

# **Simulink<sup>®</sup> Control Design<sup>™</sup>**

## **Release Notes**

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*Simulink® Control Design™ 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.

<b>Version (Release)</b>	<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
<b>Latest Version V3.4 (R2011b)</b>	Yes Details	Yes Summary	Bug Reports Includes fixes
V3.3 (R2011a)	Yes Details	No	Bug Reports Includes fixes
V3.2 (R2010b)	Yes Details	No	Bug Reports Includes fixes
V3.1 (R2010a)	Yes Details	Yes Summary	Bug Reports Includes fixes
V3.0 (R2009b)	Yes Details	No	Bug Reports Includes fixes
V2.5 (R2009a)	Yes Details	No	Bug Reports Includes fixes
V2.4 (R2008b)	Yes Details	No	Bug Reports Includes fixes
V2.3 (R2008a)	Yes Details	No	Bug Reports Includes fixes
V2.2 (R2007b)	Yes Details	No	Bug Reports Includes fixes
V2.1 (R2007a)	Yes Details	No	Bug Reports Includes fixes
V2.0.1 (R2006b)	Yes Details	No	Bug Reports Includes fixes
V2.0 (R2006a)	Yes Details	No	Bug Reports Includes fixes

<b>Version (Release)</b>	<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
V1.3 (R14SP3)	Yes Details	No	Bug Reports Includes fixes
V1.2 (R14SP2)	Yes Details	No	Bug Reports Includes fixes
V1.1 (R14SP1)	No	No	Fixed bugs
V1.0 (R14)	Yes Details	No	No bug fixes

## 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**

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.

## **Documentation on the MathWorks Web Site**

Related documentation is available on [mathworks.com](http://mathworks.com) for the latest release and for previous releases:

- Latest product documentation
- Archived documentation

## Version 3.4 (R2011b) Simulink Control Design Software

This table summarizes what's new in Version 3.4 (R2011b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	Yes — details labeled as <b>Compatibility Considerations</b> below. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are:

- “Redesigned Graphical Tool for Improved Linear Analysis Workflows” on page 4
- “Interactive Frequency Response Estimation and Validation of Linearization Results” on page 5
- “Optimization of Model Parameters to Meet Design Requirements Specified by Model Verification Blocks” on page 5
- “Automatic Tuning of PID Controller Blocks in a Referenced Model” on page 6
- “Control System Tuning for Simulink Models with looptune or hinfstruct Using slTunable Interface” on page 6
- “Change in Default Number of Samples in frest.Chirp” on page 6

### Redesigned Graphical Tool for Improved Linear Analysis Workflows

The new interactive Linear Analysis Tool streamlines workflows for linear analysis tasks such as finding steady-state operating points (trimming) and linearization.

To access the Linear Analysis Tool:

- 1 Open a Simulink model.



- 2** In the Simulink model, select **Tools > Control Design > Linear Analysis**.

For more information about using the Linear Analysis Tool for operating-point and linearization workflows, see:

- “Steady-State Operating Points”
- “Linearization”

## **Interactive Frequency Response Estimation and Validation of Linearization Results**

The new interactive Linear Analysis Tool provides a graphical interface for frequency response estimation.

To access the Linear Analysis Tool:

- 1** Open a Simulink model.
- 2** In the Simulink model, select **Tools > Control Design > Linear Analysis** to launch the Linear Analysis tool.
- 3** Click the Frequency Response Estimation tab to begin an estimation task.

For more information about using the Linear Analysis Tool for frequency response estimation, see “Frequency Response Estimation”.

## **Optimization of Model Parameters to Meet Design Requirements Specified by Model Verification Blocks**

If you have Simulink® Design Optimization™ software, you can optimize the Simulink model to meet frequency-domain requirements specified in Model Verification blocks. For example, you can optimize the linear system to meet Bode magnitude or gain and phase margin requirements. For more information, see Design Optimization To Meet Frequency-Domain Requirements (GUI).

You can also include time-domain requirements such as step response characteristics for optimization. For more information, see Design Optimization to Meet Time- and Frequency-Domain Requirements.

## Automatic Tuning of PID Controller Blocks in a Referenced Model

You can now use the PID Tuner to tune a PID Controller block in a model that is referenced in one or more open models. When you launch the PID Tuner from a block within a model reference, the software prompts you to select which of the open models is the top-level model for analysis and tuning. Previously, the PID Tuner could only use the model containing the PID Controller block as the top-level model.

For more information, see “Tuning a PID Controller Within a Model Reference”.

## Control System Tuning for Simulink Models with `looptune` or `hinfstruct` Using `sITunable` Interface

If you have Robust Control Toolbox™ software, you can use tuning commands, such as `sITunable.looptune` and `hinfstruct`, to tune control systems modeled in Simulink. The `sITunable` object provides an interface between your Simulink model and these commands.

Use `sITunable` to specify information about your control structure and parametrization. `sITunable` also automates tasks such as linearizing the Simulink model, parametrizing the tunable blocks of your system, and applying tuned parameter values to the model. After you create and configure an `sITunable` object for your control architecture, you can tune the control system using `sITunable.looptune` or `hinfstruct`.

For more information, see “Tuning Fixed Control Architectures” in the Robust Control Toolbox documentation.

## Change in Default Number of Samples in `frest.Chirp`

The default number of samples (`NumSamples`) in a `frest.Chirp` input signal for frequency response estimation is now given by the formula:

$$\frac{4\pi}{Ts * \min(FreqRange)}$$

Ts is the sampling time of the chirp signal. FreqRange is the vector of signal frequencies of the chirp signal.

This formula returns twice the value returned in previous releases.

For example, if you create a default chirp input signal with the command

```
input = frest.Chirp
```

the value of `input.NumSamples` is 10000, instead of the previous value of 5000.

For more information, see the `frest.Chirp` reference page.

### **Compatibility Considerations**

If you have scripts that rely on the default `NumSamples` formula, modify your scripts to account for the new value.

## Version 3.3 (R2011a) Simulink Control Design Software

This table summarizes what's new in Version 3.3 (R2011a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “Ability to Select Individual Bus Elements as Linearization Input and Output Points” on page 8
- “Enhanced LINLFT Command Optionally Returns Linearization of Excluded Blocks” on page 9
- “Access to Current Linearization of a Simulink Block for Specifying Custom Linearization” on page 9
- “Enhanced PID Controller Blocks Display Compensator Formula in Block Dialog Box” on page 9

### Ability to Select Individual Bus Elements as Linearization Input and Output Points

Instead of selecting an entire bus, you can now select individual elements of the bus signal as linearization inputs or outputs (I/Os). By selecting individual bus elements, you can:

- Obtain the linearization only for the channels of interest.
- Specify multiple I/Os, possibly as different types, in the same bus.

Select individual bus elements as I/Os when you want to:

- Linearize a Simulink model using the GUI or programmatically.
- Visualize time- and frequency-domain response during simulation using the Linear Analysis Plots blocks.

- Verify frequency-domain characteristics using the Model Verification blocks.

For more information, see “Select Individual Bus Elements as Linearization Points” and the `linio` reference page.

## **Enhanced LINLFT Command Optionally Returns Linearization of Excluded Blocks**

A new optional output argument to `linlft` returns the linearization of blocks you specify for exclusion from the linearized model.

For more information, see the `linlft` reference page.

## **Access to Current Linearization of a Simulink Block for Specifying Custom Linearization**

When you use a specification function to specify a custom linearization of a Simulink block, you can now access the current linearization in your function. The current linearization is stored in the new `BlockLinearization` field of the `BlockData` structure. The software automatically creates the `BlockData` structure and passes it to your block linearization specification function.

For more information and an example showing how to use the `BlockLinearization` field of `BlockData`, see “Augmenting the Linearization of a Block”.

## **Enhanced PID Controller Blocks Display Compensator Formula in Block Dialog Box**

The PID Controller and PID Controller (2DOF) blocks now display the current compensator formula in the block dialog box. This display reflects the current settings for controller type, controller form, and time domain.

## Version 3.2 (R2010b) Simulink Control Design Software

This table summarizes what's new in Version 3.2 (R2010b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “New Blocks for Plotting and Verifying Linear System Characteristics of Simulink Models” on page 10
- “New Tools for Identifying Time-Varying Source Blocks for Frequency Response Estimation” on page 12
- “Tuning Tools Update Workspace Variables That Define Parameters of Tuned Blocks” on page 12
- “Enhanced PID Tuner Including New Response Plots” on page 13
- “New Demo Illustrating Control Design for a Plant That Has Parameter Variations” on page 13

### New Blocks for Plotting and Verifying Linear System Characteristics of Simulink Models

This version of Simulink® Control Design™ software provides new blocks for:

- “Plotting Linear System Characteristics of Simulink Models” on page 10.
- “Verifying Linear System Characteristics of Simulink Models” on page 11.

### Plotting Linear System Characteristics of Simulink Models

Simulink Control Design software provides six new blocks in the **Linear Analysis Plots** library. Use these blocks to plot the time- and frequency-domain characteristics of a linear system computed from a nonlinear Simulink model. The linear system is computed and plotted during simulation at:

- Simulation snapshot times. The default snapshot time is 0.
- Trigger-based simulation events.

You can also use these blocks to specify bounds on the linear system characteristics, and view the bounds on the plot.

Because these blocks are same as the “Model Verification” blocks except for the default settings of the bound parameters, you can optionally use the blocks to verify that the bounds are satisfied during simulation.

For more information, see:

- “Visualize Bode Response of Simulink Model During Simulation”
- “Linear Analysis Plots” block reference pages
- Plotting Linear System Characteristics of a Chemical Reactor demo

## **Verifying Linear System Characteristics of Simulink Models**

Simulink Control Design software provides six new blocks in the **Model Verification** library. Use these blocks to verify that the time- and frequency-domain characteristics of a linear system, computed from a nonlinear Simulink model, satisfy specified bounds during simulation. For example, you can verify whether the linearized behavior of your model satisfies upper and lower magnitude bounds on a Bode plot or gain and phase margins.

You can perform the verification during simulation at:

- Simulation snapshot times. The default snapshot time is 0.
- Trigger-based simulation events

Because these blocks are same as the “Linear Analysis Plots” blocks except for the default settings of the bound parameters, you can use the blocks to view the bounds on time- and frequency-domain plots.

You can also use these blocks with the Simulink Model Verification library blocks to design complex logic for model verification.

If you have Simulink® Verification and Validation™ software, you can construct simulation tests for your model using the Verification Manager.

For more information, see:

- “Model Verification” in the Simulink Control Design documentation.
- “Model Verification” block reference pages
- Verifying Frequency-Domain Characteristics of an Aircraft demo

## **New Tools for Identifying Time-Varying Source Blocks for Frequency Response Estimation**

When you are performing frequency response estimation, time-varying source blocks in the signal path can skew the results. Previously, to obtain accurate estimation, you manually identified source blocks and inserted open-loop points in your model to disable them.

The new `frest.findSources` command automatically detects time-varying source blocks in the signal path of the output linearization points in your Simulink model. Additionally, a new option to the `frestimate` command, `BlocksToHoldConstant`, allows you to disable these blocks during frequency response estimation.

For more information, see the `frest.findSources` and `frestimateOptions` reference pages.

There is also a new Model Advisor check for detecting time-varying source blocks in your model. For more information about using the Model Advisor, see Consulting the Model Advisor in the *Simulink User's Guide*.

## **Tuning Tools Update Workspace Variables That Define Parameters of Tuned Blocks**

When you use Simulink Control Design tools to tune a block with parameters defined as workspace variables, the software now updates the values of the workspace variables. This update occurs when you write the compensator design to your Simulink model. The block remains parametrized by the variables. The software can update variable parameters that represent



numerical values or `Simulink.Parameter` objects, whether they reside in the base workspace or the model workspace.

Previously, tuning a block parametrized by workspace variables overwrote the block parameters with numerical values. Thus, such tuning did not change the value of the workspace variables.

## Enhanced PID Tuner Including New Response Plots

This release introduces several enhancements to the PID Tuner, including:

- New response plot options let you analyze system responses in either time domain (step plot) or frequency domain (Bode plot). Available responses are reference tracking, input and output disturbance rejection, controller effort, open loop, and plant.
- New options when the plant linearizes to zero at the operating point defined in the Simulink model.

When the plant linearizes to zero on launch of the PID Tuner, the PID Tuner provides an option to linearize at a different operating point. The PID Tuner also lets you import an LTI model of your plant, such as a model obtained by frequency response estimation. Previously, the PID Tuner did not launch when the plant linearized to zero.

For an example illustrating these options, see the new Simulink Control Design demo, *Designing PID Controller in Simulink with Estimated Frequency Response*.

For more information about using the PID Tuner, see “Automatic PID Tuning” in the *Simulink Control Design User’s Guide*.

## New Demo Illustrating Control Design for a Plant That Has Parameter Variations

The Reference Tracking of a DC Motor with Parameter Variations demo illustrates compensator design for a plant that has parameter variations. The demo shows the following techniques:

- Performing batch linearization to obtain multiple linear models from a single Simulink model

- Using the new SISO Design Tool ability to analyze a control design for multiple models simultaneously

## Version 3.1 (R2010a) Simulink Control Design Software

This table summarizes what's new in Version 3.1 (R2010a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	Yes — details labeled as <b>Compatibility Considerations</b> below. See also Summary.	Bug Reports Includes fixes

New features and changes introduced in this version are

- “New Parallel Computing Support For Frequency Response Estimation” on page 15
- “New Commands Support Recomputing Frequency Response Estimation Results at Specific Frequencies” on page 16
- “New frest.simcompare Output Argument Returns Simulation Output Data From Linear System” on page 16
- “New Options in Simulink Results Viewer GUI for Viewing Frequency Response Estimation Results” on page 16
- “New Option for Labeling Bus Signal I/O Names in the SISO Design Task” on page 16
- “Existing Simulink Blocks Now Have Analytic Jacobians” on page 17
- “Change in Format of Time Series in frestimate Output” on page 17

### New Parallel Computing Support For Frequency Response Estimation

If you have the Parallel Computing Toolbox™ software installed, you can use parallel computing to speed up frequency response estimation.

For more information, see “Speeding Up Estimation Using Parallel Computing” in the Simulink Control Design documentation.

## **New Commands Support Recomputing Frequency Response Estimation Results at Specific Frequencies**

If you use the `sinestream` input signal for estimation, you can now recompute your frequency response estimation for only those specific frequencies that do not reach steady state. Previously, you had to redo the entire estimation if a few frequencies needed recomputing.

For more information, see “Time Response Not at Steady State”.

## **New `frest.simcompare` Output Argument Returns Simulation Output Data From Linear System**

This release provides enhanced `frest.simCompare` functionality, which allows the return of simulated output data. If your linear model uses state-space representation, you can also return the state vector.

For more information, see the `frest.simCompare` reference page.

## **New Options in Simulink Results Viewer GUI for Viewing Frequency Response Estimation Results**

The Simulation Results Viewer GUI, which you display using `frest.simView`, now provides additional options for analyzing your frequency response estimation:

- You can now enable phase unwrapping in the frequency response plot. To unwrap phase, right-click the Bode plot, and select **Unwrap Phase**.
- You can also import frequency response estimation results into an open Simulation Results Viewer, which replaces the existing results. Previously, you had to open a new Viewer each time you viewed estimation results. To import results, select **File > Import** in the Simulation Results Viewer.

## **New Option for Labeling Bus Signal I/O Names in the SISO Design Task**

You can now configure the SISO Design Task to automatically label model I/Os using bus signal names. Model I/O labels describe available loops in the Graphical Tuning tab and label response plots in the Analysis Plots tab of the

SISO Design Task GUI. Previously, labels for bus signals were based on the block and port path, or the Simulink signal name.

To use this option, select **Tools > Options** in the SISO Design Task GUI, and enable **Use bus signal names to label model I/O**.

## Existing Simulink Blocks Now Have Analytic Jacobians

The following Simulink blocks now have Analytic Jacobians, which are optimized for memory consumption in large-scale models:

- Switch
- Multiport Switch
- Math Function (Transpose and Hermitian Transpose)

For more information on each block, see the block reference pages.

## Change in Format of Time Series in `frestimate` Output

When you use the `simout` output of the `frestimate` command, you obtain a cell array of `Simulink.Timeseries` objects. Previously, the time dimension was always the first dimension of each `Simulink.Timeseries` object.

As of R2010a, the time dimension of each `Simulink.Timeseries` in `simout` is:

- The first dimension, if the time series is 2-D
- The last dimension, if the time series is 3-D or higher

## Compatibility Considerations

If you have scripts that run `frestimate` on a model having an output point on a vector or matrix signal and perform operations on the resulting 3-D or higher-dimensional `Simulink.Timeseries` object in `simout`, modify your scripts to reflect the new placement of the time dimension in the time series.

For additional information, see:

- [MATLAB Data Analysis Release Notes](#)
- [frestimate reference page](#)
- [Simulink.Timeseries reference page](#)

## Version 3.0 (R2009b) Simulink Control Design Software

This table summarizes what's new in Version 3.0 (R2009b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “New GUI for Tuning New PID Controller Blocks” on page 19
- “New Automated PID Tuning Algorithm” on page 20
- “Ability to Compute Frequency Response of Simulink Models” on page 20
- “Ability to Specify the Linearization of Simulink Blocks” on page 20
- “Ability to Design Compensators for Plant Models With Time Delays” on page 20
- “New Commands to More Efficiently Compute Multiple Linearizations” on page 21
- “Ability to Set Default Plot Type for Linear Analysis Results from GUI” on page 21

### New GUI for Tuning New PID Controller Blocks

You can automatically tune the new Simulink PID Controller blocks in the PID Tuner GUI R2009b introduces. You launch the PID Tuner directly from the PID block dialogs boxes. These blocks are available in the Continuous and Discrete Simulink libraries.

For more information on tuning PID Controller using the PID Tuner, see “Automatic PID Tuning”.

## **New Automated PID Tuning Algorithm**

You can now tune compensators using a new automated PID tuning algorithm called Robust Response Time, which is available in the SISO Design Task. You specify the open-loop bandwidth and phase margin, and the software computes PID parameters to robustly stabilize your system.

For information on tuning compensators using automated tuning methods, see “Completing the Design”.

## **Ability to Compute Frequency Response of Simulink Models**

You can now compute the frequency response of a Simulink model using simulation. You use new commands to easily create input signals and simultaneously simulate and estimate the frequency response without changing your model. You can also use this capability to validate the accuracy of exact linearizations.

## **Ability to Specify the Linearization of Simulink Blocks**

You can now specify the linearization of Simulink blocks, subsystems, and model references without having to replace any block in your model. You can specify the linearizations as LTI models or Robust Control Toolbox uncertain models.

## **Ability to Design Compensators for Plant Models With Time Delays**

You can now design compensators for plants with exact time delay representations. Previously, you had to specify a Padé approximation before designing compensators.

For more information on designing compensators for plants with time delays, see “Designing Compensators for Plants with Time Delays”.



## **New Commands to More Efficiently Compute Multiple Linearizations**

You can now more efficiently compute multiple linearizations for large models when only a few blocks or model references change per linearization. You linearize the fixed portion of the model once using `linlft` and linearize the varying portion multiple times. Then, you combine the results using `linlftfold` to obtain linearizations equal to those you would receive if you linearized the entire model multiple times.

For more information, see the `linlft` and `linlftfold` reference pages.

## **Ability to Set Default Plot Type for Linear Analysis Results from GUI**

You can now set the default plot type for viewing linear analysis results computed in the Control and Estimation Tools Manager. This setting applies to all future Control and Estimation Tools Manager sessions.

To set this option in the Simulink Control Design Preferences, select **File > Preferences** in the Control and Estimation Tools Manager.

## Version 2.5 (R2009a) Simulink Control Design Software

This table summarizes what's new in Version 2.5 (R2009a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “Ability to Generate MATLAB Code from the GUI for Creating Operating Points and Linearizing Models” on page 22
- “Ability to Tune Additional Blocks” on page 22
- “New Option for Labeling Bus Signal I/O Names in Linearization Results” on page 23

### Ability to Generate MATLAB Code from the GUI for Creating Operating Points and Linearizing Models

You can now generate MATLAB code reflecting the configuration in the GUI when creating operating points and linearizing models.

### Ability to Tune Additional Blocks

You can now tune the following blocks:

- Blocks that you discretized using the Simulink Model Discretizer
- Blocks in the Simulink Extras library that specify initial states or outputs

For information about how to tune these blocks, see “Selecting Blocks to Tune” in the Simulink Control Design documentation.

## **New Option for Labeling Bus Signal I/O Names in Linearization Results**

You can now compute linear models that show the bus signal names for linearization I/O points located on buses. You can select this option using the following:

- Linearization Options GUI
- `linoptions` command

## Version 2.4 (R2008b) Simulink Control Design Software

This table summarizes what's new in Version 2.4 (R2008b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “New Upsampling Option for Rate Conversion When Linearizing Simulink Models” on page 24
- “Ability to Specify State Order of Linearized Models from the Command Line” on page 25
- “Ability to Filter the Linearization Inspector to Show Blocks in the Linearization Path” on page 25
- “Ability to Disable the Calculation of Linearization Diagnostics and Inspector Data in the GUI” on page 25

### New Upsampling Option for Rate Conversion When Linearizing Simulink Models

Version 2.4 includes an upsampling rate conversion method for linearization. This method upsamples discrete-time LTI systems at any sampling rate that is an integer-value-times faster than the sampling rate of the original system. You can select the upsampling rate conversion method in the following ways:

- Using the linearization options GUI
- From the command line using `linoptions`

For more information on the upsampling rate conversion method, see the `linoptions` reference page.

## **Ability to Specify State Order of Linearized Models from the Command Line**

You can now specify the order of the states in your linearized model directly from the command line using the `linearize` command. Previously, you could only specify state order using the GUI.

For more information on specifying state order from the command line, see the `linearize` reference page.

## **Ability to Filter the Linearization Inspector to Show Blocks in the Linearization Path**

You can now filter the list of blocks in the Linearization Inspector to show only the blocks in the linearization path. This filtering makes it easier for you to find blocks in the linearization path that you want to inspect.

## **Ability to Disable the Calculation of Linearization Diagnostics and Inspector Data in the GUI**

You can now disable the calculation of the linearization inspector and diagnostics information when you linearize using the GUI. This capability allow you to choose when you want to calculate diagnostic information.

## Version 2.3 (R2008a) Simulink Control Design Software

This table summarizes what's new in Version 2.3 (R2008a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “New Diagnostic Messages Help You Troubleshoot Linearization Results” on page 26
- “Ability to Find Operating Points for Simscape Models” on page 26
- “Updated Error and Warning Message System” on page 27

### New Diagnostic Messages Help You Troubleshoot Linearization Results

You can now view diagnostic messages for your linearized model that help you diagnose and troubleshoot linearization results. These messages identify blocks in your model that encounter the following block issues during linearization:

- Blocks that have been marked as not supported for linearization
- Blocks with linearization configuration warning messages
- Blocks without pre-programmed exact Jacobian that linearize using numerical approximation

### Ability to Find Operating Points for Simscape Models

You can now find operating points for models that include Simscape™ and SimHydraulics® blocks using the Simulink Control Design `findop` command.

For more information on finding operating point for Simscape Models, see the Simscape documentation.

## **Updated Error and Warning Message System**

The Simulink Control Design error and warning IDs and messages have been updated. If you use error and warning IDs in your code, you must update your code to reflect the new IDs.

## Version 2.2 (R2007b) Simulink Control Design Software

This table summarizes what's new in Version 2.2 (R2007b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “Ability to Linearize Models with Model-Reference Blocks by Any Linearization Method” on page 28
- “Ability to Design Compensators for Models Containing Model-Reference Blocks” on page 28
- “Ability to Generate Linearized Models with Exact Time-Delay Representations” on page 29
- “Ability to Linearize Periodic Function-Call Subsystems” on page 29

### Ability to Linearize Models with Model-Reference Blocks by Any Linearization Method

You can now perform any type of linearization for models containing Model blocks that reference other Simulink models.

Previously, you could only perform numerical perturbation linearization for models containing Model blocks. Now, you can also perform block-by-block linearization for such models when you set the simulation mode of the Model blocks to Normal.

### Ability to Design Compensators for Models Containing Model-Reference Blocks

You can now design compensators for tunable blocks inside external models referenced by your model. Your model references such external models by



using Model blocks. You can also update the tunable blocks in the external model with the new compensator designs.

To view and select tunable blocks for compensator design from the referenced model, set the simulation mode of the Model block to Normal.

For more information about the types of blocks that you can tune, see “Selecting Blocks to Tune” in the Simulink Control Design documentation.

## **Ability to Generate Linearized Models with Exact Time-Delay Representations**

You can now use the Simulink Control Design software to compute linearized models with exact time-delay representations. Time delays in the original nonlinear model can result from any of the following blocks:

- Transport Delay
- Variable Time Delay
- Variable Transport Delay
- Unit Delay
- Integer Delay

Previously, you could only achieve approximate linearizations of models with continuous time delays using a Padé approximation.

## **Ability to Linearize Periodic Function-Call Subsystems**

You can now linearize periodic function-call subsystems with a constant sample time as discrete subsystems. You must set the sample time of the function-call trigger block to equal the sample time of the function-call generator block.

For more information on function-call subsystems, see “Function-Call Subsystems” in the Simulink documentation.

## Version 2.1 (R2007a) Simulink Control Design Software

This table summarizes what's new in Version 2.1 (R2007a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “Ability to Linearize Using an Operating Point Specified Directly in a Model” on page 30
- “Ability to Capture Linearization Snapshots in GUI” on page 31
- “Ability to Perform Control Design at Snapshots in GUI” on page 31
- “Ability to Retrieve Stored Compensator Designs” on page 31

### Ability to Linearize Using an Operating Point Specified Directly in a Model

You can use the Simulink Control Design software to linearize around any operating point that you specify directly in a Simulink model. This capability allows you to make changes to a model and then perform a linearization around the newly specified operating point with the click of a single button. Previously, this same task required two steps: creating a new operating point and then linearizing around this operating point.

There are two ways to linearize around an operating point specified directly in the model:

- From the Control and Estimation Tools Manager
- Using `linearize`

## Ability to Capture Linearization Snapshots in GUI

You can use the Control and Estimation Tools Manager to linearize at snapshots of your model operating point at the following simulation points:

- Specified simulation times, such as when the simulation reaches a steady state solution
- Events during a specified simulation interval

As in prior releases, you can use `linearize` to perform linearization at snapshots in your model operating point, as described in `linearize` in the reference pages.

## Ability to Perform Control Design at Snapshots in GUI

You can use the Control and Estimation Tools Manager to perform control design at snapshots of your model operating point at the following simulation points:

- Specified simulation times, such as when the simulation reaches a steady state solution
- Events during a specified simulation interval

## Ability to Retrieve Stored Compensator Designs

When you design a compensator using the SISO design tool, you can store the current design and then continue making changes to this design. A new button called **Retrieve Design** lets you retrieve the stored design at any time by undoing the design changes you made since you last stored the design. For more information on retrieving stored compensator designs, see “Storing and Retrieving Designs” in the Simulink Control Design documentation.

## Version 2.0.1 (R2006b) Simulink Control Design Software

This table summarizes what's new in Version 2.0.1 (R2006b):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
No	No	Bug Reports Includes fixes

## Version 2.0 (R2006a) Simulink Control Design Software

This table summarizes what's new in Version 2.0 (R2006a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

### Compensator Design in Simulink Is Now Supported

This release provides new tools to streamline the workflow for designing Single-Input Single-Output (SISO) control loops directly in Simulink. In previous releases, designing a compensator was a multistep process that involved several tools.

The new tools support any linearizable control architecture, such as single loops, multiple loops, and cascaded loops. With the new tools, you simply select the blocks you want to tune. Then, the Simulink Control Design software automatically analyzes your model to identify the relevant control loops and opens a preconfigured session of the SISO Design Tool (in the Control System Toolbox™ software). For more information, see “Designing Compensators” in the Simulink Control Design documentation.

Supported tunable SISO Simulink blocks include Gain, Transfer Function, Zero-Pole-Gain, State-Space, and PID blocks.

In the SISO Design Tool you can

- Graphically tune multiple SISO loops in a single GUI.
- Gain visual insight into loop interactions and coupling effects.
- Focus the analysis on a specific loop in a multiloop design by removing the effect of other feedback loops.

- Generate first-cut compensator designs using systematic design algorithms, such as Ziegler-Nichols PID tuning, IMC design, or LQG design.
- Optimize linear responses to meet time and frequency-based design constraints (requires the Simulink® Response Optimization™ software).
- Directly tune Simulink block parameters, such as PID gains, zero-pole-gain representations, and masked blocks.
- Tune continuous or discrete control loops.
- Examine the closed-loop response of any portion of a model.

After a design is completed, you can write the tuned parameter values back to your model for verification with the full nonlinear system.

## Version 1.3 (R14SP3) Simulink Control Design Software

This table summarizes what's new in Version 1.3 (R14SP3):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “Control and Estimation Tools Manager Enhanced” on page 35
- “Support for Operating Point Search and Linearization of Models with Model Reference Blocks” on page 35

### Control and Estimation Tools Manager Enhanced

You can copy and edit operating points within the Control and Estimation Tools Manager. .

You can initialize a model for simulation using operating points from within the Control and Estimation Tools Manager.

### Support for Operating Point Search and Linearization of Models with Model Reference Blocks

You can linearize and compute operating points for models that reference other models using the Model block. Linearization of model reference models must use the numerical perturbation linearization algorithm. This algorithm accepts state and input perturbation values in the form of an operating point object.

## Version 1.2 (R14SP2) Simulink Control Design Software

This table summarizes what's new in Version 1.2 (R14SP2):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

New features and changes introduced in this version are

- “Context-Sensitive Help Added” on page 36
- “View Linearizations in the Control and Estimation Tools Manager” on page 36
- “Discretization Methods Added” on page 37
- “List of Blocks with Preprogrammed Analytic Jacobians Added” on page 37
- “Block Name Readability Improved” on page 37

### Context-Sensitive Help Added

Access context-sensitive help for the Linearization, Operating Point Search, and Linearization State Ordering Options window of the Control and Estimation Tools Manager. To access help on a field within the options window, right-click the option's label and select **What's this?** from the context menu. Help for the option will appear in this window.

### View Linearizations in the Control and Estimation Tools Manager

You can view state space, transfer function, and zero-pole gain representations of linearized models within the Control and Estimation Tools Manager without exporting to the workspace. These linearized models appear in the linearization summary pane of the Control and Estimation Tools Manager.



## **Discretization Methods Added**

You can select from three different discretization methods for linearization of multirate and hybrid models.

## **List of Blocks with Preprogrammed Analytic Jacobians Added**

You can view a complete list of blocks indicating which blocks have preprogrammed analytic Jacobians for use with the block-by-block analytic linearization algorithm.

## **Block Name Readability Improved**

You can use either truncated block names or full block names in the state space matrices of a linearized model, and within the LTI Viewer, to improve readability.

## Version 1.1 (R14SP1) Simulink Control Design Software

This table summarizes what's new in Version 1.1 (R14SP1):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
No	No	Fixed Bugs

## Version 1.0 (R14) Simulink Control Design Software

This table summarizes what's new in Version 1.0 (R14):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	No bug fixes

New features and changes introduced in this version are

### About the Simulink Control Design Software

The Simulink Control Design software provides tools for the linearization of control systems and models. A graphical user interface (GUI) simplifies the tasks of specifying operating conditions, linearizing the model, and analyzing the results. Linearized models often facilitate system analysis and compensator design. This is useful in many industries and applications, including

- Aerospace: flight control, guidance, navigation
- Automotive: cruise control, emissions control, transmission
- Equipment manufacturing: motors, disk drives, servos

The Simulink Control Design software improves upon previous Simulink linearization tools by providing more options for computing operating conditions, allowing open loop analysis without the removal of feedback loops, and including a linearization inspector and debugger. Linearization projects are easier to manage with the new Control and Estimation Tools Manager. Furthermore, the Control System Toolbox software features, such as the LTI Viewer, are integrated with the Control Designer software to improve control system analysis and design.

## Key Features Introduced

Key features of the Simulink Control Design software include the ability to

- Specify linearization input, output, and open loop analysis points using right-click menus
- Perform open loop analysis without deleting feedback loops
- Extract operating conditions from a simulation
- Compute operating conditions by optimization (trimming)
- Create output constraints for trim analysis
- Linearize individual blocks using context menus
- Inspect and debug results of the linearization
- Identify blocks in a model that contribute to a linearization
- Export results to the MATLAB workspace
- Manage linearization projects, compute operating conditions, and perform linearization with a graphical user interface (GUI)
- Use improved functions at the command line for linearization and trim analysis

## Compatibility Summary for Simulink Control Design 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 V3.4 (R2011b)	See the <b>Compatibility Considerations</b> subheading for this change: <ul style="list-style-type: none"> <li>• “Change in Default Number of Samples in frest.Chirp” on page 6</li> </ul>
V3.3 (R2011a)	None
V3.2 (R2010b)	None
V3.1 (R2010a)	See the <b>Compatibility Considerations</b> subheading for this change: <ul style="list-style-type: none"> <li>• “Change in Format of Time Series in frestimate Output” on page 17</li> </ul>
V3.0 (R2009b)	None
V2.5 (R2009a)	None
V2.4 (R2008b)	None
V2.3 (R2008a)	None
V2.2 (R2007b)	None
V2.1 (R2007a)	None
V2.0.1 (R2006b)	None
V2.0 (R2006a)	None

<b>Version (Release)</b>	<b>New Features and Changes with Version Compatibility Impact</b>
V1.3 (R14SP3)	None
V1.2 (R14SP2)	None
V1.1 (R14SP1)	None
V1.0 (R14)	None