6.26 Write a MATLAB script that uses *f_firideal* to design a linear-phase lowpass FIR filter of order $m = 40$ with passband cutoff frequency $F_p = f_s/5$ and stopband cutoff frequency $F_s = f_s/4$ where the sampling frequency is $f_s = 100$ Hz. Use a rectangular window, and set the ideal cutoff frequency to the middle of the transition band. Use *f_freqz* to compute and plot the magnitude response using the linear scale. Then use Table 6.2.3, the *hold on* command, and the *fill* function to add the following items to your magnitude response plot.

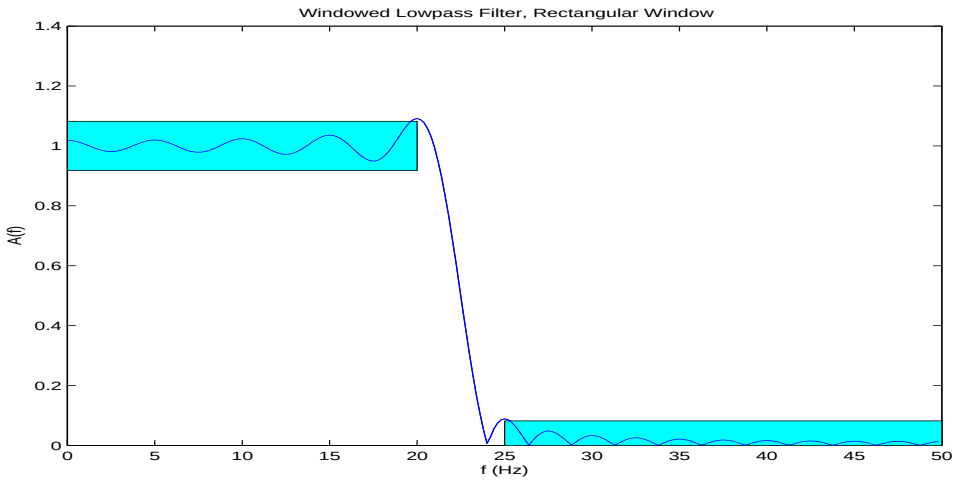
(a) A shaded area showing the passband ripple, δ_p.

(b) A shaded area showing the stopband attenuation, δ_s.

Solution

```
% Problem 6.26

% Initialize

clear
clc
fs = 100;
F_p = fs/5
F_s = fs/4

% Design filter

f_type = 0;
F_c = (F_p + F_s)/2
m = 40;
win =  0;
b = f_firideal (f_type,F_c,m,fs,win);

% Compute and plot magnitude response

a = 1;
N = 250;
[H,f] = f_freqz (b,a,N,fs);
A = abs(H);
figure
plot (f,A);
f_labels ('Windowed Lowpass Filter, Rectangular Window','f (Hz)','A(f)')

% Add specifications

hold on
delta_p = 0.0819
delta_s = 0.0819
fill ([0 F_p F_p 0],[1-delta_p,1-delta_p, 1+delta_p, 1+delta_p],'c')
fill ([F_s fs/2 fs/2 F_s],[0 0 delta_s delta_s],'c')
```

```
plot(f,A)
f_wait
```



Windowed Lowpass Filter Using Rectangular Window