Simulink® Design Optimization™ Release Notes

How to Contact MathWorks

www.mathworks.com	Web
comp.soft-sys.matlab	Newsgroup
www.mathworks.com/contact_TS.html	Technical Support

suggest@mathworks.com	Product enhancement suggestions
bugs@mathworks.com	Bug reports
doc@mathworks.com	Documentation error reports
service@mathworks.com	Order status, license renewals, passcodes
info@mathworks.com	Sales, pricing, and general information

508-647-7000 (Phone)

508-647-7001 (Fax)

The MathWorks, Inc.
3 Apple Hill Drive
Natick, MA 01760-2098

For contact information about worldwide offices, see the MathWorks Web site.

Simulink® Design Optimization™ Release Notes

Trademarks

MATLAB and Simulink are registered trademarks of The MathWorks, Inc. See www.mathworks.com/trademarks for a list of additional trademarks. Other product or brand names may be trademarks or registered trademarks of their respective holders.

Patents

MathWorks products are protected by one or more U.S. patents. Please see www.mathworks.com/patents for more information.

Contents

Summary by Version

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

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Latest Version V2.0 (R2011b)	Yes Details	Yes Summary	Bug Reports Includes fixes
V1.2.1 (R2011a)	No	No	Bug Reports Includes fixes
V1.2 (R2010b)	Yes Details	Yes Summary	Bug Reports Includes fixes
V1.1.1 (R2010a)	No	No	Bug Reports Includes fixes
V1.1 (R2009b)	Yes Details	Yes Summary	Bug Reports Includes fixes
V1.0 (R2009a)	Yes Details	Yes Summary	Bug Reports Includes 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` for the latest release and for previous releases:

- Latest product documentation
- Archived documentation

Version 2.0 (R2011b) Simulink Design Optimization Software

This table summarizes what's new in V 2.0 (R2011b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	Yes Summary	Bug Reports Includes fixes

New features and changes introduced in this version are:

- "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3

- "Formulation and Solving of Response Optimization Problems Without Adding Blocks to the Model" on page 4

- "Optimization of Model Parameters to Meet Frequency-Domain Requirements " on page 5

- "Optimization of Model Parameters to Meet Design Requirements Specified by Model Verification Blocks " on page 5

- "Custom Constraints and Cost Functions for Optimizing Model Response" on page 6

- "Assertion Detection by Blocks During Time-Domain Model Verification" on page 6

- "Functionality Being Removed or Changed" on page 7

Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows

A redesigned Design Optimization tool and new commands streamline and improve response optimization workflows. You can now:

- Create multiple sets of design and uncertain variables and time- and frequency-domain design requirements. This enables you to optimize the design using different combinations of variable sets and requirements.

- Specify design requirements without blocks, using Check blocks from the **Signal Constraints** library, or a combination of both.

- Monitor optimization progress using design variable values plot.

- Access the MATLAB and Simulink workspaces using the **Data Browser** area of the Design Optimization tool.

For more information, see:

- "Optimize Controller Parameters to Meet Step Response Requirements (GUI)"

- "Optimize Controller Parameters to Meet Step Response Requirements (Code)"

- "Optimize Controller Parameters to Track Reference Signal (GUI)"

- "Design Optimization to Meet Frequency-Domain Requirements (GUI)"

- "Design Optimization to Meet Time- and Frequency-Domain Requirements"

- "Optimize Parameters for Robustness (GUI)"

Compatibility Considerations

- Commands from previous releases now warn and will be removed in a future version. Use the new "Response Optimization" commands instead.

- The Signal Constraint block has been removed from the block library. Use `sdoupdate('modelname')` to automatically update your model to use the equivalent Check blocks from the **Signal Constraints** library.

- Simulation options, such as start and stop times and solver type, can no longer be set using Simulink® Design Optimization™ software. Use the "Configuration Parameters Dialog Box" in Simulink instead.

Formulation and Solving of Response Optimization Problems Without Adding Blocks to the Model

You can now specify time-domain requirements without adding Check blocks to the Simulink model. You can do so from the Design Optimization tool or programmatically using requirement

objects such as `sdo.requirements.StepResponseEnvelope`, `sdo.requirements.SignalBound` and `sdo.requirements.SignalTracking`.

Similarly, you can programmatically specify frequency-domain requirements without adding Check blocks from the Simulink® Control Design™ library to the model. Frequency-domain requirement objects include `sdo.requirements.BodeMagnitude` and `sdo.requirements.GainPhaseMargin`.

For more information, see how to specify requirements in the following topics:

- "Optimize Controller Parameters to Track Reference Signal (GUI)"

- "Design Optimization to Meet Custom Signal Requirements (GUI)"

- "Design Optimization to Meet a Custom Objective at the Command Line"

Optimization of Model Parameters to Meet Frequency-Domain Requirements

If your Simulink model has Simulink Control Design Model Verification blocks, you can optimize the model response to meet the frequency-domain requirements specified in them. For example, you can optimize the model response to meet Bode magnitude requirements. You can also include time-domain requirements such as step response characteristics for optimization.

For more information, see:

- "Design Optimization to Meet Frequency-Domain Requirements (GUI)"

- "Design Optimization to Meet Time- and Frequency-Domain Requirements"

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

You can optimize model response to meet requirements specified in Check Static Gap, Check Static Lower Bound and Check Static Upper Bound blocks from the Simulink Model Verification library. The Design Optimization tool automatically includes the design requirements when you open the tool.

Custom Constraints and Cost Functions for Optimizing Model Response

This release provides functionality to specify custom requirements such as minimizing a cost function, an inequality constraint or an equality constraint. You write a function describing the custom requirement that you include for optimization either from the graphical user interface or programmatically.

For more information, see:

- "Design Optimization to Meet a Custom Objective Using the GUI"
- "Design Optimization to Meet a Custom Objective at the Command Line"
- "Design Optimization to Meet Custom Signal Requirements (GUI)"

Assertion Detection by Blocks During Time-Domain Model Verification

The Check Custom Bounds, Check Step Response Characteristics and Check Against Reference blocks in the **Model Verification** library detect assertions during simulation. Use these blocks to verify the time-domain characteristics of a nonlinear Simulink model satisfy specified bounds during simulation. For example, you can verify whether a model signal satisfies upper and lower bounds on its values. See "Time-Domain Model Verification".

You can also use these blocks with the Model Verification blocks from Simulink and Simulink Control Design libraries to include frequency-domain bounds and build 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.

Functionality Being Removed or Changed

Functionality	What Happens When you Use This Functionality?	Use This Instead	Compatibility Considerations
getsro	Warns	Not applicable	See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
newsro	Warns	Not applicable	See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
optimize	Warns	sdo.optimize	Replace all instances of optimize with sdo.optimize. See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
findconstr	Warns	getbounds	Replace all instances of findconstr with getbounds. See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
findpar	Warns	sdo.getParameterFromModel	Replace all instances of findpar with sdo.getParameterFromModel. See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
initpar	Warns	Not applicable	See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.

Functionality	What Happens When you Use This Functionality?	Use This Instead	Compatibility Considerations
finddepend	Warns	sdo.getModelDependencies	Replace all instances of finddepend with sdo.getModelDependencies. See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
gridunc	Warns	Not applicable	No replacement, see Design Optimization Using the Command Line.
randunc	Warns	Not applicable	See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
setunc	Warns	Not applicable	See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
optimget	Warns	sdo.OptimizeOptions	Replace all instances of optimget with sdo.OptimizeOptions. See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
optimset	Warns	sdo.OptimizeOptions	Replace all instances of optimset with sdo.OptimizeOptions. See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.

Functionality	What Happens When you Use This Functionality?	Use This Instead	Compatibility Considerations
`GradientType` optimization setting	Errors	Not applicable	See "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3.
`simget`	Warns	Not applicable	Use the "Configuration Parameters Dialog Box"
`simset`	Warns	Not applicable	Use the "Configuration Parameters Dialog Box"
`ncdupdate`	Warns	`sdoupdate`	Replace all instances of `ncdupdate` with `sdoupdate`.

Version 1.2.1 (R2011a) Simulink Design Optimization Software

This table summarizes what's new in V 1.2.1 (R2011a):

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

Version 1.2 (R2010b) Simulink Design Optimization Software

This table summarizes what's new in V 1.2 (R2010b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	Yes Summary	Bug Reports Includes fixes

New features and changes introduced in this version are:

- "Support for Initial State Estimation of Model References, SimHydraulics, SimMechanics, SimPowerSystems, and Simscape Blocks" on page 11
- "Functions and Function Elements Being Removed" on page 12

Support for Initial State Estimation of Model References, SimHydraulics, SimMechanics, SimPowerSystems, and Simscape Blocks

You can now estimate the initial states of:

- Model references
- SimHydraulics® blocks
- SimMechanics™ blocks
- SimPowerSystems™ blocks
- Simscape™ blocks

You can perform initial state estimation either using the GUI or from the command-line interface. For more information, see:

- "Estimate Initial States"
- "Estimate Parameters (Code)"

Compatibility Considerations

- Previously, you represented the states of an Integrator block having multiple state names by using one `StateData` or `State` object. Now, *each* state name requires one `StateData` or `State` object. Therefore, estimating the states of such an Integrator block errors. Instead, create a `TransientExperiment` or `Estimation` object to automatically create `StateData` and `State` objects, respectively.

- Previously, the `Domain` property of the `State Data` and `State` objects was used to track SimMechanics and SimPowerSystems blocks with states. This property is no longer required and has been removed.

Functions and Function Elements Being Removed

Function or Function Element Name	What Happens When you Use the Function or Element?	Use This Instead	Compatibility Considerations
`Domain` property of the `State Data` and `State` objects	Errors	Not applicable	See the **Compatibility Considerations** subheading for this change: - "Support for Initial State Estimation of Model References, SimHydraulics, SimMechanics, SimPowerSystems, and Simscape Blocks" on page 11

Version 1.1.1 (R2010a) Simulink Design Optimization Software

This table summarizes what's new in V 1.1.1 (R2010a):

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

New Engine Design and Cost Tradeoffs Demo

The new Engine Design and Cost Tradeoffs demo shows how to use the Simulink Design Optimization software to optimize a design for performance and cost.

Version 1.1 (R2009b) Simulink Design Optimization Software

This table summarizes what's new in V 1.1 (R2009b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	Yes Summary	Bug Reports Includes fixes

New features and changes introduced in this version are:

- "New Algorithm Option for fmincon (Gradient descent) and lsqnonlin (Nonlinear least squares) Methods, LargeScale (Model size) Option Removed" on page 14

- "Support for Optimization-Based Compensator Design for Plants with Delays or Specified as Frequency-Response Data" on page 16

- "Functions and Properties Being Removed" on page 16

New Algorithm Option for fmincon (Gradient descent) and lsqnonlin (Nonlinear least squares) Methods, LargeScale (Model size) Option Removed

This version of the product includes changes at the command line to make the fmincon and lsqnonlin methods to be consistent with the Optimization Toolbox™ software:

- Algorithm property renamed to Method.

- New Algorithm option.

- LargeScale option removed.

The following table summarizes values of the new Algorithm option.

Method	Algorithm **Values**
`fmincon`	• `'active-set'` (default) • `'trust-region-reflective'` • `'interior-point'`
`lsqnonlin`	• `'trust-region-reflective'` (default) • `'levenberg-marquardt'`

Previously, to specify the algorithm at the command line, you set the `LargeScale` option to `'on'` or `'off'`. If you used `LargeScale='on'` in a previous release, use `Algorithm='trust-region-reflective'` instead. If you used `LargeScale='off'`, use the following instead:

- For `fmincon` – Use `Algorithm='active-set'`.

- For `lsqnonlin` – Use `Algorithm='levenberg-marquardt'`.

For more information about these options, see the *Optimization Toolbox User's Guide*.

The Options dialog box includes the following updates to the `Gradient descent` and `Nonlinear least squares` methods that correspond to the command-line changes.

- **Algorithm** option is renamed to **Method**.
- **Model size** option is deprecated and replaced by **Algorithm**.

  When you load a saved project, the software uses the **Model size** value to update the **Algorithm** value automatically.

When you optimize parameters using the `Gradient Descent` method, an **Algorithm** value other than the default value of `Active-Set` can lead to a slightly different result.

For more information on how to specify the method and its algorithm, see "Estimation Options" and "Optimization Options".

Support for Optimization-Based Compensator Design for Plants with Delays or Specified as Frequency-Response Data

You can now use optimization-based compensator design for frequency-response data (FRD) plants or plants with exact time delays in the SISO Design Tool. For more information, see "Designing Optimization-Based Controllers for LTI Systems" and "Designing Linear Controllers for Simulink Models" in the *Simulink Design Optimization User's Guide*.

Functions and Properties Being Removed

Function or Property Name	What Happens When You Use Function or Property?	Use This Instead	Compatibility Considerations
Algorithm	Errors	Method	See "New Algorithm Option for fmincon (Gradient descent) and lsqnonlin (Nonlinear least squares) Methods, LargeScale (Model size) Option Removed" on page 14
LargeScale	Errors	Algorithm	See "New Algorithm Option for fmincon (Gradient descent) and lsqnonlin (Nonlinear

Function or Property Name	What Happens When You Use Function or Property?	Use This Instead	Compatibility Considerations
			least squares) Methods, LargeScale (Model size) Option Removed" on page 14

Version 1.0 (R2009a) Simulink Design Optimization Software

This table summarizes what's new in V 1.0 (R2009a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	Yes Summary	Bug Reports Includes fixes

Note As of R2009a, Simulink® Parameter Estimation™ and Simulink® Response Optimization™ functionality are merged into a new product, Simulink Design Optimization. Simulink Parameter Estimation and Simulink Response Optimization are no longer available.

New features and changes introduced in this version are:

- "New Parallel Computing Support for Estimating Model Parameters" on page 18
- "Updated Demos" on page 19
- "Upgrading from Nonlinear Control Design Blockset Software" on page 19

New Parallel Computing Support for Estimating Model Parameters

If you have the Parallel Computing Toolbox™ software installed, you can use parallel computing to speed up estimating parameters of a Simulink model. The parallel computing option is available in the `Nonlinear least squares`, `Gradient descent` and `Pattern search` algorithms. You can enable this option from either the GUI or at the command line.

Using parallel computing can speed up the estimation time in the following situations:

- The model contains a large number of parameters to estimate.

- The model is complex and takes a long time to simulate.

For more information about using parallel computing for estimating model parameters, see "Speedup Using Parallel Computing" in the Simulink Design Optimization documentation.

Updated Demos

The Simulink Design Optimization demos have been categorized into the following new categories:

- Parameter Estimation in Simulink

- Response Optimization in Simulink

- Response Optimization in SISO Design Tool

- Design Optimization Using Parallel Computing

- Adaptive Lookup Tables

To open the Simulink Design Optimization demos, type

```
demo simulink 'simulink design optimization'
```

at the MATLAB prompt.

Upgrading from Nonlinear Control Design Blockset Software

Prior to R14, Simulink Response Optimization software was called Nonlinear Control Design Blockset software. If you are upgrading from Nonlinear Control Design Blockset software, your models will not work with Simulink Design Optimization software. To make the models compatible with Simulink Design Optimization software, use ncdupdate.

Compatibility Summary for Simulink Design Optimization 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 V 2.0 (R2011b)	See the **Compatibility Considerations** subheading for "Redesigned Graphical Tool and Commands for Improved Response Optimization Workflows" on page 3. See "Functionality Being Removed or Changed" on page 7
V 1.2.1 (R2011a)	None
V 1.2 (R2010b)	See "Functions and Function Elements Being Removed" on page 12.
V 1.1.1 (R2010a)	None
V 1.1 (R2009b)	See "Functions and Properties Being Removed" on page 16.
V 1.0 (R2009a)	See "Upgrading from Nonlinear Control Design Blockset Software" on page 19.