SimMechanics™ Release Notes

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SimMechanics™ Release Notes

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Summary by Version

This table provides quick access to what's new in each version. For clarification, see "Using Release Notes" on page 2.

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Latest Version V3.2 (R2010a)	Yes Details	No	Bug Reports Includes fixes	Printable Release Notes: PDF Current product documentation
V3.1.1 (R2009b)	No	No	Bug Reports Includes fixes	No
V3.1 (R2009a)	No	No	Bug Reports Includes fixes	No
V3.0 (R2008b)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V2.7.1 (R2008a)	Yes Details	No	Bug Reports Includes fixes	Printable Product Documentation: PDF
V2.7 (R2007b)	Yes Details	No	Bug Reports Includes fixes	No
V2.6 (R2007a)	Yes Details	Yes Summary	Bug Reports Includes fixes	No

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
V2.5 (R2006b)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V2.4 (R2006a)	Yes Details	No	Bug Reports at Web site	No
V2.3 (R14SP3)	Yes Details	No	Bug Reports at Web site	No
V2.2.2 (R14SP2)	Yes Details	No	Bug Reports at Web site	No
V2.2.1 (R14SP1)	Yes Details	No	Fixed bugs at Web site	No
V2.2 (R14)	Yes Details	Yes Summary	Fixed bugs at Web site	No
V2.1.1 (R13SP1)	No	No	Yes Details	No
V2.1 (R13+)	Yes Details	No	Fixed bugs at Web site	No
V2.0.1 (R13+)	No	No	Yes Details	No
V2.0 (R13+)	Yes Details	No	Fixed Bugs at Web Site	No

Using Release Notes

Use release notes when upgrading to a newer version to learn about:

- New features
- Changes
- Potential impact on your existing files and practices

Review the release notes for other MathWorks™ products required for this product (for example, MATLAB® or Simulink®). Determine if enhancements, bugs, or compatibility considerations in other products impact you.

If you are upgrading from a software version other than the most recent one, review the current release notes and all interim versions. For example, when you upgrade from V1.0 to V1.2, review the release notes for V1.1 and V1.2.

What Is in the Release Notes

New Features and Changes

- New functionality
- Changes to existing functionality

Version Compatibility Considerations

When a new feature or change introduces a reported incompatibility between versions, the **Compatibility Considerations** subsection explains the impact.

Compatibility issues reported after the product release appear under Bug Reports at The MathWorks™ Web site. Bug fixes can sometimes result in incompatibilities, so review the fixed bugs in Bug Reports for any compatibility impact.

Fixed Bugs and Known Problems

The MathWorks offers a user-searchable Bug Reports database so you can view Bug Reports. The development team updates this database at release time and as more information becomes available. Bug Reports include provisions for any known workarounds or file replacements. Information is available for bugs existing in or fixed in Release 14SP2 or later. Information is not available for all bugs in earlier releases.

Access Bug Reports using your MathWorks Account.

About Commands Being Removed

This section lists commands removed or in the process of being removed. Commands typically go through several stages across multiple releases before being completely removed. This provides time for you to make adjustments to your code.

- Announcement — The Release Notes announce the planned removal, but there are no functional changes; the command runs as it did before.
- Warning — When you execute the command, it displays a warning message indicating it will be removed in a future release; otherwise the command executes as it did before.
- Error — When you execute the command, it produces an error. The error message indicates the command was removed and suggests a replacement command, if one is available.
- Removal — When you run the command, it fails. The error message is the standard message when MATLAB does not recognize an entry.

Commands might be in a stage for one or more releases before moving to another stage. Commands are listed in the Commands Being Removed section only when they enter a new stage and their behavior changes. For example, if a command displayed a warning in the previous release and errors in this release, it appears on the list. If it continues to display a warning, it does not appear on the list because there was no change between the releases.

Not all commands go through all stages. For example, a command's impending removal might not be announced, but instead, the first notification might be that the command displays a warning.

The Release Notes include actions you can take to mitigate the effects of command removal, such as adapting your code to use a replacement command.

Version 3.2 (R2010a) SimMechanics Software

This table summarizes what's new in Version 3.2 (R2010a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	No	Bug Reports at Web site	Printable Release Notes: PDF Current product documentation

New features and changes introduced in this version are

- "Optional Simplification of Subsystem Hierarchy During Model Import" on page 5
- ""What's This?" Context-Sensitive Help Available for Import Physical Modeling XML Dialog Box" on page 6
- "Connection Port Block Consolidated to Simscape Library and Documentation" on page 6
- "New Demos" on page 6

Optional Simplification of Subsystem Hierarchy During Model Import

When you generate SimMechanics™ models with the `mech_import` command, you can now choose certain automatic simplifications of the imported model's hierarchy:

- Bringing all joints in the generated model to the highest level being imported, either the whole model or a subsystem.
- Grouping all welded bodies at each level of the model hierarchy into new rigid subsystems at the same level.

Without these options, the generated model's hierarchy follows the hierarchy specified in the imported XML file, derived from its original CAD assembly.

"What's This?" Context-Sensitive Help Available for Import Physical Modeling XML Dialog Box

This release introduces "What's This?" context-sensitive help for parameters that appear in the Import Physical Modeling XML dialog opened by entering `mech_import` with no arguments at the command line. This feature provides quick access to a detailed description of the parameters, saving you the time it would take to find the information in the Help browser.

To use the "What's This?" help, do the following:

1. Place your cursor over the label of a parameter.
2. Right-click. A **What's This?** context menu appears.

   For example, the following figure shows the **What's This?** context menu appearing after a right-click on the **Start time** parameter in the **Solver** pane.

3. Click **What's This?** A context-sensitive help window appears showing a description of the parameter.

Connection Port Block Consolidated to Simscape Library and Documentation

The Connection Port block has been removed from the block libraries of all add-on products dependent on Simscape™ software. When using these dependent add-on products, look for the Connection Port block in the Simscape "Utilities" library.

The Connection Port block help for these add-on products now directs you to the Simscape block reference.

New Demos

Two new demos have been added.

Model Hierarchy Simplification During Import

You can learn more about how to simplify imported model hierarchy by reviewing the new demo page.

This demo uses two new Physical Modeling XML files, `SimplificationExample1.xml` and `SimplificationExample2.xml`.

Reference Coordinate Systems in Imported Physical Modeling XML

With the SimMechanics Link utility, you can export reference coordinate systems that you insert into CAD assemblies. (This feature is not supported on all CAD platforms.) From the exported Physical Modeling XML, you can generate a SimMechanics model with extra Body coordinate systems corresponding to the assembly reference coordinate systems and not associated with CAD constraints and automatically generated Joints.

Using the new `GearAssembly.xml` file, the new demo page explains how you can use reference coordinate systems to help you manually add a Constraint block to a model after import.

Version 3.1.1 (R2009b) SimMechanics Software

This table summarizes what's new in Version 3.1.1 (R2009b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
No	No	Bug Reports at Web site	No

Version 3.1 (R2009a) SimMechanics Software

This table summarizes what's new in Version 3.1 (R2009a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
No	No	Bug Reports at Web site	No

Changes introduced in this version are

- "Changes to External Virtual Reality Visualization" on page 9
- "Pro/ENGINEER CAD Translation Case Study" on page 9

Changes to External Virtual Reality Visualization

The new Simulink® 3D Animation™ software replaces the Virtual Reality Toolbox™ product for visualizing virtual scenes. The documentation section on building and using a virtual reality client to visualize SimMechanics models has been updated to reflect this change.

Pro/ENGINEER CAD Translation Case Study

The CAD translation chapter now contains a case study demonstrating assembly export and re-export, along with model import and update. The study uses SimMechanics and SimMechanics Link software, together with Pro/ENGINEER®, and models a double pendulum, subsequently modified to a triple pendulum. The study illustrates how you can update an existing generated CAD-based model with successive changes to the original CAD assembly.

Version 3.0 (R2008b) SimMechanics Software

This table summarizes what's new in Version 3.0 (R2008b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	Yes—Details labeled as **Compatibility Considerations**, below. See also Summary.	Bug Reports at Web site	No

New features and changes introduced in this version are

- "New SimMechanics Visualization and Animation" on page 10
- "New SimMechanics Link Utility" on page 12
- "Upgraded Mechanical Import and Automatic Model Generation" on page 13
- "BodyBuilder for Creating STL Body Geometry Files" on page 13
- "Command Being Removed" on page 14
- "SimMechanics Documentation Reorganized" on page 14
- "Physical Modeling of Mechanical Friction" on page 14

New SimMechanics Visualization and Animation

The visualization has been upgraded with new features and a new interface. It now supports

- Customizable body geometries with STL (stereolithographic) files
- Customizable body colors
- Better dynamic view control
- Better animation speed control

Consult the new *SimMechanics Visualization and Import Guide* for complete information.

For more about creating STL files, see "BodyBuilder for Creating STL Body Geometry Files" on page 13.

Compatibility Considerations

The old SimMechanics visualization allowed you to save visualization settings to a MAT-file associated with a SimMechanics model.

When you open such a model in the new version, the model will attempt to load the MAT-file, as before, and map the old visualization options to the new options as closely as possible. This is a one-time conversion. The MAT-file has to be on the MATLAB path so it can be found when you open the model.

To save these converted visualization settings:

1. You must open the visualization window and save these settings to the model.
2. Then you must save the model itself.

Use the visualization controls to save the settings to the model. See the *SimMechanics Visualization and Import Guide*.

Caution To save visualization settings from an old model in the new visualization, you must follow these steps, in this order. Otherwise, you might lose the old settings permanently.

Compressed Animation Recording from New Visualization on Windows Vista and 64-Bit Windows Operating Systems

To compress a recorded animation of a simulation, you need the Indeo 5 codec. This codec might not be available on the 32-bit Windows Vista™ operating system and the 64-bit Windows® XP and Windows Vista operating systems. If you require compression and the codec is not found, the animation AVI file is still saved, but without compression. A warning appears.

For further details, consult Technical Solution 1-1HTNHW at the MathWorks web site.

New Visualization Window Status Bar Not Available on Intel Mac Operating System

The status bar of the new visualization window, below the machine display, does not appear at all on the Intel® Mac® operating system. On other operating systems, the status bar shows simulation time, as well as Body block and coordinate system names.

New Visualization Not Supported on Solaris 64 UNIX Operating System

The new visualization and animation interface is not available on the Solaris 64 UNIX operating system. SimMechanics software automatically reverts to the old visualization interface.

Consult the R2008a *SimMechanics User's Guide* (PDF format) on the MathWorks Web site for more information about the old visualization interface (chapter 6).

New SimMechanics Link Utility

The new SimMechanics Link utility provides a bridge from third-party mechanical design and modeling applications to the system and control design features of MATLAB and Simulink. It connects computer-aided design (CAD) platforms to mechanical modeling with SimMechanics software by enabling export of CAD assemblies into the Physical Modeling XML format that allows for automatic generation of SimMechanics models.

Refer to the SimMechanics Link documentation for more information. The SimMechanics Link utility requires MATLAB, but not Simulink, Simscape, or SimMechanics.

Upgraded Mechanical Import and Automatic Model Generation

The new `mech_import` command works with externally defined Physical Modeling XML files to automatically generate SimMechanics models. It supports a new SimMechanics feature, updating models generated previously.

Compatibility Considerations

Physical Modeling XML files generated by the old CAD-to-SimMechanics translators remain compatible with `mech_import`. Using this command, you can still import old XML files to generate SimMechanics models. Because these models have no associated exported STL body geometry files, they will visualize using the standard (noncustom) body shapes.

The updating feature of `mech_import` works only with Physical Modeling XML files generated by exporting from the SimMechanics Link utility. This feature does not work with Physical Modeling XML files generated from the old CAD-to-SimMechanics translators.

You should replace all existing instances of the `import_physmod` command with the new `mech_import` command. See "Command Being Removed" on page 14.

Caution Do not attempt to use the `import_physmod` command in older SimMechanics versions with Physical Modeling XML files generated by the new SimMechanics Link exporter.

BodyBuilder for Creating STL Body Geometry Files

In addition to generating STL body geometry files automatically from a CAD assembly, you can also create STL files by hand or by using a body geometry editor. BodyBuilder is an application based on MATLAB that provides a graphical means to create STL files for use in SimMechanics body visualization. You can obtain BodyBuilder from MATLAB Central. In the MATLAB Desktop File Exchange tool, search for "BodyBuilder".

Command Being Removed

Command Name	What Happens When You Use Command?	Use This Instead	Compatibility Considerations
`import_physmod`	Still runs	`mech_import`	Replace all existing instances of `import_physmod` with `mech_import`.

SimMechanics Documentation Reorganized

The SimMechanics documentation is now organized into four books.

Book	Includes Material from Old Chapters
SimMechanics Getting Started Guide	1, 2, and 3
SimMechanics User's Guide	4, 5, 8, and 9
SimMechanics Visualization and Import Guide	6 and 7
SimMechanics Reference	10, 11, 12, and 13

Physical Modeling of Mechanical Friction

A recent MATLAB Digest article explains how to simulate mechanical friction with Simulink, SimDriveline™, and SimMechanics models. A set of models accompanies the article in a compressed zip archive available from MATLAB Central. In the MATLAB Desktop File Exchange tool, search for "Mechanical Friction with Simulink and Physical Modeling".

Version 2.7.1 (R2008a) SimMechanics Software

This table summarizes what's new in Version 2.7.1 (R2008a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	No	Bug Reports at Web site	Printable Product Documentation: PDF

New features and changes introduced in this version are

"What's This?" Context-Sensitive Help Available for Simulink Configuration Parameters Dialog

R2008a introduces "What's This?" context-sensitive help for parameters that appear in the Simulink Configuration Parameters dialog. This feature provides quick access to a detailed description of the parameters, saving you the time it would take to find the information in the Help browser.

To use the "What's This?" help, do the following:

1. Place your cursor over the label of a parameter.
2. Right-click. A **What's This?** context menu appears.

   For example, the following figure shows the **What's This?** context menu appearing after a right-click on the **Start time** parameter in the **Solver** pane.

3. Click **What's This?** A context-sensitive help window appears showing a description of the parameter.

Version 2.7 (R2007b) SimMechanics Software

This table summarizes what's new in Version 2.7 (R2007b):

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

New features and changes introduced in this version are

- "Interfacing with One-Dimensional Simscape Domains" on page 16
- "SimMechanics State Names Now Available to Simulink and Real-Time Workshop" on page 17
- "Controlling Redundant Constraint Analysis with New Tolerance Setting" on page 17
- "New Demos" on page 17
- "Code Generation Documentation Consolidated to Simscape User's Guide" on page 18

Interfacing with One-Dimensional Simscape Domains

The Prismatic-Translational Interface and Revolute-Rotational Interface blocks of the new Interface Elements library allow you to connect a SimMechanics Prismatic or Revolute joint primitive to a Physical Networks line connected to Simscape blocks. The Prismatic-Translational Interface and Revolute-Rotational Interface blocks transfer mechanical velocities and forces/torques as Physical Networks cross- and through-variables, respectively, without energy loss, along or around axes that you can define.

Several new demos illustrate the use of the Interface Elements blocks. See "New Demos" on page 17.

SimMechanics State Names Now Available to Simulink and Real-Time Workshop

You can access the names of the mechanical states of your SimMechanics models through the `mech_stateVectorMgr` command. The names of these states and the SimMechanics blocks that define them are now available to Simulink and appear in the outputs of model simulations. They also appear in simulations based on code generated with Real-Time Workshop®.

See the Simulink and Real-Time Workshop documentation for further details about states.

Controlling Redundant Constraint Analysis with New Tolerance Setting

You can now adjust the sensitivity of the SimMechanics redundant constraint analysis in the **Constraints** tab of the Machine Environment block, which allows you to choose between automatic constraint redundancy analysis or specifying a constraint redundancy tolerance explicitly.

Certain mechanical configurations are sensitive to the constraint redundancy tolerance and can spuriously lose or gain degrees of freedom if this tolerance is adjusted incorrectly. See “Configuring Methods of Solution”, “How SimMechanics Software Works”, and “Troubleshooting Simulation Errors” in the *SimMechanics User’s Guide*.

New Demos

Nine new demos have been added.

Interface Blocks

These demos illustrate how to use the new Interface Elements blocks. See “Interfacing with One-Dimensional Simscape Domains” on page 16.

- `mech_interface_crate_transfer`
- `mech_interface_dspring_damper`
- `mech_interface_hyd_cylinder`
- `mech_interface_hyd_slidercrank`

- `mech_interface_rot_spr_damper`
- `mech_interface_trans_spr_damper`

Car Modeling

These new demos provide examples of sophisticated automotive modeling.

- `mech_car_handling`
- `mech_car_kinematics`

These demos shipped in the Version 2.6 (R2007a) SimMechanics product.

Code Generation Documentation Consolidated to Simscape User's Guide

Documentation of code generation features common to all Physical Modeling add-on products based on Simscape software has been consolidated to the *Simscape User's Guide*. The *SimMechanics User's Guide* continues to document uniquely SimMechanics features related to code generation.

Version 2.6 (R2007a) SimMechanics Software

This table summarizes what's new in Version 2.6 (R2007a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	Yes—Details labeled as **Compatibility Considerations**, below. See also Summary.	Bug Reports at Web site	No

New features and changes introduced in this version are

- "SimMechanics Software Now Requires Simscape Product" on page 19
- "Sharing Models Using Simscape Editing Modes" on page 19
- "Block Library Links Must Be Resolved" on page 20
- "Two Blocks Now with Tunable Parameters" on page 20
- "Demos Expanded" on page 21
- "Modeling Constraints with SimMechanics Software" on page 21

SimMechanics Software Now Requires Simscape Product

SimMechanics software now depends on and requires Simscape software, the foundation for Physical Modeling products. Simscape software includes common Physical Modeling utilities and block libraries. See "Product Overview" and the Simscape documentation.

Sharing Models Using Simscape Editing Modes

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

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

For more details, see “Using the Simscape Editing Mode” in “Running Mechanical Models”.

Block Library Links Must Be Resolved

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

Compatibility Considerations

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

If you have disabled or broken the SimMechanics 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 is the SimMechanics block library or your own.

Two Blocks Now with Tunable Parameters

These SimMechanics parameters are now tunable from their respective block dialogs:

- The **Gravity vector** field of the Machine Environment block.
- All three parameter fields of the Body Spring & Damper block.

See “Limitations” in “Running Mechanical Models” for more about SimMechanics tunable parameters and the Simulink documentation for tunable parameters in general.

Demos Expanded

Five new demos have been added.

Angular Motion Equivalence

The `mech_gimbal_transform` demo shows the equivalence of a body’s angular motion as measured by Joint Sensors and as measured by Body Sensors.

Joint Limits

Two demos illustrate how to model limits or clearance on joint motion:

- `mech_jointlimit_prismatic`
- `mech_jointlimit_revolute`

The first illustrates limits on translational motion; the second, limits on rotational motion.

Stochastic Oscillator and Controller

Two demos simulate a mixture of deterministic and random forces with a model of a micromechanical damped linear oscillator:

- `mech_brownian_osc`
- `mech_brownian_osc_control`

The first model has no controller; the second, a control force in addition to the damped spring and white noise forces.

Modeling Constraints with SimMechanics Software

A new MATLAB Digest article explains how to model mechanical constraints with SimMechanics blocks. The article uses a set of four existing SimMechanics demos as illustrations.

Version 2.5 (R2006b) SimMechanics Software

This table summarizes what's new in Version 2.5 (R2006b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	Yes—Details labeled as **Compatibility Considerations**, below. See also Summary.	Bug Reports at Web site	No

New features and changes introduced in this version are described here.

- "Computer-Aided Design Translator for Pro/ENGINEER Available via the Web" on page 22
- "SolidWorks-to-SimMechanics Translator Now Available Only via the Web" on page 23
- "New Demo" on page 24
- "Modeling Flexible Bodies with SimMechanics Software" on page 24

Computer-Aided Design Translator for Pro/ENGINEER Available via the Web

A new computer-aided design (CAD) Pro/ENGINEER-to-SimMechanics translator is available. You install and use this translator with Pro/ENGINEER. It is independent of MATLAB.

The translator converts a Pro/ENGINEER CAD machine assembly into an XML file in the Physical Modeling format. The XML file represents the assembly in a form that you can use to generate a SimMechanics block diagram model dynamically equivalent to the original CAD assembly. To generate models, use the `import_physmod` command.

Installing the Pro/ENGINEER-to-SimMechanicsTranslator

Obtain and use the installer executable by locating and downloading its archive at `www.mathworks.com/products/simmechanics/`. A README page is provided that describes installation and configuration details.

Translator Documentation

Help files accompany the Pro/ENGINEER-to-SimMechanics translator. They include two HTML pages and a PDF book. These files are independent of the MATLAB help system.

Translator Examples

Some examples of Pro/ENGINEER CAD assemblies are included with the Pro/ENGINEER-to-SimMechanics translator.

One of the examples is a robot arm assembly. The corresponding XML file in Physical Modeling format, `robot.xml`, is located in the `toolbox/physmod/mech/mechdemos/` folder, relative to your MATLAB root.

Compatibility Considerations

Versions of Pro/ENGINEER compatible with the Pro/ENGINEER-to-SimMechanics translator are listed at the MathWorks Web site. The translator is available only for the Microsoft Windows (32-bit) operating system.

SolidWorks-to-SimMechanics Translator Now Available Only via the Web

The existing SolidWorks®-to-SimMechanics translator for the SolidWorks CAD platform continues to be available via the Web, at `www.mathworks.com/products/simmechanics/`. However, it no longer ships with the SimMechanics product.

Compatibility Considerations

Versions of SolidWorks compatible with the SolidWorks-to-SimMechanics translator are listed at the MathWorks Web site.

The SolidWorks CAD platform and the SolidWorks-to-SimMechanics translator are available only for the Microsoft Windows (32-bit) operating system.

New Demo

This version of SimMechanics software includes one new demo model, `mech_brownian_osc`, a stochastic linear harmonic oscillator based on micro- and biomechanics.

Modeling Flexible Bodies with SimMechanics Software

A new MATLAB Digest article and related technical paper explain how to simulate flexible bodies with SimMechanics models and third-party finite element analysis applications. A set of models accompanies the technical paper in a compressed zip archive available from MATLAB Central. In the MATLAB Desktop File Exchange tool, search for “Modeling Flexible Bodies in SimMechanics”.

Version 2.4 (R2006a) SimMechanics Software

This table summarizes what's new in V2.4 (R2006a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	Yes—Details labeled as **Compatibility Considerations**, below. See also Summary.	Bug Reports at Web site	No

New features and changes introduced in this version are described here.

- "New Block Dialogs and the Simulink Model Explorer" on page 25
- "Joint Spring & Damper Adds Extra Simulink State When Connected to a Revolute" on page 25
- "Improved SolidWorks CAD Translation" on page 26

New Block Dialogs and the Simulink Model Explorer

Most of the SimMechanics block dialogs have been upgraded and are now compatible with the Simulink Model Explorer. See the Simulink documentation for more about Model Explorer.

Block Dialogs Not Rendered in Model Explorer

Model Explorer cannot render the dialogs of these blocks:

- Shared Environment
- Point-Curve Constraint

Joint Spring & Damper Adds Extra Simulink State When Connected to a Revolute

Each Joint Spring & Damper block connected to a revolute primitive now adds a Simulink state to your model. These states are in addition to other normal

Simulink states, such as those associated with Integrator and Transfer Fcn blocks. See the Simulink documentation for more about Simulink model states.

This new feature does not change the mechanical states of your model, those associated with SimMechanics joint blocks. See the `mech_stateVectorMgr` command reference for more about mechanical states.

Improved SolidWorks CAD Translation

The SolidWorks-to-SimMechanics translator and Physical Modeling XML import command have been improved. See "Importing Mechanical Models" and the `import_physmod` command reference in the *SimMechanics User's Guide*.

- Mates in a CAD assembly (restrictions on the free motion of CAD parts) are now translated into Joint blocks that reflect a particular combination of joint primitives, such as Prismatic, Revolute, Spherical, Bushing, etc. Previously, all degrees of freedom in a CAD assembly were translated into appropriately configured Custom Joint blocks. Rigid connections between parts continue to be translated into Welds.
- Blocks in SimMechanics models generated from Physical Modeling XML files are now, by default, labeled with shorter names. You can change the naming convention in the `import_physmod` command options.

Version 2.3 (R14SP3) SimMechanics Software

This table summarizes what's new in V2.3 (R14SP3):

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

New features and changes introduced in this version are described here.

- "New Shared Environment Block" on page 27
- "Updated Body Spring & Damper Block" on page 27
- "Normalizing Rotations" on page 28
- "New State Vector Commands" on page 28
- "New import_physmod Dialog" on page 28
- "Demos Expanded" on page 28
- "Documentation Enhancements" on page 29

New Shared Environment Block

The new Shared Environment block allows you to link two separate SimMechanics block diagrams with a nonphysical connection. The block enforces the same machine environment settings on both machines but adds no mechanical components (bodies or degrees of freedom) to either. Two machines so connected require exactly one Machine Environment block, rather than two.

See the Shared Environment block reference for further details.

Updated Body Spring & Damper Block

The Body Spring & Damper block no longer contains any degrees of freedom.

Previous versions of the Body Spring & Damper block contained six degrees of freedom (DoFs) represented by a Joint. This Joint had to be taken into account when counting DoFs and loops in your model.

The new Body Spring & Damper block instead uses a Shared Environment block to connect the two sides and contains no DoFs. See their respective block references for more information.

Normalizing Rotations

The Body dialog accepts various rotational forms (Euler angles, rotation matrix, quaternion). The Body block now interprets these rotational forms in a slightly different way, so that the standard normalization conditions on rotation matrices and quaternions are consistently enforced. As a result, you might now see slightly different simulation results from earlier versions.

New State Vector Commands

Four new SimMechanics commands allow you to manipulate the mechanical states of your models. See the command references for more.

- `mech_get_states`
- `mech_runtime_states`
- `mech_set_states`
- `mech_transfer_states`

New import_physmod Dialog

The `import_physmod` command generates SimMechanics models from Physical Modeling XML files. In addition to importing Physical Modeling XML through the command line, you can now set up the command through a dialog.

See the `import_physmod` command reference for further information.

Demos Expanded

Two new demos have been added:

- `mech_flexible_four_bar` models a flexible four bar machine.

- `mech_pole_vault` models a rigid pole vaulter, with a discrete event.

The second demo has an associated MAT-file.

Documentation Enhancements

The *SimMechanics User's Guide* has been enhanced.

- The review on representing motion has been revised.
- The analyzing motion has been revised.
- The computer-aided design (CAD) documentation (also available as a separate book) has been significantly revised. See the CAD chapter.
- A new chapter of case studies, based on the Stewart platform, has been added. The studies apply advanced methods and tasks to this system. SimMechanics software includes a related set of demo model and library files.
  - Degrees of freedom, states, closed topology, and constraints
  - Trimming and linearization
  - Designing controllers for the platform
  - Generating code versions of the model
  - Implementing code on dedicated hardware (hardware in the loop)

Version 2.2.2 (R14SP2) SimMechanics Software

This table summarizes what's new in V2.2.2 (R14SP2):

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

New features and changes introduced in this version are described here.

- "Demos Expanded" on page 30
- "Documentation Enhancements" on page 30

Demos Expanded

Two new demos have been added:

- `mech_sticky_box`
- `mech_sticky_screw`

Each demo has an associated MAT-file.

These demos illustrate static friction (stiction) implemented with the Joint Stiction Actuator.

Documentation Enhancements

The online SimMechanics Help has been enhanced with links to four new Web-based AVI animation files (one of them new in this release) that record SimMechanics simulations.

You can access these links most easily by using the Examples index in the Help browser, under **Prerecorded Animations**.

Version 2.2.1 (R14SP1) SimMechanics Software

This table summarizes what's new in V2.2.1 (R14SP1):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	No	Fixed bugs at Web site	No

New features and changes introduced in this version are described here.

- "Demos Updated and Expanded" on page 31
- "Documentation Enhancements" on page 31

Demos Updated and Expanded

The demos used in the open-topology Inverse Dynamics case study have been changed:

- `mech_dpend_invdyn1`
- `mech_dpend_invdyn2`
- `mech_dpend_act` (a new demo replacing `mech_dpend_stat`)

The last, new demo has an associated MAT-file, `mech_dpend_act.mat`. See "Documentation Enhancements" on page 31.

Two other new demos have been added:

- `mech_cambelt` models a cam, belt, and pulley system with a Point-Curve Constraint block.
- `mech_viscous` illustrates how to model a viscous medium with a Joint Spring & Damper block.

Documentation Enhancements

The online SimMechanics Help has been enhanced with additional multimedia support.

- The online Help contains four detailed mechanical drawings for systems modeled in the user's guide: the conveyor, the four bar machine, and the Stewart platform.
- The online Help also contains links to three new Web-based AVI animation files that record SimMechanics simulations.

You can access these features most easily by using the Examples index in the Help browser, under **Mechanical Drawings** and **Prerecorded Animations**, respectively.

The open-topology Inverse Dynamics section of the motion analysis chapter has been enhanced with a new, more complex and more realistic example. The related demos have been changed as well; see "Demos Updated and Expanded" on page 31 previously.

Version 2.2 (R14) SimMechanics Software

This table summarizes what's new in V2.2 (R14):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	Yes—Details labeled as **Compatibility Considerations**, below. See also Summary.	Fixed bugs at Web site	No

New features and changes introduced in this version are described here.

- "Simulation and Visualization Controls Changes" on page 34
- "New Machine Environment Block" on page 34
- "Choosing a Ground Block as Machine Root" on page 35
- "Optional Two-Dimensional Solver" on page 35
- "Optional Gravity Signal" on page 35
- "New SimMechanics Diagnostics Settings" on page 36
- "Restricted Body Coordinate System References" on page 36
- "Minimum Number of Body Coordinate Systems" on page 36
- "Visualization Controls Relocated" on page 37
- "Manual Updating of Body Visualization" on page 37
- "Internal Virtual Reality Visualization No Longer Supported" on page 37
- "Code Generation with Point-Curve Constraint Now Enabled" on page 38
- "Code Generation Improvements" on page 38
- "Additional Simulink Features Now Supported" on page 38
- "SimMechanics Software Now Supported on HP-UX Platforms" on page 38
- "Demos Updated and Expanded" on page 38

- "Documentation Enhancements" on page 39

Simulation and Visualization Controls Changes

This version of SimMechanics software introduces significant changes to how you control simulation, mechanical environment, and visualization in SimMechanics models. These changes, summarized below, include

- "New Machine Environment Block" on page 34
- "Choosing a Ground Block as Machine Root" on page 35
- "Optional Two-Dimensional Solver" on page 35
- "Optional Gravity Signal" on page 35
- "New SimMechanics Diagnostics Settings" on page 36
- "Visualization Controls Relocated" on page 37
- "Manual Updating of Body Visualization" on page 37

The new controls are fully documented in the *SimMechanics User's Guide* chapters on running simulations and visualization.

New Machine Environment Block

In the new version of SimMechanics software, you configure the mechanical environment for an entire model in the **SimMechanics** node of the **Configuration Parameters** dialog, accessed via the **Simulation** menu. You configure the mechanical environment for each separate machine diagram (one or more per model) via its Machine Environment block. These two dialogs replace the old **Mechanical Environment Settings** dialog.

You must connect exactly one Machine Environment block to each separate machine diagram at one of the machine's Ground blocks. The new Machine Environment block is located in the Bodies library.

See "Choosing a Ground Block as Machine Root" on page 35.

Compatibility Considerations

Prior to this version, SimMechanics models recorded mechanical environment data in the **Mechanical Environment Settings** dialog. Although you can

no longer access this dialog from the **Simulation** menu, you can continue to run old models as they are. If you want to view these old settings, enter `mech_environment(gcs)` at the command line with your old model open. You cannot change the dialog settings.

If you want to change the settings in old models or build a new SimMechanics model, you must use the new Machine Environment block. Copying this block from the Bodies library into an old model causes the old **Mechanical Environment Settings** data to be copied into the block. You can then reconfigure the new block as you want.

Choosing a Ground Block as Machine Root

The new Ground block has the option of being chosen as the root for a machine's Machine Environment block. In each separate machine diagram (one or more per model), choose one such Ground by selecting **Show Mechanical Environment port** in its dialog. The corresponding port then appears on the Ground. Then connect a Machine Environment block to the Ground at this port.

See "New Machine Environment Block" on page 34.

Optional Two-Dimensional Solver

The new Machine Environment block allows you to choose, through its **Machine dimensionality** pull-down menu, a specialized solver for a machine that moves in only two dimensions. SimMechanics software detects the dimensionality and automatically adjusts the solver by default. But you can override the default and require SimMechanics software to simulate in either three or two dimensions.

The two-dimensional solver significantly improves simulation performance in two and one dimensions.

Optional Gravity Signal

The new Machine Environment block allows you to input gravity as an external Simulink signal. In the block dialog, select **Input gravity as signal**. A Simulink inport appears for connecting the Simulink signal line. The gravity must be a three-component vector signal. You choose the units in

the **Gravity vector** units pull-down menu of the block dialog. SimMechanics software interprets the vector gravity signal the same way it interprets the static **Gravity vector** field value in the block dialog.

If you choose gravity as a signal, the **Gravity vector** field is ignored.

New SimMechanics Diagnostics Settings

SimMechanics software now lets you control diagnostic messages. In the **SimMechanics** node of the **Configuration Parameters** dialog, accessed via the **Simulation** menu, you can select to enable or disable certain warning messages, and whether to mark closed-loop joints cut automatically by SimMechanics software.

Restricted Body Coordinate System References

All coordinate system (CS) references in Body blocks from one CS to another CS must now refer to only

- Other CSs on the same Body
- Adjoining CSs (coordinate systems on Bodies directly connected to the referring body)
- World

All other CS references now cause simulation errors.

Compatibility Considerations

Other types of CS references from one Body to another now lead to simulation errors. If any of your old models contain such references, you must update them.

Minimum Number of Body Coordinate Systems

You can no longer eliminate all the non-center-of-gravity (CG) Body coordinate systems (CSs) on a Body block dialog. Besides the undeletable CG CS entry, at least one non-CG CS must remain.

Visualization Controls Relocated

You now enable SimMechanics visualization and animation for an entire model in the **Visualization** area of the **SimMechanics** node of the **Configuration Parameters** dialog, reached via the **Simulation** menu. You now enable or disable visualization for individual machines within a model via the **Visualization** tab of the Machine Environment block dialog. See "New Machine Environment Block" on page 34.

All SimMechanics visualization controls are now located on the specially configured MATLAB Graphics visualization window, in the **SimMechanics** menu and toolbar.

Manual Updating of Body Visualization

SimMechanics visualization no longer immediately displays a Body newly added to a model. Instead you must update the model by selecting **Update Diagram** from the **Edit** menu.

Internal Virtual Reality Visualization No Longer Supported

SimMechanics software no longer includes internally integrated Virtual Reality Toolbox visualization. Models configured to use virtual reality now default to the MATLAB Graphics visualization/animation tool, which is still supported by SimMechanics software.

See the "Visualizing with a Virtual Reality Client" of the visualization chapter in the SimMechanics documentation.

Consult the Web product page for more about Virtual Reality Toolbox.

Compatibility Considerations

You can continue to use Virtual Reality Toolbox with SimMechanics models by creating your own virtual world for your machine, incorporating into your model a VR Sink block linked to your virtual world, and feeding Body Sensor signals to the VR Sink.

Code Generation with Point-Curve Constraint Now Enabled

The Point-Curve Constraint no longer creates algebraic loops in Simulink. This improvement means that you can now generate code from models containing Point-Curve Constraints.

Code Generation Improvements

The stand-alone SimMechanics library used for code generation is now precompiled for supported platforms using standard targets. This feature significantly speeds up compilation of generated code.

SimMechanics code generation now supports Real-Time Windows Target.

Additional Simulink Features Now Supported

SimMechanics software now supports Model Referencing and S-function target. It also now supports Simulink External mode, but without visualization. See the sections on generating code and SimMechanics limitations in the SimMechanics documentation.

SimMechanics Software Now Supported on HP-UX Platforms

SimMechanics software is now supported on the Hewlett-Packard UNIX® (HP-UX) operating system.

Demos Updated and Expanded

All SimMechanics demos have been updated with the new Machine Environment block. New demos have also been added:

- `mech_bouncing_ball` demonstrates how to model impact and collisional forces using a bouncing ball.
- `mech_flyball` models a flyball governor mechanism.
- `mech_rack_pinion` models a driven rack-and-pinion mechanism.
- `mech_rolling_sphere` demonstrates how to model nonholonomic constraints using a sphere rolling on a two-dimensional surface.

- `mech_toroid` illustrates the Point-Curve Constraint with a body sliding on a toroidal curve.

Documentation Enhancements

The *SimMechanics User's Guide* has been enhanced.

- The review chapter on body motion and coordinate systems is expanded with greater detail and more examples.
- The computer-aided design (CAD) documentation (also available as a separate book) has been significantly revised and expanded. See the CAD chapter.
- The case study sections on trimming and linearization have been revised and expanded, including a new closed-loop linearization example.

You can find a more complex closed-loop linearization example using a Stewart platform model at

```
www.mathworks.com/company/newsletters/digest/sept02/stewart.html
```

Version 2.1.1 (R13SP1) SimMechanics Software

This table summarizes what's new in V2.1.1 (R13SP1):

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

New changes introduced in this version are described here.

Model Reinitialization After Simulation Errors

Restarting a model that had encountered an error during a previous simulation sometimes returned warnings and zero results. Starting the model a third time reproduced the errors of the first simulation. This bug is now fixed.

Version 2.1 (R13+) SimMechanics Software

This table summarizes what's new in V2.1 (R13+):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Fixed bugs at Web site	No

New features and changes introduced in this version are described here.

- "Computer-Aided Design Translator for SolidWorks" on page 41
- "import_physmod Command for Generating Models" on page 42
- "Documentation and Examples for SolidWorks-to-SimMechanics Translator" on page 42

Computer-Aided Design Translator for SolidWorks

SimMechanics version 2.1 contains a standalone computer-aided design (CAD) translator for the SolidWorks CAD platform. You install and use this translator with SolidWorks but independently of MATLAB.

The translator converts a SolidWorks CAD machine assembly into an XML file in the Physical Modeling format. The XML file represents the assembly in a form that you can use to generate a SimMechanics block diagram model dynamically equivalent to the original CAD assembly. To generate models, use the new `import_physmod` command. See "import_physmod Command for Generating Models" on page 42 below.

Installing the SolidWorks-to-SimMechanics Translator

Obtain the self-extracting executable archive `SimMechanics_Translator_for_SolidWorks.exe` by locating and downloading its archive at `www.mathworks.com/products/simmechanics/`.

import_physmod Command for Generating Models

Using the CAD-to-SimMechanics translator, you export a CAD assembly into an XML file in the Physical Modeling format. (See "Computer-Aided Design Translator for SolidWorks" on page 41.)

This XML file represents the assembly in a form that you can use to generate a SimMechanics block diagram model dynamically equivalent to the original CAD assembly. You generate the model from the XML file with the `import_physmod` command.

The generated model contains Bodies and Joints that represent the original parts and degrees of freedom of the assembly. You can edit the generated model to add additional SimMechanics and Simulink blocks.

Documentation and Examples for SolidWorks-to-SimMechanics Translator

The *SimMechanics User's Guide* has not been updated for this release.

Translator Documentation

Special help files accompany the SolidWorks-to-SimMechanics translator. They include two HTML pages and a PDF book. These files are independent of the MATLAB help system.

Translator Examples

Some examples of SolidWorks CAD assemblies are included with the SolidWorks-to-SimMechanics translator.

One of the examples is a robot arm assembly. The corresponding XML file in Physical Modeling format, `robot.xml`, is located in the `toolbox/physmod/mech/mechdemos` folder, relative to your MATLAB root.

Version 2.0.1 (R13+) SimMechanics Software

This table summarizes what's new in V2.0.1 (R13+):

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

New changes introduced in this version are described here.

Code Compilation with LCC Compiler

Attempting to compile code generated from SimMechanics models using LCC led to errors in Version 2.0. This bug is now fixed.

Version 2.0 (R13+) SimMechanics Software

This table summarizes what's new in V2.0 (R13+):

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

New features and changes introduced in this version are described here.

- "Code Generation with Real-Time Workshop" on page 44
- "Accelerator Mode and Discrete Events" on page 44
- "Expanded Handle Graphics Visualization Features" on page 45
- "Variable Body Mass and Inertia Tensor" on page 45
- "Vectorized Joint Initial Condition Actuation" on page 45
- "Damped Linear Force Element Blocks" on page 45
- "New Mechanical Branching Bar Block" on page 45

Code Generation with Real-Time Workshop

You can now generate stand-alone C code from SimMechanics models using Real-Time Workshop. You can also export it to a PC kernel using xPC Target.

SimMechanics version 2.0 requires Real-Time Workshop 5.0.1 or later to generate code for the Rapid Simulation (RSIM) target.

Accelerator Mode and Discrete Events

Accelerator mode now supports discrete events associated with the Joint Stiction Actuator and the Point-Curve Constraint.

Expanded Handle Graphics Visualization Features

The SimMechanics visualization tool has a large number of new features, including recording and playback of simulation animations.

Variable Body Mass and Inertia Tensor

The Sensors & Actuators library features a new Variable Mass & Inertia Actuator block. This block accepts Simulink signals that vary the mass and/or inertia tensor of the Body block to which it is connected. The block only simulates the changes in the body's mass properties and does not simulate the effect of the thrust forces or torques resulting from the accretion or ejection of mass.

Vectorized Joint Initial Condition Actuation

The Joint Initial Condition Actuator block now lists all the primitives in the Joint block to which it is connected. You can set initial positions/angles and initial velocities separately for each prismatic and revolute primitive.

Damped Linear Force Element Blocks

This release introduces a new block library, Force Elements, with two blocks representing damped linear harmonic oscillator forces. The Body Spring & Damper block simulates a damped spring-like force between two bodies. The Joint Spring & Damper block actuates a joint primitive with a damped spring-like force or torque.

New Mechanical Branching Bar Block

The Utilities library features the new Mechanical Branching Bar block. You can use this block to map multiple sensor and actuator lines to one sensor/actuator port on a Joint, Constraint, or Driver or to one Body coordinate system on a Body.

Compatibility Summary for SimMechanics Software

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 V3.2 (R2010a)	No
V3.1.1 (R2009b)	No
V3.1 (R2009a)	No
V3.0 (R2008b)	See the **Compatibility Considerations** subheading for this new feature: • "New SimMechanics Visualization and Animation" on page 10 • "Upgraded Mechanical Import and Automatic Model Generation" on page 13 See "Command Being Removed" on page 14.
V2.7.1 (R2008a)	No
V2.7 (R2007b)	No
V2.6 (R2007a)	See the **Compatibility Considerations** subheading for this new feature: • "Block Library Links Must Be Resolved" on page 20
V2.5 (R2006b)	See the **Compatibility Considerations** subheading for each of these new features: • "Computer-Aided Design Translator for Pro/ENGINEER Available via the Web" on page 22 • "SolidWorks-to-SimMechanics Translator Now Available Only via the Web" on page 23

Version (Release)	New Features and Changes with Version Compatibility Impact
V2.4 (R2006a)	No
V2.3 (R14SP3)	No
V2.2.2 (R14SP2)	No
V2.2.1 (R14SP1)	No
V2.2 (R14)	See the **Compatibility Considerations** subheading for each of these new features or changes: • "New Machine Environment Block" on page 34 • "Restricted Body Coordinate System References" on page 36 • "Internal Virtual Reality Visualization No Longer Supported" on page 37
V2.1.1 (R13SP1)	No
V2.1 (R13+)	No
V2.0.1 (R13+)	No
V2.0 (R13+)	No