

# suspensionSIM®

MECHANICAL SIMULATION®

Powerful, easy-to-use tool for designing and evaluation car and truck suspensions



SuspensionSim simulates quasi-static Kinematics and Compliance (K&C) tests applied to suspension systems. SuspensionSim models include both kinematics and compliance effects of joints.

SuspensionSim is one of four VehicleSim products from Mechanical Simulation. The others (BikeSim, CarSim, and TruckSim) simulate dynamic vehicle behavior. All four products share VehicleSim tools, libraries, and documentation.

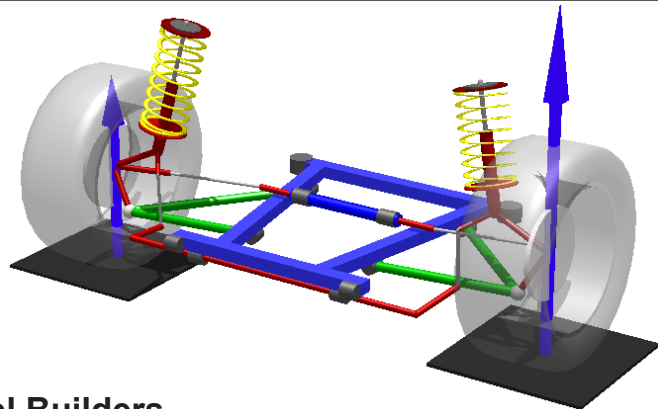
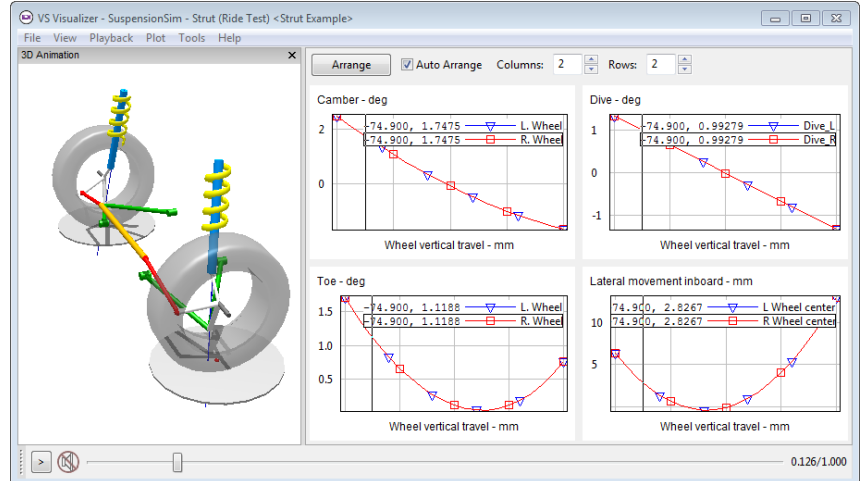
SuspensionSim is intended for use by two levels of users. Model Users are engineers and designers who will be working with a given suspension layout, changing hard-point coordinates and stiffness properties, and then evaluating the suspension behavior by analyzing simulated test results. Model Builders are advanced users who can assemble new multibody models to simulate suspension types that are not already available from existing templates.

## Model Users

The parametric capabilities of SuspensionSim are used to isolate parameters that will be changed by Model Users from the inputs used to build the model. These typically include coordinates of design points and stiffness properties of springs and bushing.

In typically use, a few datasets from an existing model are copied such that some of the numerical values of parameters for that model can be modified. The new version (called a variant) has the same parameters and output variables, but the numerical values assigned to the parameters may be different.

As with other VehicleSim products, SuspensionSim supports advanced inputs such as user-specified units, formula inputs, VS Commands (scripting), and remote control using an API.

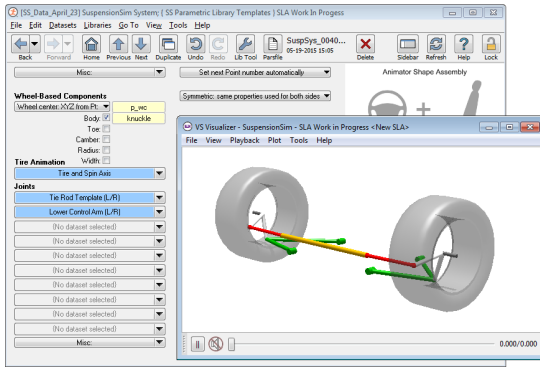


## Model Builders

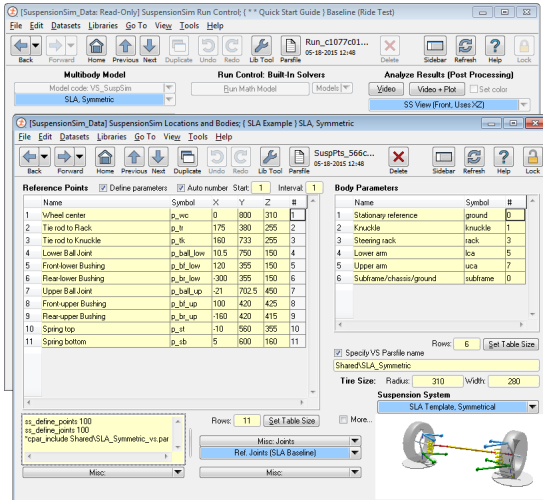
A Model Builder can assemble new suspension models from existing templates (reusable datasets), and design new datasets as needed. The multibody program in SuspensionSim can assemble complicated systems, built with SuspensionSim Bodies, Points, Joints, and Vectors. Joints include ball joints, axial springs, generic axial Joints with user-defined controls for motion or load, or nonlinear force/deflection behavior, 3D bushings, and generic 3D Joints with user-defined controls for motion or load, or nonlinear force/translation or moment/rotation behavior.

Without restriction to a template set, a modeler can assemble the entire car instead of just one suspension, constrain it any way he chooses, to represent the test methods applied by any physical K&C rig. Novel suspensions can readily be built and evaluated.

SuspensionSim's advanced capabilities go far beyond any kinematic and compliance modeling software available today. It brings CarSim's powerful features for producing detailed procedures, including VS Commands, Events, Restoring to a Previous State, and Continued Runs.



Partial assemblies can be viewed for debugging.



Model users can make variant suspensions using only a few screens.

## PRODUCT HIGHLIGHTS

### Rear Suspension Templates

- 5 link independent
- Hotchkiss
- Live 3 bar with Watt
- Live 4 bar with Panhard
- Live 4 bar
- Live 4 bar with Watt
- Semi-trailing arm
- Tri-Link with strut
- Twist axle with Panhard
- Push/Pull Rod (Formula SAE)

### Front Suspension Templates

- Kingpin Carrier Double Wishbone
- Multi-link
- SLA
- SLA spring on LCA front rack
- SLA with coil over parallel steer
- Strut
- Strut with coil over front.
- Push/Pull Rod (Formula SAE)

### Load Conditions

- Ride
- Roll
- Steering Input
- Lateral force at tire contact patch (TCP) in phase
- Lateral force at TCP out of phase
- Longitudinal force at TCP
- Aligning torque at TCP in phase
- Aligning torque at TCP out of phase
- Custom Force
- Advanced user defined conditions

### Export Formats

- BikeSim
- CarSim
- TruckSim
- Excel

### Suspension Components

- Ball Joint
- Ball link
- Bump stop
- Bushing
- Constraint
- Non-linear beam
- Rack/steering gear
- Simple rectangular beam
- Simple round beam
- Slider
- Spring
- Tie-rod
- Weld
- Leaf spring
- Stabilizer bar

## VS Visualizer

All VehicleSim products use the same architecture, file formats, and the VS Visualizer tool. VS Visualizer can show video animation alone, plots, or video and plots synchronized. The option to view synchronized videos and plots can give you exceptional insight.

Predefined plots from the database are activated with a single button click. Cursor movements are synchronized for all visible plots. If a video animation is visible, it is also synchronized. Digital displays of all plotted variables can be shown simultaneously as the cursor is moved through the plot area.

## VS GUI, Database, and Browser

The SuspensionSim GUI generates inputs to the multibody program automatically. For Model Users, the main inputs are parameters for coordinates, stiffness coefficients, and nonlinear tables for springs or bushing properties. For Model Builders, the GUI also provides commands that assemble the multibody model, and customize the names of parameters and outputs to match the use in the model. The GUI is also setup to link animation information to the multibody model, so that the model can be visualized at all stages of its development.

## Send Data to BikeSim, CarSim, and TruckSim

SuspensionSim can generate custom outputs based on user specifications. Generate suspension kinematics and compliance properties in Parsfiles, for direct use in CarSim, TruckSim, and BikeSim. For example, with a set of simulated K&C test procedures, you only need a single button click to generate a Parsfile for suspension/steering information usable in a VehicleSim vehicle model.