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Simcenter 3D Motion MF-Swift

Simulate tire forces for vehicle ride comfort and vibration analyses

Benefits

- Accurately predict tire forces on generic 3D road surfaces using an industry-proven formulation
- Extend the industry-standard Pacejka Magic Formula to higher-frequency applications such as vehicle ride comfort, suspension or driveline vibration analyses
- Perform handling and stability analyses such as braking and power-off in a turn on uneven roads
- Simulate vehicle control active systems over a broad range of operating conditions
- Analyze tire enveloping effects when driving over short discrete obstacles

Summary

Simcenter™ 3D Motion MF-Swift software enables you to create a tire model that corresponds to the Delft-Tyre implementation (revision 6.2.0) of the global standard, semi-empirical Pacejka Magic Formula from Professor Hans Pacejka. These models can accurately and efficiently simulate the tire-road contact forces for several vehicle types such as passenger cars, motorcycles, trucks and aircraft landing gear, from steady-state to high-frequency analyses.

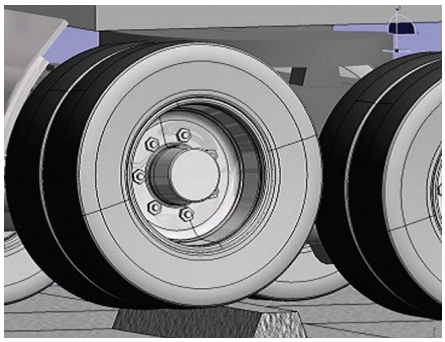
Simcenter 3D Motion MF-Swift is the higher-frequency extension (up to about 100Hz) of the Magic Formula MF-Tyre model, enabling accurate full vehicle ride comfort, durability and vibration analyses. It can successfully simulate vehicle control systems such as anti-lock braking system (ABS), electronic stability program (ESP), vehicle stability control (VSC), traction control system (TCS) and more, over a wide range of operational conditions.

Parameters and measurements

To run simulations with Simcenter 3D Motion MF-Swift, you need a tire property file with a list of parameters that contains the characteristics of a measured tire.

The Delft-Tyre formulation has been extensively validated through multiple experiments and under different conditions. In addition, Siemens (through TASS International – A Siemens Business) also provides measurement services in order to determine the MF-Swift model parameters for a specific tire.

Starting from version 6.1, the effects from inflation pressure can be taken into account when calculating tire forces and moments. A full measurement protocol at a nominal inflation pressure and limited additional measurements at +/- 0.5 bar provide sufficient information to parameterize the MF-Swift 6.1 models. Moreover, the models can interpolate between the highest and lowest inflation pressure on which measurements were done.



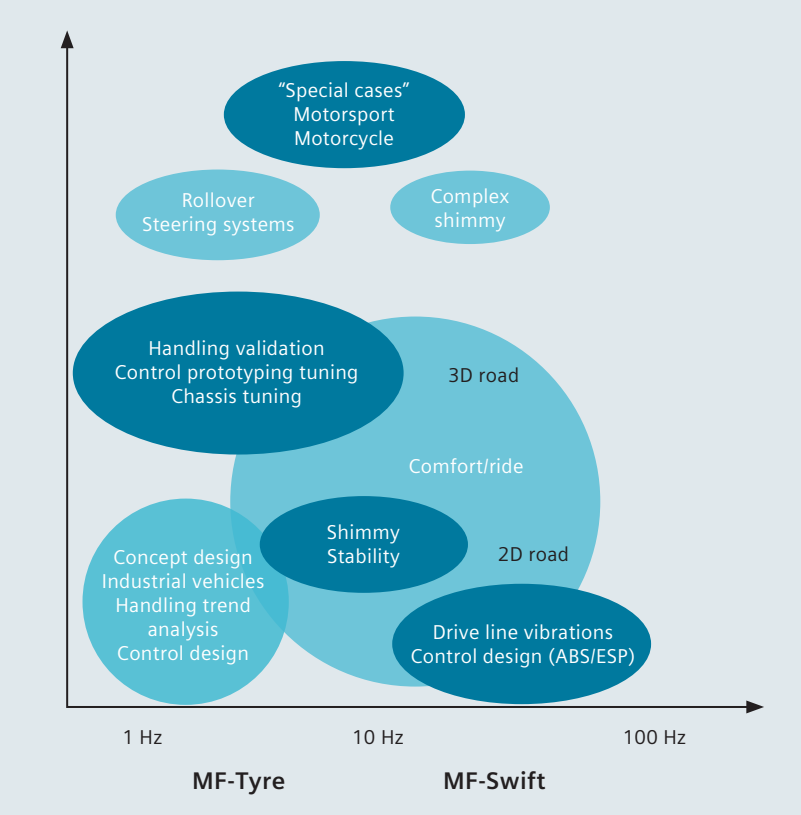
Simcenter 3D Motion MF-Swift

Capabilities

Simcenter 3D Motion MF-Swift creates a semi-empirical model based on physical aspects of the tire, using a rigid ring to model the tire belt and supporting additional generic 3D obstacle enveloping and belt dynamic effects. The model enables you to accurately predict tire-road contact forces and moments in a frequency range in which the bending modes of the tire can be neglected (up to 60-100Hz, depending on the tire type). The empirical relations enable a fast and accurate description of the tire characteristics, while the physical meaning of the tire parameters give insight into its physical properties.

The suspension between rigid ring and the rim is flexible in lateral, longitudinal, vertical and rotational direction. The interaction forces and moments between the tire belt and the road are calculated using the standard MF-Tyre formulation, thus ensuring a seamless compatibility with the MF-Tyre model and MF-Tyre parameter sets. Path curvatures with a wavelength of about two times the length of the contact area can be considered, whereas for braking/traction applications wavelengths in the order of half the contact length are well described. The inverse proportion between slip and relaxation length can also be modeled in order to correctly represent the transient slip behavior up to full sliding condition.

Simcenter 3D Motion MF-Swift accurately describes the nonlinear enveloping effects when driving over 3D short-wavelength obstacles. Moreover, the model supports driving over large obstacles, including the impact on the rim. These aspects make MF-Swift an excellent model for ride comfort and vibration studies, with essential gyroscopic effects also taken into account.



Up to 190 additional parameters can be specified to accurately describe parking and turn slip behavior with validity for camber angles over 60 degrees.

Compatibility

Simcenter 3D Motion MF-Swift accepts MF-Tyre/MF-Swift 6.0, 6.1 and 6.2, MF-Tyre 5.2, MF-MC-Tyre 1.0 and 1.1 as well as PAC89 and PAC94 tire property files. Under normal driving conditions, the simulation results will be the same as for all Delft-Tyre models. If for certain conditions a 6.2 version or higher is required, tire measurement data can be refitted using the MF-Tool, or using a built-in parameter estimation functionality.

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