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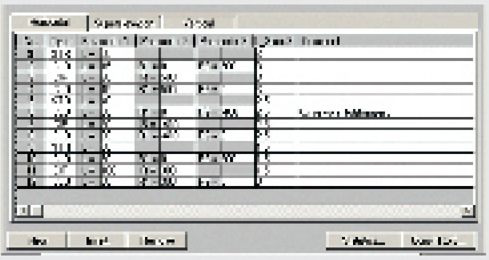
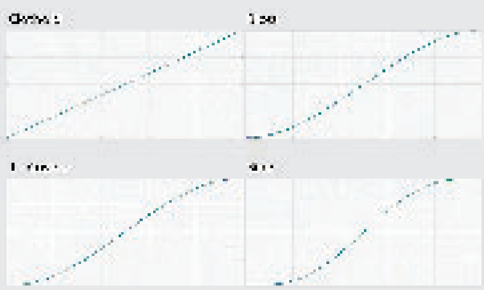
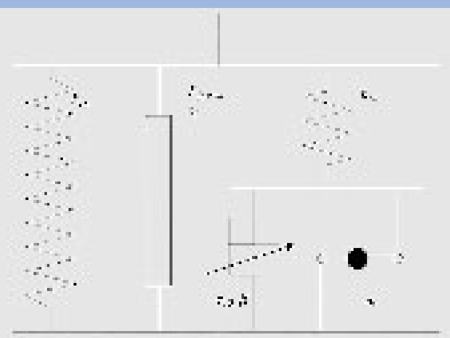
What's New in SIMPACK Wheel/Rail 8.7



Detail of New User Interface for Cartographic Track



Comparison of Curvature Runs for Different Transition Curve Types



Vertical Model of Advanced Air Spring with Stiffness, Coulomb Friction and Internal Dynamics Non-Linear Damping and Series Stiffness

As in every major SIMPACK release, the new SIMPACK release - 8.7 - has a lot of new features and improvements for our Wheel/Rail customers. The focus this time was not just on new developments, but on improving and enhancing the existing functionality.

NEW CARTOGRAPHIC TRACK

The new release offers a redesigned Cartographic Track Module, which offers more flexibility and user-friendliness. The Track no longer comprises of "ensembles", but is defined from individual true-to-life elements. In the horizontal, the elements used are straight sections and circular arcs, as well as the transition elements clothoid, bloss curves and sine and '1-cosine' transition curves. Corresponding elements are also available for the Track superelevation. The vertical elements consist of a constant slope element, as well as parabolic and circular arc transition elements. This new approach allows new Track elements types to be easily implemented.
There are no restrictions on which elements can be connected to each other. If the Track derivatives of conjoining elements are not continuous, then the transition will be smoothed. If the derivatives are continuous, then the smoothing is optional. The new GUI allows the Track data to be defined effortlessly, and to each Track section a comment can be added. In addition, it is possible to generate a file containing the Track information and load this into SIMPACK.
The Cartographic Track will soon be able to be parameterised, which will give the user a lot more freedom in varying Track data in the Virtual Testing Lab.

NEW ASCII MEASURED TRACK

The form in which data is entered into the Measured Track has been improved and made easier to understand. The Track data can now be entered in three different ASCII formats which are read-in directly by SIMPACK. The user defines the vertical and horizontal curvature and the superelevation, like in the old binary format. In addition, there are two new data formats, whereby the data is entered in Cartesian Co-ordinates (x,y,z). In one format the user enters the camber mm/m, and in the other, the superelevation is entered. In addition, the vertical trajectory is now considered for all file types.

IMPROVED IRREGULARITIES

The two most commonly used Track irregularities have been improved. Excitation type 08: 'Nonlin. Stoch. by Polynomial' can now include up to 2000 individual excitation frequencies, instead of the previous 500. Excitation type 09: 'Nonlin. Stoch. from File' now shows the mean value and the standard deviation of the signal for each direction in the SIMPACK Echo Area. Moreover it is now possible to shift or scale the irregularities read from the file. Thus also measured irregularities can now be widely used for sensitivity analyses or with different levels in more than one model.

NEW FORCE ELEMENTS

In SIMPACK 8.7 three new force elements are of interest to Wheel/Rail users. The Force Element 79: Shear Spring models the bending and shear effects in helical springs, which are often used as the primary or secondary springs. If the coupling Markers move sideways, there will be a restoring force as well as a torque; both will be applied equally at the 'From' and 'To' Marker.
The Force Element 80: Air Spring Advanced models an individual non-linear air-spring containing an additional volume and a spring connected in series. The data can be entered into the element as property parameters, e.g. bellow volume or effective area, or from measured test data. A complex non-linear modelling of the horizontal behaviour is coupled to the vertical behaviour using a shear spring approach. The user can easily switch the behaviour in the Force Element to linearised.
The Force Element 61: Vehicle Anti-

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Rollbar is used for the simplified modelling of anti-roll-bars; the four respective Markers on the bogie and traverse are entered as well as the torsional stiffness. The element distributes the resulting forces automatically at the four Markers.

IMPROVEMENTS IN NOMINAL FORCE CALCULATION

The automatic calculation of the nominal forces in railed vehicles can sometimes be a taxing problem. User errors will inevitably lead to incorrect or unusable results; vehicle unsymmetries can also cause problems and leave the user without an equilibrium. To help prevent user errors, the Nominal Force Parameters documentation has been improved, including a specialised section on railed vehicles. If the vehicle is unsymmetrical (e.g. if a wheelset generates tangential forces due to an initial yaw angle, then the resulting tangential forces cannot be brought into equilibrium by a nominal force), then it is possible to disable the wheel-rail contact by switching the wheelset Joints to rheonomic Joints for the duration of the calculation.

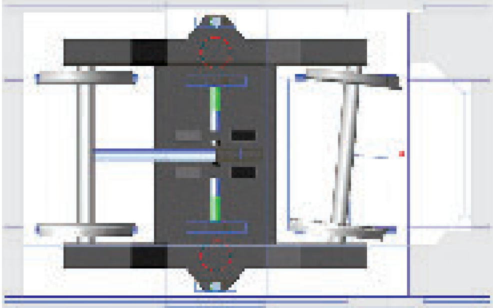
IMPROVEMENTS IN WHEEL/RAIL CONTACT

A new wheel-rail contact model has been introduced; it is now possible to use an elastic multi-point contact model for constant rail profiles. The principle is similar to the standard multi-point contact, however the normal forces at the contact point are not provided by a Constraint, but from a spring-damper element. As well as being numerically more stable in critical contact situations, this approach allows the accurate modelling of wheel lift and rail re-contact. This contact method is therefore particularly suitable for derailment investigations.
In addition the handling of the multi-point contact has been simplified. The boundaries between the tread, flange and back flange can be set in the vehicle globals. The "Check Profiles/Tables" plots show clearly the different contact functions.

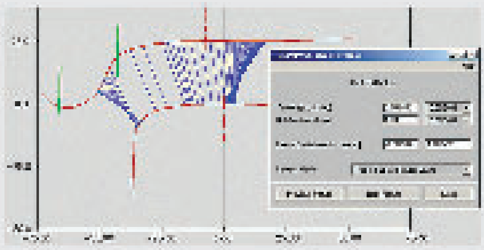
It is now possible for vehicles to come to a complete standstill and then start moving again. If the option for the calculation of the creep reference velocity in the Vehicle Globals is set to "v mean" and the vehicle is close to stopping, SIMPACK changes the friction from creep theory to Coulombic, allowing a realistic simulation of the standstill even on a slope or in a superelevated section of the Track.
The Polách creep theory now also allows the friction to fall off with higher creep velocities. FASTSIM now offers a finer discretisation of the contact area, leading to a more realistic simulation for high creep coefficients near to the friction value. Additionally an enhanced FASTSIM returns the wear coefficients of the individual wheels as output values, making it possible to perform simple wear estimates.

WHAT ARE THE CURRENT AND FUTURE DEVELOPMENTS?

Up until the next major release we will be mainly working on improvements to the wheel-rail contact. Based on the tried and tested quasi-elastic contact, we will improve the flexibility and user-friendliness of the contact model. The model will offer the user a clear overview and will allow further enhancements to be easily added, for example wear calculation or non-elliptical contact. As always, the new developments in SIMPACK Wheel/Rail are driven by customer wishes and requirements and you can look forward to the new functionality that will be available at the next User Meeting.



Nominal Forces Can Now Be Calculated Easily also for Unsymmetric Models



Improved „Check Profiles/Tables" Plot