

Signal Processing Toolbox 6

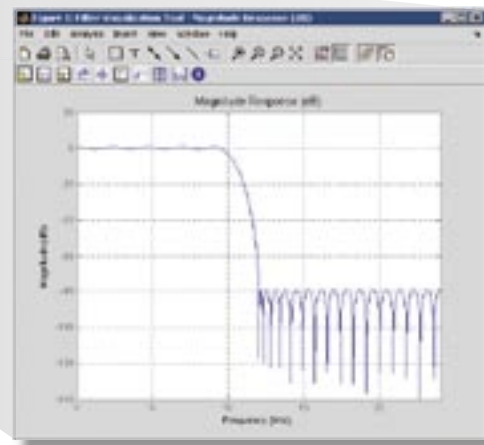
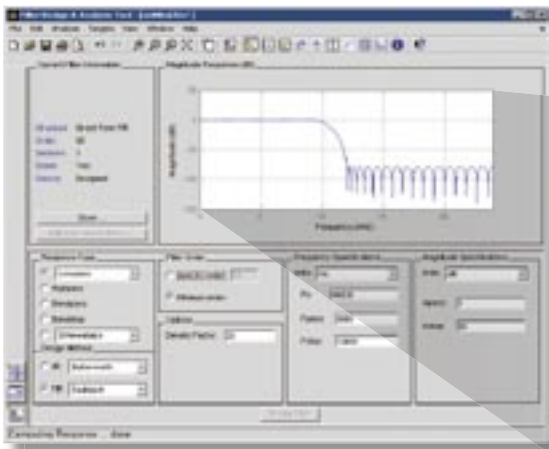
Perform signal processing, analysis, and algorithm development

The Signal Processing Toolbox is a collection of industry-standard algorithms for analog and digital signal processing. It provides graphical user interfaces (GUIs) for interactive design and analysis and command-line functions for advanced algorithm development.

Most toolbox functions are implemented in the open MATLAB® language. This means that you can inspect the algorithms, modify the source code, and create your own custom functions. You can use the toolbox for applications such as speech and audio processing, wired and wireless communications, financial modeling and analysis, and medical imaging and instrumentation.

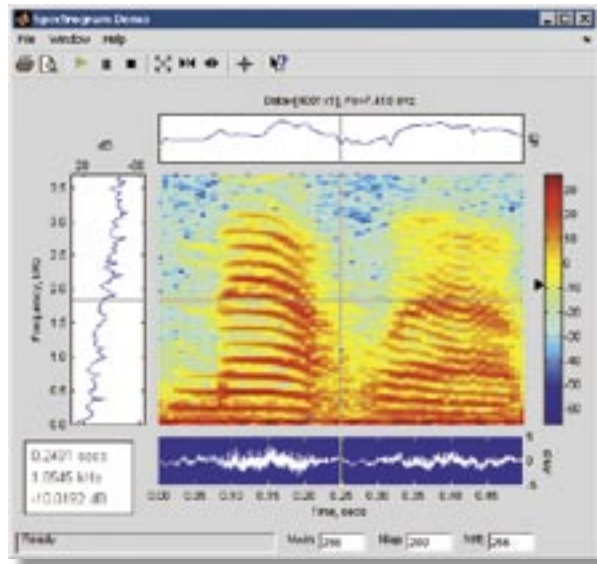
KEY FEATURES

- Comprehensive set of signal and linear system models
- Tools for finite impulse response (FIR) and infinite impulse response (IIR) digital filter design, analysis, and implementation
- Tools for analog filter design
- Access to the most widely used transforms, such as fast Fourier and discrete cosine
- Tools for spectral analysis and statistical signal processing
- Functions for parametric time-series modeling
- Routines for waveform generation, including a Gaussian pulse generator, a periodic sinc generator, and a pulse train generator
- Extensive data windowing algorithms
- Graphical user interfaces for designing, analyzing, and visualizing signals, filters, and windows



The magnitude response of a lowpass filter, designed in the Filter Design and Analysis Tool (left), and a print preview of the filter's response (above), created in the Filter Visualization Tool.

A spectrogram of the input signal showing the signal's time-frequency distribution and power spectral density, created using the Signal Processing Toolbox spectrogram demo.



Signal and Linear System Models

The Signal Processing Toolbox provides a broad range of models for representing signals and linear time-invariant systems, including representations for transfer functions, state space, and zero-pole gain. The toolbox also includes functions for transforming models from one representation to another.

Digital Filter Design Methods

A full suite of design methods is available for finite impulse response (FIR) and infinite impulse response (IIR) digital filters. These methods support the rapid design and evaluation of lowpass, highpass, bandpass, bandstop, and multiband filters, such as Butterworth, Chebyshev, elliptic, Yule-Walker, window-based, least squares, and Parks-McClellan (real and complex). Available filter structures include the direct forms I and II, lattice, lattice-ladder, and second-order sections.

Transforms

The Signal Processing toolbox provides tools for computing the most widely used transforms. These include discrete Fourier, discrete cosine, Hilbert, and Goertzel.

Spectral Analysis Tools

The Signal Processing Toolbox provides capabilities for frequency-domain analysis and spectral estimation, including tools for measuring power spectral density, mean-square spectrum, and average power. Several of these methods are based on a highly optimized fast Fourier transform. The spectral analysis methods include Welch, Burg, modified covariance, Yule-Walker, the multitaper method, and the MUSIC method.

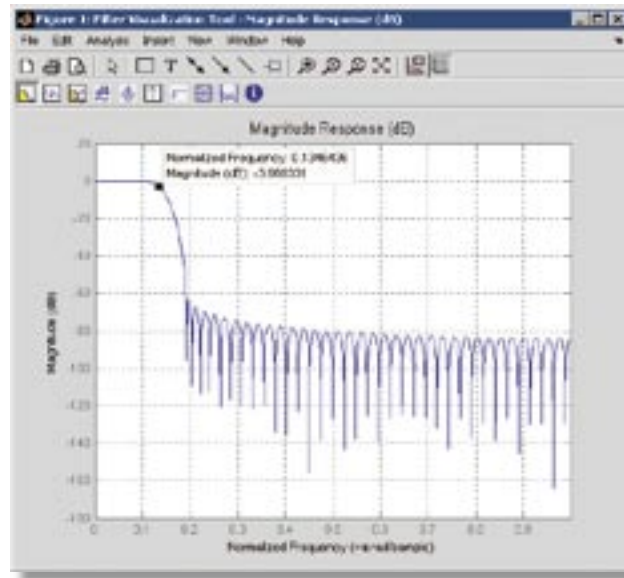
GUIs for Filter Design, Analysis, and Visualization

The GUIs in the Signal Processing Toolbox let you interactively view and measure signals, design and apply filters, design and analyze spectral windows, and perform spectral analysis while exploring the effects of different parameters and methods. The GUIs are particularly useful for visualizing time-frequency information, spectra, and pole-zero locations. For example, you can interactively design a filter by graphically placing the poles and zeros in the z-plane.

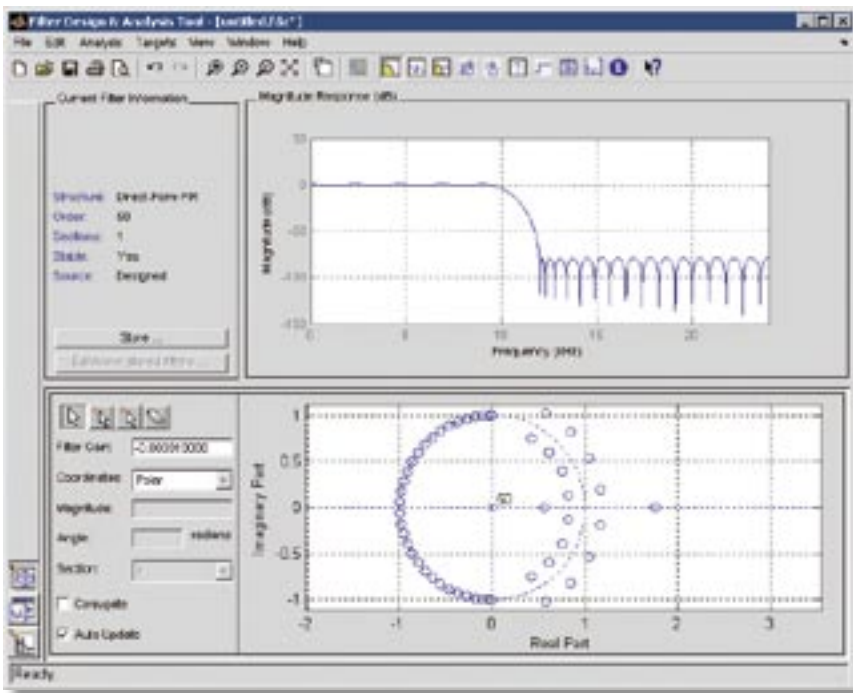
The Signal Processing Toolbox provides four GUIs: FDATool, FVTool, SPTool, and WINTool.

FDATool provides access to most FIR and IIR filter design methods in the toolbox. Additionally, you can:

- Design filters by graphically placing poles and zeros in the z-plane
- Analyze filters by examining magnitude, phase, impulse, and step responses, group delay, and pole-zero plots
- Generate C header files
- Import designed filters and filter coefficients stored in the MATLAB workspace and export filter coefficients
- Access additional filter design methods and quantization features in the Filter Design Toolbox (available separately)



Magnitude response of the specified digital filter, created using FVTool. Data markers determine the frequency and magnitude values of any chosen data point.

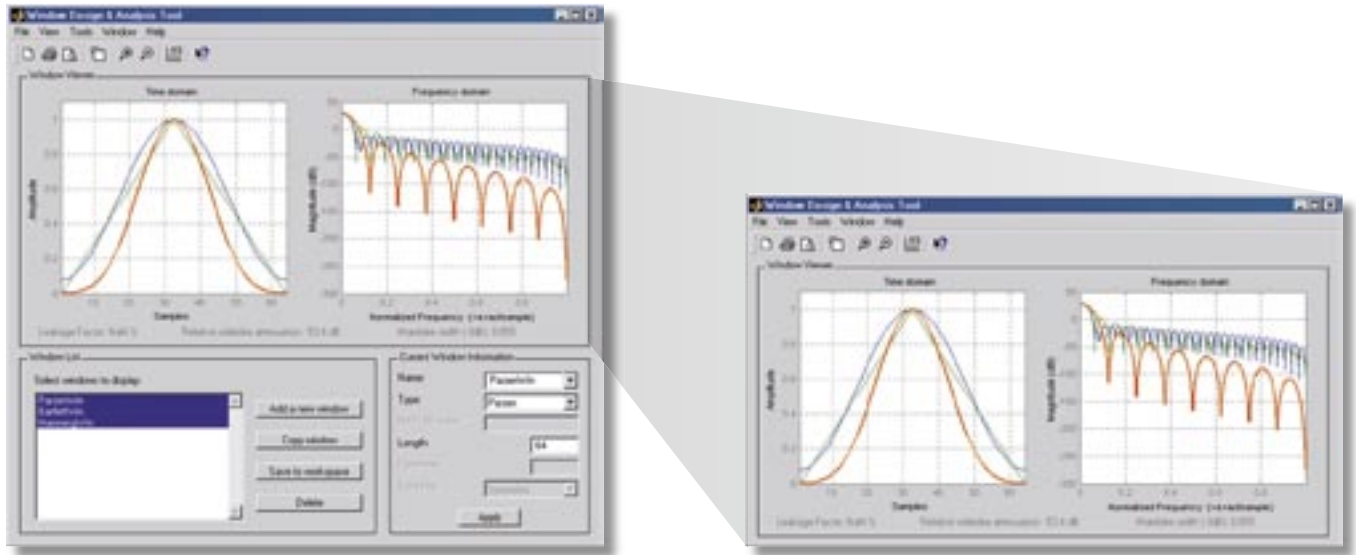


FVTool lets you view the characteristics of a designed or imported filter, including its magnitude response, phase response, group delay, pole-zero plot, impulse response, and step response.

SPTool provides access to signal, filter, and spectral analysis functions. You can:

- Measure and analyze the time-domain information of one or more signals and send audio signal to the PC's sound card
- Apply the filter to a selected signal
- Graphically analyze frequency-domain data using a variety of spectral estimation methods, including Burg, FFT, multitaper (MTM), MUSIC, eigenvector, Welch, and Yule-Walker AR

FDATool includes a Pole/Zero Editor that lets you design a filter through the graphical placement of poles and zeros.



The Window Viewer in WINTool displays the time-domain and frequency-domain representations of multiple windows for easy comparison.

WINTool lets you design and analyze spectral windows. You can:

- Display time-domain and frequency-domain representations of the selected window(s)
- Export window vectors or window objects to the MATLAB workspace, a MAT-file, or a text file
- View typical window measurements, such as leakage factor, relative sidelobe attenuation, and mainlobe width
- Visualize, annotate, and print time-domain and frequency-domain plots

Required Products

MATLAB

Related Products

Communications Toolbox. Design and analyze algorithms for the physical layer of communication systems

Filter Design Toolbox. Design and analyze fixed-point, adaptive, and multirate filters

Image Processing Toolbox. Perform image processing, analysis, and algorithm development

Signal Processing Blockset. Design and simulate signal processing systems and devices

Wavelet Toolbox. Analyze and synthesize signals and images using wavelet techniques

For more information on related products, visit www.mathworks.com/products/signal

Platform and System Requirements

For platform and system requirements, visit www.mathworks.com/products/signal

For demos, application examples, tutorials, user stories, and pricing:

- Visit www.mathworks.com

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