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Simcenter 3D Motion CDTire

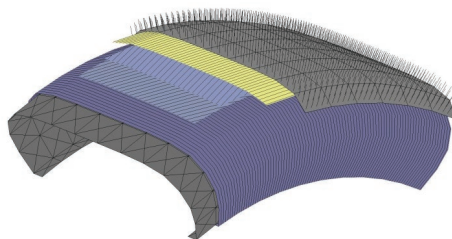
A dedicated family of tire models for vehicle ride comfort and durability assessment

Benefits

- Accurately calculate tire forces for vehicles on arbitrary road surfaces
- Cover a broad frequency range for durability, ride comfort and handling analyses of full vehicles or suspensions
- Build scalable models with different levels of complexity and computational performance

Summary

Simcenter™ 3D Motion CDTire software delivers a family of tire models developed by ITWM Fraunhofer, available as third-party software in Simcenter 3D. These models are suitable for simulation of passenger cars, trucks and buses, off-highway vehicles, motorcycles and aircraft, and enable multi-body analysts to accurately predict the tire behavior for full-vehicle handling, ride comfort and durability analyses. Through a detailed modeling of belt dynamics, rim contact and interactions with any arbitrary 3D road surface, Simcenter 3D Motion CDTire enables you to accurately capture the tire behavior in both time and frequency domains, as well as in static and steady-state conditions. Parallel solving is also supported for faster computations.



Applications

The Simcenter 3D Motion CDTire models span a very broad frequency range, making them suitable for a wide range of applications, such as:

- Ride comfort studies on digitized road surfaces
- Harshness analysis when hitting artificial obstacles such as cleats
- Predict spindle forces when driving on a durability test track
- Steering moment analysis during parking maneuvers
- Tire-coupled test rig applications with up to all 6 directions driven for each tire
- Handling analysis on flat and 3D roads
- Active safety analysis, including systems such as anti-lock braking system (ABS) and electronic stability program (ESP)
- Safety analysis with different fourth wheel
- Analyses with varying inflation pressure

Multiple, scalable tire models

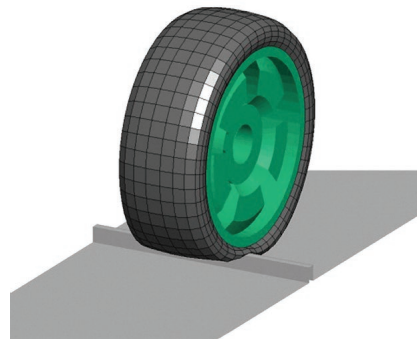
During multibody simulation, Simcenter 3D Motion CDTire computes the spindle forces and moments acting on each wheel, as well as the local contact forces while driving on 3D road surfaces or attached to advanced tire-coupled test rigs. Multiple and scalable tire

formulations are available to cover specific applications at different frequency ranges, such as:

- CDTire50 is the Simcenter 3D Motion denomination of ITWM Fraunhofer's commercial CDTire/3D model. It is the most detailed tire model available in the Simcenter 3D Motion CDTire family. It includes a complete 3D shell-based model of sidewalls and belt, allowing a separate modeling and parameterization of all functional layers of a modern tire. Dedicated models for belt, carcass, cap plies and tread are available, in order to capture the correct belt/rim flexible contact conditions with similar deformation capabilities as granted by finite element models. Fully scalable in terms of spatial discretization and functional capabilities, CDTire50 is applicable on any arbitrary 3D road surface, and capable of simulating any variation of the inflation pressure, including total loss of pressure. The model can also be adapted to a motorcycle tire for accurate simulation of motorcycle maneuvers with very large camber angles, even on rough roads.
- CDTire40 is an older version of CDTire/3D, no longer actively developed but still supported. CDTire40 parameter files are automatically converted to CDTire/3D models by switching to a membrane-type sidewall model with a reduced set of parameters.
- CDTire30HPS is the Simcenter 3D Motion denomination of ITWM Fraunhofer's commercial CDTire/Realtime. Based on a flexible belt model with scalable discretization level and real-time capabilities, the model includes a local brush-type contact model. It is suitable for ride

comfort and durability applications on any road surface with arbitrary longitudinal wavelength such as cleats, curbs and 2D road surfaces, with high accuracy in a frequency range up to 150Hz. Thanks to the low computational effort this model requires, it is particularly suitable for full-vehicle quality optimization processes.

- CDTire30 is an older variant of CDTire/Realtime that accepts previous-generation parameter files (.cdt30, .ctr), automatically converted by the solver to the new format.



Parameters and measurements

To run simulations with CDTire, a tire data set is needed that describes the physical properties of the tire. Each CDTire sub-model has its own tire parameter file. ITWM Fraunhofer provides measurement services and parameter identification (PI) services in order to determine the CDTire model parameters of any specific tire: the CDTire PI procedure is based on physical measurements from a tire test lab under various conditions, where the measured data is systematically compared to simulation results to identify the best set of tire properties. The tool CDTire/PI can be obtained from Fraunhofer ITWM if a customer wants to perform the parameter identification themselves.

Road definition

To correctly simulate the forces due to the interaction between the tire and the road, Simcenter 3D Motion CDTire requires a geometric surface model that provides the road height as a function of the longitudinal and lateral coordinates, and the tire-road friction coefficient. The road can be fixed, or it can be dynamically moved in all translational and rotational directions for more complex and accurate test rig applications. Simcenter 3D Motion CDTire supports the following road formats:

- RSM1000: user-defined parametric obstacles and a 3D digitized test track in simple ASCII-format
- RSM1002: rolling drum surface for one axle
- RSM2000: 3D digitized test track including parametric obstacles optimized for large data sets
- RSM3000/OpenCRG: 3D digitized test track

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