SIMPACK Code Export

The Basis for Mechatronic Simulation
Contents

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Overview

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

• ...
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?

- 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
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
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

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

SIMPACK Element library for RTPC (Linux)

SIMULINK model

ETAS

ETAS RTPC
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

- 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.