAS – HIL Environment



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Conception

Code which satisfies ETAS requirements is created, if ETAS option is selected in Code Configuration GUI

Features

- ETAS Real Time PC (RTPC) based on Linux OS
- ETAS Parser integrated in Code Export process
- Parameterisation is adapted to ETAS requirements

Current Implementations - Outview

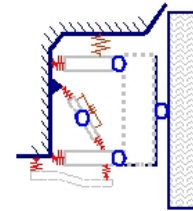


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- next steps for Code Export Stage 1
- Export of C-Code
- automated access to further HIL environments
- automation process for quality assurance
- definition of Code Export Stage 2



In future most 3-dim multi-body models will be used in non-multi-body environments by non-multi-body experts

