

# **Robust Control Toolbox™**

## **Release Notes**

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*Robust Control Toolbox™ 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>Related Documentation at Web Site</b>
<b>Latest Version V3.5 (R2010b)</b>	Yes Details	No	Bug Reports Includes fixes	Printable Release Notes: PDF  Current product documentation
V3.4.1 (R2010a)	No	No	Bug Reports Includes fixes	No
V3.4 (R2009b)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V3.3.3 (R2009a)	No	No	Bug Reports Includes fixes	No
V3.3.2(R2008b)	No	No	Bug Reports Includes fixes	No
V3.3.1 (R2008a)	Yes Details	No	No bug fixes	No
V3.3 (R2007b)	No	No	No bug fixes	No
V3.2 (R2007a)	Yes Details	No	No bug fixes	No
V3.1.1 (R2006b)	Yes Details	No	No bug fixes	No
V3.1 (R2006a)	No	No	No bug fixes	No
V3.0.2 (R14SP3)	No	No	No bug fixes	No
V3.0.1 (R14SP2)	Yes Details	No	No bug fixes	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

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.

## Version 3.5 (R2010b) Robust Control Toolbox Software

This table summarizes what's new in Version 3.5 (R2010b):

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

New features introduced in this version:

### New Commands for H-Infinity Synthesis of Fixed-Structure Control Systems

New commands in this release allow you to tune fixed-structure SISO and MIMO control systems using the techniques of  $H_\infty$  synthesis .

The new `hinfstruct` command lets you use the frequency-domain methods of  $H_\infty$  synthesis to tune control systems with a broad range of architectures and controller structures. For example, you can tune:

- Fixed-order, fixed-structure controllers, such as pure gains, PID controllers, or fixed-order transfer function or state-space models
- Single feedback-loop architectures with multiple tunable elements, such as a PID controller plus a filter
- Multiple feedback-loop architectures with multiple tunable elements

Specify the tunable elements of your system using the new parametrized Control Design blocks `ltiblock.gain`, `ltiblock.pid`, `ltiblock.ss`, and `ltiblock.tf`.



For examples of designing controllers for several different architectures using `hinfstruct`, see the following new demos:

- Loop Shaping Design with HINFSTRUCT
- Tuning of a Fixed-Structure Autopilot
- Decoupling Controller for a Distillation Column
- Multi-Loop PID Control of a Robot Arm

For more information, see “H-Infinity Tuning of Fixed Control Structures” in the *Robust Control Toolbox™ Getting Started Guide*.

## Version 3.4.1 (R2010a) Robust Control Toolbox Software

This table summarizes what's new in Version 3.4.1 (R2010a):

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

## Version 3.4 (R2009b) Robust Control Toolbox Software

This table summarizes what's new in Version 3.4 (R2009b):

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

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

- “New Option to Improve Robust Performance by Accounting for Real Uncertain Parameters” on page 7
- “New Command to Linearize Simulink Models with Uncertainty” on page 7
- “New Interface for Simulating Effects of Uncertainty in Simulink Models” on page 8
- “New Command to Model Multiple LTI Responses as One Uncertain System” on page 8
- “New and Updated Demos” on page 8
- “Functions, Properties and Blocks Being Removed” on page 9

### **New Option to Improve Robust Performance by Accounting for Real Uncertain Parameters**

You can now improve robust performance by accounting for real uncertain parameters when designing controllers using  $\mu$ -synthesis. The user-defined options you use in the `dksyn` command now includes a new option `MixedMU`. Set this option to 'on' to account for real uncertain parameters in your system. For more information, see the `dkitopt`, and `dksyn` reference pages.

### **New Command to Linearize Simulink Models with Uncertainty**

If you have Simulink® Control Design™ software installed, you can take model uncertainty into account when linearizing a Simulink model. You can

then use the resulting uncertain linearized model (uss object) to perform linear analysis and robust control design.

If your model already contains Uncertain State Space blocks, use the new `ulinearize` command to obtain an `uss` model. If you want to account for uncertainty in your linear analysis without using Uncertain State Space blocks, you can specify individual Simulink blocks to linearize to an uncertain variable. For more information, see "Computing Uncertain State-Space Models from Simulink Models" in the *Robust Control Toolbox User's Guide*.

## **New Interface for Simulating Effects of Uncertainty in Simulink Models**

This version of the product provides a new interface to simulate the effects of uncertainty in Simulink models. The interface includes the following:

- Uncertain State Space block to specify uncertain system in Simulink. You should replace USS System blocks in your existing models with the Uncertain State Space block. To do so, run the `supdate` command on your models.
- `ufind` command to extract all uncertain variables from a Simulink model.
- `usample` command to generate random values of these uncertain variables.

For more information on simulating the effects of uncertainty using the new interface, see "Simulating Effects of Uncertainty" in the *Robust Control Toolbox User's Guide*.

## **New Command to Model Multiple LTI Responses as One Uncertain System**

This version of the product includes a new `ucover` command that lets you model a family of LTI responses as one uncertain system. For more information, see the `ucover` reference page.

## **New and Updated Demos**

The following new and updated demos illustrate use of the new features:

- "Control of Spring-Mass-Damper Using Mixed  $\mu$ -Synthesis" shows use of the new MixedMU option and dksyn command for mixed- $\mu$  synthesis.
- "Linearization of Simulink Models with Uncertainty" shows how to compute uncertain state-space models using ulinearize and Simulink Control Design software.
- "Robustness Analysis in Simulink" uses the new interface for simulating effects of uncertainty in Simulink models.
- "Simultaneous Stabilization Using Robust Control" and "Modeling a Family of Responses as an Uncertain System" show use of the ucover command.
- "First-Cut Robust Design" shows use of the usample, ucover and dksyn commands.

To access the demos, type

```
demo('toolbox','robust control')
```

## Functions, Properties and Blocks Being Removed

Function, Property or Block Name	What Happens When You Use Function or Property?	Use This Instead	Compatibility Considerations
usiminfo	Still runs	ufind	See "New Interface for Simulating Effects of Uncertainty in Simulink Models" on page 8.
usimfill	Still runs	ufind	See "New Interface for Simulating Effects of Uncertainty in Simulink Models" on page 8.
usimsamp	Still runs	usample	See "New Interface for Simulating Effects of Uncertainty in Simulink Models" on page 8.

<b>Function, Property or Block Name</b>	<b>What Happens When You Use Function or Property?</b>	<b>Use This Instead</b>	<b>Compatibility Considerations</b>
USS System block	Still runs	Uncertain State Space block	See “New Interface for Simulating Effects of Uncertainty in Simulink Models” on page 8.
ltiarray2uss	Still runs	ucover	See “New Command to Model Multiple LTI Responses as One Uncertain System” on page 8.

## Version 3.3.3 (R2009a) Robust Control Toolbox Software

This table summarizes what's new in Version 3.3.3 (R2009a):

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

## Version 3.3.2 (R2008b) Robust Control Toolbox Software

This table summarizes what's new in Version 3.3.2 (R2008b):

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



## Version 3.3.1 (R2008a) Robust Control Toolbox Software

This table summarizes what's new in Version 3.3.1 (R2008a):

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

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

### Ability to Use LOOPMARGIN with Simulink

This version of Robust Control Toolbox software lets you analyze the robustness of nonlinear Simulink models using the LOOPMARGIN command.

If you have the Simulink Control Design product installed, you can perform stability margin analysis of a Simulink model by passing the model name and a point within that model to the LOOPMARGIN command.

## Version 3.3 (R2007b) Robust Control Toolbox Software

This table summarizes what's new in Version 3.3 (R2007b):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	No bug fixes	No

## Version 3.2 (R2007a) Robust Control Toolbox Software

This table summarizes what's new in Version 3.2 (R2007a):

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

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

### New Simulink Blocks

- **USS System** — This Robust Control Toolbox version introduces a new Simulink block, USS System. You can use this block to import uncertain systems into Simulink models.
- **Multiplot Graph** — Plot multiple signals in one figure.

## Version 3.1.1 (R2006b) Robust Control Toolbox Software

This table summarizes what's new in Version 3.1.1 (R2006b):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
Yes Details below	No	No bug fixes	No

### **New Function `ltiarray2uss`**

This Robust Control Toolbox version introduces a new function, `ltiarray2uss`. This function constructs an uncertain state-space model from an LTI array.

## Version 3.1 (R2006a) Robust Control Toolbox Software

This table summarizes what's new in Version 3.1 (R2006a):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	No bug fixes	No

## Version 3.0.2 (R14SP3) Robust Control Toolbox Software

This table summarizes what's new in Version 3.0.2 (R14SP3):

<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>	<b>Related Documentation at Web Site</b>
No	No	No bug fixes	No

## Version 3.0.1 (R14SP2) Robust Control Toolbox Software

This table summarizes what's new in Version 3.0.1 (R14SP2):

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

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

### **mussvunwrap Is Renamed**

mussvunwrap has been renamed. It is now called mussvextract.

### **New Functions `actual2normalized` and `normalized2actual`**

This Robust Control Toolbox version introduced two new functions:

- `actual2normalized` — Calculate normalized distance between nominal value and given value for uncertain atom.
- `normalized2actual` — Convert value for atom in normalized coordinates to corresponding actual value.

## Compatibility Summary for Robust Control Toolbox 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 with the description of the new feature or change.

<b>Version (Release)</b>	<b>New Features and Changes with Version Compatibility Impact</b>
<b>Latest Version V3.5 (R2010b)</b>	None
V3.4.1 (R2010a)	None
V3.4 (R2009b)	See “Functions, Properties and Blocks Being Removed” on page 9.
V3.3.3 (R2009a)	None
V3.3.2 (R2008b)	None
V3.3.1 (R2008a)	None
V3.3 (R2007b)	None
V3.2 (R2007a)	None
V3.1.1 (R2006b)	None
V3.1 (R2006a)	None
V3.0.2 (R14SP3)	None
V3.0.1 (R14SP2)	None