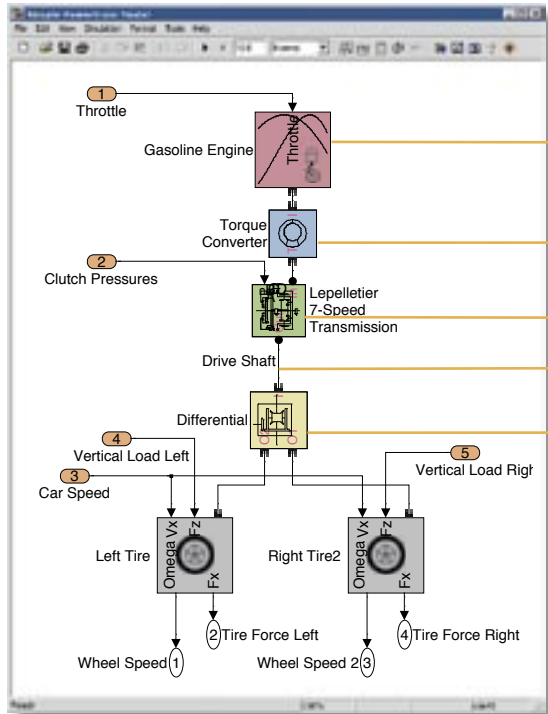


SimDriveline 1

Model and simulate the mechanics of driveline systems

SimDriveline extends Simulink® with tools for modeling and simulating the mechanics of driveline (drivetrain) systems. These tools include components such as gears, rotating shafts, and clutches; standard transmission templates; and engine and tire models. SimDriveline is optimized for ease of use and speed of calculation for driveline mechanics. 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.

SimDriveline can be used for a variety of automotive, aerospace, defense, and industrial applications. It is particularly suited to the development of controllers for automotive and aerospace transmission systems.

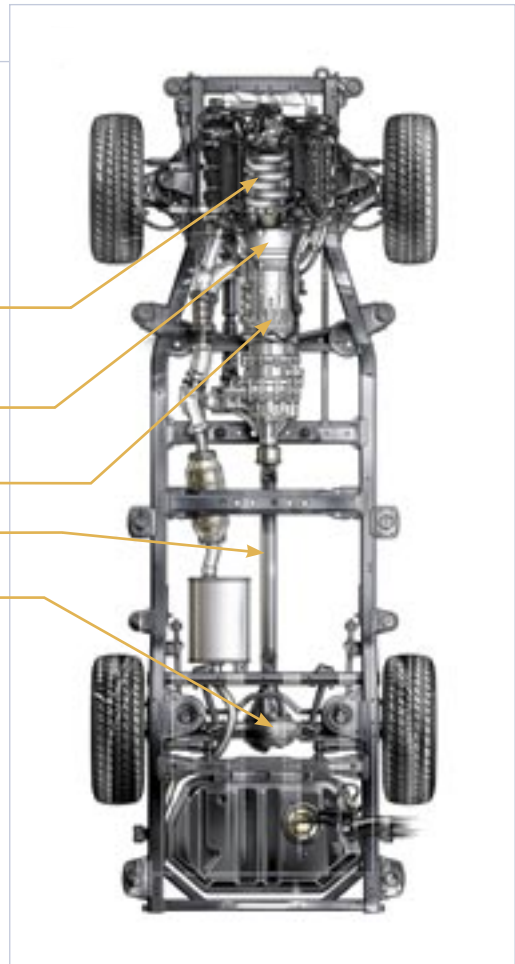


Through the network block diagram interface, SimDriveline enables you to build powertrain models with detailed driveline components.



KEY FEATURES

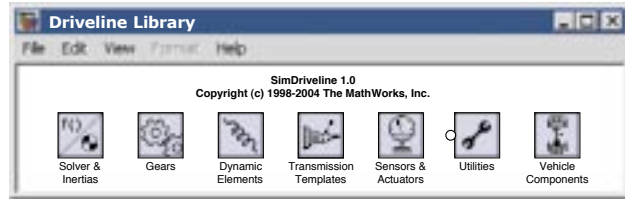
- Modeling environment for defining the mechanics of a driveline system in Simulink
- Library of common gear configurations
- Library of dynamic elements, including clutches and rotational stops, torque converters, and torsional spring-dampers
- Templates for common transmission systems
- Basic models of vehicle components, including engines, longitudinal vehicle dynamics, and tires



Modeling Environment for Driveline Systems

SimDriveline provides an efficient way to build driveline models in the Simulink environment. You use a block-diagram network description to represent the system. The blocks represent components, such as gears, clutches, and torque converters. The lines that connect the blocks represent rotating components, such as drive shafts.

In SimDriveline, you have access to all Simulink functionality. Using sensor blocks, you can measure values for velocity, acceleration, and torque and pass these signals into



SimDriveline provides fundamental tools for building sophisticated gear systems.

standard Simulink blocks. Actuator blocks enable Simulink signals to define values for driving torques or prescribed motion parameters for shafts.

SimDriveline provides an efficient alternative to full 3-D mechanical simulators because

it focuses exclusively on rotating machinery mechanics. Motion for each shaft is restricted to rotation about a single axis. As a result, you assign mass properties for each shaft through a single component of inertia. Tracking only rotational velocity for each shaft results in rapid simulation execution.

Libraries of Common Gear Configurations

SimDriveline lets you develop both simple and complex gear systems. Predefined blocks are provided for the basic gear configurations. You characterize these blocks by assigning the appropriate gear ratio.

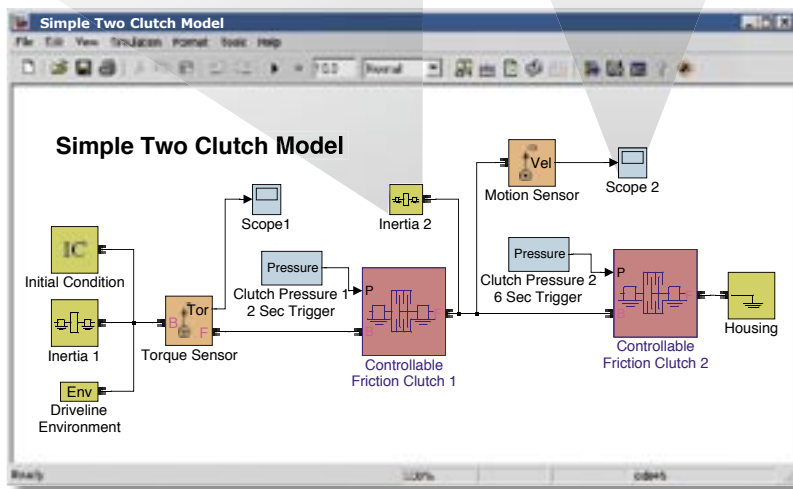
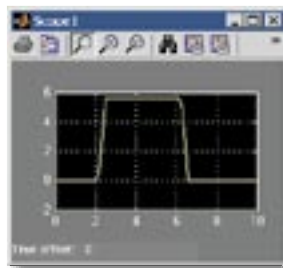
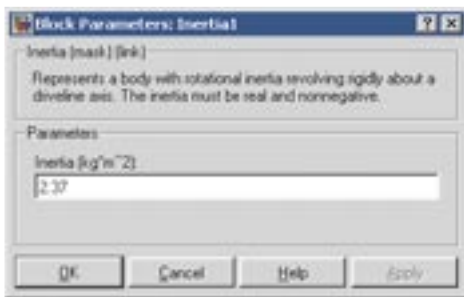
You can combine these simple configurations to create more complex gear systems, such as those found in transmissions. SimDriveline also provides models for commonly used complex gear systems, such as Ravigneaux gear sets and differentials.

Clutches and Other Dynamic Elements

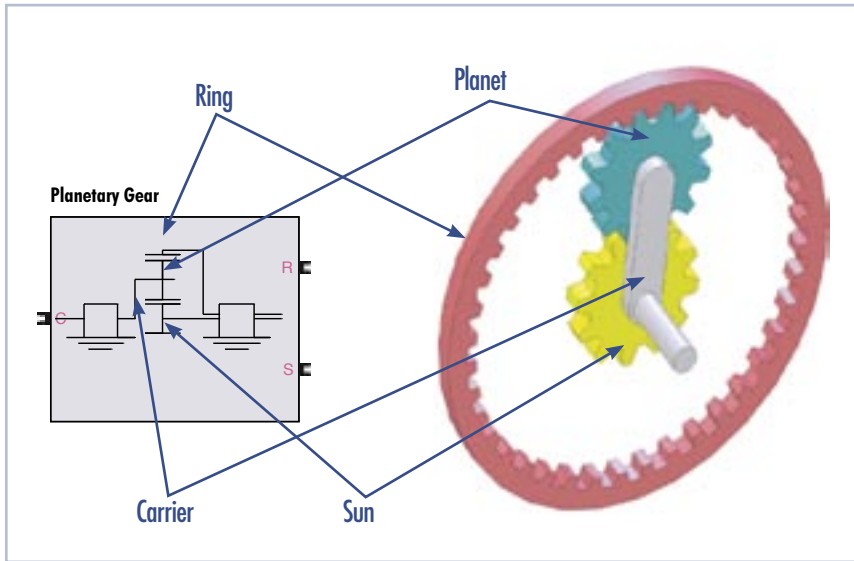
SimDriveline includes a library of dynamic elements that, together with the gear sets, provide a complete set of driveshaft connectors. For example, the Controllable Friction Clutch models the action of a clutch as it engages and then locks shafts moving at different rotational speeds. The Controllable Friction Clutch employs a kinetic friction model for the transition and a static friction model for the locked condition.

SimDriveline also includes the following dynamic elements:

- Torque Converter—lets you model fluid-bearing connections



The network description efficiently represents the driveline system. You can easily define drive shaft properties and connect the model to standard Simulink blocks.



Standard schematics label each gear block to show which arrangement of gears and carriers it represents.

The Vehicle Components library includes the following:

- Gasoline and Diesel Engine blocks—for modeling the relationship between torque, engine speed, and throttle, with the throttle value assigned through a Simulink input signal
- Tire model—for evaluating the forces and moments associated with the tire-road interaction and calculating the rotational speed of the tire and wheel axle
- Longitudinal Vehicle Dynamics model—for evaluating the response of the vehicle to the accelerations and torques generated by the driveline

- Hard Stop—lets you include backlash in your driveline and account for the resultant power loss
- Torsional Spring-Damper—lets you model a damped torsional spring with backlash

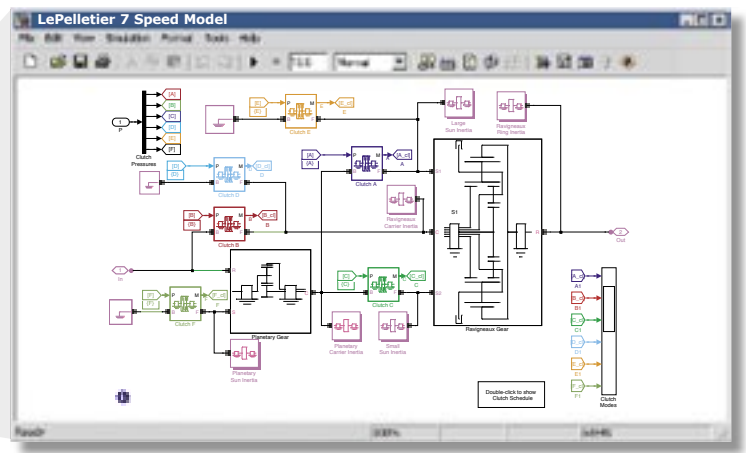
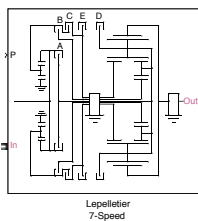
Vehicle Components

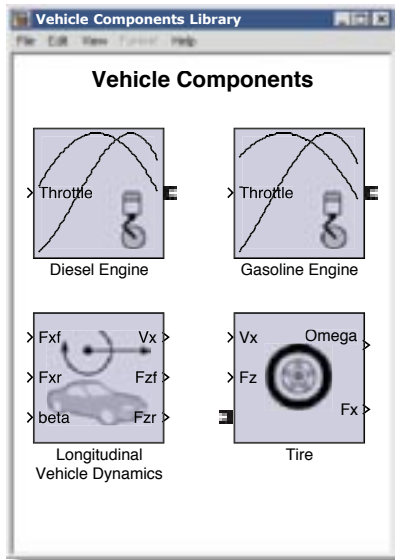
SimDriveline includes simple vehicle component models that let you model a complete powertrain and its impact on a vehicle's motion performance. These models enable early evaluation of overall system performance. As with the transmission templates, you can add the detail required for your own powertrain and vehicle dynamics models.

Transmission Templates

SimDriveline provides models for the Lepelletier 6- and 7-speed, Simpson 4-speed, and Ravigneaux 4-speed transmissions. These subsystems can be used as templates to guide you in modeling your transmission systems. You can modify the topology of the model or values for gear ratios, shaft inertias, and clutch characteristics through the component blocks in the model.

The Lepelletier 7-speed transmission block masks the detailed model. You can use the standard transmission sample models as templates.





Simple vehicle component models included in SimDriveline.

Multidomain Physical Modeling in Simulink

SimDriveline 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 SimDriveline, 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 SimDriveline.

Required Products

MATLAB
Simulink

Related Products

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

SimMechanics. Model and simulate mechanical systems

SimPowerSystems. Model and simulate electrical power systems

Stateflow. Design and simulate event-driven systems

xPC Target. Perform real-time prototyping and hardware-in-the-loop simulation using PC hardware

For more information on related products, visit www.mathworks.com/products/simdriveline

Platform and System Requirements

For platform and system requirements, visit www.mathworks.com/products/simdriveline ■

Generating Code

You can deploy your SimDriveline models using code generated with Real-Time Workshop® (available separately). The generated code can be used to:

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

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

- Visit www.mathworks.com

- Contact The MathWorks directly

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