SimHydraulics Release Notes

Contents

Summary by Version

This table provides quick access to what's new in each version. For clarification, see "About Release Notes" on page 1.

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Latest Version V1.2 (R2007a)	Yes Details	Yes Summary	Bug Reports Includes fixes	Printable Release Notes: PDF Current product documentation
V1.1 (R2006b)	Yes Details	No	Bug Reports Includes fixes	No
V1.0 (R2006a+)	Yes Details	Not applicable	Bug Reports	No

About Release Notes

Use release notes when upgrading to a newer version to learn about new features and changes, and the potential impact on your existing files and practices. Release notes are also beneficial if you use or support multiple versions.

If you are not upgrading from the most recent previous version, review release notes for all interim versions, not just for the version you are installing. For example, when upgrading from V1.0 to V1.2, review the New Features and Changes, Version Compatibility Considerations, and Bug Reports for V1.1 and V1.2.

New Features and Changes

These include

- New functionality

- Changes to existing functionality
- Changes to system requirements (complete system requirements for the current version are at the MathWorks Web site)
- Any version compatibility considerations associated with each new feature or change

Version Compatibility Considerations

When a new feature or change introduces a known incompatibility between versions, its description includes a **Compatibility Considerations** subsection that details the impact. For a list of all new features and changes that have compatibility impact, see the "Compatibility Summary for SimHydraulics" on page 14.

Compatibility issues that become known after the product has been released are added to Bug Reports at the MathWorks Web site. Because bug fixes can sometimes result in incompatibilities, also review fixed bugs in Bug Reports for any compatibility impact.

Fixed Bugs and Known Problems

MathWorks Bug Reports is a user-searchable database of known problems, workarounds, and fixes. The MathWorks updates the Bug Reports database as new problems and resolutions become known, so check it as needed for the latest information.

Access Bug Reports at the MathWorks Web site using your MathWorks Account. If you are not logged in to your MathWorks Account when you link to Bug Reports, you are prompted to log in or create an account. You then can view bug fixes and known problems for R14SP2 and more recent releases.

Related Documentation at Web Site

Printable Release Notes (PDF). You can print release notes from the PDF version, located at the MathWorks Web site. The PDF version does not support links to other documents or to the Web site, such as to Bug Reports. Use the browser-based version of release notes for access to all information.

Product Documentation. At the MathWorks Web site, you can access complete product documentation for the current version and some previous versions, as noted in the summary table.

Version 1.2 (R2007a) SimHydraulics

This table summarizes what's new in Version 1.2 (R2007a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes—Details labeled as **Compatibility Considerations**, below. See also Summary.	Bug Reports Includes fixes	Printable Release Notes: PDF Current product documentation

New features and changes introduced in this version are

SimHydraulics Now Requires Simscape

SimHydraulics™ now depends on and requires Simscape, the foundation for all Physical Modeling products. Simscape includes common Physical Modeling utilities and block libraries.

Block Libraries Moved from SimHydraulics to Simscape

The Foundation and Utilities block libraries that used to be included in SimHydraulics (V1.0 and V1.1) are now part of Simscape.

Sharing Models Using the Simscape Editing Modes

SimHydraulics now features a selection of two Simscape editing modes that allow full or restricted editing of models.

- The Restricted mode requires SimHydraulics to be installed, but does not require a license. It allows you change a limited set of model parameters, but not the blocks or connections, in a SimHydraulics model.
- The Full mode requires SimHydraulics to be installed with a license. It allows you to change anything in a SimHydraulics model.

New SimHydraulics Blocks

The new blocks introduced in SimHydraulics 1.2 are listed below:

- Centrifugal Pump
- Single-Acting Rotary Actuator
- Double-Acting Rotary Actuator
- Hydraulic Single-Acting Valve Actuator
- Hydraulic Double-Acting Valve Actuator
- Valve Hydraulic Force
- Spool Orifice Hydraulic Force

Initial Conditions Added for Certain Blocks

Several blocks now have a parameter that specifies the initial condition for use in computing the block's initial state at the beginning of a simulation run. Note that some of these blocks, which used to be included in SimHydraulics (V1.0 and V1.1), are now part of Simscape. The following is a complete list of blocks where you can specify an initial condition through the block dialog box:

- Gas-Charged Accumulator
- Spring-Loaded Accumulator
- Constant Volume Chamber
- Variable Volume Chamber
- Fluid Inertia

- Inertia
- Mass
- PS Integrator
- Rotational Spring
- Translational Spring

For details, see the block reference pages.

Compatibility Considerations

In this version, there is a difference in the way the initial conditions are computed, and as a result, the blocks that have an initial condition parameter work differently than they used to in the previous version.

Block Library Links Must Be Resolved

All SimHydraulics blocks in your models must now have resolved block library links. You can neither disable nor break these library links. This is a global requirement of Simscape. Consult the Simscape documentation for further details.

Compatibility Considerations

If you have an existing SimHydraulics model with disabled or broken links from SimHydraulics blocks to the SimHydraulics block library, you must restore all the broken block library links for your model to be valid.

If you have disabled or broken the SimHydraulics library link for blocks that you have customized and want to keep these modified blocks in your model, you must move these modified blocks to your own custom library or libraries, then copy the block instances that you need to your model.

You must still restore the block link to its parent library, whether that parent library is SimHydraulics or your own.

Changes to SimHydraulics Demos

The following demos have been added in SimHydraulics 1.2:

Demo Name	Description
Hydraulic Actuator with Two-Chamber Snubbers (`sh_actuator_with_2_chamber_snubbers`)	The reciprocal actuator demonstrated in this model is equipped with snubbers (cushions) on both sides of the cylinder.
Digital Hydraulic Actuator (`sh_digital_hydraulic_actuator`)	The digital hydraulic actuator consists of three double-acting cylinders mounted in the same shell and interconnected through the hard stops.
Hydraulic Actuator with Load-Sensing Variable-Displacement Pump (`sh_hydraulic_actuator_load_sensing_pump`)	The circuit demonstrates usage of a load-sensing and pressure-limiting unit in a conventional reciprocal system with variable load on the forward stroke.
Hydraulic Actuator with Telescopic Cylinder (`sh_hydraulic_actuator_telescopic_cylinder`)	The actuator is built around a telescopic hydraulic cylinder, which is equipped with three rods interacting with each other through hard stops.
Closed-Circuit Reciprocal Actuator (`sh_hydraulic_closed_circuit_reciprocal_actuator`)	The demo illustrates a closed-circuit electrohydraulic actuator driven by a variable-velocity electrical motor.
Power-Assisted Steering Mechanism (`sh_hydraulic_power_assisted_steering`)	The model represents a simplified version of a power-assisted steering mechanism showing all its major parts.
Hydraulic System with Servo-Valve (`sh_hydraulic_system_with_servo_valve`)	The demo represents the model of a two-stage servo-valve with a 4-way, 3-position spool valve in the power stage and a flapper-nozzle amplifier in the pilot stage.
Hydraulic Transmission with Secondary Control (`sh_hydraulic_transmission_secondary_control`)	The system demonstrates usage of the so-called *secondary control* in hydrostatic transmissions with a variable-displacement motor.
Hydrostatic Transmission with Shuttle Valve (`sh_hydrostatic_transmission_shuttle_valve`)	The circuit demonstrates a hydrostatic transmission with a shuttle valve in the control unit.
Hydraulic Circuit with Load-Sensing Velocity Control (`sh_load_sensing_velocity_control`)	The circuit is equipped with the load-sensing velocity regulator installed between the pump and directional valve.

Oscillating Hydraulic Mechanism (`sh_oscillating_hydraulic_mechanism`)	The oscillating hydraulic mechanism consists of a single-acting hydraulic rotary actuator, winch, flow control valve, two-position electrohydraulic valve, and power and control units.
Reciprocal Actuator with Counterbalance Valves (`sh_reciprocal_actuator_cntrb_valves`)	The actuator is built of a double-acting cylinder, directional valve, flow control, block of counterbalance valves, power unit, replenishment arrangement, and a control unit.
Sequencing Circuit with Rotary Actuators (`sh_sequencing_circuit_rotary_actuators`)	The sequence circuit is based on four check valves installed in both pressure and return lines of the second rotary actuator.

The following demos that used to be in SimHydraulics 1.1 are now part of Simscape:

Demo Name	Description
Simple Mechanical System (`ssc_simple_mechanical_system`)	This model is built of both rotational and translational mechanical blocks to illustrate their use in a system.
Mechanical System with Translational Friction (`ssc_mechanical_system_translational_friction`)	The demo illustrates a mass loaded with a spring and viscous damper.
Mechanical System with Translational Hard Stop (`ssc_mechanical_system_translational_hardstop`)	The demo illustrates two masses interacting through a hard stop.
Mechanical Rotational System with Stick-Slip Motion (`ssc_rot_system_stick_slip`)	This model demonstrates a mechanical rotational system, where a load is driven by a velocity source with a friction element between them, and stick-slip motion is developed in the regions of constant velocities.
Linkage Mechanism (`ssc_linkage_mechanism`)	The model demonstrates the use of the Lever block in a linkage mechanism.

Version 1.1 (R2006b) SimHydraulics

This table summarizes what's new in Version 1.1 (R2006b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Bug Reports Includes fixes	No

New features introduced in this version are described here.

Linearization Support

The Simulink `linmod` and `dlinmod` commands create continuous- or discrete-time linear time-invariant (LTI) state-space models from Simulink models. You can now use these commands to generate an LTI state-space model from a model containing SimHydraulics components.

There are two basic ways `linmod` and `dlinmod` can be used, and the behavior of linearization differs depending on which method is chosen. If `linmod(mdl)` is called (that is, the arguments for time, state, and input are not provided), then consistent initial conditions are solved for in the same way as on the first step of a simulation. If you call `linmod(mdl, t, x, u)`, it is particularly important to provide it with a consistent state to linearize about. For more information, see "Linearizing Simscape Models" in the SimHydraulics User's Guide.

New Solver Option Allows Starting Transient Analysis from a Steady State

A new solver option allows you to specify that simulation starts from a steady state. Steady state means that the system variables are no longer changing with time.

If you select the **Start simulation from steady state** check box in the Solver block dialog, the solver attempts to find the steady state that would

result if the inputs to the system were held constant for a sufficiently large time, starting from the initial state obtained from the initial conditions computation. Although the solver tries to find the particular steady state resulting from the given initial conditions, it is not guaranteed to do so. All that is guaranteed is that if the steady-state solve succeeds, the state found is a steady state (within tolerance). Simulation then starts from this steady state.

Note If the simulation fails at or near the start time when you use the **Start simulation from steady state** option, consider clearing the check box and simulating with the plain initial conditions computation only.

Extended Functionality for Working with Physical Units

SimHydraulics 1.1 provides the following commands that help you specify the physical units for your system:

- `pm_adddimension`
- `pm_addunit`
- `pm_getunits`

SimHydraulics unit names are defined in the `pm_units.m` file, which is shipped with the product. You can open this file to see how the SimHydraulics physical units are defined, and also as an example when adding your own units. This file is located in the directory *`matlabroot`*`\toolbox\physmod\pm_util\pm_util`.

Use the `pm_getunits` command to get an up-to-date list of units currently defined in your unit registry. Use the `pm_adddimension` and `pm_addunit` commands to define additional units.

For more information, see “Working with Physical Units” in the SimHydraulics User’s Guide.

New SimHydraulics Blocks

The new blocks introduced in SimHydraulics 1.1 are listed below:

- Annular Orifice
- Cylinder Friction
- Reservoir
- Elbow
- Pipe Bend
- T-junction
- Gradual Area Change
- Sudden Area Change
- Variable-Displacement Motor
- Variable-Displacement Pump
- Shuttle Valve
- PS Product
- PS Divide

Version 1.0 (R2006a+) SimHydraulics

This table summarizes what's new in Version 1.0 (R2006a+):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Not applicable	Bug Reports	No

New features introduced in this version are described here.

Introduction of SimHydraulics

SimHydraulics is a modeling environment for the engineering design and simulation of hydraulic power and control systems within Simulink® and MATLAB®. It is based on the Physical Network approach and contains a comprehensive library of hydraulic blocks, as well as one-dimensional translational and rotational mechanical elements and utility blocks.

SimHydraulics has the following key features:

- Enables modeling and simulation of hydraulic power and control systems in Simulink
- Provides intuitive and convenient description of multidomain models based on physical networks
- Includes a library of hydraulic components, such as pumps, valves, accumulators, and pipelines, that account for effects such as fluid compressibility, turbulence transition, and fluid inertia
- Provides foundation library of hydraulic building blocks, as well as fundamental mechanical and mathematical elements, to enable efficient extension and customization of models
- Provides customizable library of hydraulic fluids

SimHydraulics employs a network approach to model building. Components in the network correspond to physical elements, such as pumps, motors,

valves, etc. The lines that join the components correspond to physical connections that transmit power between components. Unlike traditional Simulink block diagrams, these connections are non-directional and do not require the user to resolve the causality of the system while building the model. SimHydraulics libraries contain more than 75 models of hydraulic and mechanical components. All the models were developed to be easily characterized by data normally available in manufacturer's catalogs or data sheets. SimHydraulics has been designed such that building a model of a system is analogous to assembling the actual physical system with off-the-shelf components. The end result is a hydraulic circuit schematic in concurrence with ISO 1219 Fluid Power Standard.

SimHydraulics has the following limitations:

- Explicit solvers are not currently supported. Only the following solvers are supported in SimHydraulics: `ode15s`, `ode23t`, and `ode14x`.
- A SimHydraulics physical network should not exist within a Simulink algebraic loop. This means that you should not directly connect an output of a PS-Simulink Converter block to an input of a Simulink-PS Converter block of the same physical network.
- Code generation is not currently supported in SimHydraulics.

Compatibility Summary for SimHydraulics

This table summarizes new features and changes that might cause incompatibilities when you upgrade from an earlier version, or when you use files on multiple versions. Details are provided in the description of the new feature or change.

Version (Release)	New Features and Changes with Version Compatibility Impact
Latest Version V1.2 (R2007a)	See the **Compatibility Considerations** subheading for these new features or changes: • "Initial Conditions Added for Certain Blocks" on page 5 • "Block Library Links Must Be Resolved" on page 6
V1.1 (R2006b)	None
V1.0 (R2006a+)	Not applicable