Infinite Impulse Response Filter Design

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This code will prove to be classic example for proper use of the given functions for Butterworth filter, Chebyshev Type 1 filter and Chebyshev Type 2 Filter Design

Inputs Provided

Passband Attenuation

```
Ap = 3;
```

Sampling Frequency

```
Fs = 500;
```

Stopband Attenuation

```
As = 60;
```

Passband Frequency

```
Wp = 40;
```

Dividing by Sampling Frequeny

```
Wp = Wp / Fs;
```

Stopband Frequency

```
Ws = 150;
```

Dividing by Sampling Frequeny

```
Ws = Ws / Fs;
```

Derivation by butterord

```
[n,Wn] = buttord(Wp,Ws,Ap,As);
```

Formula for Order n of Butterworth filter

$$n = \frac{\log \varepsilon}{\log \Omega_p - \log \Omega_s + \frac{1}{n} \log \sqrt{A^2 - 1}}$$

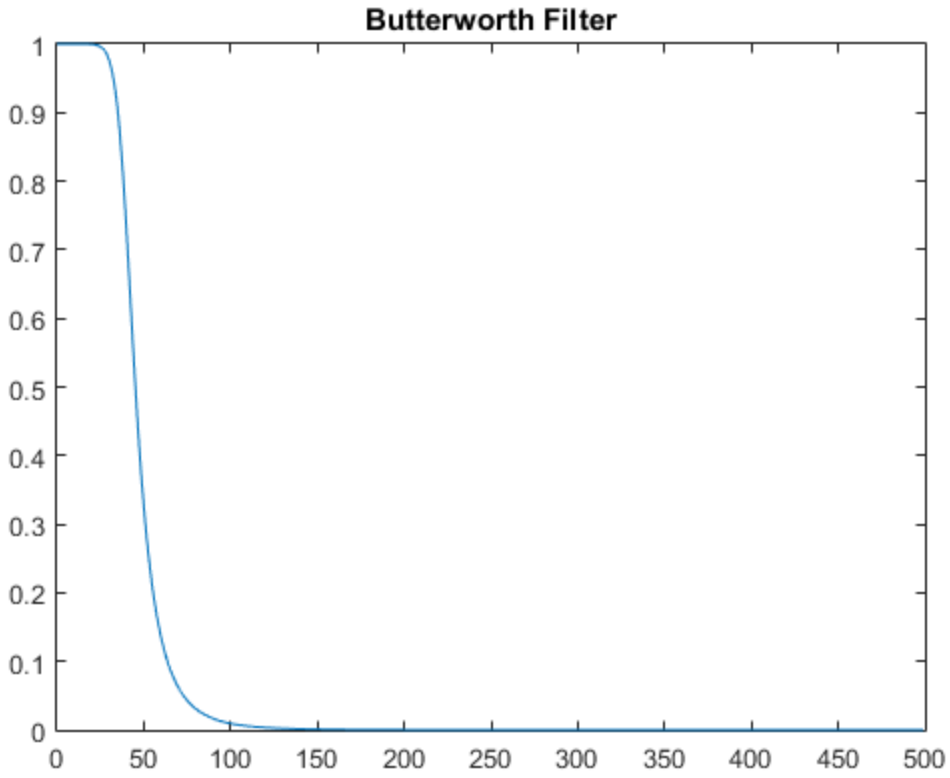
OR another simplified version will be

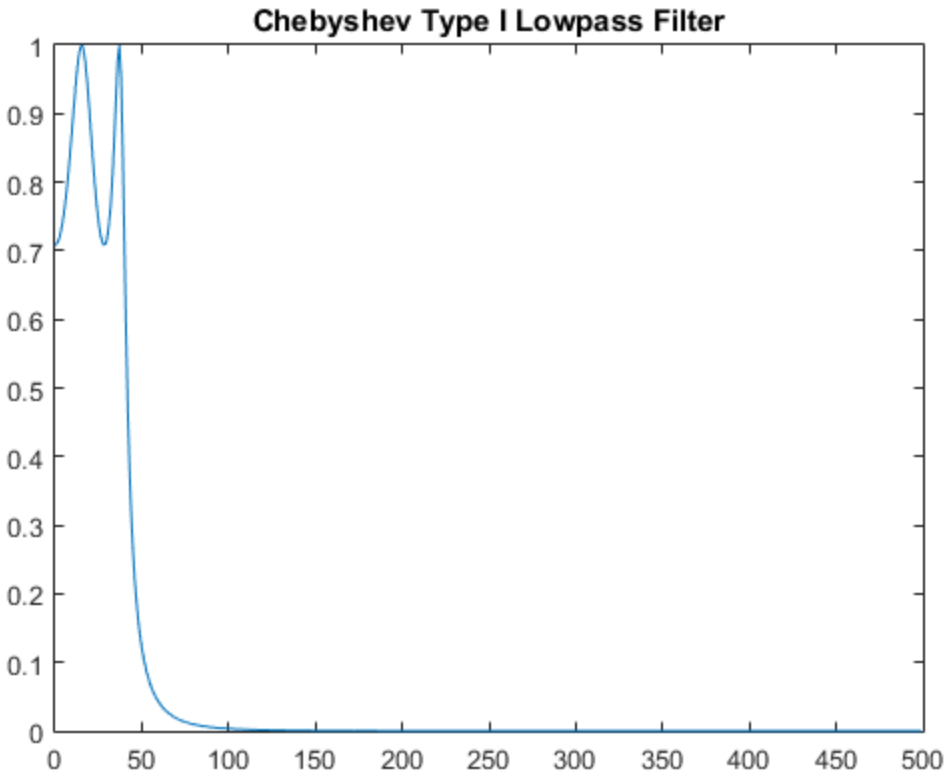
$$n = \frac{\log\left(\varepsilon / \sqrt{A^2 - 1} \right)}{\log\left(\Omega_p / \Omega_s \right)}$$

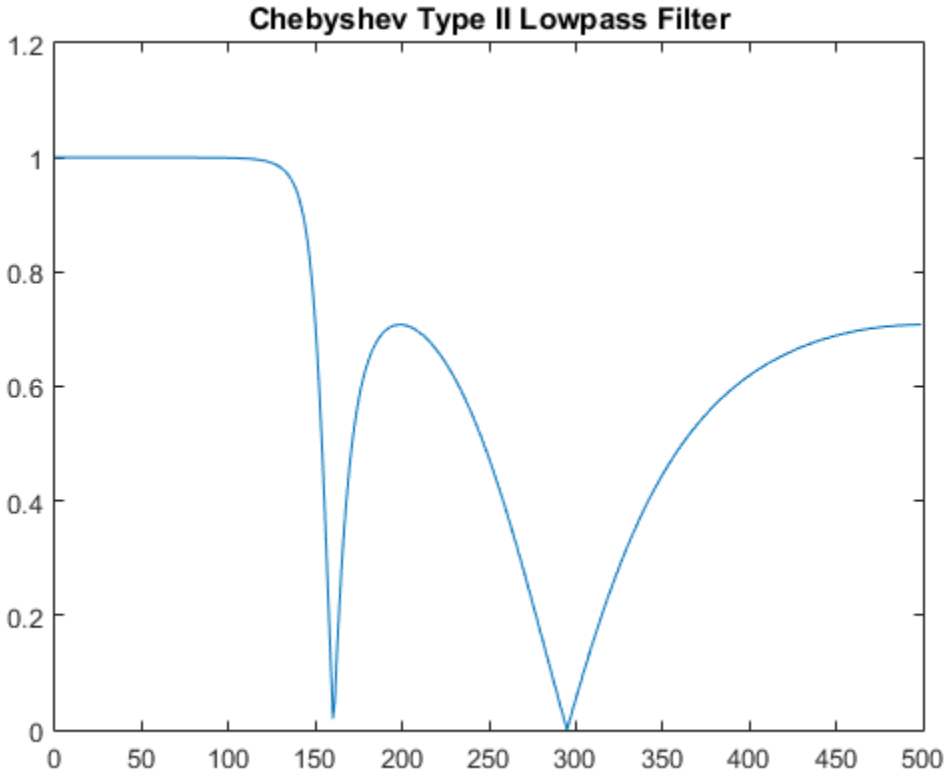
```
[b,a] = butter(n,Wn);
[h,w] = freqz(b,a);

W = w*Fs/pi;
h = abs(h);
figure();
plot(W,h);
title('Butterworth Filter')



[n,Wp] = cheb1ord(Wp,Ws,Ap,As);
[b,a] = cheby1(n,Ap,Wp);
[h,w] = freqz(b,a);
W = w*Fs/pi;
h = abs(h);
figure();
```

```
plot(W,h);
title('Chebyshev Type I Lowpass Filter')
```

```
[n,Wp] = cheb2ord(Wp,Ws,Ap,As);
[b,a] = cheby2(n,Ap,Wp);
[h,w] = freqz(b,a);
W = w*Fs/pi;
h = abs(h);
figure();
plot(W,h);
title('Chebyshev Type II Lowpass Filter')
```

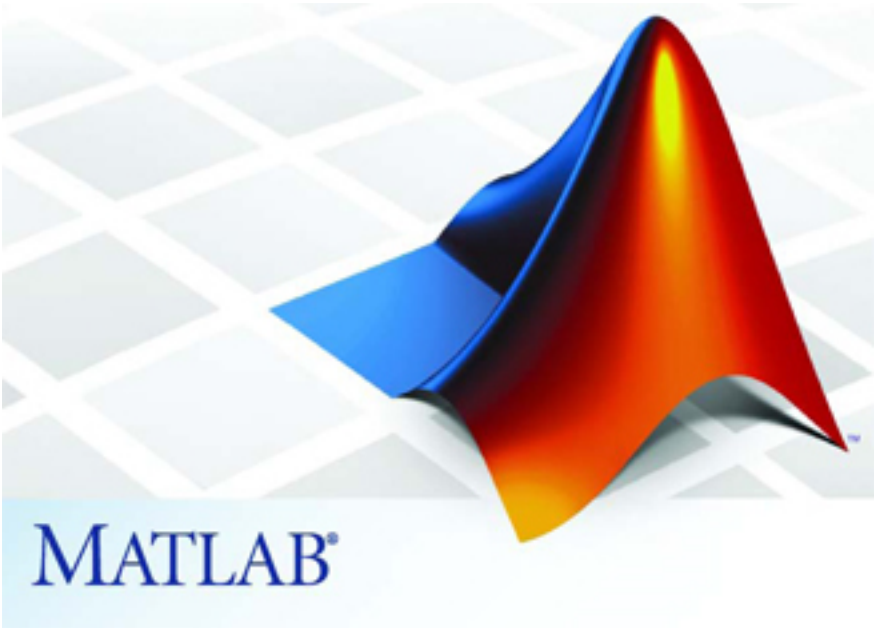



Chebyshev Type I Lowpass Filter
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
150
200
250
300
350
400
450
500


Chebyshev Type II Lowpass Filter
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
300
350
400
450
500

Author: Kaustubh Shivdikar

MATLAB Lab experiment of Linear to circular convolution.



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