

Digital Filter Design Using FDATool

25.108 Intro to Engineering II

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What is a Digital Filter

- Passes a band of frequencies and rejects other frequencies
 - Three Bands of Interest
 - Pass band, The frequencies which get through
 - Stop band, the frequencies which don't get through
 - Transition bands, the bands in which part of the frequencies get through, between stop and pass bands

Types of Digital Filters

- Low Pass
- High Pass
- Band Pass
- Band Stop

Filter Implementations

- Infinite Impulse Response (IIR)
 - Feedback filter
- Finite Impulse response
 - Feed Forward
- Hybrid IIR/FIR

Key parameters in filter design

- Sampling rate
- Number of Taps
- Pass band
- Stop Band
- Stop Band Depth (rejection)

Using FDA tool

- Type "FDATool" at command prompt

The screenshot shows the Filter Design & Analysis Tool (FDATool) interface. The window title is "Filter Design & Analysis Tool - [untitled.fda]". The interface is divided into several sections:

- Current Filter Information:** Structure: Direct form FIR, Order: 50, Sections: 1, Stable: Yes, Source: Designed.
- Filter Specifications:** A plot of Magnitude (dB) vs. Frequency (Hz). The plot shows a passband from 0 to F_{pass} and a stopband from F_{stop} to $F_s/2$. The magnitude is 0 dB in the passband and A_{stop} dB in the stopband. The passband ripple is A_{pass} .
- Filter Type:** Lowpass (selected), Highpass, Bandpass, Bandstop, Differentiator.
- Filter Order:** Specify order: 40, Minimum order (selected), Density factor: 16.
- Frequency Specifications:** Units: Hz, F_s : 48000, F_{pass} : 9600, F_{stop} : 12000.
- Magnitude Specifications:** Units: dB, A_{pass} : 1, A_{stop} : 80.

Annotations with arrows point to various parts of the interface:

- "Pass band" points to the flat region of the magnitude plot.
- "Stop Band" points to the region where the magnitude drops to A_{stop} .
- "Out of Band Rejection" points to the A_{stop} value in the magnitude specifications.
- "Compute Filter Button" points to the "Design Filter" button at the bottom.
- "Filter Type" points to the "FIR Equiripple" option in the Design Method section.
- "Don't touch this" points to the "Density factor" field.
- "Sampling Frequency" points to the F_s field.

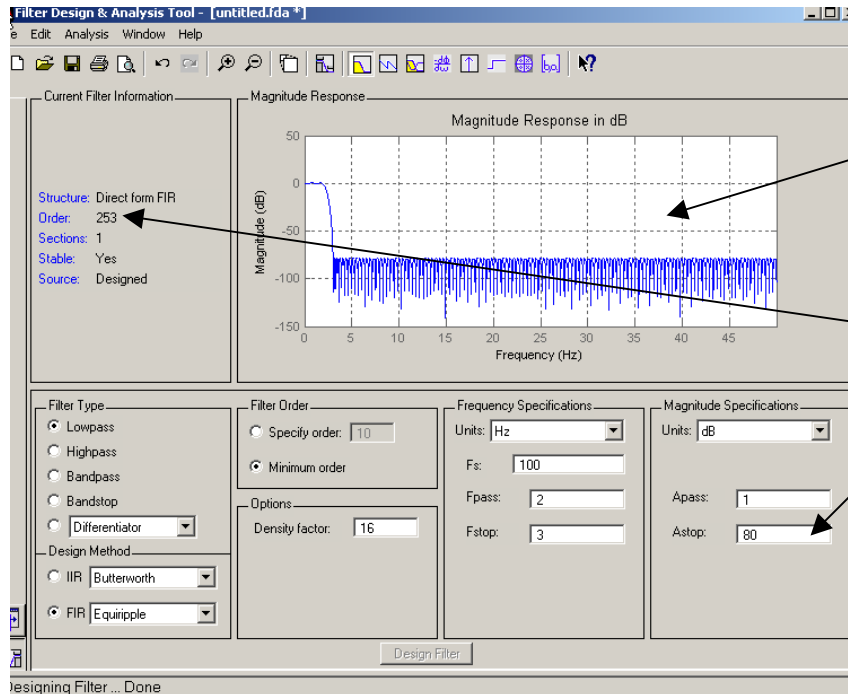
Step 2: Enter Parameters

- Enter Sampling Frequency
- Pass Band
- Stop Band
- Leave Everything else the same

Step 3: Design Filter

- Push “design Filter Button

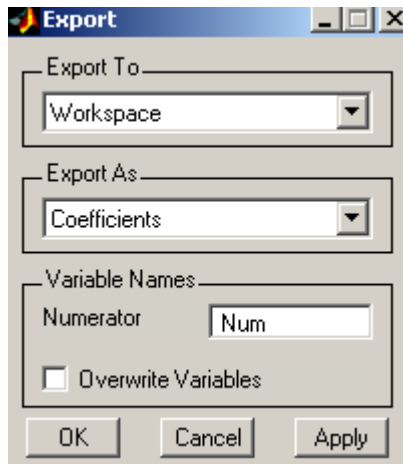
Filter Response Shown



Number of Taps, if too many, change rejection, to say 50 or 60

Step 4: Export Coefficients

- On “File Menu” Type Export



Create “Num”, and “Den”. If you have matlab 6.5, type “Den=1”

Step 5: do the filtering

- Type
- “>> Output=filter(Num,Den,Input)” to apply the filter you have created. It is simple as that.