Further Developments and New Applications of Simpack Code Export
Further Developments - Overview

Further Developments in SIMPACK Code Export

- extension of solver functionality
- new supported elements
- export of C-code
- access to HIL targets
“DAE Interface”

• enable solver for system of non-linear equations in Code Export (assemble system)
• enable reset of state vector from User Routines
• activate solver re-initialisation and assemble of state vector from User Routines

-> Purpose: enable User Routines with modifications in force law

Quasi-static Solver (driven equilibrium)

• get solution $x$ for
  $$xp = \text{sum}[F(x,u)]M^{-1} := 0$$
  or alternatively
  $$M*xp = \text{sum}[F(x,u)] := 0$$

• calculates static equilibrium for given positions $u(t)$

-> Purpose: much faster solution for quasi-static problems than time integration
New Supported Elements

• enable arithmetic **if-loops** in Substitution Variables for code parametrisation

• enable Code Export with parametrisation and **Elastic Bodies**

• enable **spck_dv_forceatmarker**

• enable tyre-model **TM-Easy** and **MF-Tyre** with tyre Force Element in Code Export

• enable Force „61: Virtual Anti Roll Bar“ and Force „64: Virtual Steering“ in Code Export

• enable **Moved Marker by Controller Input 6 DOF** (Moved Marker 81 and Control Element 124)

• enable **MATLAB Workspace based parametrisation** of Substitution Variables, Input Functions and Function Arrays (Dev)
Export of C-Code (Dev)

Why C-code?
- avoid usage of Fortran compiler for exported code
- enable access to arbitrary OS/CPU combinations (Hil-targets)

Problem:
- shareware f2c only available for f77 (SIMPACK contains F90 since v8.5)
- commercial converters require run-time library

Solution:
- development of SIMPACK-specific f90-2-C converter which supports reduced functionality of Fortran90: ForC (by Cobalt Blue)

Application Scenario:
- ForC will be integrated in CE-process, to convert model specific code
- appropriate C-based element library will be provided by Intec
- can be used alternatively to F90 based solution

Release:
- will be released as soon as test phase is completed successfully
Export of C-Code (Dev)

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Export of C-Code (Dev)

**License libraries in SIMPACK installation**

- **code_export_f90.lib**
  - for Windows, Linux, ...
  - Compile and executable for ODE time integration
  - and executable for DAE time integration
  - and DNI/LINK S-Function
  - and executable for driven equilibrium
  - and user specific executable

- **code_export_C.lib**
  - for Windows, Linux, ...
  - Compile and executable

**SIMPACK Release**

**SIMPACK Dev Version**

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**SIL**

- `<model>.f`
  - Compile / create S-function
  - Convert (ForC)

- `<model>.c`
  - Compile / create S-function
Ready to use vehicle model: VDYM

- fully parametrised
- suspension kinematics by semitrailing arm,
- (elasto-)kinematic lookup-table, macro joint
- contains ETAS road and driver and SIMPACK vehicle model
- trailer soon available
- available for ETAS RTPC, can be ported to other HIL-Targets

Code Export to Realtime Target

- available as process with engineering support by Intec
- for arbitrary user specific models
- Intec provides element libraries for:
  
  ETAS RTPC
  XPc-Target
  dSPACE ds1005
  dSPACE ds1006

- libraries can be provided on different plattforms on user demand
Access to HIL Targets

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Customer Application Examples

SIMPACK Release
SIMPACK Dev Version
... with INTEC Engineering

Licensed libraries in SIMPACK installation

code_export_f90.lib
for Windows, Linux, ...
code_export_C.lib
for Windows, Linux, ...
code_export_C.lib
for HIL-target

SIL

<model>.f ➔ compile / create S-function ➔

convert (ForC)

<model>.c ➔ compile / create S-function

HIL

compile for HIL-target

RTW