```
% MATLAB script for Power Spectral Density
clc;  clear all; close all;
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
figure(1) %Press key to see power spectral density of signal
plot(f,pxsd);xlabel('frequency');ylabel('PSD');title('Part 1');
figure(2)%Press key to see filter response
plot(f,abs(h));xlabel('frequency');ylabel('|H(f)| Filter');title('Part
 1');
popsd=pxsd.*h2';
figure(3)%Press key to see output psd
plot(f,popsd);xlabel('frequency');ylabel('PSD Filter
 Output');title('Part 1');

%part 2 8th order filter 100Hz cutoff

% MATLAB script for Power Spectral Density
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(8,100/500);  %100 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
figure(4) %Press key to see power spectral density of signal
plot(f,pxsd);xlabel('frequency');ylabel('PSD');title('Part 2');
figure(5)%Press key to see filter response
plot(f,abs(h));xlabel('frequency');ylabel('|H(f)| Filter');title('Part
 2');
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popsd=pxsd.*h2';
figure(6)%Press key to see output psd
plot(f,popsd);xlabel('frequency');ylabel('PSD Filter
 Output');title('Part 2');

%Move on to Part III, 8th Order Filter, 50 and 100 Hz freq

% MATLAB script for Power Spectral Density
echo on
ts=0.001;   % sample period
fs=1/ts;
t=[0:ts:10];  %time variable
x=0.8*cos(2*pi*50*t)+1.2*cos(2*pi*100*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(8,100/500);  %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
figure(7) %Press key to see power spectral density of signal
plot(f,pxsd);xlabel('frequency');ylabel('PSD');title('Part 3');
figure(8)%Press key to see filter response
plot(f,abs(h));xlabel('frequency');ylabel('|H(f)| Filter');title('Part
 3');
popsd=pxsd.*h2';
figure(9)%Press key to see output psd
plot(f,popsd);xlabel('frequency');ylabel('PSD Filter
 Output');title('Part 3');
```

```
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

pwr =

    1.0403

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
```

```
figure(1) %Press key to see power spectral density of signal
plot(f,pxsd);xlabel('frequency');ylabel('PSD');title('Part 1');
figure(2)%Press key to see filter response
plot(f,abs(h));xlabel('frequency');ylabel('|H(f)| Filter');title('Part
 1');
popsd=pxsd.*h2';
figure(3)%Press key to see output psd
plot(f,popsd);xlabel('frequency');ylabel('PSD Filter
 Output');title('Part 1');

%part 2 8th order filter 100Hz cutoff

% MATLAB script for Power Spectral Density
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

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    1.0403

xd=fft(x,1024);%discrete transform
psd=ts*abs(xd).^2;  %power spectral density
[b,a]=butter(8,100/500);  %100 Hz cut-off, & returns b and a
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f=w*500/pi; %converts normalized angular frequency to frequency
pxsd=psd(1:512);%positive frequency portion of power spectral density
figure(4) %Press key to see power spectral density of signal
plot(f,pxsd);xlabel('frequency');ylabel('PSD');title('Part 2');
figure(5)%Press key to see filter response
plot(f,abs(h));xlabel('frequency');ylabel('|H(f)| Filter');title('Part
 2');
popsd=pxsd.*h2';
figure(6)%Press key to see output psd
plot(f,popsd);xlabel('frequency');ylabel('PSD Filter
 Output');title('Part 2');

%Move on to Part III, 8th Order Filter, 50 and 100 Hz freq

% MATLAB script for Power Spectral Density
echo on
ts=0.001;   % sample period
fs=1/ts;
t=[0:ts:10];  %time variable
x=0.8*cos(2*pi*50*t)+1.2*cos(2*pi*100*t); % signal with two
 frequencies
pwr=sum(x.*x)/length(t) %average power in signal
```

```
pwr =

    1.0403

xd=fft(x,1024);%discrete transform
psd=ts*abs(xd).^2;  %power spectral density
[b,a]=butter(8,100/500);  %300 Hz cut-off, & returns b and a
 coefficients for H(z)
[h,w]=freqz(b,a,512); %provides complex frequency response from
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h2=abs(h).^2;%transfer function squared
f=w*500/pi; %converts normalized angular frequency to frequency
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plot(f,abs(h));xlabel('frequency');ylabel('|H(f)| Filter');title('Part
 3');
popsd=pxsd.*h2';
figure(9)%Press key to see output psd
plot(f,popsd);xlabel('frequency');ylabel('PSD Filter
 Output');title('Part 3');
```
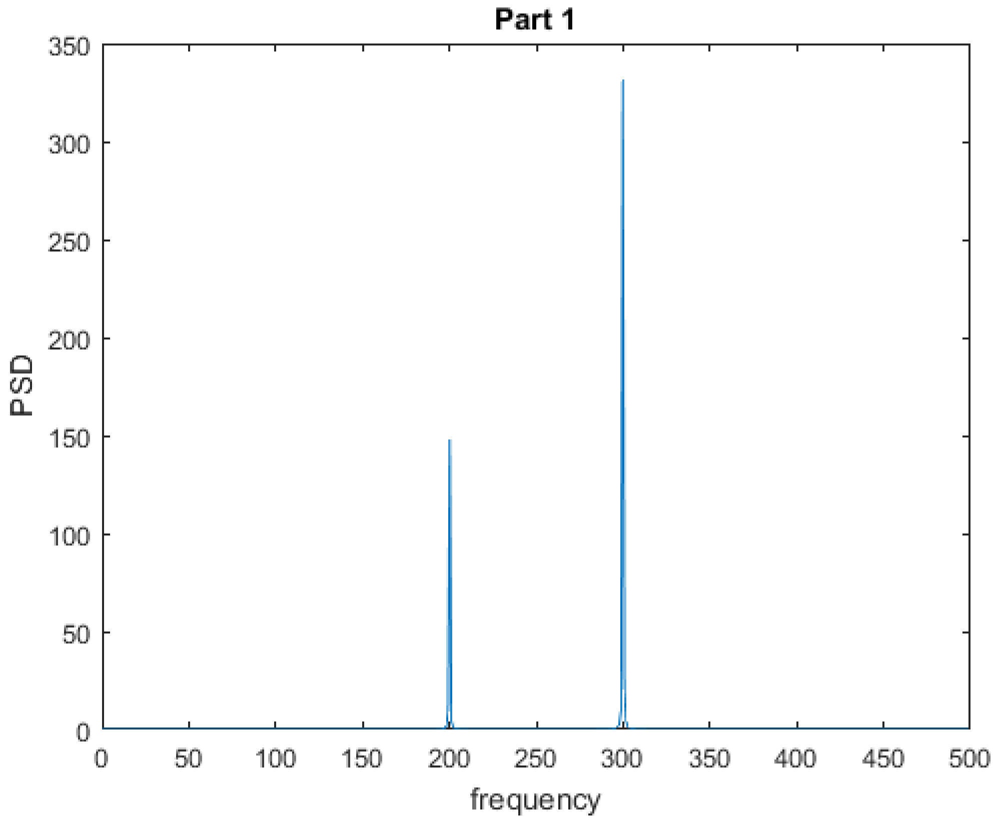
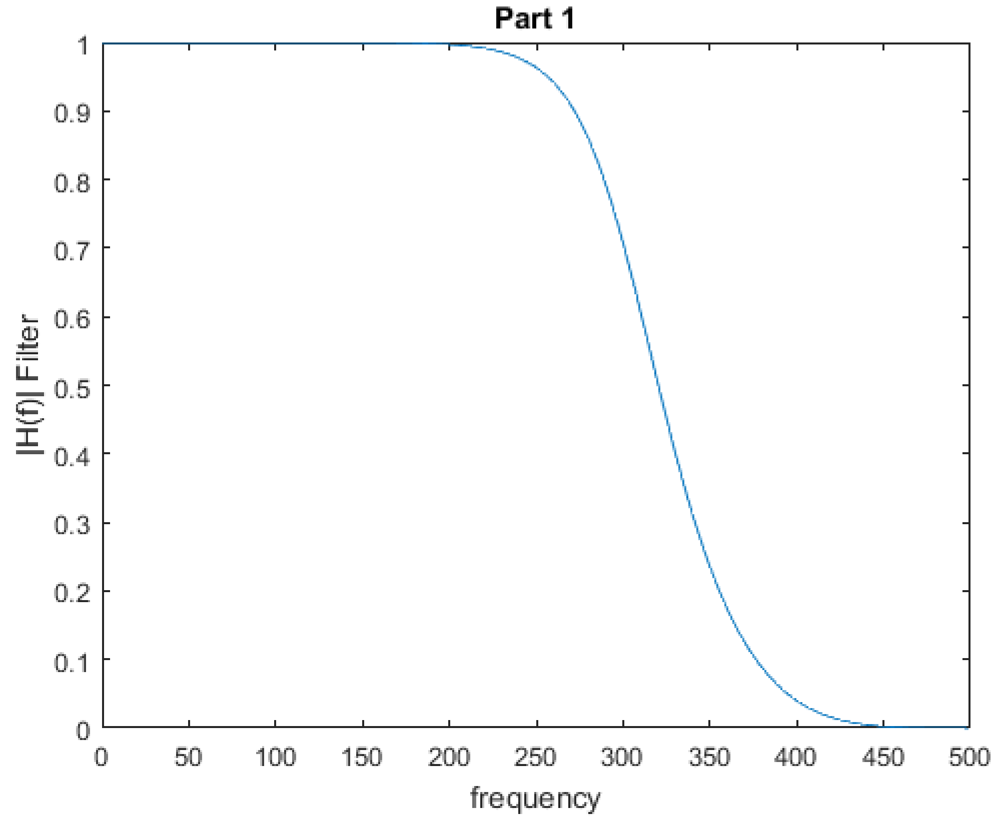
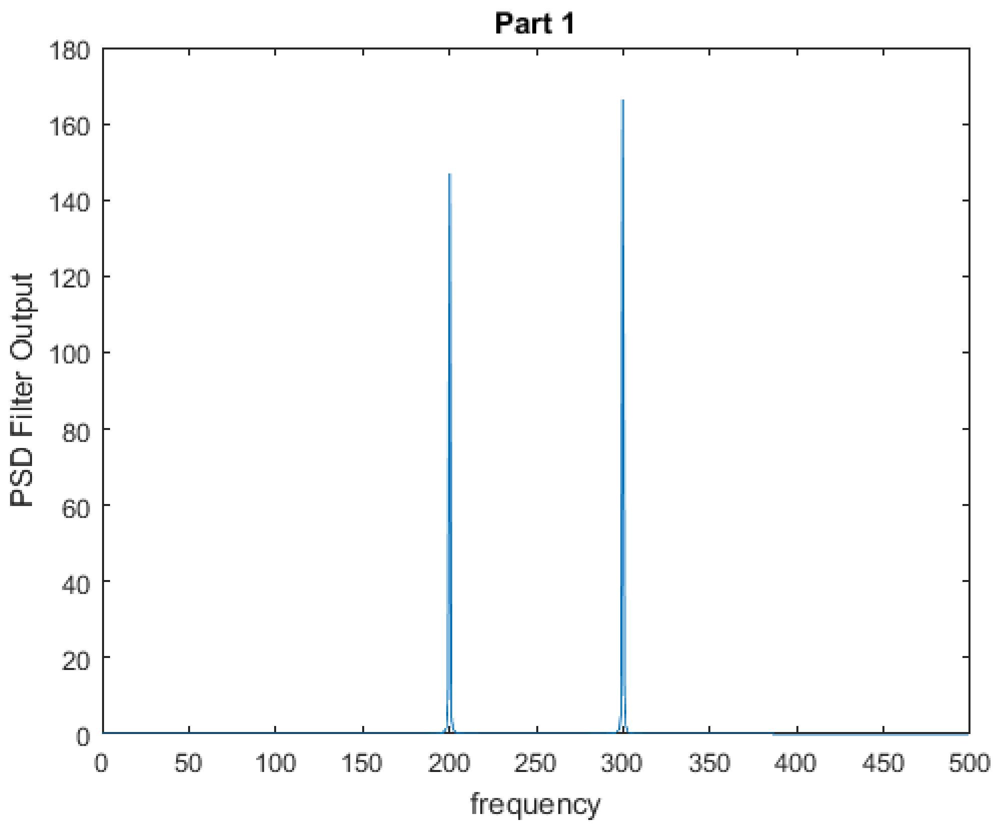
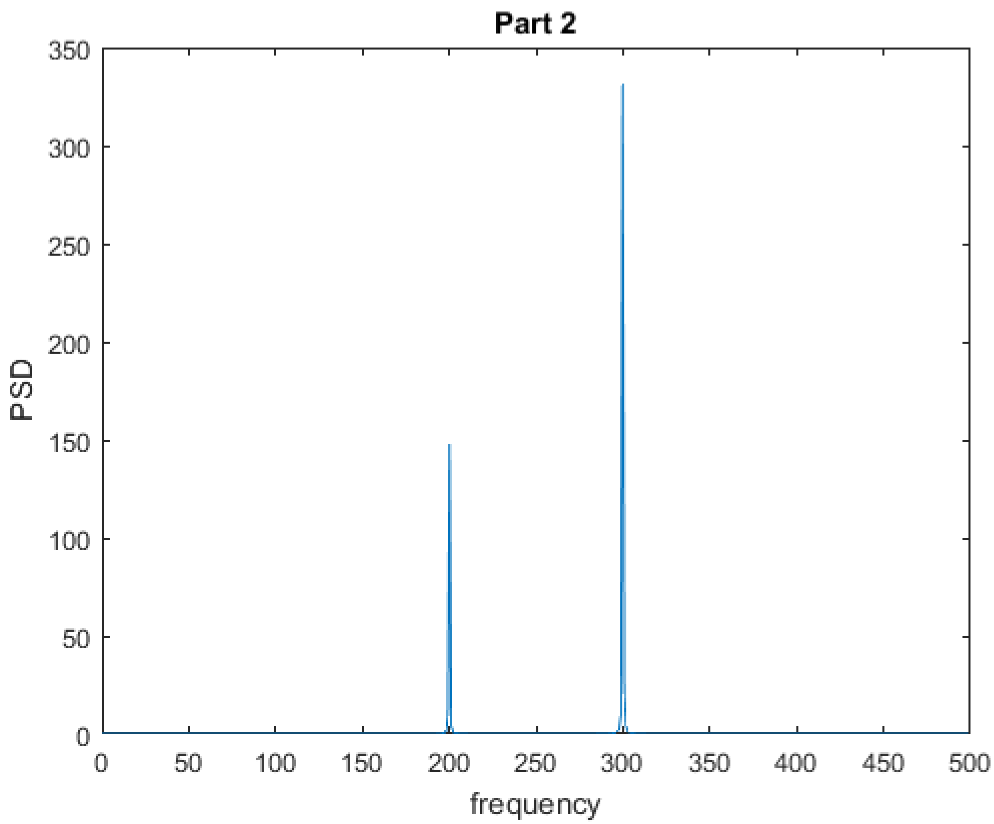
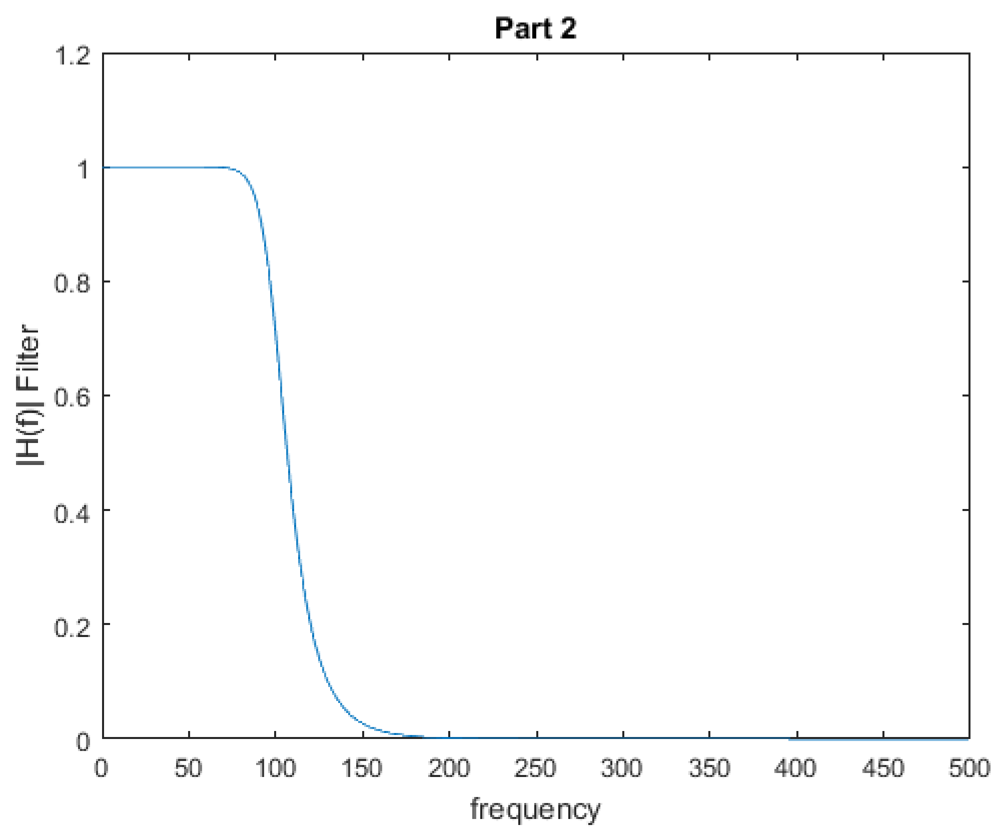
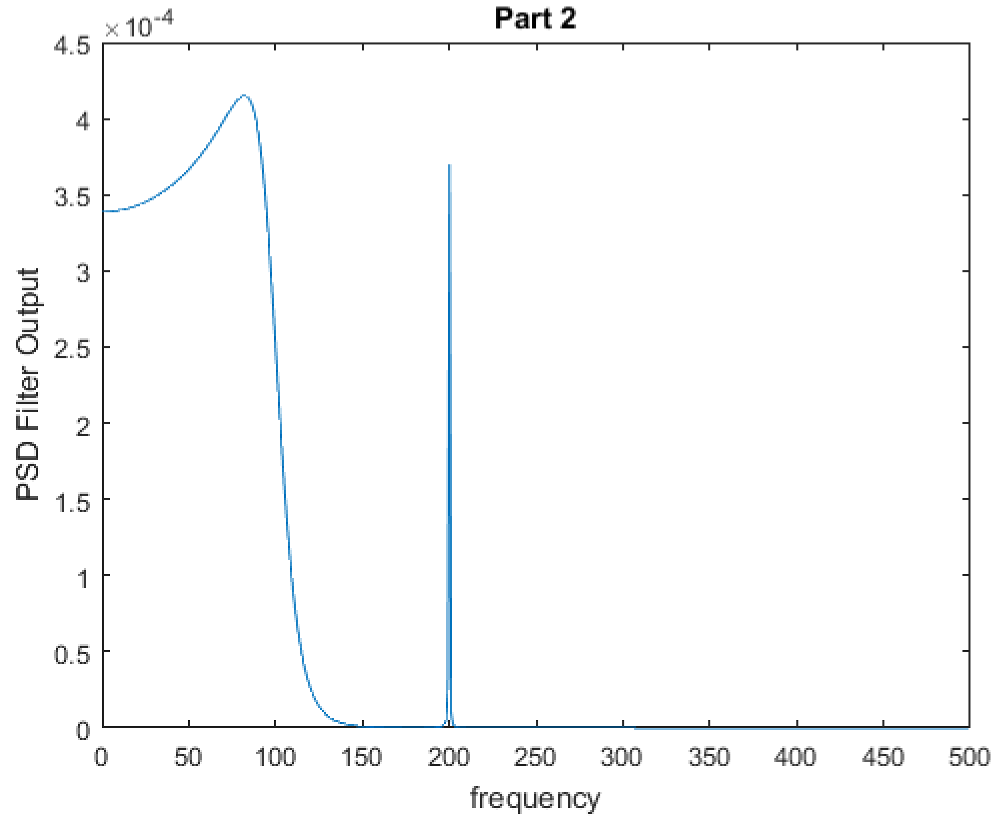



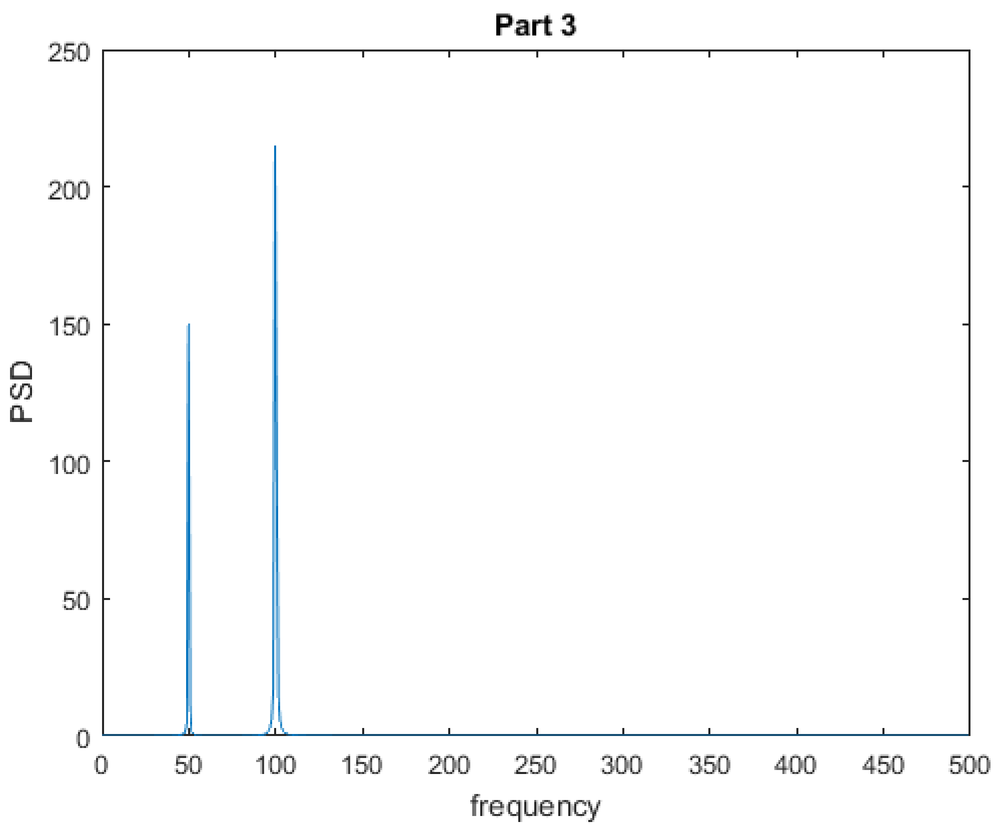

Part 1
|H(f)| Filter
frequency
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
50
100
150
200
250
300
350
400
450
500

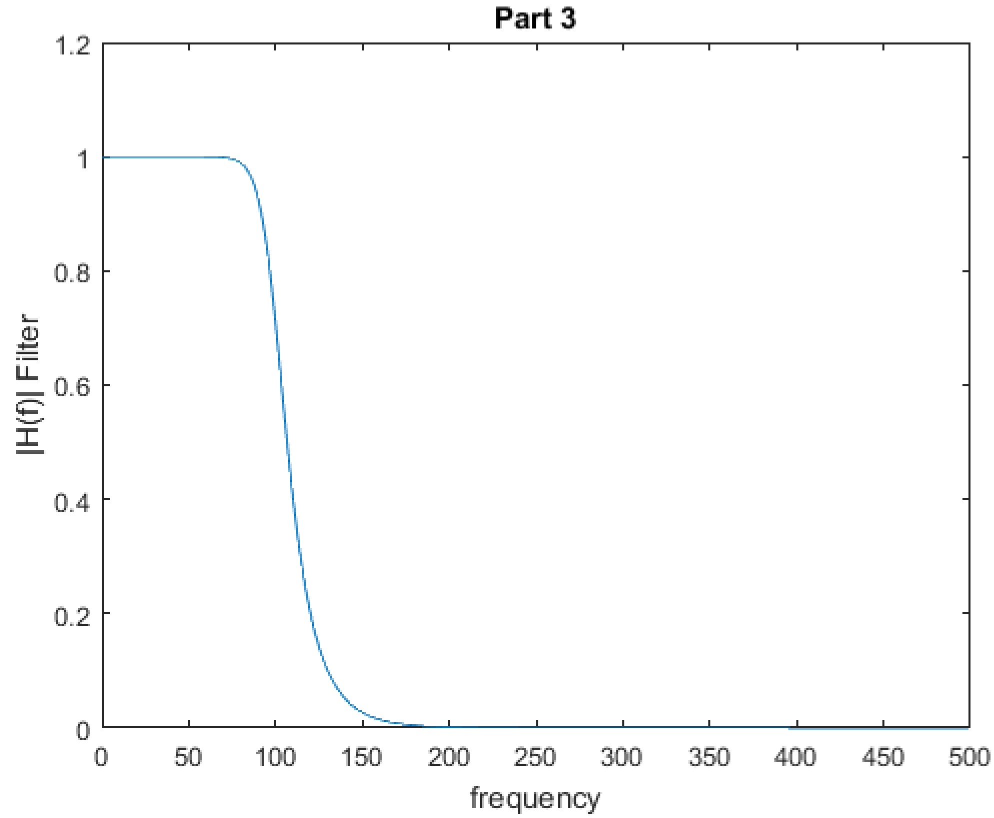

Part 1
PSD Filter Output
frequency
0
20
40
60
80
100
120
140
160
180
50
100
150
200
250
300
350
400
450
500

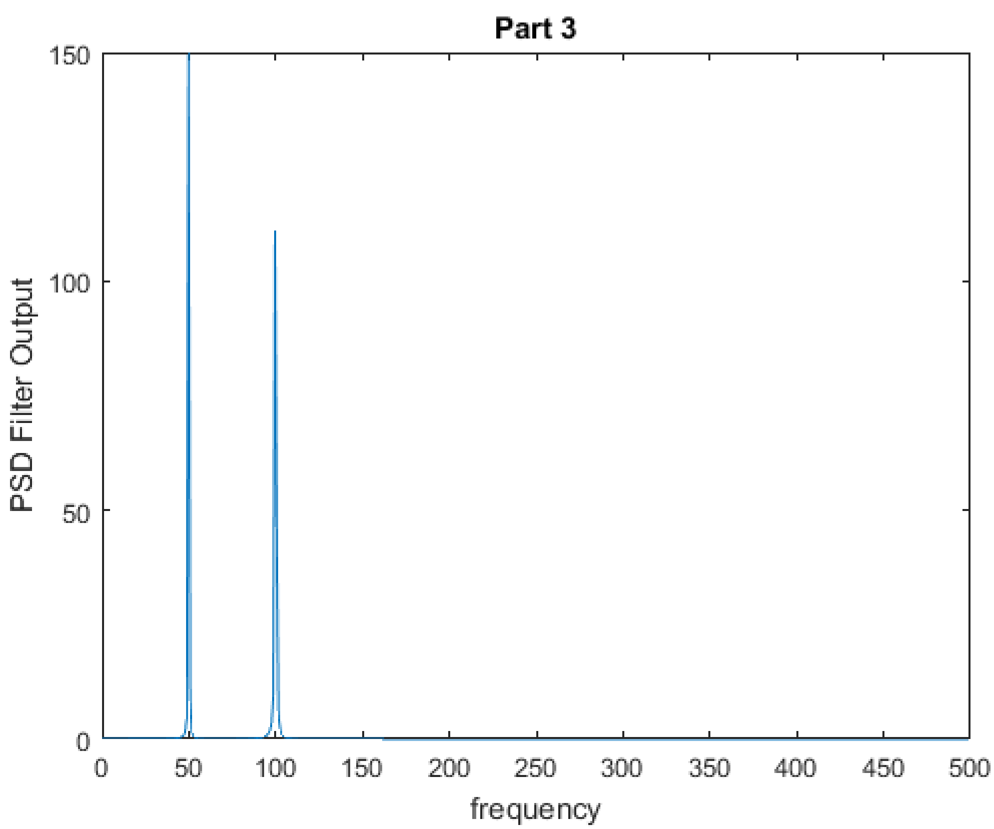

Part 2
PSD
frequency
0
50
100
150
200
250
300
350
400
450
500


Part 2
|H(f)| Filter
frequency
0
0.2
0.4
0.6
0.8
1
1.2


Part 2
×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


Part 3
250
200
150
100
50
0
PSD
0
50
100
150
200
250
300
350
400
450
500
frequency


Part 3
|H(f)| Filter
frequency
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
300
350
400
450
500


Part 3
PSD Filter Output
frequency
150
100
50
0
0
50
100
150
200
250
300
350
400
450
500

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