

# 200 New Features and Improvements introduced with SIMPACK Version 8904

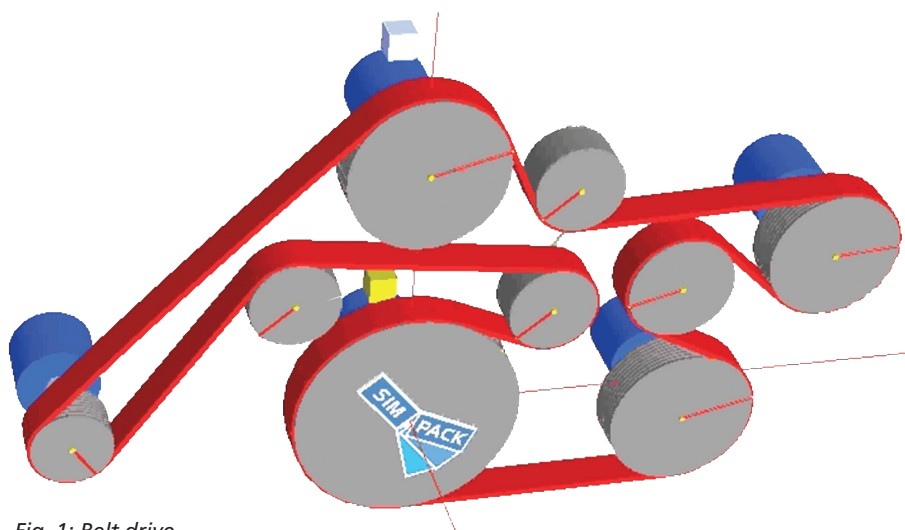


Fig. 1: Belt drive

The SIMPACK development team is strongly focused on creating SIMPACK 9000, the next major SIMPACK release due in 2011. Nevertheless, a lot of attention and development effort was put into SIMPACK 8904, the latest SIMPACK version, released in September 2010. Almost 200 new features and improvements have been added to SIMPACK 8904.

These include brand new SIMPACK modules such as the belt drive module or the Bio-Mechanics module, as well as major new features for existing modules, such as the newly added Gear Pair Force Element capabilities. The most important of these new features and improvements are summarized in the following sections.

For in-depth information on all changes, please refer to the release notes of SIMPACK 8904 which are available on the SIMPACK Download Server.

## GEARWHEEL SIMULATIONS GOING 3D

The fast and accurate SIMPACK Gear Pair Force Element was greatly enhanced in numerous ways. Functionalities such as automatic slicing and effects like force shuttling can now be used to include 3D effects into the gearwheel simulation. Additionally, different methods were added for taking into account profile and flank modifications of the gears.

The list of supported geometry pairings was expanded to facilitate the simulation of rack and pinion pairs. To enable easier postprocessing and greater insight, the generated outputs were completely reworked, including drastically improved 3D visualizations of the forces acting in a gear pair. Another important new capability is the data check facility that lets the user see all important gear pairing data in a central location. For more details, see the separate article on gearwheel simulation in this edition of the SIMPACK news (see page 25).

## BRAND NEW BELT DRIVE MODULE

The list of the major drivetrain coupling elements of gearwheels and chains was complemented by adding the Belt Drive module (Fig. 1). Starting with SIMPACK 8904, detailed and fast belt drive simulations can be performed via a modal belt description. A belt drive is defined by the pulleys, the optional tensioner system and the belt force element that connect the former elements to a belt drive. The belt itself is defined via its geometry and material properties. From these inputs, SIMPACK automatically computes a modal description of the belt. Different friction models are available.

## CHAIN DRIVE ENHANCEMENTS

The Chain Drive module, the third of the three drivetrain coupling modules, was enhanced with the capability to include an additional centrifugal ring when using smart chains (Fig. 2). Now, in addition to the contact of the chain plate with the chain

wheel shoulder, the chain plate can have contact with these additional rings.

## DYNAMIC BUSHING PARAMETER FITTING AND NEW OPERATING MODE

A new operating mode was added to the dynamic bushing force element to enable a hysteresis computation that provides for a memory effect typically seen in bushing measurements.

Finding the right set of parameters for the dynamic bushing was made much simpler and quicker by introducing a parameter fitting utility. This utility allows the user to tune the force element parameters interactively via sliders while a plot shows the comparison of measured and computed data.



Fig. 2: Centrifugal contact ring for chains

## TIRE NEWS

CDTire (Fig. 3), a tire model for comfort and durability applications, owned and now developed by the Fraunhofer Institute for Durability and System Reliability LBF, is now available as one of the tire modules shipped with SIMPACK. CDTire can automatically adapt to changing road situations by switching between different internal representations. These include detailed models for large deformations and allow for tire rim contact. In addition, the CDTire implementation in SIMPACK can take full advantage of multi core and multi CPU computers by utilizing one CPU core per tire if requested by the user.

The DELFT Tire module integrated in SIMPACK is now version 6.1.2. In addition

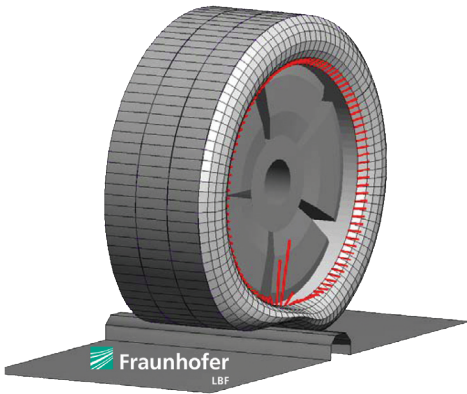


Fig. 3: CDTire

to many improvements, support for a new road type was added with this DELFT Tire version. The curved regular grid road (or CRG road), which describes the road via a grid of measured road heights lateral to a spine, can now be used with this tire model.

### NEW RAIL NEWS

The New Rail module was expanded to enable simulations of untrue (out-of-round) wheels. In addition, the simulation of large yaw angles was reworked and significantly improved leading to greater accuracy and robustness.

### MORE SIMULATION POWER FOR WIND ENERGY

In addition to many new features offered for drivetrain simulations which are also applicable for wind turbines, more wind specific functionality was added to this SIMPACK release. This includes a SIMPACK native integration of NREL's aerodynamic library AeroDyn for simulating the wind forces acting on rotorblades of horizontal axis wind turbines.

For simulating large non-linear deformations in rotorblades an option was added to SIMPACK's rotorblade generator to automatically split the rotorblade into different flexible bodies.

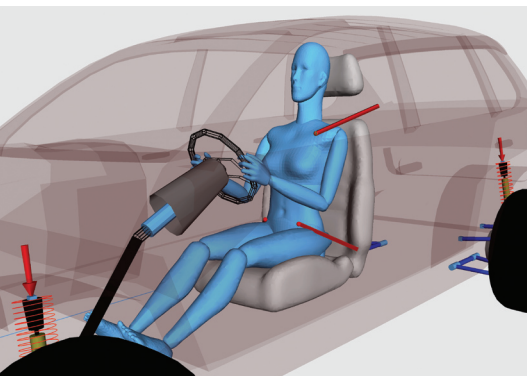


Fig. 4: Biomechanics

### BIOMECHANICS POWERED BY BIOMOTION SOLUTIONS

For analyzing biomechanic systems such as a human being interacting with a power drill, a seat restraint system or a motorcycle, a completely new module was added to SIMPACK (Fig. 4). This module consists of special force and control elements for modelling muscles, tendons and their respective controllers, spinal discs and so called wobbling masses. These elements are used in full or partial models of human beings with an adaptable level of detail. The models can be generated by a model generator that works off a database of typical human beings. The Biomechanics solution is contributed by Biomotion Solutions ([www.biomotion-solutions.com](http://www.biomotion-solutions.com)), a company that specializes in measuring and simulating the biomechanics of human beings.

### TIME EXCITATIONS SPED UP

The time excitation types 15 - for importing measured data on either position, velocity or acceleration level — and 20 — for importing a speed profile given over position — were significantly sped up and reworked to offer more options on dealing with the measured data. In addition, the time excitation type 17 — for importing velocity dependent periodic signals — was expanded to enable the definition of the Fourier Series via Re and Im as well as magnitude and phase.

### 3D PRIMITIVES

New primitives were added for displaying belt pulleys and the belt path. The gear wheel primitive was reworked to provide for a much more realistic display of bevel gears, and cylinder primitives can now have a hole.

### FLEXIBLE BODIES AND FATIGUE

The flexible body interface FEMBS now supports cdb files of ANSYS 12 models for the graphical representation of flexible bodies. Also, the solver performance for flexible bodies with a large number of modes has been greatly improved.

A solution for performing fatigue analysis was added directly into SIMPACK. This solution is based on the FAT4FEM technology (Fig. 5) developed by SafeFEM GmbH ([www.safe-fem.com](http://www.safe-fem.com)). Please see the separate article about this module in this SIMPACK news edition (see page 27).

### STRESS AND STRAIN COMPUTATION

SIMPACK 8904 now offers the possibility to compute and display strains for selected flex body nodes. The strains can be plotted as

standard 2D curves and can be exported in various formats.

The stress display capability of SIMPACK has been greatly sped up for ABAQUS and improved so that much larger FE-result files can now be processed.

### CODE EXPORT

The Code Export module was reworked to provide a simpler and cleaner interface by supplying the runtime library as convenient DLL. Also, the Code Export licensing is now completely based on OLicense.

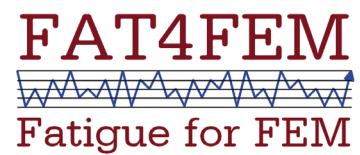


Fig. 5: FAT4FEM

### POSTPROCESSOR

A new spectrum filter was added to the PostProcessor, providing many interesting features such as overlapping averaging windows. The integration and differentiation filters were both redesigned and extended and can now also handle signals with non-equidistant x-axis values.

Displaying and scaling 3D force arrows was improved by adding a smarter scaling algorithm and more scaling options.

New commands were added to the scripting engine. The script execution now only requires a license if PostProcessing functionality is triggered by the script. In addition, the size of curve markers is now user definable.

### MATLAB® AND AMESIM INTERFACES

The MATLAB® interfaces SIMAT and MatSIM now support MATLAB version 2009b and 2010a.

The AMESim interface SIMAS now supports AMESim version 8 and 9.

### PLATFORM NEWS

Windows 7 is now a fully supported and certified SIMPACK platform.

Official support for RedHat Enterprise 5.3 was also added with this SIMPACK version.

On 64 bit operating systems, SIMPACK 8904 supports up to 4 GB of memory even with 32bit binaries. This is useful for simulation tasks that require huge amounts of memory, e.g. due to large result files that should be generated. It is therefore highly recommended to always install SIMPACK on machines with a 64bit operating system.