

Geometrical Suspension Models

- Extensions to ASM axle models
- Asymmetrical kinematics look-up tables
- Geometrical suspension models

Two major extensions for simulating wheel suspensions come with Version 1.3 of Automotive Simulation Models (ASM) from spring 2007: These are wheel suspension models that can be parameterized asymmetrically, and models with geometrical descriptions of the axle kinematics. All axle types can be parameterized simply in graphical form via ModelDesk.

One method of simulating wheel suspensions with the ASM – Vehicle Dynamics Simulation Package is to collect measurement data (for example, from kinematics & compliances (K&C) test benches or from multibody simulation (MBS) tools such as ADAMS/Car) and integrate it into the model via look-up tables. The tables describe the kinematics of a wheel suspension as functions of spring compression, steering, etc. The compliances in the wheel suspension are simulated by overlaying suitable look-up tables.

Asymmetrical Parameterization of Kinematics Look-Up Tables

Version 1.3 of ASM now allows asymmetrical axle kinematics to be implemented, in addition to the table-based symmetrical wheel suspension parameterization already available. The ModelDesk parameterization software detects dynamically which axle variant is used, and allows parameters to be assigned to the look-up tables.

Geometrical Axle Descriptions

A completely new kind of axle simulation is provided by the geometrical wheel suspension models. The axle kinematics are not represented by look-up tables, but implemented as formulas and calculated analytically in each simulation step. The particular advantage of geometrical descriptions of axle kinematics is that they do not require measurement data. Instead, they can be simply parameterized graphically in ModelDesk. This is done by configuring the relevant geometrical linkage points connecting the steering rods to the wheel carrier and the chassis. The analytical modeling approach allows the linkage points to be modified freely during run time, and also ensures that the entire value range of the input variables is covered, so no interpolations or extrapolations are necessary. The geometrical axle descriptions include the well-known axle types McPherson strut, semi-trailing arm, and rigid axle. To take the bearing compliances in the wheel suspensions into account, the geometrical axle models can be overlaid with appropriate look-up tables.

Left Side | Right Side |

Suspension Kinematics Front - McPherson Strut

Point	x [m]	y [m]	z [m]
Position of wheel center [m] (M)	0.000000	0.730000	0.000000
Connection of control arm to chassis (front point) [m] (D)	-0.060000	0.320000	-0.100000
Connection of control arm to chassis (rear point) [m] (C)	-0.350000	0.310000	-0.100000
Connection of control arm to wheel carrier [m] (E)	0.020000	0.680000	-0.120000
Connection of steering rod to wheel carrier (outer point) [m] (Q)	0.100000	0.680000	-0.110000
Connection of steering rod to steering system (inner point) [m] (P)	0.040000	0.300000	-0.090000
Connection of suspension strut to wheel carrier [m] (U)	0.040000	0.650000	-0.080000
Connection of suspension strut to chassis [m] (O)	-0.120000	0.500000	-0.490000
Connection of stabilizer to wheel carrier [m] (S)	0.030000	0.510000	-0.120000

Initial camber angle of wheel: 0.000000 [deg]

Initial toe-in angle of wheel: 0.000000 [deg]

Selection of Stabilizer (0: No Stabilizer used, 1: Stabilizer used)

Mirror parameters to right side

▲ Convenient parameterization of a McPherson wheel suspension with ModelDesk.