SimMechanics Release Notes

The "SimMechanics 2.2 Release Notes" on page 1-1 describe the changes in this product since Version 2.1.1. The following topics are discussed in these Release Notes.

- "New Features" on page 1-2
- "Major Bug Fixes" on page 1-7
- "Upgrading from an Earlier Release" on page 1-8
- "Known Software and Documentation Limitations" on page 1-10

If you are upgrading from a version earlier than Version 2.1.1, you should also see:

- "SimMechanics 2.1.1 Release Notes" on page 2-1
- "SimMechanics 2.1 Release Notes" on page 3-1
- "SimMechanics 2.0.1 Release Notes" on page 4-1
- "SimMechanics 2.0 Release Notes" on page 5-1

Printing the Release Notes
If you would like to print the Release Notes, you can link to a PDF version.

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SimMechanics 2.2 Release Notes

New Features

Simulation and Visualization Controls Changes

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

- New Machine Environment Block
- Choosing a Ground Block as Machine Root
- Optional Two-Dimensional Solver
- Optional Gravity Signal
- New SimMechanics Diagnostics Settings
- Visualization Controls Relocated
- Manual Updating of Body Visualization

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, 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" following. See also "Updating Mechanical Environment Settings."

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. A special port appears on the Ground. Then connect a Machine Environment block to the Ground at this port.

See "New Machine Environment Block" preceding.

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 detects the dimensionality and automatically adjusts the solver by default. But you can override the default and require SimMechanics to work 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 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 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.

Restricted Body Coordinate System References

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

- 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.

See also "Major Bug Fixes," and "Restricting Body Coordinate System References" under "Upgrading from an Earlier Release."

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. See also "Major Bug Fixes."

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** pane of the Machine Environment block dialog. See "New Machine Environment Block" preceding.

All SimMechanics visualization controls are now located on the MATLAB® Graphics visualization window, in the special **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.

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 the Real-Time Windows Target.

Additional Simulink Features Now Supported

SimMechanics 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 Now Supported on HP-UX Platforms

SimMechanics 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

Major Bug Fixes

SimMechanics 2.2 includes these important bug fixes made since Version 2.1.1.

If you are viewing these Release Notes in PDF form, refer to the HTML form of the Release Notes, using either the Help browser or the MathWorks Web site, and use the link provided.

Upgrading from an Earlier Release

SimMechanics 2.2 presents several important issues if you are upgrading from a previous version.

Updating Mechanical Environment Settings

Prior to Version 2.2, 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.

See "New Machine Environment Block" and "Choosing a Ground Block as Machine Root" under "New Features."

Restricting Body Coordinate System References

All coordinate system (CS) references in Body blocks to CSs must now refer only to other CSs on the same Body, to Adjoining CSs (coordinate systems on bodies directly connected to the referring body), or to World.

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.

Internal Virtual Reality Visualization No Longer Supported

SimMechanics 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.

You can continue to use Virtual Reality Toolbox with SimMechanics 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.

See the virtual reality section of the visualization sections in the SimMechanics documentation.

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

Known Software and Documentation Limitations

The following software bugs, workarounds, and compatibility issues are relevant to SimMechanics 2.2.

Known Software Bugs

This section includes a link to a description of known software problems in SimMechanics 2.2.

If you are viewing these Release Notes in PDF form, refer to the HTML form of the Release Notes, using either the Help browser or the MathWorks Web site, and use the link provided.

Avoiding Singular Initial Configurations

Avoid starting a machine in a singular configuration. Its subsequent motion violates assembly tolerances, as the simulation incorrectly removes one or more necessary constraints. A common singular configuration is one where the machine can move in two or three dimensions, but starts in exactly one or two dimensions.

The new **SimMechanics** node of the **Configuration Parameters** dialog allows you to require SimMechanics to warn you of the possible presence of singular initial configurations. See "New SimMechanics Diagnostics Settings" under "New Features."

Work around an initial singularity by slightly misaligning the joint axes, within assembly tolerances, before starting the simulation.

You can mitigate singularities encountered later in a simulation by selecting the **Use robust singularity handling** check box on the **Constraints** pane of the Machine Environment block dialog.

SolidWorks Versions Compatibility for CAD Translator

The SimMechanics computer-aided design (CAD) translator for SolidWorks is designed to work with SolidWorks 2001Plus SP2.0 or later versions.

Uninstalling and Reinstalling the CAD Translator

If you remove the CAD translator for SolidWorks and want to reinstall it, you must reboot your system first after uninstalling. Then you can reinstall the translator.

SolidWorks CAD Platform Limitations

The SolidWorks CAD platform and the SimMechanics CAD translator for SolidWorks are available only for the Microsoft Windows operating system.

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SimMechanics 2.1.1 Release Notes

Major Bug Fixes

SimMechanics 2.1.1 includes the following bug fix.

Model Reinitialization After Simulation Errors

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

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SimMechanics 2.1 Release Notes

New Features

Two important features have been introduced in SimMechanics 2.1 since Version 2.0.1.

Computer-Aided Design Translator for SolidWorks

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

The translator converts a SolidWorks CAD machine assembly into an XML file in a special Physical Modeling format. The XML file represents the assembly in a form that you can use with SimMechanics to generate a 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" below.

Relative to the main directory of your SolidWorks installation, the CAD translator installs to Applications/TheMathWorks/SimMechanics/.

import_physmod Command for Generating Models

Using the CAD translator (see above), you export a CAD assembly into an XML file in the Physical Modeling format.

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.

Special Documentation and Examples for CAD Translator

Special help files accompany the CAD translator. They include two HTML pages and a special PDF book.

These files are independent of the MATLAB help system. Relative to the main directory of your SolidWorks installation, the special CAD translator documentation installs to `Applications/TheMathWorks/SimMechanics/help/`.

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

Some examples of SolidWorks CAD assemblies are installed to `Applications/TheMathWorks/SimMechanics/examples/`. 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` directory, relative to your MATLAB root.

Major Bug Fixes

SimMechanics 2.1 includes these important bug fixes made since Version 2.0.1.

If you are viewing these Release Notes in PDF form, please refer to the HTML form of the Release Notes, using either the Help browser or the MathWorks Web site, and use the link provided.

Upgrading from an Earlier Release

This section presents issues involved in upgrading from SimMechanics 2.0 to SimMechanics 2.1.

Installing the CAD Translator for SolidWorks

The computer-aided design (CAD) translator for SolidWorks is independent of MATLAB. You must install it separately, then interface it with SolidWorks.

Installing

You can obtain the self-extracting executable archive `SimMechanics_Translator_for_SolidWorks.exe` in two ways.

- When you install SimMechanics 2.1, the archive is installed to `toolbox/physmod/import/standalone/solidworks/win32/`, relative to your MATLAB root.
- Alternatively, you can download the archive independently of MATLAB at `www.mathworks.com/products/simmechanics/`.

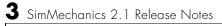Once you have the archive, run it. Click **Setup**.

The setup utility searches your hard drive for the SolidWorks installation location. If you wish to specify the location yourself, you can interrupt the search at any time by pressing the spacebar and then entering a full or partial path to your SolidWorks directory. Once the installer finds SolidWorks, it prompts you to confirm. After you confirm, the installation runs to completion.

A README file, with additional instructions, appears after installation.

Linking to SolidWorks

After you have completed the preceding steps to install the translator, start SolidWorks.

Choose **Add-Ins** from the **Tools** menu. Then select **SimMechanics**.

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SimMechanics 2.0.1 Release Notes

Major Bug Fixes

SimMechanics 2.0.1 includes the following bug fix.

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.

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SimMechanics 2.0 Release Notes

New Features

A number of important features have been introduced in SimMechanics 2.0 since Version 1.1 (Release 13). This section summarizes them.

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 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 MATLAB Graphics visualization tool of SimMechanics 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.

Major Bug Fixes

SimMechanics 2.0 includes these important bug fixes made since Version 1.1 (Release 13).