System Identification Toolbox Release Notes

Contents

Summary by Version

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

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Latest Version V7.1 (R2007b)	Yes Details	No	Bug Reports	Printable Release Notes: PDF Current product documentation
V7.0 (R2007a)	Yes Details	No	Bug Reports	No
V6.2 (R2006b)	Yes Details	No	Bug Reports	No
V6.1.3 (R2006a)	Yes Details	Yes Summary	Bug Reports	No
V6.1.2 (R14SP3)	No	No	Bug Reports	No
V6.1.1 (R14SP2)	No	No	Fixed bugs	No
V6.0 (R13SP2)	Yes Details	Yes Summary	No bug fixes	V6.0 product documentation

About Release Notes

Use release notes when upgrading to a newer version to learn about new features and changes, and the potential impact on your existing files and practices. Release notes are also beneficial if you use or support multiple versions.

If you are not upgrading from the most recent previous version, review release notes for all interim versions, not just for the version you are installing. For example, when upgrading from V1.0 to V1.2, review the New Features and

Changes, Version Compatibility Considerations, and Bug Reports for V1.1 and V1.2.

New Features and Changes

These include

- New functionality
- Changes to existing functionality
- Changes to system requirements (complete system requirements for the current version are at the MathWorks Web site)
- Any version compatibility considerations associated with each new feature or change

Version Compatibility Considerations

When a new feature or change introduces a reported incompatibility with the previous version, its description includes a **Compatibility Considerations** subsection that details the impact. For a list of all new features and changes that have reported compatibility impact, see the "Compatibility Summary for System Identification Toolbox" on page 17.

Compatibility issues that are reported after the product has been released are added to Bug Reports at the MathWorks Web site. Because bug fixes can sometimes result in incompatibilities, also review fixed bugs in Bug Reports for any compatibility impact.

Fixed Bugs and Known Problems

MathWorks Bug Reports is a user-searchable database of known problems, workarounds, and fixes. The MathWorks updates the Bug Reports database as new problems and resolutions are reported, so check it as needed for the latest information.

Access Bug Reports at the MathWorks Web site using your MathWorks Account. If you are not logged in to your MathWorks Account when you link to Bug Reports, you are prompted to log in or create an account. You then can view bug fixes and known problems for R14SP2 and more recent releases.

The Bug Reports database was introduced for R14SP2 and does not include information for prior releases. You can access a list of bug fixes made in prior versions via the links in the summary table.

Related Documentation at Web Site

Printable Release Notes (PDF). You can print release notes from the PDF version, located at the MathWorks Web site. The PDF version does not support links to other documents or to the Web site, such as to Bug Reports. Use the browser-based version of release notes for access to all information.

Product Documentation. At the MathWorks Web site, you can access complete product documentation for the current version and some previous versions, as noted in the summary table.

Version 7.1 (R2007b) System Identification Toolbox

This table summarizes what's new in Version 7.1 (R2007b):

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

New feature introduced in this version:

New Polynomial Nonlinearity Estimator for Hammerstein-Wiener Models

You can now estimate nonlinearities for Hammerstein-Wiener models using a single-variable polynomial at either the input or the output. This nonlinearity estimator is available at the command line.

For more information, see the `poly1d` reference pages. For more information about estimating Hammerstein-Wiener models, see "Estimating Hammerstein-Wiener Models" in the System Identification Toolbox documentation.

Version 7.0 (R2007a) System Identification Toolbox

This table summarizes what's new in Version 7.0 (R2007a):

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

New features and changes introduced in this version are:

- "New Nonlinear Black-Box Modeling Options" on page 5
- "New Nonlinear Grey-Box Modeling Option" on page 6
- "New Getting Started Guide" on page 7
- "Revised and Expanded User's Guide" on page 7

New Nonlinear Black-Box Modeling Options

You can now estimate nonlinear discrete-time black-box models for both single-output and multiple-output time-domain data. System Identification Toolbox supports the following types of nonlinear black-box models:

- Hammerstein-Wiener
- Nonlinear ARX

To learn how to estimate nonlinear black-box models using the System Identification Tool GUI or commands in the MATLAB Command Window, see System Identification Toolbox documentation.

Note You can estimate Hammerstein-Wiener black-box models from input-output data only. These models do not support time-series data, where there is no input.

New demos are available to help you explore nonlinear black-box functions. For more information, see the collection of demos in the Tutorials on Nonlinear ARX and Hammerstein-Wiener Model Identification category.

New Nonlinear Grey-Box Modeling Option

You can now estimate nonlinear discrete-time and continuous-time models for arbitrary nonlinear ordinary differential equations using single-output and multiple-output time-domain data, or time-series data (no measured inputs). Models that you can specify as a set of nonlinear ordinary differential equations (ODEs) are called *grey-box models*.

To learn how to estimate nonlinear grey-box models using the commands in the MATLAB Command Window, see System Identification Toolbox documentation.

Specify the ODE in an M-file or a MEX-file. The template file for writing the MEX-file, `IDNLGREY_MODEL_TEMPLATE.c`, is located in `matlab/toolbox/ident/nlident`.

To estimate the equation parameters using System Identification Toolbox, first construct an `idnlgrey` object to specify the ODE file and the parameters you want to estimate. Use `pem` to estimate the ODE parameters. For more information, see the `idnlgrey` and `pem` reference pages.

New demos are available to help you explore nonlinear grey-box functions. For more information, see the collection of demos in the Tutorials on Nonlinear Grey-Box Model Identification category.

Optimization Toolbox Search Method for Nonlinear Estimation Is Supported

If you have Optimization Toolbox installed, you can specify the `lsqnonlin` search method for estimating black-box and grey-box nonlinear models in the MATLAB Command Window.

```
model.algorithm.searchmethod='lsqnonlin'
```

For more information, see the `idnlarx`, `idnlhw`, and `idnlgrey` reference pages.

New Getting Started Guide

System Identification Toolbox now provides a new Getting Started guide. This guide introduces fundamental identification concepts and provides the following tutorials to help you get started quickly:

- “Tutorial: Estimating Linear Models Using the GUI” — Tutorial for using the System Identification Tool graphical user interface (GUI) to estimate linear black-box models for single-input and single-output (SISO) data.
- “Tutorial: Estimating Process Models Using the GUI” — Tutorial for using the System Identification Tool graphical user interface (GUI) to estimate low-order transfer functions to fit single-input and single-output (SISO) data.
- “Tutorial: Estimating Linear Models Using the Command Line” — Tutorial for estimating models using System Identification Toolbox objects and methods for multiple-input and single-output (MISO) data.

Revised and Expanded User’s Guide

The System Identification Toolbox User’s Guide documentation has been revised and expanded.

Version 6.2 (R2006b) System Identification Toolbox

This table summarizes what's new in Version 6.2 (R2006b):

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

New feature introduced in this version:

MATLAB Compiler Support

System Identification Toolbox now supports MATLAB Compiler.

You can use MATLAB Compiler to take M-files as input and generate redistributable, standalone applications that include System Identification Toolbox functionality, including the following:

- Creating data and model objects
- Preprocessing and manipulating data
- Simulating models
- Transforming models, including conversions between continuous and discrete time and model reduction
- Plotting transient and frequency response

To use these features, write an M-file that uses the MATLAB interface for System Identification Toolbox, then use MATLAB Compiler to create a stand-alone application. For more information, see the MATLAB Compiler documentation.

Standalone applications that include System Identification Toolbox functionality have the following limitations:

- No Simulink support, which results in no access to the System Identification Toolbox Simulink library (`slident`)

- No support for model estimation

Version 6.1.3 (R2006a) System Identification Toolbox

This table summarizes what's new in Version 6.1.3 (R2006a):

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

New features and changes introduced in this version are:

- "balred Introduced for Model Reduction" on page 10
- "Search Direction for Minimizing Criteria Can Be Computed by Adaptive Gauss-Newton Method" on page 10
- "Maximum Number of Bisections Used by Line Search Is Increased" on page 11

balred Introduced for Model Reduction

Use `balred` to perform model reduction instead of `idmodred`.

Compatibility Considerations

`idmodred` is now removed. Please use `balred` instead.

Search Direction for Minimizing Criteria Can Be Computed by Adaptive Gauss-Newton Method

An adaptive Gauss-Newton method is now available for computing the direction of the line search for cost-function minimization. Use this method when you observe convergence problems in the estimation results, or as an alternative to the Levenberg-Marquard (`lm`) method.

The gna search method was suggested by Adrian Wills, Brett Ninness, and Stuart Gibson in their paper "On Gradient-Based Search for Multivariable System Estimates", presented at the IFAC World Congress in Prague in 2005. gna is an adaptive version of gns and uses a cutoff value for the singular values of the criterion Hessian, which is adjusted adaptively depending on the success of the line search.

Specify the gna method by setting the SearchDirection property to 'gna'. For example:

```
m = pem(data,model_structure,'se','gna')
```

The default initial value of gamma in the gna search is 10^-4. You can set a different value using the InitGnaTol property. For more information about SearchDirection, see the Algorithm Properties reference pages.

Maximum Number of Bisections Used by Line Search Is Increased

The default value for the MaxBisections property, which is the maximum number of bisections along the search direction used by line search, is increased from 10 to 25. This increases the number of attempts to find a lower criterion value along the search vector.

For more information about Search properties, see the Algorithm Properties reference page.

Version 6.1.2 (R14SP3) System Identification Toolbox

This table summarizes what's new in Version 6.1.2 (R14SP3):

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

Version 6.1.1 (R14SP2) System Identification Toolbox

This table summarizes what's new in Version 6.1.1 (R14SP2):

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

Version 6.0 (R13SP2) System Identification Toolbox

This table summarizes what's new in Version 6.0 (R13SP2):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes — Details labeled as **Compatibility Considerations**, below. See also Summary.	No bug fixes	V6.0 product documentation

New features and changes introduced in this version are:

- "idproc Model Object Added" on page 14
- "Estimation and Validation in Frequency Domain Now Supported" on page 15
- "Continuous-Time Data Can Now Be Stored Using Frequency-Domain Objects" on page 15
- "Simulink Now Supports iddata and idmodel Objects" on page 16
- "advice About Data and Models Now Available" on page 16
- "Theta Models No Longer Supported" on page 16

idproc Model Object Added

A new model object, `idproc`, is used to represent simple continuous-time process models. This object is characterized by static gain, possible dead time, and dominating time constant(s). A new GUI that supports this object is available in the System Identification Toolbox window.

To learn more about this object, type `iddemopr` at the MATLAB prompt to run a demo.

You can also try the command

```
m = pem(data,'p1d')
```

Estimation and Validation in Frequency Domain Now Supported

You can now perform estimation and validation using frequency-domain data, such as the following:

- Inputs and outputs, entered as frequency-domain data in the `iddata` object
- Frequency-response data from a frequency analyzer

Both System Identification Toolbox functions and the graphical user interface (GUI) support this.

All estimation, simulation, and validation routines accept frequency-domain data and frequency-response data as inputs, similar to time-domain data. The frequency-response data must be packaged as an `frd` or `idfrd` object.

Use the `fft` and `ifft`functions to transform between the time and frequency domains. Use the `spafdr` function to estimate frequency responses using frequency-dependent resolution.

Type at the MATLAB prompt:

```
help iddata
```

or

```
idprops data
```

for complete descriptions. To access a demo, type `iddemofr`.

Continuous-Time Data Can Now Be Stored Using Frequency-Domain Objects

You can now store continuous-time data as a frequency-domain data object. Continuous-time Fourier-transformed data is now stored at a finite number of arbitrary frequencies, letting you estimate continuous-time models directly. For example, type at the MATLAB prompt:

```
help oe
```

Simulink Now Supports iddata and idmodel Objects

You can now simulate estimated models using Simulink. The `iddata` and `idmodel` objects from System Identification Toolbox are now compatible with Simulink.

The command `slident` opens a Simulink block library, which you can use to simulate any `idmodel` (with or without noise). This library also contains data sources and sinks for `iddata` objects.

advice About Data and Models Now Available

Use the new `advice` command to get helpful tips about the quality, problems, and options associated with an `iddata` or `idmodel` object.

For more information, type at the MATLAB prompt:

```
help iddata/advice
```

and

```
help idmodel/advice
```

Theta Models No Longer Supported

Theta models (matrices) are no longer supported.

Compatibility Considerations

Existing code that uses functions, such as `th2par` and `th2ss`, to access the theta model data will continue to work in System Identification Toolbox 6.0. However, if you have code that directly indexes into the theta matrix (e.g., `th(1,3)`), this code will no longer work.

Compatibility Summary for System Identification Toolbox

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.

Version (Release)	New Features and Changes with Version Compatibility Impact
Latest Version **V7.1** **(R2007b)**	None
V7.0 (R2007a)	None
V6.2 (R2006b)	None
V6.1.3 (R2006a)	See the **Compatibility Considerations** subheading for this new feature or change: • "balred Introduced for Model Reduction" on page 10
V6.1.2 (R14SP3)	None
V6.1.1 (R14SP2)	None
V6.0 (R13SP2)	See the **Compatibility Considerations** subheading for this new feature or change: • "Theta Models No Longer Supported" on page 16