Release Notes for SimDriveline™

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Release Notes for SimDriveline™

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Contents

R2011b

R2011a

R2013a

Version: 2.4
New Features: Yes
Bug Fixes: No

Translational Power Sensor and Rotational Power Sensor blocks

SimDriveline™ contains a new library, Sensors. The library contains two blocks.

Block	Description
Translational Power Sensor	Mechanical sensor used to measure average or instantaneous translational power
Rotational Power Sensor	Mechanical sensor used to measure average or instantaneous rotational power

Variable and nonlinear spring and damper component library

The Couplings & Drives library contains a new sublibrary, Springs & Dampers. The sublibrary contains eight blocks.

Block	Description
Nonlinear Translational Spring	Translational spring with nonlinear force-displacement curve
Nonlinear Translational Damper	Translational damper with nonlinear force-velocity curve
Nonlinear Rotational Spring	Rotational spring with nonlinear torque-displacement curve
Nonlinear Rotational Damper	Rotational damper with nonlinear torque-velocity curve
Variable Translational Spring	Translational spring with variable spring stiffness
Variable Translational Damper	Translational damper with variable damping coefficient
Variable Rotational Spring	Rotational spring with variable spring stiffness
Variable Rotational Damper	Viscous rotational damper with variable damping coefficient

Shock Absorber block

The Couplings & Drives library contains one new block.

Block	Description
Shock Absorber	Linear spring-damper with friction and hard stops

Simple Gear with Variable Efficiency block

The Gears library contains one new block.

Block	Description
Simple Gear with Variable Efficiency	Simple gear with externally specified meshing efficiency

Fuel consumption and idle speed controller added to Generic Engine block

The Generic Engine block contains new options:

- Specify and sense engine fuel consumption

- Specify an idle speed controller to prevent engine stall at low engine speeds

Featured examples

Three new featured examples are available:

- Engine Braking
- Simpson Three-Speed Transmission
- Suspension System Comparison

R2012b

Version: 2.3
New Features: Yes
Bug Fixes: No

Double-Shoe Brake and Band Brake blocks

SimDriveline adds two blocks to the Brakes and Detents library:

Block	Description
Double-Shoe Brake	Friction brake with two diametrically opposed rigid shoes positioned about a rotating drum
Band Brake	Friction brake with a flexible band wrapped around a rotating drum

Double-Sided Synchronizer and Synchronizer blocks

SimDriveline adds two blocks to the Clutches library:

Block	Description
Synchronizer	Clutch synchronizer with one dog clutch, one cone clutch, and one detent
Double-Sided Synchronizer	Double-sided clutch synchronizer with two dog clutches, two cone clutches, and one detent

Rolling Resistance block for custom tire models

SimDriveline adds one block to the Tires & Vehicles Library:

Block	Description
Rolling Resistance	Resistance force due to road-wheel contact

Optional rolling resistance in Tire (Friction Parameterized) and Tire (Magic Formula) blocks

The Tire (Friction Parameterized) and Tire (Magic Formula) blocks introduce an optional set of rolling resistance parameters. Represent tire rolling resistance with a constant resistance coefficient or with a pressure and velocity dependent model that meets the SAE J2452 standard.

Five-speed transmission demonstration model with individually controlled double-sided synchronizers

A new example demonstrates a five-speed transmission model. The model contains five forward gears and one reverse gear driven by an engine. Proportional control systems govern a set of double-sided synchronizers that engage each gear with an output shaft.

Four new examples

SimDriveline introduces four examples:

- Five-Speed Transmission (highlighted above)
- Reversing Transmission
- Hydromechanical Hoist
- Braking Mechanism

R2012a

Version: 2.2
New Features: Yes
Bug Fixes: No

New Blocks

New Couplings and Drives Block

Block	Description
Belt Drive	Model a belt drive
Belt Pulley	Model a belt pulley
Chain Drive	Model a chain drive
Rope Drum	Model a rope drum

New Tire Blocks

Block	Description
Tire (Friction Parameterized)	Model a tire using kinetic and static friction coefficients
Tire (Simple)	Model a no-slip tire with minimal parameters

New and Updated Examples

New Examples

Example	Description
Stepping Mechanism with Detents sdl_stepping_mechanism_with_detents	Models a stepping mechanism, including using Translational Detent blocks.
Power Window System sdl_power_window	Models a power window system, including using the new Rope Drum and Belt Pulley blocks.
Sheet Metal Feeder sdl_sheet_metal_feeder	Models the feeding mechanism of a sheet metal cutter, including the use of the Loaded Contact Translational Friction block.

Updated Example

The "Vehicle with Four-Wheel Drive" example (sdl_4wd_dynamics) now uses Simulink® subsystem variants to allow testing with several different tire models.

Input Filtering Usability Enhancements in SimDriveline Version 2 Transitional Library Blocks
Compatibility Considerations: Yes

SimDriveline Version 2 Transitional library blocks that accept Simulink inputs now have an **Input Handling** tab. You can choose between no filtering, first-order filtering, and second-order filtering with a time constant that you specify. For more information, see Input Handling Options in Version 2 Transitional Library Blocks.

Some Transitional library blocks have multiple Simulink input ports. Changing the settings under the **Input Handling** tab affects all Simulink input ports equally.

Simulink-PS Converter blocks provide input handling options in Transitional library blocks. The SimDriveline software uses these Simscape™ blocks in the architecture of the Transitional library blocks. These blocks exist behind a mask. For more information, see Input Filtering Usability Enhancements and Simulink-PS Converter in the Simscape documentation.

Note In the Version 2 Transitional library, the Motion Actuator block does not require an acceleration input. The input port is still present to provide a consistent block interface, but it no longer uses an acceleration signal. For more information, see version 2 transitional library.

Compatibility Considerations

When using an explicit Simulink solver in a SimDriveline Version 2 model, you must specify a sufficient number of input derivatives in the **Input Handling** tab. Failure to do so results in an error.

R2011b

Version: 2.1
New Features: Yes
Bug Fixes: No

New and Updated Blocks

New Blocks

These blocks have been added in Version 2.1.

- Flexible Shaft

- Rotational Detent

- Translational Detent

Updated Blocks

These blocks have been improved in Version 2.1.

Block	Enhancement
Generic Engine	Simulation diagnostics added
Torque Converter	Additional parameterization options
Variable Ratio Transmission	Simulation diagnostics added

Changes to Data Logging Object Naming
Compatibility Considerations: Yes

If you log data in a SimDriveline model using the Simscape data logging feature, some internal node and subcomponent names will change when you log data from an unchanged model using SimDriveline 2.1, as compared with Version 2.0.

These changes enhance your understanding of the internal structure of SimDriveline models, as reflected in the data logging object.

Compatibility Considerations

If you have written a script that depends on the specific names of nodes and subcomponents in SimDriveline data logging objects, you need to update your script so that it conforms with the new naming scheme.

New Examples

The new version contains four new examples illustrating how to model hybrid (gasoline-electric) transmissions with SimDriveline software.

- sdl_power_split_hybrid
- sdl_parallel_hybrid
- sdl_series_hybrid
- sdl_dual_mode_hybrid

Improved Documentation

Manual Reconstruction of Version 1 Models

The reference chapter on working with legacy Version 1 models and libraries has been expanded with a new section on how to rebuild Version 1 models in Version 2 without automatic conversion. See Manual Reconstruction of Version 1 Models in Version 2 in Relationship of Version 1 and Version 2.

R2011a

Version: 2.0
New Features: Yes
Bug Fixes: No

SimDriveline 2.0 Software

SimDriveline 2.0 is a new version of an existing product in the Physical Modeling family that models and simulates drivetrain systems. The new version is fully integrated with Simscape software and supports physical connections, physical signals, data logging, local solvers, and other Simscape features. At the same time, this new version extends the Simscape library with additional rotational and translational mechanical components.

With SimDriveline software, you can model bodies rotating around and translating along multiple axes, connect them with gears, and create powertrains with clutches, transmissions, and other dynamic elements and subsystems. SimDriveline software also lets you actuate and measure torques, forces, and motion. You can model, simulate, analyze, and control the motion of complex drivetrains.

SimDriveline 2.0 also includes:

- Components that couple rotational and translational motion.
- Gears with optional friction loss.
- Clutches using Coulomb friction that lock and unlock.
- Improved algorithms for simulation of redundant dynamic constraints.
- A translator function to convert Version 1 models and user-defined libraries to be compatible with the new Version 2 product library.

Required Products

SimDriveline software is an extension of the Simscape product and requires these products:

- MATLAB®
- Simulink
- Simscape

Selected Version 2 Capabilities Based on Simscape Software

For an introduction to Simscape blocks, modeling, and simulation, consult the *Simscape Getting Started Guide*.

For learn more about the Simscape features that improve how you model and simulate driveline systems, see these sections of the *Simscape User's Guide*:

- Basic Principles of Modeling Physical Networks.
- Data Logging.
- Setting Up Solvers for Physical Models and Customizing Solvers for Physical Models.

To learn how to define Simscape based blocks programmatically, see the *Simscape Language Guide*.

For details on Simscape mechanical and utility blocks that replace certain Version 1 blocks, see the block categories in the *Simscape Reference*.

Selected Version 2.0 Features Compared with Version 1 Features

Features Improved in Version 2.0

- Efficiency and other frictional losses in Version 2 gears.

  These loss features are now built into the gear blocks. MathWorks recommends that you select adaptive zero-crossing in the Configuration Parameters menu of models that include gears with efficiency loss.

- Data logging without sensors.

  Version 2 supports the Simscape data logging capability.

- Simscape fixed-step local solver now supported.

  You can use a separate local, fixed-step solver on physical networks in Version 2 models.

- Redundant dynamic constraints now solved without errors.

  In Version 2 models, when ideal clutches lock and carry the same load, the load is now distributed between the clutches without generating simulation errors.

Features Changed in Version 2.0

- Certain mechanical rotational components in the Version 1 library now provided by the Simscape Foundation library, in its mechanical and utilities sublibraries.

  These equivalent components include Solver Configuration, Inertia, various sensors and sources, and simple rotational mechanisms.

- Direct connection to other Simscape components.

  You can directly connect Version 2 blocks to other components based on Simscape software, without an interface component, as long as you respect the Simscape rules concerning physical ports and connections. SimDriveline driveline ports and connection lines are now mechanical conserving rotational or translational ports and physical connection lines.

- Motion initial conditions set in Version 2 Inertia and Mass blocks.

In Version 1, you set initial conditions in a separate block.

- Simulink variable-step solvers for variable-step simulation.

  Version 2 is compatible with all Simulink solvers. For variable-step simulation, MathWorks recommends that you select `ode23t` or `ode15s` in your model Configuration Parameters menu.

Other Changes in Version 2.0

- Version 2 generated code simulation is slower than with Version 1.

- Tunable parameters are not supported with the SimDriveline 2 libraries.

  Changing block parameter values for simulating with generated code requires changing those parameter values in the block dialog boxes and regenerating the code from the model. A workaround is:

  1 Create your own versions of the blocks using the Simscape language.

  2 Make the parameters that you want to tune into signal inputs by defining the input values as Simulink Constant blocks.

  3 Convert these Simulink constant signals into physical signals with Simulink-PS Converter blocks.

  4 Tune the Constant block values during the simulation.

Working with Version 1 Models and Libraries
Compatibility Considerations: Yes

Compatibility Considerations

Block diagrams built from Version 1 and block diagrams built from Version 2 can coexist in the same model or library. You can indirectly connect Version 1 block diagrams and Version 2 block diagrams using Version 1 Rotational Coupling interface blocks. You cannot connect them directly.

You can continue to create and use Version 1 models and libraries, separately from Version 2 models and libraries.

Converting Models and Libraries from Version 1 to Version 2

Optionally, you can convert models and user-defined libraries from Version 1 to Version 2 with a model conversion utility, accessed through the `sdl_update` function. This utility creates new models and user-defined libraries with Version 1 components replaced by new versions using a transitional library that is based on the SimDriveline 2 and Simscape libraries.

For more information on conversion, see the `sdl_update` function reference page and Relationship of Version 1 and Version 2.

Accessing Version 1

The Version 1 library and documentation are included with Version 2.

Accessing the Version 1 Library

To open the Version 1 library, at the command line, enter `drivelib` or `driveline`.

Accessing the Version 1 Examples

To view a list of the Version 1 example models, do one of the following:

- In the Help browser, on the Version 1 SimDriveline product roadmap page, click the product examples link.

- At the command line, enter `help drivedemos`.

If you use the command line, the examples list appears at the command line. If you click a linked individual example model name, information about that model appears at the command line.

Accessing the Version 1 Documentation

To access the Version 1 documentation, access the online version of the Version 2 release notes through the Help browser or at the MathWorks Web site, `www.mathworks.com`.