Working with SIMPACK 8.7 and Beyond
Overview

- The Philosophy and Focus of SIMPACK 8.7
- The Numbers of SIMPACK 8.7
- The Key Features of SIMPACK 8.7 and “Hands-on”
- SIMPACK what’s next
- Summary
The Philosophy and Focus of SIMPACK 8.7

Philosophy

- Evolution of existing Functionality based on 8.6 Architecture
- Revolutionary new functionality
- Strongly driven by Customer Inputs and Requirements

Focus

- Engine
- Code Export / Realtime
- Solver
- General Enhancements
- New Architecture
The Numbers of SIMPACK 8.7

- Development Start Q1 2003
- More than 400 items:
  - Customer Driven
  - Technology Driven
  - Bug Fixes
- Incremental Releases of New Functionality started Q3 2003
- All major new Functionality completed in July 2004
Key Features of SIMPACK 8.7, General I

SIMBEAM

- Support for other than 6-DOF Joints
- Rigid Body Elements
  - Massless
  - With Mass

SIMAT

- Linear System Matrix Export with Names of u, x and y-Vector
- Export of linearization State to .m File

MATSIM

- Discrete Blocks
Key Features of SIMPACK 8.7, General II

Array Function Set

- Multiple Array Functions (Input Function Arrays) in one File
- e.g. for Virtual Suspension Properties

U-Vector

- Standard Element with Name
- Full control over sequence of elements
Key Features of SIMPACK 8.7, General III

- **GearWheel**
  - External and internal GearWheels
  - Spur and Helical GearWheels
  - Analytical Contact Computation
  - Directly connected to 3D Graphics

- **Hertzian Contact Force Element**
  - ball – ball, cylinder – cylinder, plane – ball, plane – cylinder
  - Body fixed or Moved Markers
  - Rigid or Flexible Bodies

- Flexible body curve/surface contact
Key Features of SIMPACK 8.7, General IV

- Scaled Transient Animation
  - separate for Rotations and Translations of rigid Body Motions
  - Scaling wrt. any Marker on the scaled Body
  - Scaling Reference selectable
  - Scaling Direction Reference selectable

- Copy and Paste of Elements via Right Mouse Button
Key Features of SIMPACK 8.7, General V

- Extended MBS-Info
- Documentation revised and enriched with example models
- Linux Port
  - Solver, GUI and Graphics
  - Support for RedHat 8 with GNOME Desktop
Key Features of SIMPACK 8.7, Automotive I

- Delft Tyre 6.0
  - Belt Movement Visualization
  - Support of Test Rig (“moving Road”)
  - Works @ zero Velocity incl. steering
  - low level / standard / supreme

- Non-linear Elastomer (Pfeffer model)
  - Dynamic Stiffness vs Frequency and Amplitude
  - Loss Angle vs Frequency and Amplitude
  - Measurements of Standard Parameter Sufficient
  - Computing Time
  - Simple Input Parameters
Key Features of SIMPACK 8.7, Automotive II

- Virtual Suspension
  - Kinematics and Elastokinematics
  - Steered and non-steered
  - Suspension array generation

- Virtual Anti Roll Bar
  - Single Force Element between up to 4 Markers
  - Linear and non-linear Kinematics
  - Linear and non-linear Spring Rate and Damping

- Track (see Wheel Rail)
  - Cartographic
  - Measured
Key Features of SIMPACK 8.7, Wheel Rail I

- New Cartographic Track

- Uses simple track elements that can be arbitrarily assembled
- No restriction in number of elements
- No restrictions in element combination
- Many types of transition curves, ramps and vertical transitions
- Comments for each element
- Can be read from data files in common formats (e.g. DB-GIS)
- SubVar parametrizable
Key Features of SIMPACK 8.7, Wheel Rail II

New Measured Track

- Three common ASCII formats for measured track
- No conversion to binary format necessary
- Vertical layout is now considered
- s-coordinate or x/y/z coordinate based input
- unit conversion

```
header.begin
data.type = 3
! File format Type: 1/2/3 = s,psis,gems,u / x,y,z,cmh / x,y,z,u

data.par(1) = 1.0
  ! UnitFactor = x,y,z[User] / x,y,z[m] (m)
data.par(2) = 1000.0
  ! UnitFactor = u[User] / u[m] (mm)
data.par(4) = 1
  ! 0/1/2 = Super-elevation about center/inner/outer Rail
data.par(5) = 1.506
  ! Reference Length of Super-elevation [m]
data.par(7) = 1
  ! Increment for Data Reduction
header.end

! x [m]   y [m]   z [m]   u [mm]
0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00
0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00
0.0000000E+00 0.0000000E+00 0.0000000E+00 0.0000000E+00
1.993289 0.0000000E+00 0.0000000E+00 0.0000000E+00
```
Key Features of SIMPACK 8.7, Wheel Rail III

- Improved Track Irregularities
  - Any combination of irregularity types possible
  - Scaling and offset for irregularities read from file

- Updated Vehicle Globals

- New Force Elements
  - Advanced Air Spring with many options
  - Shear Spring with improved lateral and bending behavior

- Improved Wheel Rail contact
  - Contact boundaries on wheel profile now available in Vehicle Globals
  - Improved profile check plots for multipoint contact
  - New elastic multipoint contact, more stable than constraint multipoint contact
  - Stop to zero speed and restart possible, even on a slope and with
Key Features of SIMPACK 8.7, CodeExport / RealTime

- **Code Export**
  - Export of SubVar parametrized Models
  - Support for RealTime specific Elements
  - Support for Flexible Bodies
  - ... see presentation of F. Kohlschmied, INTEC

- **RealTime**
  - SIMPACK CodeExport based ETAS
    - Vehicle Dynamics Model VDYM 5.0
  - ... see presentation of F. Kohlschmied, INTEC and G. Wittler, ETAS
Key Features of SIMPACK 8.7, ENGINE I

SIMPACK User Meeting 04, SIMPACK 8.7 and Beyond, 2004 Nov 09, W. Trautenberg

Valve Train
Timing Mechanisms
Accessory Drive
Crank Train
SIMPACK
Engine

Details: see Presentation of M. Schittenhelm, INTEC
Key Features of SIMPACK 8.7, Solver

- Nominal Forces:
  - Adaption to Wheel Rail models
  - Wheel-Rail elements may be disabled during calculation
  - Useful for torsionally elastic bogie frames

- VTL / Parameter Variation:
  - new Pre-Calculation options

- Enhanced Linear System Analysis

- Speed up of flexible Body Simulation
  - optimization of internal Matrix computations
  - Linear Subsystem (LSS) see presentation of Dr. Dietz, INTEC
Key Features of SIMPACK 8.7, CatSIM V5

New Product CatSIM V5: Interface to CATIA V5

- Model Export to SIMPACK DataBase
- Part/Body Export to SIMPACK DataBase
- Curve Export to SIMPACK DataBase
- ... SIMPACK result import (for DMU)
- ...

[Images of software interfaces and models]
Key Features of SIMPACK 8.7, ProSIM 5.1

Complete Revision of Interface to Pro/ENGINEER Wildfire

- Support for German and English language
- Speed improvements for Windows through DLL
- Standard SIMPACK naming conventions
- Optionally switch on/off
  - geometry file export
  - SIMPACK file export
- Multiple use of the same part
- Optionally connect all 'unfixed' parts by 0-DOF joint
- Merge parts easily via 0-DOF joints which are generated automatically
Software Architecture

- Completely new Object oriented Data Structures

- C++ as Coding Language

- New GUI Toolkit (QT)

- New Graphics Toolkit (OpenInventor)
New SIMPACK Architecture: SIMPACK Plot
What’s Next?

- SIMPACK Engine
- Solver
- Wheel Rail
- RealTime / CodeExport
- New Architecture
SIMPACK 8.7

- Evolution and Revolution
- Strongly Customer driven
- Production Ready
- Very well Tested
- New Functionality already on its Way