Signal Processing Toolbox Release Notes

The "Signal Processing Toolbox 6.3 Release Notes" on page 1-1 describe the changes introduced in the latest version of the Signal Processing Toolbox. The following topics are discussed in these Release Notes:

- "New Features" on page 1-2
- "Major Bug Fixes" on page 1-4
- "Upgrading from an Earlier Release" on page 1-5
- "Known Software and Documentation Problems" on page 1-8

The Signal Processing Toolbox Release Notes also provide information about recent versions of the product, in case you are upgrading from a version that was released prior to Release 14SP1.

- "Signal Processing Toolbox 6.2.1 Release Notes" on page 2-1
- "Signal Processing Toolbox 6.2 Release Notes" on page 3-1
- "Signal Processing Toolbox 6.1 Release Notes" on page 4-1

Printing the Release Notes

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

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Signal Processing Toolbox 6.3 Release Notes

New Features

The following new features and enhancements have been added to the Signal Processing Toolbox Version 6.3.

New spectrogram Function

This function replaces the grandfathered `specgram` function. It uses new default values and the order of the inputs has changed. If you use this function with no outputs, a surface plot is dispayed, instead of an image. See `spectrogram` for more information.

New gaussfir Function

This function replaces the grandfathered `firgauss` function. `gaussfir` uses parameters that are common to communications systems. See `gaussfir` for more information.

FDATool Enhancements

Tip of the Day

A new Tip of the Day dialog displays when you start FDATool. It contains tips and hints for using FDATool.

Spectral Rejection Masks

You can draw lines on your filter response in FDATool to indicate rejection areas.

Generated C Header File Complex Filter Support

FDATool now supports generating C header files for complex filters.

Analysis Parameters

Three new options have been added to the Analysis Parameters for magnitude response displays. These options are also available in FVTool.

- **Normalize Magnitude to 1 (0 dB)** — displays the magnitude so that the maximum magnitude value occurs at 0 dB

- **Autoscale axes** — automatically scales the response data *y*-axis

- **dB Display Range** — If you are not using autoscale and the magnitude display is in dB, this allows you to specify the *y*-axis limits, .

FVTool Enhancements

SOS Filter Coefficients Display
The coefficient view in FVTool now displays each section of a second-order section filter as a separate filter with its own numerator, denominator, and gain.

New Demos
The Signal Processing Toolbox demos have been reorganized and a new demo on the analysis of a numerically controlled oscillator (NCO) has been added.

Major Bug Fixes

The Signal Processing Toolbox Version 6.3 includes important bug fixes made since Version 6.2.1. You can see a list of major Version 6.3 bug fixes on the MathWorks Web site.

If you are viewing these release notes in PDF form on the MathWorks Web site, please refer to the HTML form of the release notes on the MathWorks Web site and use the link provided.

If you are upgrading from a version earlier than Version 6.2.1, you should also see Major Bug Fixes in the Version 6.2 Release Notes.

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Signal Processing Toolbox 6.2.1 to Version 6.3.

If you are upgrading from Version 6.2 or earlier, see "Upgrading from an Earlier Release" on page 3-8 in the Signal Processing Toolbox 6.2 Release Notes.

dfilt — Coefficients Method

The `dfilt` coefficients method has been changed to the `coeffs` method, which returns a structure. See the Methods section of `dfilt` for information.

dfilt — Passing Filter States

You cannot pass filter states (initial and final conditions) via the `dfilt` filter method. You must use the `states` property. See `dfilt` for more information.

FDATool — State Space Filters

FDATool no longer supports state space filters. If you load a saved session that contains a state space filter, it is converted to a direct-form II transposed filter.

Filter Wizard Product Dependency

The Filter Wizard no longer requires the Signal Processing Blockset. You can use the Filter Wizard if you have the Signal Processing Toolbox and Simulink installed. If you have the Signal Processing Blockset installed, more options are available. See `dspfwiz` for more information.

firpm and cfirpm Inputs

The `firpm` and `cfirpm` functions now take function handles as inputs instead of strings.

FVTool — Default Phase Units

The default units for the phase response in FVTool have been changed to radians. This is consistent with the `phasez` function.

Plotting PSD Objects and Function Output

The following functions and methods now generate standard MATLAB plots, instead of launching an interactive plot:

- `dspdata plot` method
- `spectrum psd`, `pseudospectrum`, and `msspectrum` methods
- `pburg`
- `pcov`
- `periodogram`
- `pmcov`
- `pmtm`
- `pwelch`
- `pyulear`

Refer to the MATLAB documentation for information on plots.

Spectral Analysis Functions Inputs

`pwelch` (and the other spectrum analysis functions) no longer accept `'half'` or `'whole'`. You must use `'onesided'` or `'twosided'` to indicate the type of analysis you want.

Obsolete Functions from Version 6.3

Oboslete Function	Replacement Function
specgram	spectrogram
firgauss	gaussfir

Obsolete Functions from Version 6.2

Oboslete Function	Replacement Function
psd	psd method on spectrum object or plot method on dspdata.psd object
psdplot	psd method on spectrum object or plot method on dspdata.psd object
pmem	spectrum.yulear
remez	firpm
cremez	cfirpm
remezord	firpmord
tfe	tfestimate*
csd	cpsd*
cohere	mscohere*

*tfestimate, cpsd, and mscohere have new default values and, in some cases, produce different results. Refer to their reference pages for more information.

Known Software and Documentation Problems

The MathWorks Web site includes a list of known software and documentation problems in Version 6.3.

If you are viewing these release notes in PDF form on the MathWorks Web site, please refer to the HTML form of the release notes on the MathWorks Web site and use the link provided.

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Signal Processing Toolbox 6.2.1 Release Notes

Enhancements

The following enhancements have been added to the Signal Processing Toolbox Version 6.2.1.

FDATool Enhancements

Changing the Order of Filters in a Cascaded Filter

The FDATool Filter Manager now has Up and Down buttons that allow you to rearrange the order in which filters are cascaded.

Exporting Filter Coefficient Files

You can now export filter coefficient files in either decimal or hexadecimal format from FDATool.

Exporting Lattice ARMA filters to C Header Files

You can now export Lattice ARMA filters to C header files from FDATool.

Changed Code Generation Dialogs Buttons

The code generation dialogs in FDATool now include Generate and Close buttons, instead of OK, Cancel, and Apply buttons

FVTool Enhancement

Numeric Format Selection in Coefficient Viewer

You can now select decimal or hexadecimal numeric format in the FVTool Coefficient Viewer.

Major Bug Fixes

The Signal Processing Toolbox includes several bug fixes made since Version 6.2.1. This section describes the particularly important Version 6.2.1 bug fixes.

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

If you are upgrading from a release earlier than Version 6.2, then you should also see the bug fixes summary in the Signal Processing Toolbox 6.2 Release Notes.

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Signal Processing Toolbox 6.2 to Version 6.2.1.

If you are upgrading from Version 6.2 or earlier, see "Upgrading from an Earlier Release" on page 3-8 in the Signal Processing Toolbox 6.2 Release Notes.

Changes to Discrete-time Filters (DFILTs)

The ResetBeforeFiltering property of the dfilt object has been renamed to PersistentMemory. Refer to the dfilt reference page for information.

The NumSamplesProcessed property no longer displays automatially for every dfilt. You can view this property with the following command, where Hd is a created dfilt:

```
get(Hd,'NumSamplesProcessed')
```

Undo/Redo Removed from FDATool

The Undo and Redo buttons have been removed from FDATool.

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Signal Processing Toolbox 6.2 Release Notes

New Features

This section summarizes the new features and enhancements introduced in the Signal Processing Toolbox 6.2.

This section is organized into the following subsections:

- "Spectrum Objects" on page 3-2
- "Dspdata Objects" on page 3-2
- "Options Objects" on page 3-3
- "Filter States Objects" on page 3-3
- "Enhancements to Discrete-time Filter Objects" on page 3-3
- "Enhancements to Window Objects" on page 3-4
- "Enhancement to Spectral Estimation Functions" on page 3-4
- "FDATool Enhancements" on page 3-4
- "FVTool Enhancement" on page 3-5

Spectrum Objects

The Signal Processing Toolbox 6.2 adds a new `spectrum` object. Spectrum objects contain parameter information for a particular spectral estimation method (e.g., `spectrum.welch`). This object provides an improved way to view and manipulate spectral estimation parameters. See the `spectrum` reference page and the associated estimation method reference pages for more information.

Dspdata Objects

A new data object `dspdata` has been added. These data objects contain parameter information for spectral data. Available types of data objects are `dspdata.msspectrum`, `dspdata.psd`, and `dspdata.pseudospectrum`. These objects contain the mean-square spectrum data, the power spectral density data, and the pseudospectrum data, respectively. With these objects, you can apply methods that calculate certain values or modify the data, such as computing the average power, centering the DC value, converting the spectrum between one-sided and two-sided, and normalizing the frequency. You can plot the data in a new **Spectral Analysis** plot. See `dspdata` for information.

Options Objects

A new options object `dspopts` has been added. This object contains optional parameter information for spectrum objects. You create options objects via methods on other objects. See `dspopts` for information.

Filter States Objects

A new filter states object `filtstates` with two properties—Numerator and Denominator, that contain the filter states for an IIR Direct-form I filter, has been added. The states property of a `dfilt.df1`, `dfilt.df1t`, `dfilt.df1sos`, or `dfilt.df1tsos` filter now contains a `filtstates.dfiir` object, instead of a double vector. See `filtstates` for more information.

Note that you cannot change the values in the Numerator or Denominator using this syntax:

```
Hd.states.numerator = [<data>]
```

Note The sign of the Denominator states for `dfilt.df1t` and `dfilt.df1tsos` is negated from what it was in previous versions. Refer to the structure diagrams shown on the reference pages.

If you use the `double` command on a filter states object to get a vector of double-precision values of the numerator and denominator, the numerator values are listed first, followed by the denominator values. In previous versions, the denominator values were listed first.

States saved for SOS objects in previous versions cannot be loaded into the current version.

Enhancements to Discrete-time Filter Objects

- The leading coefficient of the denominator (a0) can not be set to zero.
- New methods have been added to `dfilt` objects:
  - `fcfwrite`—writes an ASCII filter coefficient file.
  - `info`—displays filter structure, order, stability and linear phase information.

- The terminology used for multistage and second-order sections (SOS) filters has been clarified and some `dfilt` method names have been changed. SOS filters have sections, where sections compose a single filter. Cascade and parallel filters have stages, where each stage is a separate filter. See the "Methods" section of the `dfilt` reference page for information on methods related to sections and stages. The new or renamed methods are

  - `addstage`—adds a stage to a parallel or cascade filter object.
  - `nstages`—returns the number of stages in the filter.
  - `removestage`—removes a stage from a parallel or cascade filter object.
  - `setstage`—overwrites a stage of a parallel or cascade filter object.

Enhancements to Window Objects

Two new methods have been added to `sigwin` objects:

- `winwrite`—writes an ASCII file containing window weights
- `info`—displays information about the window object

Note To obtain command line help for Signal Toolbox objects, type `help` *objectname* or `help` *objectname*/*classname* or `help` *objectname*/ *methodname*. For example, to display help on the `psd` class of `dspdata`, type `help dspdata/psd` and for help on the average power method, type `help dspdata/avgpower`.

Enhancement to Spectral Estimation Functions

All of the spectral estimation functions (`pburg`, `pcov`, `peig`, `periodogram`, `pmcov`, `pmtm`, `pmusic`, `pwelch`, and `pyulear`) now use the new **Spectral Analysis** plot when no output arguments are specified. For an example of this plot, see the `spectrum` reference page.

FDATool Enhancements

- A new graphical **Pole/Zero Editor** panel has been added. You can graphically edit the filter (move, add, and delete poles/zeros) and see the resulting effect on your filter design.

- **File->Export** changes include adding the ability to export the filter directly to SPTool, exporting an ASCII coefficient file instead of a text file, exporting cascades and parallel structures, and general improvements to the dialog box.
- FIR Constrained Least Squares (`fircls`) and complex and nonlinear-phase equiripple FIR (`cfirpm`) filters have been added as design methods.
- A Filter Manager has been added. You can use the Filter Manager to store and recall multiple filters in a single FDATool session. You can also use it to cascade filters easily.
- The Analysis Parameters dialog box has been reorganized and simplified. The Frequency Units field has been removed and a **Normalized Frequency** checkbox has been added. (This also applies to FVTool.)

FVTool Enhancement

From the command line, you can change the sampling frequency (Fs) for the filter(s) in FVTool. See the Controlling FVTool from the MATLAB Command Line section of `fvtool` for more information.

New Demos

Two new demos have been added:

- Waveform Generation — generates common waveforms, such as pulse trains.
- DTMF — generates telephone pad tones.

Major Bug Fixes

The Signal Processing Toolbox includes several bug fixes made since Version 6.1. This section describes the particularly important Version 6.2 bug fixes.

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

If you are upgrading from a release earlier than Release 13 with Service Pack 1, then you should see the bug fixes summary in the Signal Processing Toolbox 6.1 Release Notes.

Platform Limitations

FDATool — 800 x 600 Resolution

On all platforms, FDATool requires a screen resolution of at least 800 x 600.

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Signal Processing Toolbox 6.1 to Version 6.2.

If you are upgrading from Version 6.0 or earlier, see "Upgrading from an Earlier Release" on page 4-5 in the Signal Processing Toolbox 6.1 Release Notes.

Discrete-Time Filter States Property

In previous version of the Signal Processing Toolbox, the output of the `states` property of a `dfilt.df1`, `dfilt.df1t`, `dfilt.df1sos` or `dfilt.df1tsos` object was a vector of doubles. In the current version, the output is a `filtstates` object, `Hs`. To obtain a vector of doubles from the `Hs` object, use

```
double(Hs)
```

You cannot load the states of an SOS object saved in a previous versions into the current version.

Note that the order of the double-precision numerator and denominator values differs from the order in previous versions. In the current version, numerator values are listed first, followed by denominator values.

Note also that the sign of the Denominator states for `dfilt.df1t` and `dfilt.df1tsos` is negated from what it was in previous versions. Refer to the structure diagrams shown on the reference pages.

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Signal Processing Toolbox 6.1 Release Notes

New Features

This section summarizes the new features and enhancements introduced in the Signal Processing Toolbox.

If you are upgrading from a release earlier than Release 13, then you should see "Upgrading from an Earlier Release" on page 4-5.

This section is organized into the following subsections:

- "Discrete-Time Filter Objects" on page 4-2
- "FDATool Enhancements" on page 4-2
- "FVTool Enhancements" on page 4-3
- "SPTool Enhancement—Filter Viewer" on page 4-3

Discrete-Time Filter Objects

Several new features have been added to discrete-time filter objects. For more information, see the `dfilt` reference page.

- New properties—You can now include initial conditions in your `dfilt` objects with the `States` and `ResetBeforeFiltering` properties.
- New structure—An overlap-add FFT FIR filter structure has been added. See `dfilt.fftfir`.
- New method—The `block` method creates a Simulink block of the `dfilt` object. This method is available only if the DSP Blockset is installed.
- Array handling—Some `dfilt` methods can now take an array of objects as input.
- `freqz` method—The `S` output has been removed from the `dfilt freqz` method.

FDATool Enhancements

- Creating M-code—You can now generate an M-file that includes code for the filter designed in FDATool. Use **Generate M-file** on the **Targets** menu. Note that this option is available only for designed filters and is disabled if you perform any other action on the filter.

- Zooming—Zoom menu items have been moved from the **Tools** menu to the **View** menu. Zooming in the *x*- and *y*-directions has been added. (This change also applies to FVTool, WinTool, and WVTool.)
- Complex filters—You can load complex filters into FDATool and view their step and impulse responses. (This change also applies to FVTool.)
- Exporting filters as text files—Exported text files now include more information in the file header (toolbox version number and filter structure information). Only coefficients can be exported as text files.

FVTool Enhancements

- Command line access—You can now control FVTool from the command line in the same manner as you control other figures using gcf. For example, you can turn on and specify the legend strings from the command line. See the fvtool reference page for more information.
- Overlaying responses—You can add a second response to the analysis display.
- Phase Delay—The phase delay response has been added to the available filter analyses.
- Filter Information—Detailed filter information has been added to the filter analyses.
- Boundary masks—You can turn on filter specification lines in the analysis display to view the ideal filter response based on your filter specifications. Note that these lines can be turned on only for displays showing the same units as the units in which the filter was designed (e.g., Magnitude(dB) for filters designed in dB, Magnitude and Zero-phase for filters designed in linear).

SPTool Enhancement—Filter Viewer

Selecting the filter viewer in SPTool now starts FVTool.

Major Bug Fixes

You can see a list of the particularly important Version 6.1 bug fixes.

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

Upgrading from an Earlier Release

This section describes the upgrade issues involved in moving from the Signal Processing Toolbox Version 6.0 to Version 6.1.

Uninstall Previous Versions Before Installing Version 6.1

Verson 6.1 of the toolbox relocates some files to improve performance, so you must completely uninstall all earlier version of the Signal Processing Toolbox before installing the R13+ version.

Caution Uninstalling the toolbox deletes all files in the `$MATLAB/toolbox` `signal` directory. Backup any files you may need to another directory before performing the uninstall steps.

Close MATLAB before attempting to uninstall the toolbox.

On Windows systems, use the **MATLAB Uninstaller** which you can access from **Start->Programs-> MATLAB 6.5-> Uninstall MATLAB 6.5**. Select the Signal Processing Toolbox from the **Uninstall Product List**.

On Unix systems, use:

```
rm -rf $MATLAB/toolbox/signal
```

where `$MATLAB` represents the name of your top-level MATLAB installation directory.

Filter Structure Name Changes

The following changes have been made to the names of some filter structures.

Old Name	New Name
direct form	direct-form

Old Name	New Name
auto-regressive	autoregressive
moving average	moving-average

New Warning Message for DFILT Filter method

If you pass initial condtions using the `dfilt filter` method, a warning message is displayed. The preferred way to pass initial conditions to a `dfilt` is with the new `States` method.