

Signal Processing 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 About Release Notes.

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Latest Version V6.5 (R2006a)	Yes Details	Yes Summary	Bug Reports at Web site	Printable Release Notes: PDF V6.5 product documentation
V6.4 (R14SP3)	Yes Details	No	Bug Reports at Web site	V6.4 product documentation
V6.3 (R14SP2)	Yes Details	Yes Summary	Bug Reports at Web site	No
V6.2.1 (R14SP1)	Yes Details	Yes Summary	Fixed Bugs Known Problems	No
V6.2 (R14)	Yes Details	Yes Summary	Fixed Bugs Known Problems	No

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 known 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 compatibility impact, see the Compatibility Summary for Signal Processing Toolbox.

Compatibility issues that become known 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 become known, 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 6.5 (R2006a) Signal Processing Toolbox

This table summarizes what's new in Version 6.5 (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 at Web site	Printable Release Notes: PDF V6.5 product documentation

New features and changes introduced in this version are

- Taylor Window Function Added
- SPTool Filter Designer Replaced by FDATool
- sgolay Example Improved
- zp2sos zeroflag Parameter Added
- Help for Objects Changed

Taylor Window Function Added

A new function `taylorwin` for generating Taylor windows has been added.

SPTool Filter Designer Replaced by FDATool

FDATool has replaced the SPTool Filter Designer as the preferred method for designing filters for use in SPTool. For details, see *SPTool: A Signal Processing GUI Suite* in the Signal Toolbox documentation.

Compatibility Considerations

The format in which filters are saved differs between SPTool Filter Designer and FDATool. When you load an SPTool session with saved filters, you are prompted to upgrade your filters to use FDATool format.

sgolay Example Improved

The example for `sgolay` has been improved and expanded.

zp2sos zeroflag Parameter Added

A new parameter `zeroflag` has been added to `zp2sos`. This parameter is used for real zeros that are the negatives of each other. For these zeros it specifies whether to keep them together instead of ordering them according to proximity to poles.

Help for Objects Changed

To obtain help for objects, use `help object.constructor` instead of the old `help object/constructor`. Note that to obtain help for methods, you still use `help object/method`.

Version 6.4 (R14SP3) Signal Processing Toolbox

This table summarizes what's new in Version 6.4 (R14SP3):

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

New features and changes introduced in this version are described here

dfilt (Discrete-Time Filters) Delay Structure Added

A new delay structure (`dfilt.delay`) has been added to `dfilt` objects. This structure adds latency to any signal filtered with it.

WinTool/WVTool Normalize Magnitude Added

A `Normalize magnitude` option has been added to the **Analysis Parameters** of WinTool and WVTool magnitude plots.

FDATool/FVTool Plot Displays Improved

The default plots for filter responses have been improved. The *y*-axis autoscaling includes buffer regions around the data and shows only the significant data. To see all of the data without any buffer regions, select **Full view** from the **View** menu.

FVTool Passband Zoom Added

If you have a filter in FVTool that was created in FDATool or from a Filter Design Toolbox `fdesign` object, you can use **Passband** on the **View** menu to zoom the passband region.

Version 6.3 (R14SP2) Signal Processing Toolbox

This table summarizes what's new in Version 6.3 (R14SP2):

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 at Web site	No

New features and changes introduced in this version are organized by these topics:

- FDATool and FVTool Changes
- dfilt Changes
- Spectral Analysis Changes
- Other Changes

FDATool and FVTool Changes

FDATool Spectral Rejection Masks Added

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

FDATool Generated C Header File Complex Filter Support

FDATool now supports generating C header files for complex filters.

FDATool Tip of the Day Added

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

FDATool State Space Filters Support Removed

FDATool no longer supports state space filters.

Compatibility Consideration. If you load a saved FDATool session that contains a state space filter, it is converted to a direct-form II transposed filter.

FDATool/FVTool New Analysis Parameters Magnitude Response Options

Three new options have been added to the Analysis Parameters for magnitude response displays.

- **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 SOS Filter Coefficients Display Enhancement

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.

FVTool Default Phase Units Changed

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

Compatibility Consideration. You should verify that the FVTool phase plots generated by existing code display the desired units.

dfilt Changes

dfilt Coefficients Method Changed

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

Compatibility Consideration. You should update any code that uses the `coefficients` method to use the new `coeffs` method and its returned structure.

dfilt Filter States Changed to Use States Property

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.

Compatibility Consideration. You should update any code that passed filter states via the `dfilt` filter method to use the new `states` property.

Spectral Analysis Changes

spectrogram Function Replaces specgram

`spectrogram` has been added to replace the grandfathered `specgram` function. If you use this function with no outputs, a surface plot is displayed, instead of an image.

Compatibility Consideration. You should update any code that references `specgram` to use the new `spectrogram` function. `spectrogram` uses different default values than `specgram` and the order of the inputs has changed.

Spectral Analysis Functions Inputs Changed

`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.

Compatibility Consideration. You should update any code that uses `'half'` or `'whole'` with spectral analysis functions and instead use `'onesided'` or `'twosided'`, respectively.

PSD Objects and Function Output Plots Changed

The following functions and methods now generate standard MATLAB plots, instead of launching an interactive plot. Refer to the MATLAB documentation for information on plots.

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

- `pmtm`
- `pwelch`
- `pyulear`

Other Changes

gaussfir Function Replaces firgauss

`gaussfir` has been added to replace the grandfathered `firgauss` function. `gaussfir` uses parameters that are common to communications systems.

Compatibility Consideration. You should update any code that references `firgauss` to use the new `gaussfir`.

firpm and cfirpm Inputs Changed

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

Compatibility Consideration. You should update any code that uses `firpm` or `cfirpm` so that it will work correctly with function handle inputs instead of string input.

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.

Filter Wizard Product Dependency Removed

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.

Version 6.2.1 (R14SP1) Signal Processing Toolbox

This table summarizes what's new in Version 6.2.1 (R14SP1):

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.	Fixed Bugs Known Problems	No

New features and changes introduced in this version are

- FDATool Changing Order of Filters in Cascaded Filter
- FDATool Exporting Filter Coefficient Files Added
- FDATool Exporting Lattice ARMA filters to C Header Files Added
- FDATool Code Generation Dialogs Buttons Changed
- FDATool Undo/Redo Buttons Removed
- FVTool Numeric Format Selection in Coefficient Viewer
- dfilt ResetBeforeFiltering Property Renamed
- dfilt NumSamplesProcessed Property Display Changed

FDATool Changing Order of Filters in Cascaded Filter

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

FDATool Exporting Filter Coefficient Files Added

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

FDATool Exporting Lattice ARMA filters to C Header Files Added

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

FDATool Code Generation Dialogs Buttons Changed

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

FDATool Undo/Redo Buttons Removed

The Undo and Redo buttons have been removed from FDATool.

FVTool Numeric Format Selection in Coefficient Viewer

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

dfilt ResetBeforeFiltering Property Renamed

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

Compatibility Consideration

You should update any code that uses the `ResetBeforeFiltering` property to use the `PersistentMemory` property.

dfilt NumSamplesProcessed Property Display Changed

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

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

Compatibility Consideration

You should update any code that assumes the `NumSamplesProcessed` is displayed to use the code shown above to display that property.

Version 6.2 (R14) Signal Processing Toolbox

This table summarizes what's new in Version 6.2 (R14):

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.	Fixed Bugs Known Problems	No

New features and changes introduced in this version are

- Spectral Estimation Objects Changes
- dfilt Enhancements
- Filter States Object Added
- sigwin Enhancements
- FDATool/FVTool Changes
- Function Name Changes
- New Demos

Spectral Estimation Objects Changes

Spectrum Object Added

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 Object Added

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.

Spectrum Options Object Added

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

Spectral Estimation Functions Enhancement

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.

psd and psdplot Functions Replaced by psd and plot methods

The `psd` method on spectrum objects or `plot` method on `dspdata.psd` objects replaces the obsolete `psd` function.

Compatibility Consideration. You should update any code that uses `psd` to use the `plot` or `dspdata.psd` method.

pmem Function Replaced by spectrum.yulear

The `pmem` function has been replaced by the new `spectrum.yulear` object.

Compatibility Consideration. You should update any code that uses `pmem` to use `spectrum.yulear` instead.

dfilt Enhancements

- The leading coefficient of the denominator (a_0) 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.

Filter States Object Added

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>]
```

Compatibility Considerations

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.

sigwin Enhancements

Two new methods have been added to sigwin objects:

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

FDATool/FVTool Changes

FDATool Pole/Zero Editor Added

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.

FDATool File Export Enhancements

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.

FDATool New Design Methods Added

FIR Constrained Least Squares (`firc1s`) and complex and nonlinear-phase equiripple FIR (`cfirpm`) filters have been added as design methods.

FDATool Filter Manager Added

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.

FDATool/FVTool Analysis Parameters Improved

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 Changing Sampling Frequency

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

Function Name Changes

remez Function Replaced by firpm

The `remez` function has been replaced by the new `firpm` function.

Compatibility Consideration. You should update any code that uses `remez` to use `firpm` instead.

cremez Function Replaced by cfirpm

The `cremez` function has been replaced by the new `cfirpm` function.

Compatibility Consideration. You should update any code that uses `cremez` to use `cfirpm` instead.

remezord Function Replaced by firpmord

The `remezord` function has been replaced by the new `firpmord` function.

Compatibility Consideration. You should update any code that uses `remezord` to use `firpmord` instead.

tfe Function Replaced by tfestimate

The `tfe` function has been replaced by the new `tfestimate` function.

Compatibility Consideration. You should update any code that uses `tfe` to use `tfestimate` instead. Note that `tfestimate` has different default values and may produce different results.

csd Function Replaced by cpsd

The `csd` function has been replaced by the new `cpsd` function.

Compatibility Consideration. You should update any code that uses `csd` to use `cpsd` instead. Note that `cpsd` has different default values and may produce different results.

cohere Function Replaced by mscohere

The cohere function has been replaced by the new mscohere function.

Compatibility Consideration. You should update any code that uses cohere to use mscohere instead. Note that mscohere has different default values and may produce different results.

New Demos

Two new demos have been added:

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

Compatibility Summary for Signal Processing 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 V6.5 (R6.5)	See the Compatibility Considerations subheading for this new feature or change: <ul style="list-style-type: none"> • SPTool Filter Designer Replaced by FDATool
V6.4 (R14SP3)	None
V6.3 (R14SP2)	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none"> • FDATool State Space Filters Support Removed • FVTool Default Phase Units Changed • dfilt Coefficients Method Changed • dfilt Filter States Changed to Use States Property • spectrogram Function Replaces specgram • Spectral Analysis Functions Inputs Changed • gaussfir Function Replaces firgauss • firpm and cfirpm Inputs Changed

V6.2.1 (R14SP1)	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• dfilt ResetBeforeFiltering Property Renamed• dfilt NumSamplesProcessed Property Display Changed
V6.2 (R14)	See the Compatibility Considerations subheading for each of these new features or changes: <ul style="list-style-type: none">• psd and psdplot Functions Replaced by psd and plot methods• pmem Function Replaced by spectrum.yulear• Filter States Object Added• remez Function Replaced by firpm• cremez Function Replaced by cfirpm• remezord Function Replaced by firpmord• tfe Function Replaced by tfestimate• csd Function Replaced by cpsd• cohere Function Replaced by mscohere
