SimMechanics 2.2

Model and simulate mechanical systems

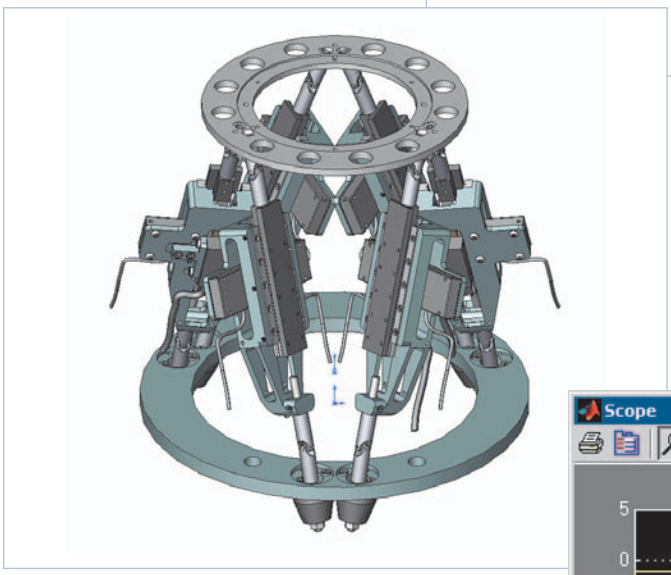
SimMechanics extends Simulink® with tools for modeling and simulating mechanical systems.

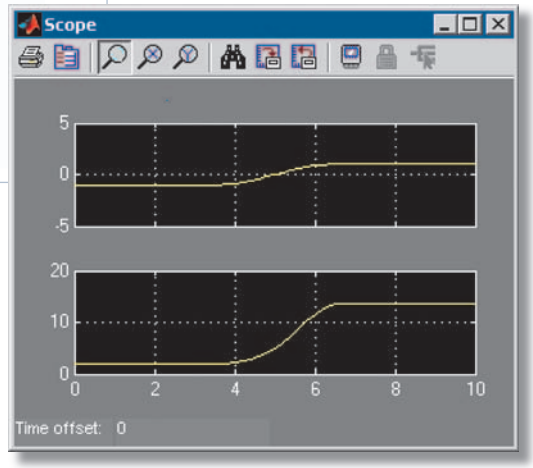
SimMechanics simulates the motion of mechanical devices and generates mechanical performance measurements associated with this motion. It is integrated with MathWorks control design and code generation products, enabling you to design controllers and test them in real time with the model of the mechanical system.

SimMechanics can be used for a variety of aerospace, defense, and automotive applications, such as the development of active suspension, antirollover, landing gear and control surface actuation systems.

KEY FEATURES

- Provides a modeling environment for building three-dimensional rigid-body mechanical systems
- Includes a variety of simulation techniques for analyzing motion and sizing mechanical components
- Enables the visualization and animation of mechanical system dynamics
- Enables the implementation of high-fidelity, nonlinear plant models in Simulink to support the development and testing of control systems
- Provides a SolidWorks translator to enable the use of CAD tools to define mechanical models



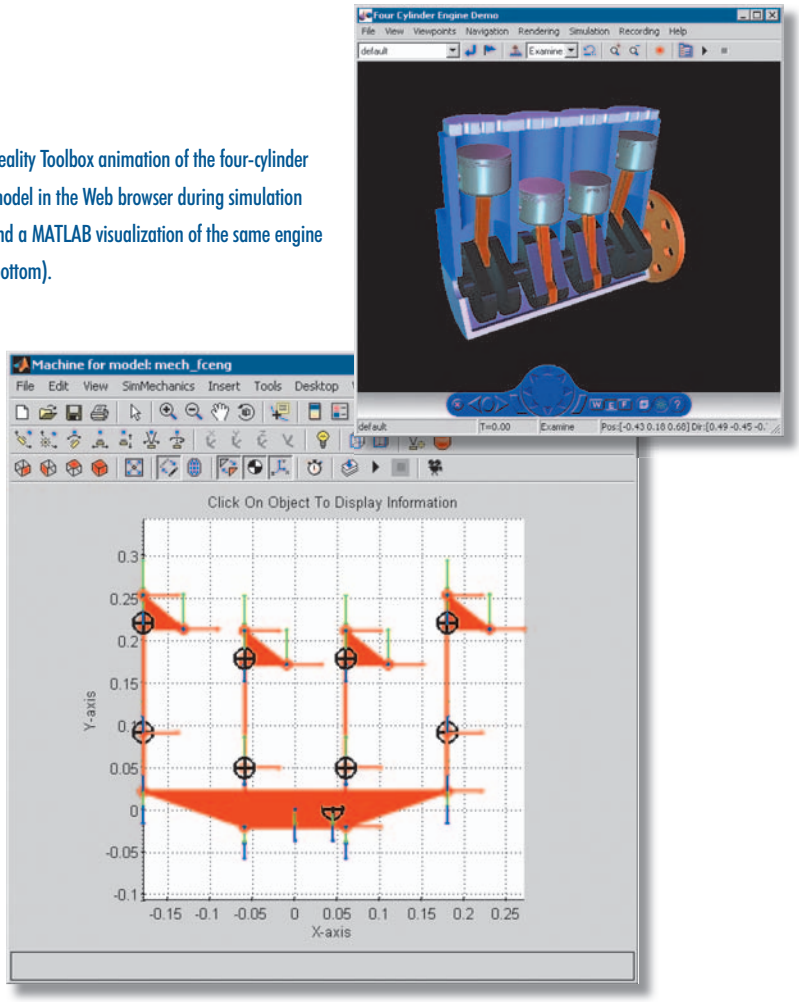


Model of a Stewart platform, built in SimMechanics. The force and power plots show the calculated requirements of the motion driving actuators.

Building Mechanical Systems

SimMechanics provides tools for building mechanical models that include bodies, joints, coordinate systems, and constraints. You can connect SimMechanics blocks with Simulink blocks to include nonmechanical, multidomain effects in your mechanical models. You can save models that combine Simulink and SimMechanics blocks as subsystems for reuse in many applications. These subsystems include:

- Nonlinear springs that use Simulink lookup tables and SimMechanics sensors and actuators
- Aerodynamic drag models that attach pressure distributions to aerospace components, such as ailerons and rudders
- Active vehicle suspension subsystems, such as antiroll mechanisms and controllers
- Tire models for aircraft and ground vehicles



Virtual Reality Toolbox animation of the four-cylinder engine model in the Web browser during simulation (right) and a MATLAB visualization of the same engine model (bottom).

Simulating and Analyzing Mechanical Motion

By simulating your SimMechanics model, you can impose kinematic constraints, apply forces and torques, and measure the resulting motions and forces. You can also develop and test motion-driving actuators, such as electric motors, ball screws, hydraulic cylinders, and engines.

SimMechanics supports five motion analysis modes:

Forward Dynamics—Assigns driving forces and torques to the motion-driving actuators and calculates the resulting motions of the entire system

Inverse Dynamics and Kinematics—Determines the forces and torques that must be exerted by the actuators to produce user-specified motions

Trimming—Identifies the steady-state equilibrium points to be used for linearization and system analysis

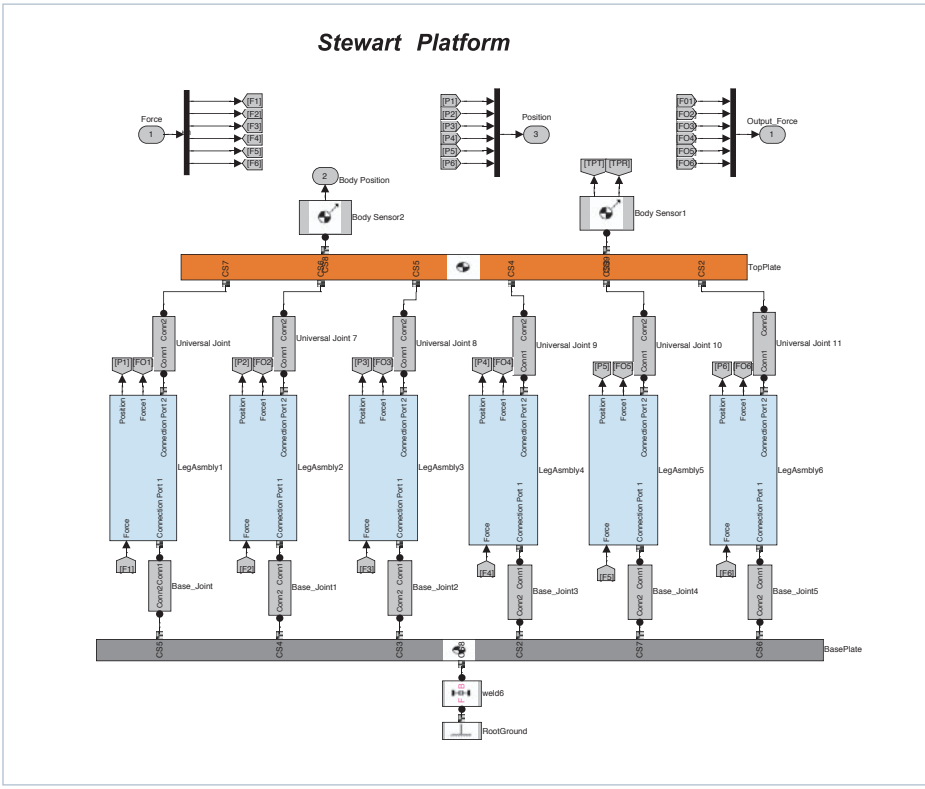
Linearization—Extracts a linear model that predicts the system's response to perturbations in driving forces, joint and constraint configurations, and initial conditions

Collectively, these modes of analysis enable you to test mechanical performance, select proper actuation systems, and develop optimal controls.

Creating Animations

SimMechanics gives you access to all standard MATLAB® graphics functions, and automatically creates three-dimensional animations of your mechanical system.

With the Virtual Reality Toolbox (available separately) you can connect to a VRML environment and create presentation-quality animations.



A complex SimMechanics model that captures the dynamics of a Stewart platform.

Developing and Testing Controls

SimMechanics implements high-fidelity, nonlinear plant models in Simulink that can be used in the development and testing of control systems. You can extract linear plant models from the complete, nonlinear model using Simulink Control Design (available separately) for use with any MathWorks control design product.

Generating Code

SimMechanics models can be deployed through automatic code generation with Real-Time Workshop® (available separately). You can use the generated code to:

- Build stand-alone executables of your SimMechanics models that can be integrated into C programs or other MATLAB and Simulink models
- Run hardware-in-the-loop simulations by porting SimMechanics plant models onto real-time processors that interface directly with hardware
- Improve the calculation speed of your model by compiling the C code

Exporting CAD Assemblies from SolidWorks into SimMechanics

SimMechanics includes a translator that lets you automatically create a SimMechanics model based on a SolidWorks CAD assembly. You simply save the CAD assembly in SolidWorks as a SimMechanics XML file.

The SolidWorks-to-SimMechanics translator exports the mass and inertia of each part in the assembly and creates the appropriate part in SimMechanics. The translator also queries the SolidWorks mate definitions to automatically connect the SimMechanics parts with the appropriate joints.

The SolidWorks-to-SimMechanics translator can be downloaded free of charge.

Multidomain Physical Modeling in Simulink

SimMechanics provides expanded capabilities for simulating physical systems in Simulink.

Standard Simulink blocks define a transfer function between input and output signal flows. For applications such as control systems design and signal processing, this approach is natural, practical, and functional.

Modeling interactions among components in mechanical systems requires a broader paradigm. For example, unidirectional signal flow is inadequate for modeling mechanical bodies that are exerting forces on each other.

With SimMechanics, you can create a control system as a standard unidirectional signal flow block diagram and then connect this model to a physical plant, modeled using a mixture of traditional Simulink blocks and the specialized physical modeling blocks in SimMechanics.

Required Products

MATLAB
Simulink

Related Products

Real-Time Workshop. Generate optimized, portable, and customizable code from Simulink models

SimPowerSystems. Model and simulate electrical power systems

Simulink Control Design. Perform linear analysis

Virtual Reality Toolbox. Animate and visualize Simulink systems in three dimensions

For more information on related products, visit *www.mathworks.com/products/simmechanics* ■

Platform and System Requirements

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For demos, application examples, tutorials, user stories, and pricing:

- Visit **www.mathworks.com**
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