Filter Design Toolbox 4

Design and analyze fixed-point, adaptive, and multirate filters

The Filter Design Toolbox is a collection of tools that provide advanced techniques for designing, simulating, and analyzing digital filters. It extends Signal Processing Toolbox (required, available separately) with filter architectures and design methods for complex real-time DSP applications, including adaptive and multirate filtering.

When used with Fixed-Point Toolbox (available separately), Filter Design Toolbox provides functions that simplify the design of fixed-point filters and the analysis of quantization effects. When used with Filter Design HDL Coder (available separately), Filter Design Toolbox lets you generate VHDL and Verilog code for fixed-point filters. When used with Signal Processing Blockset (available separately), Filter Design Toolbox enables you to fully integrate the filter design process with modeling and simulation in Simulink® by providing a filter design block library.

FIR and IIR Filter Design

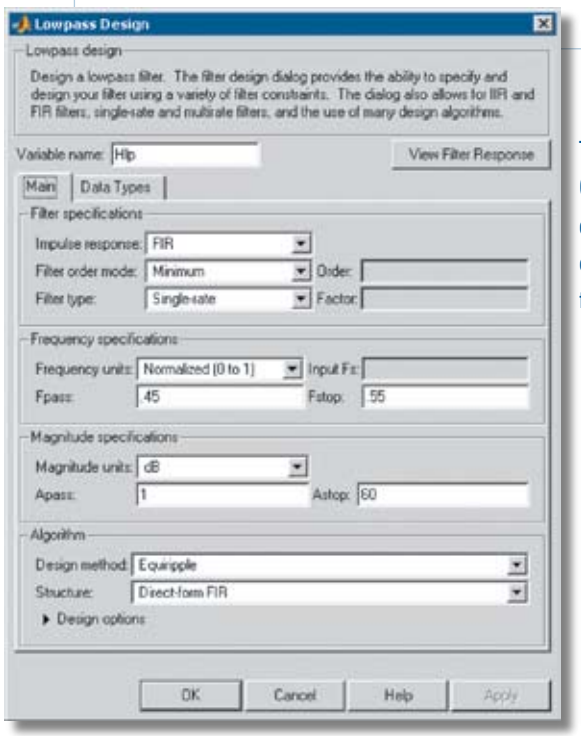
The Filter Design Toolbox enables you to design advanced FIR and IIR filters, import designed filters to Simulink, quantize floating-point filters, and analyze quantization effects. You can design filters from the MATLAB® command line, in Simulink with the filter design block library, or from a graphical user interface such as FilterBuilder in the toolbox or Filter Design and Analysis Tool (FDATool).

Multirate Filters

Filter Design Toolbox provides functions for the design and implementation of multirate filters, including polyphase interpolators, decimators, sample-rate converters, and CIC filters and compensators; and support for multistage design methods. Specialized analysis functions to automatically estimate the computational complexity of multirate filters are also available.

KEY FEATURES

- Advanced FIR filter design methods, including minimum-order, minimum-phase, halfband, complexity-optimized multistage, Farrow, and interpolated FIR
- Advanced IIR design methods, including arbitrary magnitude, group-delay equalizers, halfband, quasi-linear phase, and comb filters
- Multirate filter design methods, including cascaded integrator-comb (CIC), CIC compensator, polyphase FIR and IIR, and multistage Nyquist filters
- Support for efficient IIR filter implementations, including second-order sections and lattice wave digital filters
- Adaptive filter design, analysis, and implementation, including LMS-based, RLS-based, lattice-based, frequency-domain, fast transversal, and affine projection



The new FilterBuilder GUI facilitates the filter design process with capabilities beyond those of the FDATool.

Design Methods (partial list)

Advanced equiripple FIR filters, including minimum-order, constrained-ripple, minimum-phase designs

Nyquist and halfband FIR and IIR filters, providing linear phase, minimum-phase, and quasi-linear phase (IIR) designs, as well as equiripple, sloped-stopband, and window methods

Optimized multistage designs, enabling you to optimize the number of cascaded stages to achieve the lowest computational complexity

Fractional-delay filters, including implementation using Farrow filter structures well-suited for tunable filtering applications

Allpass IIR filters with arbitrary group delay, enabling you to compensate for the group delays of other IIR filters to obtain an approximate linear phase passband response

Lattice wave digital IIR filters, for robust fixed-point implementation

Arbitrary magnitude and phase FIR and IIR, enabling design of any user-specified filter

Fixed-Point Filters and Floating-to-Fixed-Point Conversion

When used with Fixed-Point Toolbox, the Filter Design Toolbox offers bit-true, fixed-point implementation of single-rate and multirate filters, including second-order sections (SOS) with section scaling and reordering, CIC, polyphase FIR and IIR filters. Word lengths for different quantities, such as coefficients, products, and accumulators, can be set to arbitrary values. Full-precision modes are available to simulate the filtering process without round-off errors. The Filter Design Toolbox provides analysis tools for easier conversion of a design from floating-point to a fixed-point representation, including dynamic range and round-off-noise analyses.

Adaptive Filters

The Filter Design Toolbox provides the following techniques for adaptive filters: LMS-based, RLS-based, affine projection, fast transversal, frequency-domain, and lattice-based. The toolbox also includes algorithms for the analysis of these filters, including tracking of coefficients, learning curves, and convergence.

Integrating Filter Design with System Simulation

Filter Design Toolbox integrates the filter design process in MATLAB with system-level simulation in Simulink. It provides functions that generate bit-true Simulink models from MATLAB filter objects. When you use Filter Design Toolbox with Signal Processing Blockset, you have access to a block library that lets you design, simulate, and implement filters directly in Simulink.

Required Products

MATLAB
Signal Processing Toolbox

Related Products

Filter Design HDL Coder. Generate VHDL and Verilog code for fixed-point filters from MATLAB

Fixed-Point Toolbox. Design and verify fixed-point algorithms and analyze fixed-point data

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

Simulink® Fixed Point. Design and simulate fixed-point systems

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

Platform and System Requirements

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