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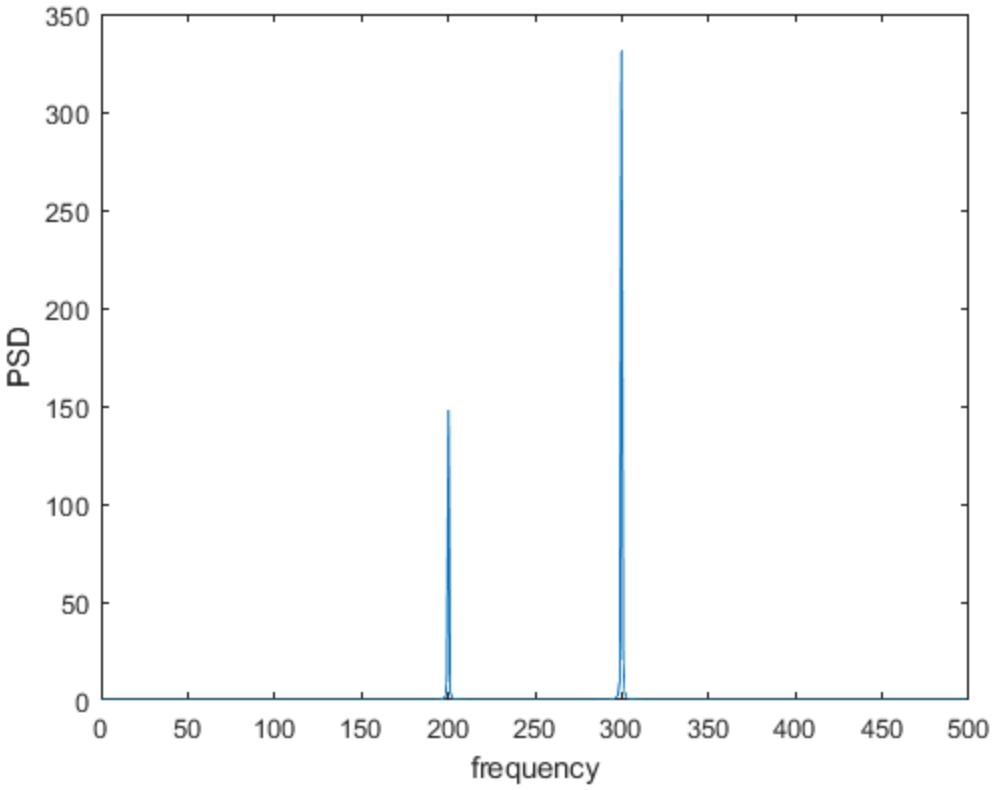
```
clc;
clear;
```

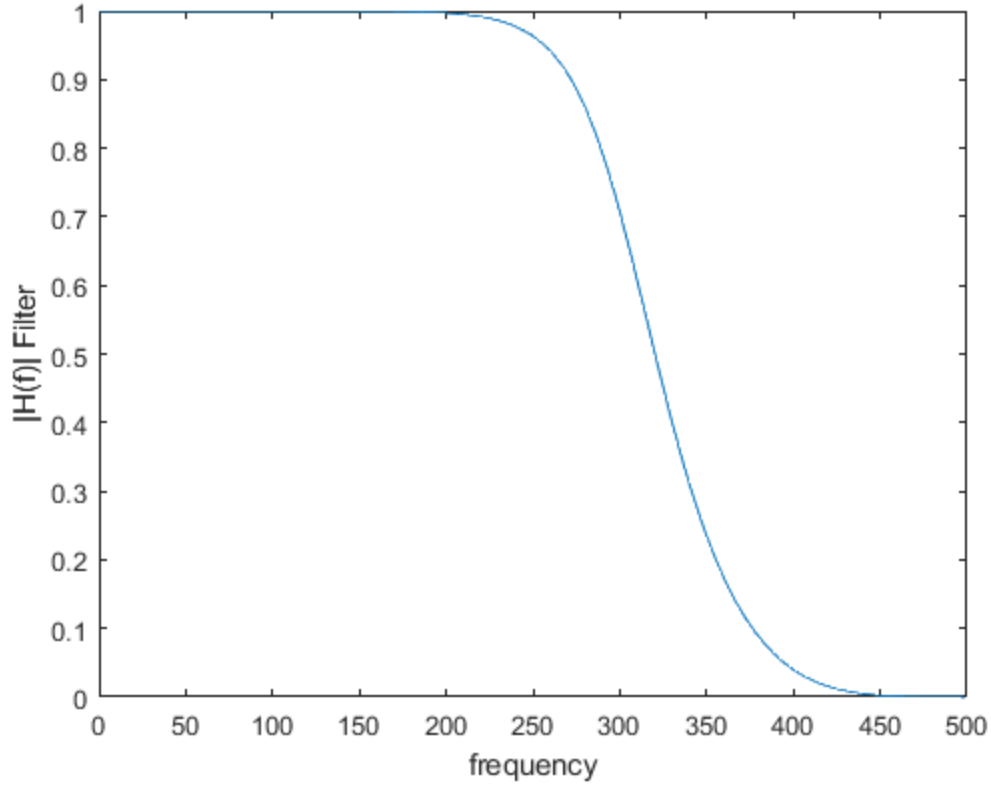
Task 2, script

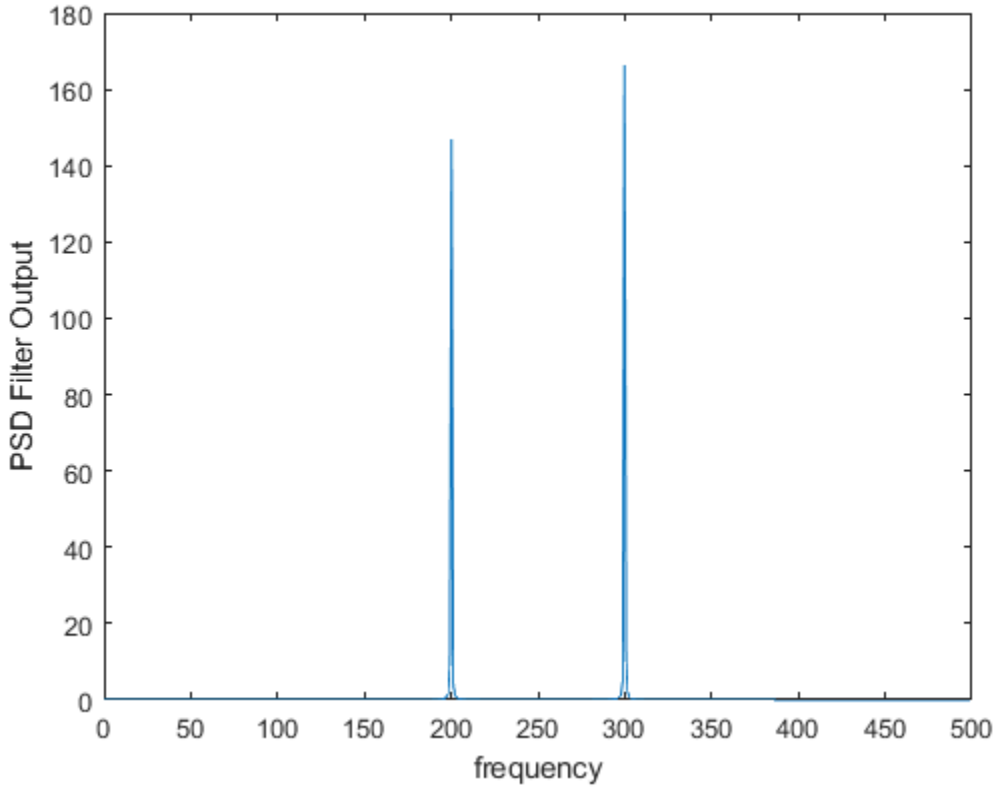
```
%echo on
ts =0.001; % sample period
fs =1/ts;
t = [0:ts:10]; %time variable
x=0.8*cos(2*pi*200*t)+1.2*cos(2*pi*300*t); % signal with two
 frequencies
pwr = sum(x.*x)/length(t) %average power in signal
xd = fft(x,1024); %discrete transform
psd = ts*abs(xd).^2; %power spectral density
[b,a] = butter(4,300/500); %300 Hz cut-off, & returns b and a
 coefficients for H(z)
[h,w] = freqz(b,a,512); %provides complex frequency response from
 coefficients
h2 = abs(h).^2; %transfer function squared
f = w*500/pi; %converts normalized angular frequency to frequency
pxsd = psd(1:512); %positive frequency portion of power spectral
 density
%pause %Press key to see power spectral density of signal
figure(1);
plot(f,pxsd);
xlabel('frequency');
ylabel('PSD')
%pause %Press key to see filter response
figure(2);
plot(f,abs(h));
xlabel('frequency');
ylabel('|H(f)| Filter')
popsd = pxsd.*h2';
%pause %Press key to see output psd
figure(3);
plot(f,popsd);
xlabel('frequency');
ylabel('PSD Filter Output')
```

```
pwr =
```

```
1.0403
```




|H(f)| Filter
frequency
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150
200
250
300
350
400
450
500


PSD Filter Output
frequency
0
20
40
60
80
100
120
140
160
180
0
50
100
150
200
250
300
350
400
450
500

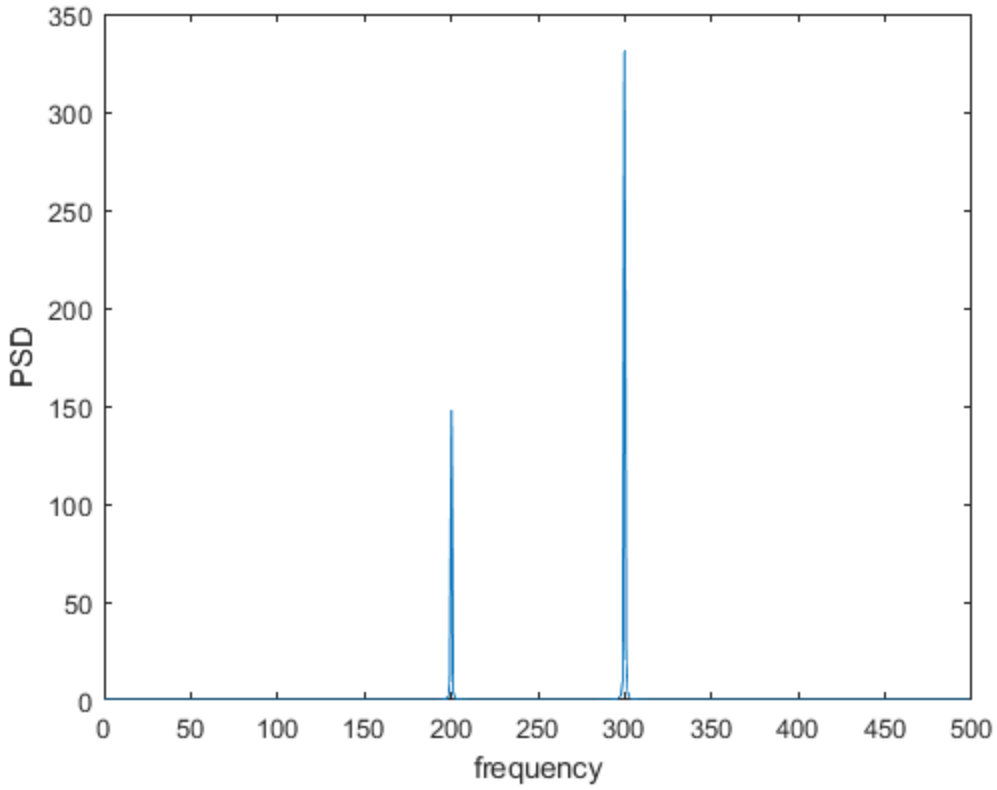
Task 2, part 2

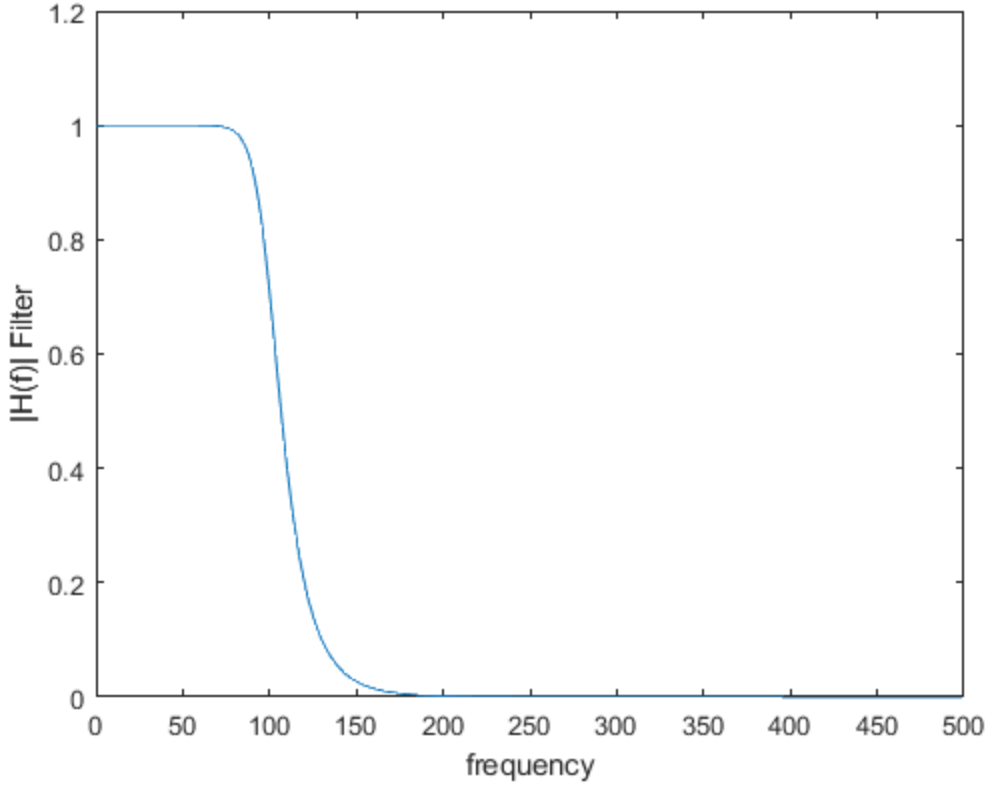
8th order Butterworth with a cutoff of 100Hz

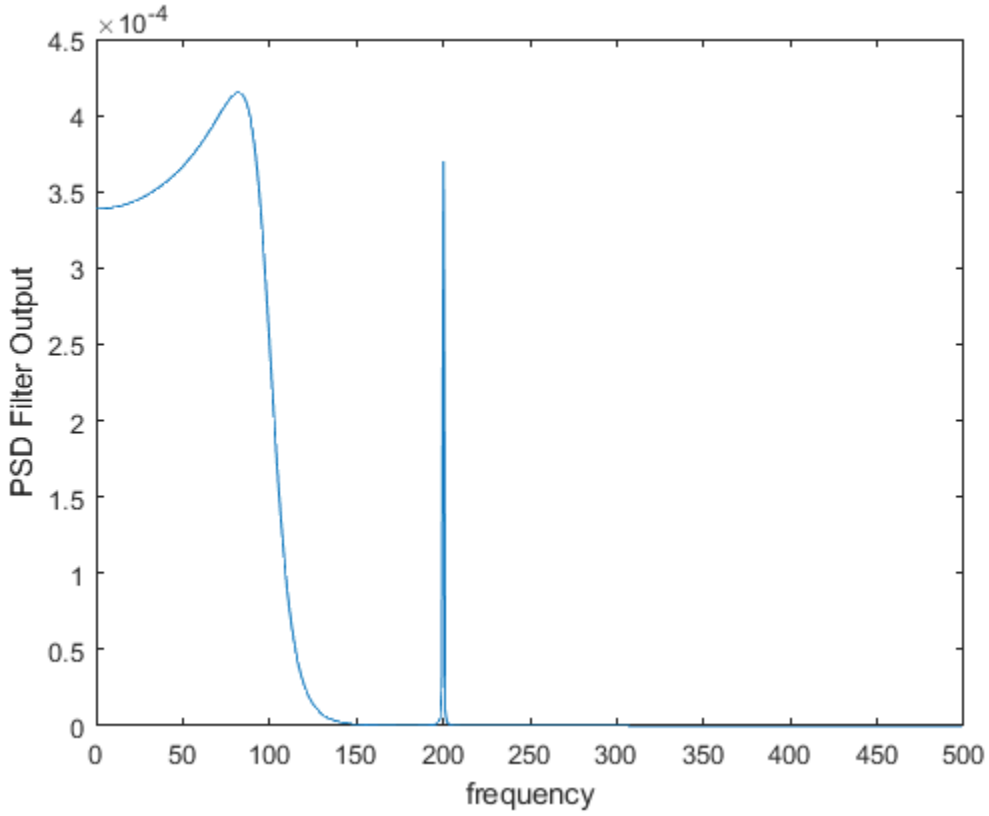
```
%echo on
ts = 0.001;
fs = 1/ts;
t = [0:ts:10];
x = 0.8*cos(2*pi*200*t)+1.2*cos(2*pi*300*t);
pwr = sum(x.*x)/length(t)
xd = fft(x,1024);
psd = ts*abs(xd).^2;
[b,a] = butter(8,100/500)
[h,w] = freqz(b,a,512);
h2 = abs(h).^2;
f = w*500/pi;
pxsd = psd(1:512);
%pause
figure(4)
plot(f,pxsd);xlabel('frequency');
ylabel('PSD')
%pause
figure(5)
plot(f,abs(h));
xlabel('frequency');
ylabel('|H(f)| Filter')
popsd = pxsd.*h2';
%pause
figure(6)
plot(f,popsd);
xlabel('frequency');
ylabel('PSD Filter Output')
```

```
pwr =

    1.0403


b =

  Columns 1 through 7

    0.0000    0.0002    0.0007    0.0013    0.0017    0.0013    0.0007

  Columns 8 through 9

    0.0002    0.0000


a =

  Columns 1 through 7
```

```
  1.0000   -4.7845   10.4450  -13.4577   11.1293   -6.0253    2.0793

Columns 8 through 9

 -0.4172    0.0372
```



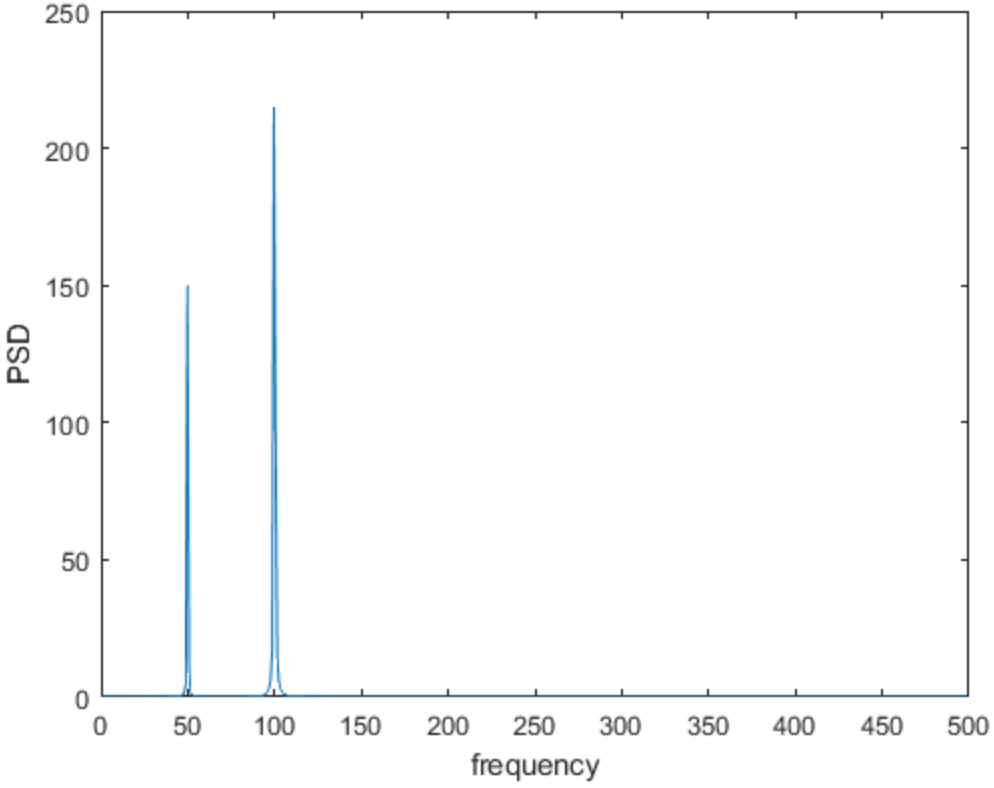

1.2
1
0.8
0.6
0.4
0.2
0
|H(f)| Filter
0
50
100
150
200
250
300
350
400
450
500
frequency

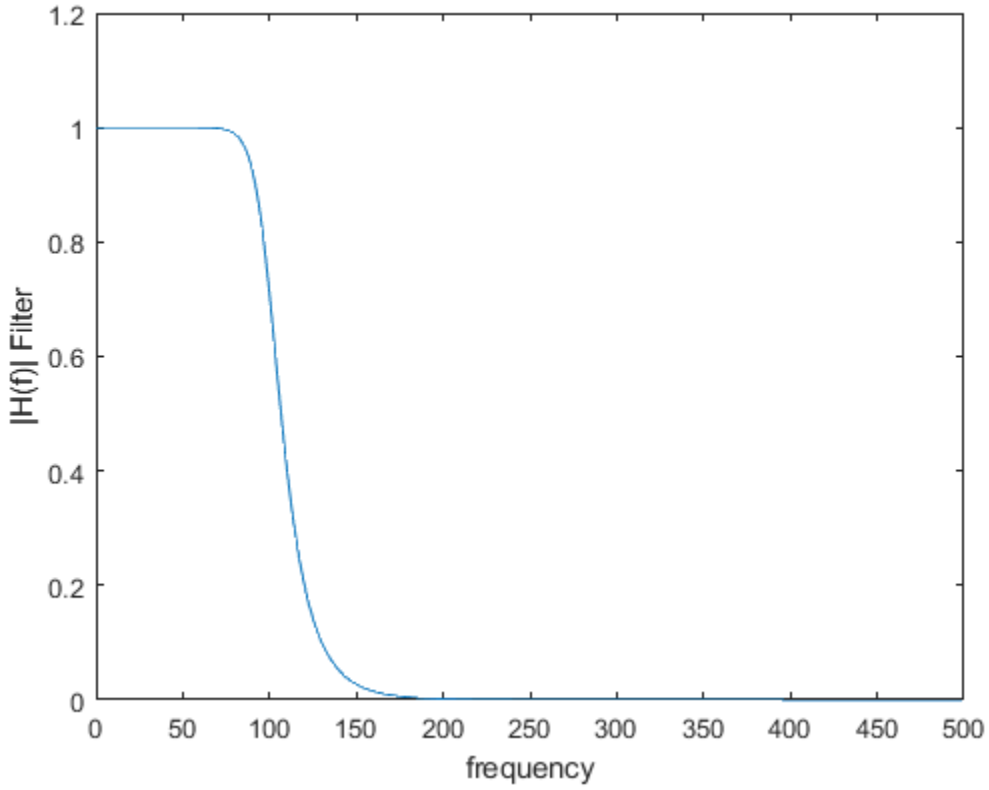

×10-4
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
PSD Filter Output
0
50
100
150
200
250
300
350
400
450
500
frequency

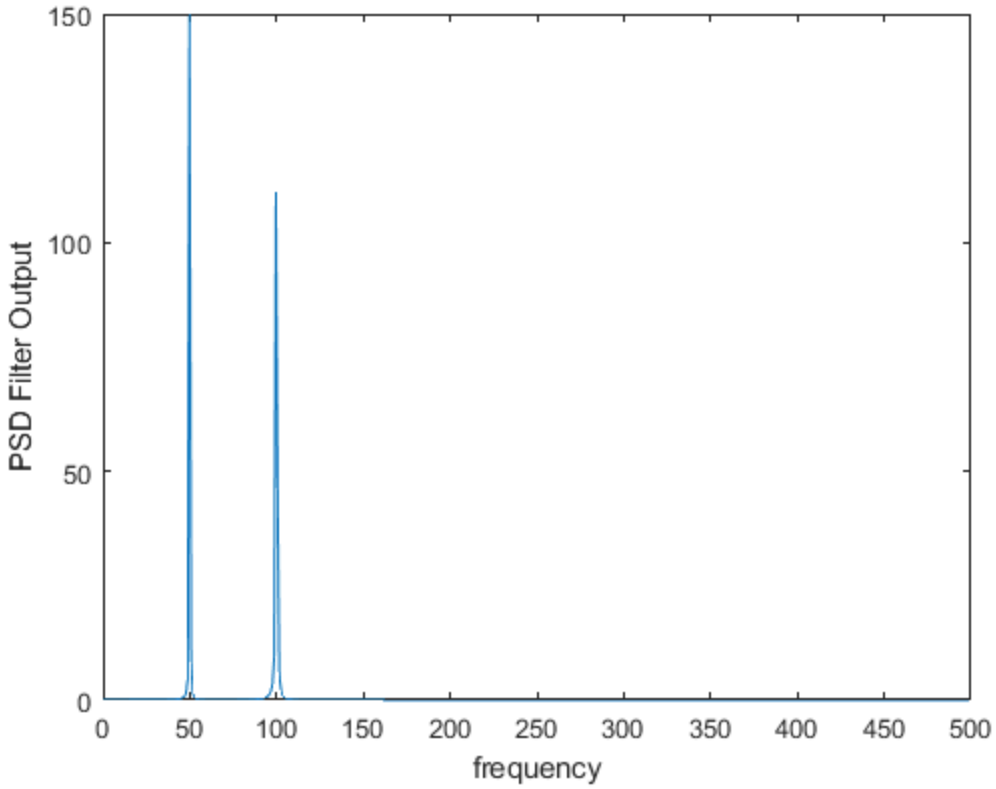
Task 2, part 3

50 and 100Hz signal considering 8th order Butterworth with a cutoff of 100Hz

```
%echo on
ts = 0.001;
fs = 1/ts;
t = [0:ts:10];
x = 0.8*cos(2*pi*50*t) + 1.2 * cos(2*pi*100*t);
pwr = sum (x .*x)/length(t);
xd = fft(x,1024);
psd = ts*abs(xd).^2;
[b,a] = butter(8,100/500);
[h,w] = freqz(b,a,512);
h2 = abs(h).^2;
f = w*500/pi;
pxsd = psd(1:512);
%pause
figure(7)
plot(f,pxsd);
xlabel('frequency');
ylabel('PSD');
%pause
figure(8);
plot(f,abs(h));
xlabel('frequency');
ylabel('|H(f)| Filter');
popsd = pxsd.*h2';
%pause
figure(9)
plot(f,popsd)
xlabel('frequency');
ylabel('PSD Filter Output');
```


PSD
frequency
0
50
100
150
200
250
300
350
400
450
500


|H(f)| Filter
frequency
0
0.2
0.4
0.6
0.8
1
1.2
50
100
150
200
250
300
350
400
450
500



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