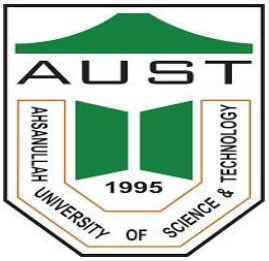



# Ahsanullah University of Science & Technology

## DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

## OPEN ENDED LAB REPORT

**Course No** : EEE 3218

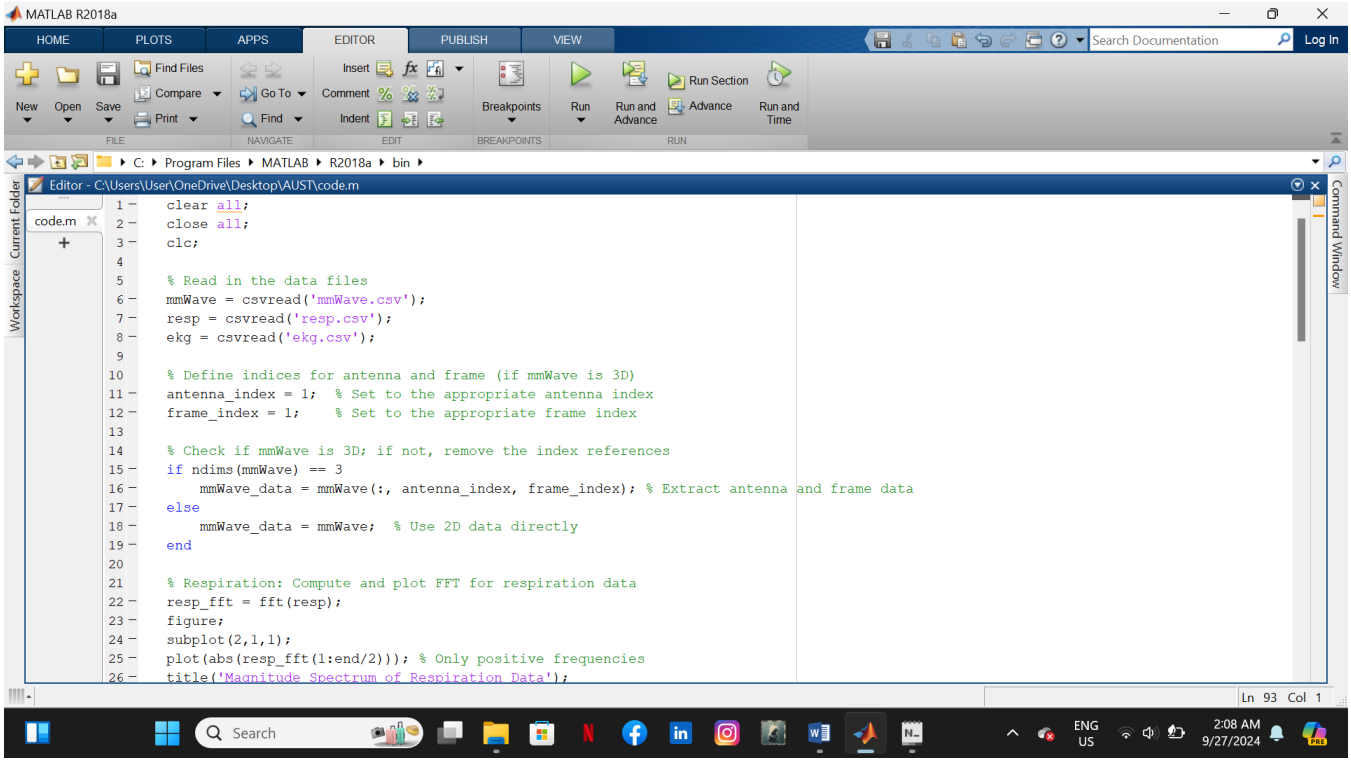
**Course Name** : Digital Signal Processing Lab .

**Submitted By ,**

**Name** : Akash Barua

**ID** : 190105009

**Section** : A1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Editor - C:\Users\User\OneDrive\Desktop\AUST\code.m
code.m
Current Folder
Workspace
Command Window
1 clear all;
2 close all;
3 clc;
4
5 % Read in the data files
6 mmWave = csvread('mmWave.csv');
7 resp = csvread('resp.csv');
8 ekg = csvread('ekg.csv');
9
10 % Define indices for antenna and frame (if mmWave is 3D)
11 antenna_index = 1; % Set to the appropriate antenna index
12 frame_index = 1; % Set to the appropriate frame index
13
14 % Check if mmWave is 3D; if not, remove the index references
15 if ndims(mmWave) == 3
16 mmWave_data = mmWave(:, antenna_index, frame_index); % Extract antenna and frame data
17 else
18 mmWave_data = mmWave; % Use 2D data directly
19 end
20
21 % Respiration: Compute and plot FFT for respiration data
22 resp_fft = fft(resp);
23 figure;
24 subplot(2,1,1);
25 plot(abs(resp_fft(1:end/2))); % Only positive frequencies
26 title('Magnitude Spectrum of Respiration Data');
Ln 93 Col 1
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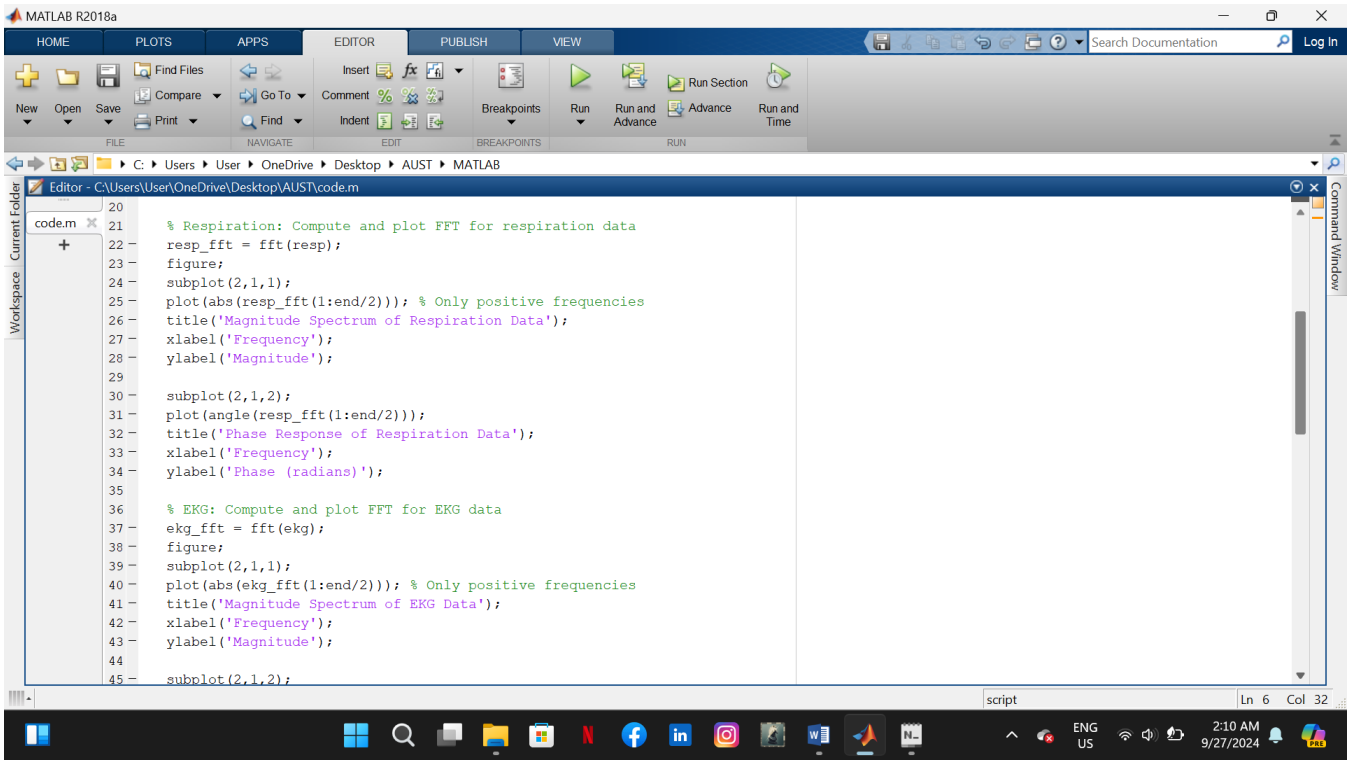
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Workspace
Command Window
20
21 % Respiration: Compute and plot FFT for respiration data
22 resp_fft = fft(resp);
23 figure;
24 subplot(2,1,1);
25 plot(abs(resp_fft(1:end/2))); % Only positive frequencies
26 title('Magnitude Spectrum of Respiration Data');
27 xlabel('Frequency');
28 ylabel('Magnitude');
29
30 subplot(2,1,2);
31 plot(angle(resp_fft(1:end/2)));
32 title('Phase Response of Respiration Data');
33 xlabel('Frequency');
34 ylabel('Phase (radians)');
35
36 % EKG: Compute and plot FFT for EKG data
37 ekg_fft = fft(ekg);
38 figure;
39 subplot(2,1,1);
40 plot(abs(ekg_fft(1:end/2))); % Only positive frequencies
41 title('Magnitude Spectrum of EKG Data');
42 xlabel('Frequency');
43 ylabel('Magnitude');
44
45 subplot(2,1,2);
script
Ln 6 Col 32
ENG
US
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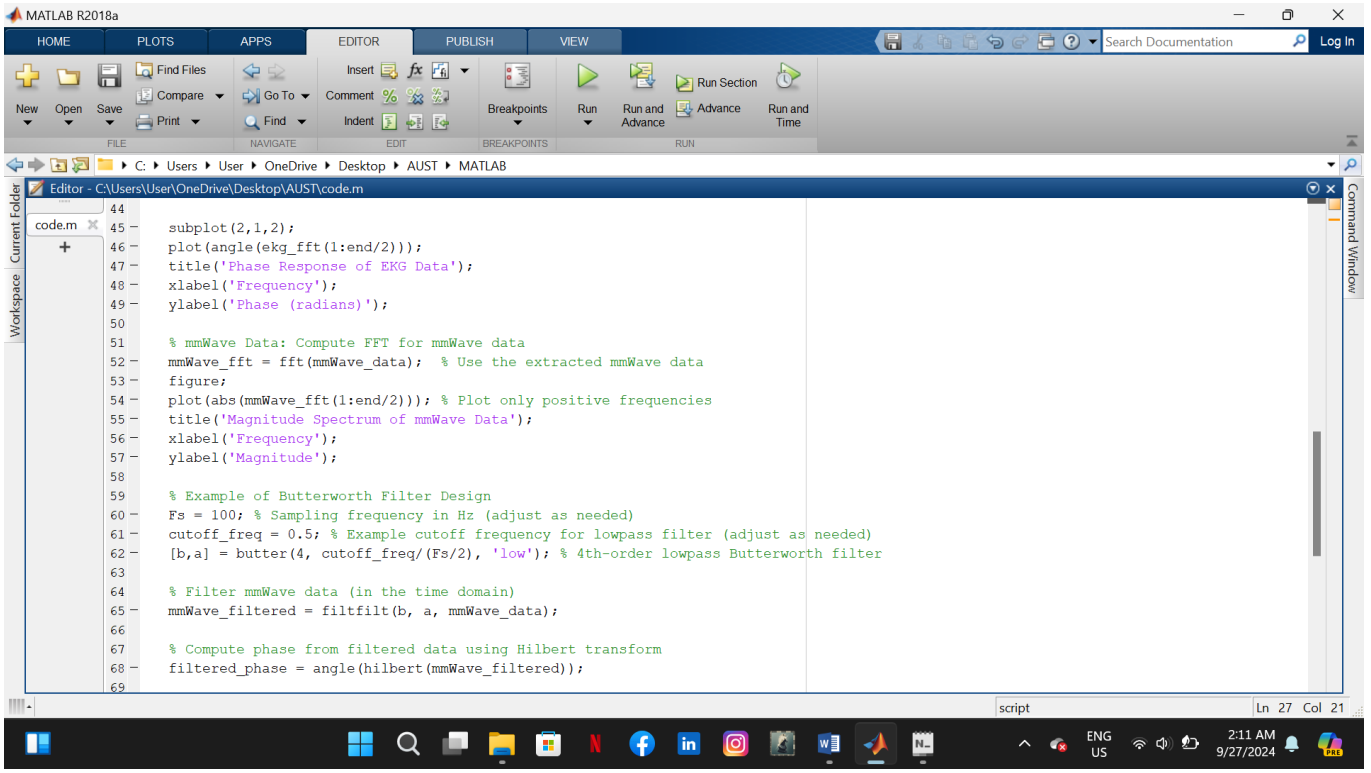
9/27/2024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44
45 subplot(2,1,2);
46 plot(angle(ekg_fft(1:end/2)));
47 title('Phase Response of EKG Data');
48 xlabel('Frequency');
49 ylabel('Phase (radians)');
50
51 % mmWave Data: Compute FFT for mmWave data
52 mmWave_fft = fft(mmWave_data); % Use the extracted mmWave data
53 figure;
54 plot(abs(mmWave_fft(1:end/2))); % Plot only positive frequencies
55 title('Magnitude Spectrum of mmWave Data');
56 xlabel('Frequency');
57 ylabel('Magnitude');
58
59 % Example of Butterworth Filter Design
60 Fs = 100; % Sampling frequency in Hz (adjust as needed)
61 cutoff_freq = 0.5; % Example cutoff frequency for lowpass filter (adjust as needed)
62 [b,a] = butter(4, cutoff_freq/(Fs/2), 'low'); % 4th-order lowpass Butterworth filter
63
64 % Filter mmWave data (in the time domain)
65 mmWave_filtered = filtfilt(b, a, mmWave_data);
66
67 % Compute phase from filtered data using Hilbert transform
68 filtered_phase = angle(hilbert(mmWave_filtered));
69
script
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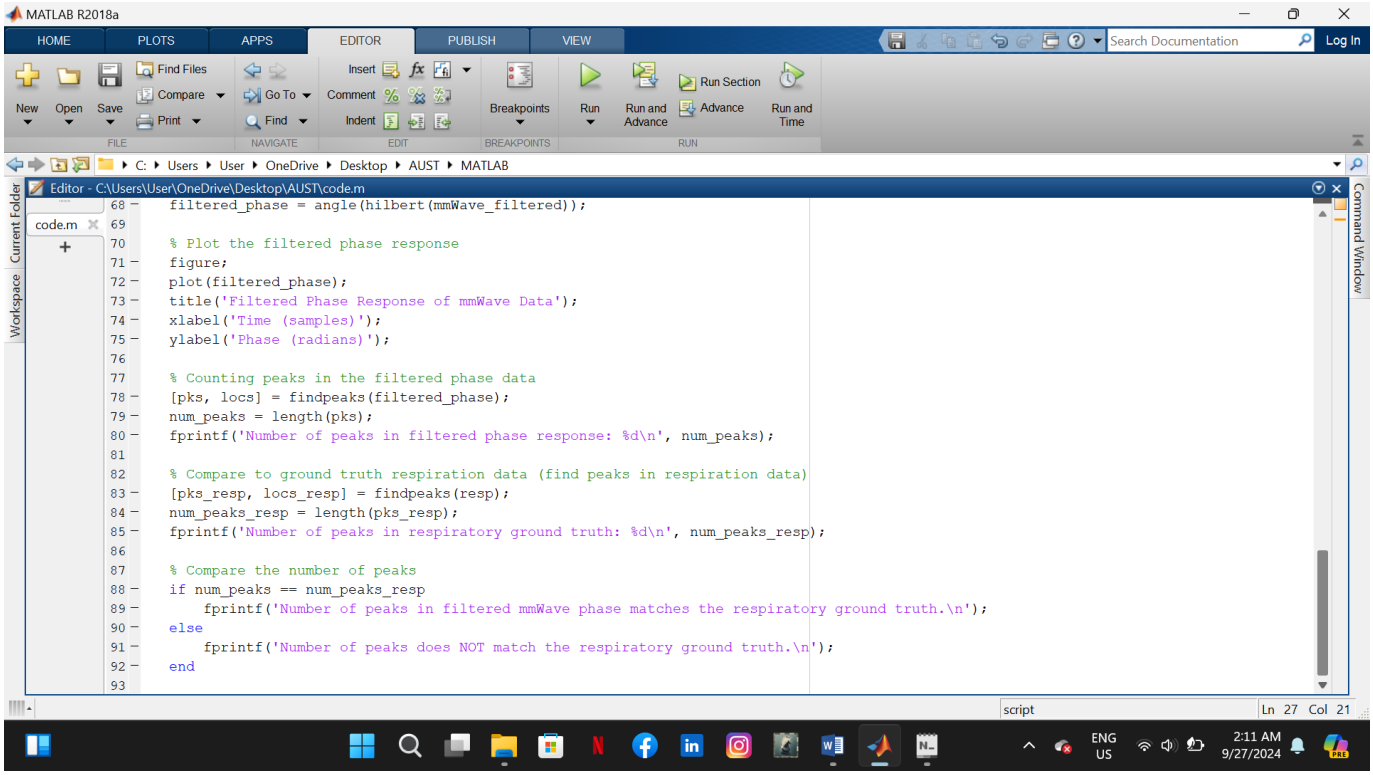
9/27/2024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Current Folder
Workspace
Command Window
68 filtered_phase = angle(hilbert(mmWave_filtered));
69
70 % Plot the filtered phase response
71 figure;
72 plot(filtered_phase);
73 title('Filtered Phase Response of mmWave Data');
74 xlabel('Time (samples)');
75 ylabel('Phase (radians)');
76
77 % Counting peaks in the filtered phase data
78 [pks, locs] = findpeaks(filtered_phase);
79 num_peaks = length(pks);
80 fprintf('Number of peaks in filtered phase response: %d\n', num_peaks);
81
82 % Compare to ground truth respiration data (find peaks in respiration data)
83 [pks_resp, locs_resp] = findpeaks(resp);
84 num_peaks_resp = length(pks_resp);
85 fprintf('Number of peaks in respiratory ground truth: %d\n', num_peaks_resp);
86
87 % Compare the number of peaks
88 if num_peaks == num_peaks_resp
89 fprintf('Number of peaks in filtered mmWave phase matches the respiratory ground truth.\n');
90 else
91 fprintf('Number of peaks does NOT match the respiratory ground truth.\n');
92 end
93
script
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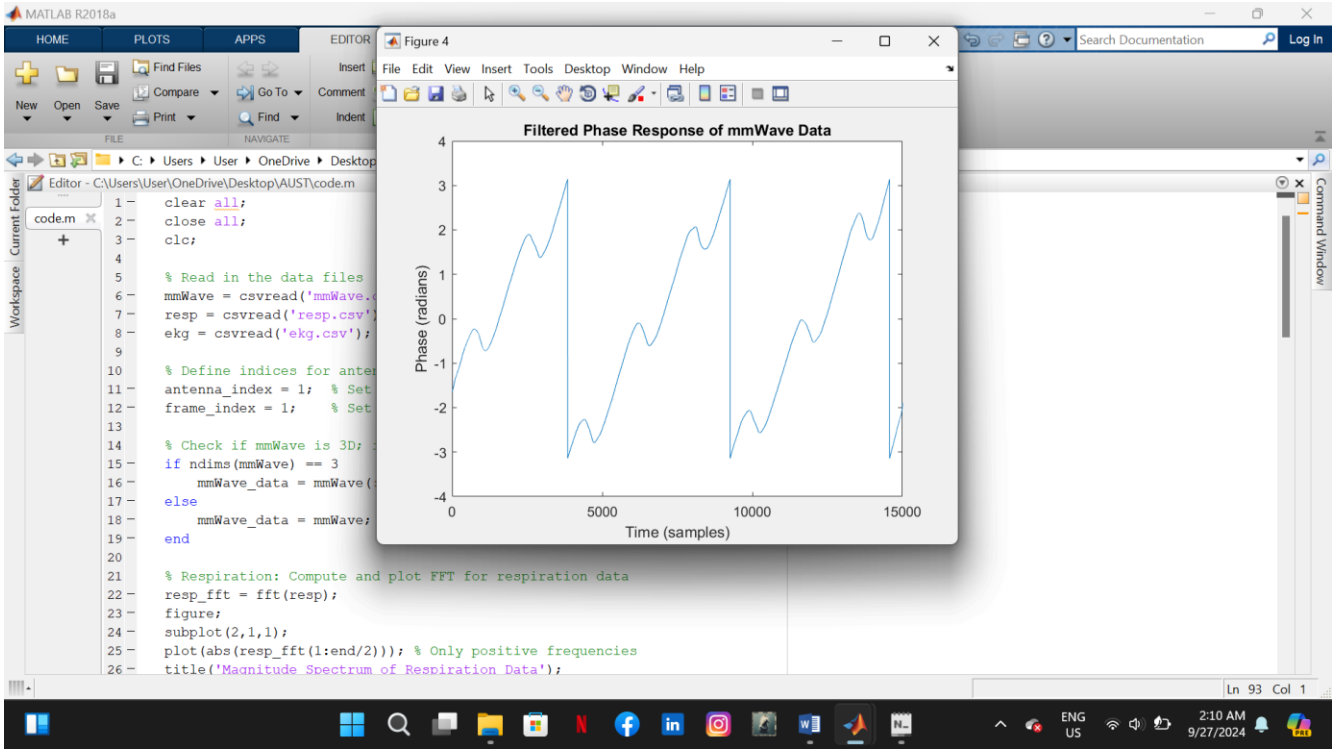
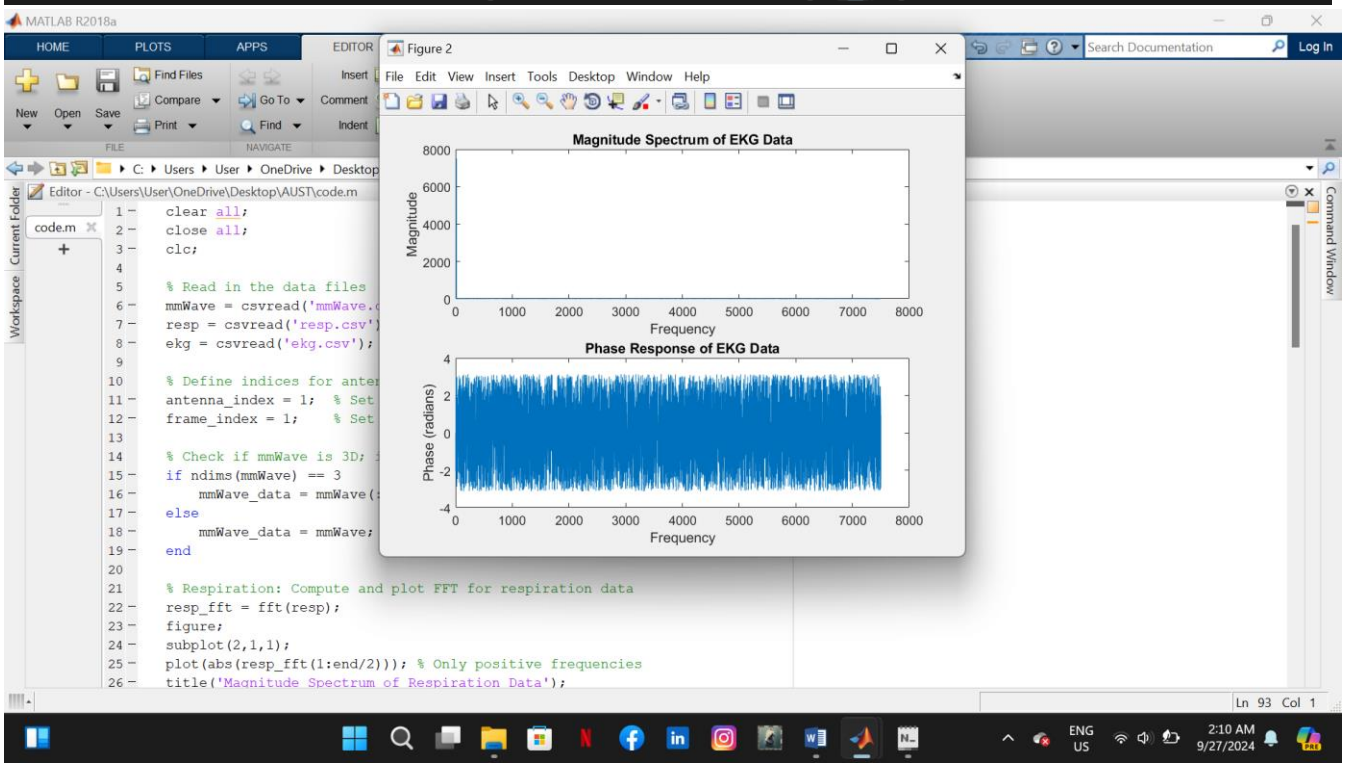

MATLAB R2018a
Figure 4
File Edit View Insert Tools Desktop Window Help
Filtered Phase Response of mmWave Data
Phase (radians)
Time (samples)
Editor - C:\Users\User\OneDrive\Desktop\AUST\code.m
code.m
clear all;
close all;
clc;
% Read in the data files
% Define indices for anter
antenna_index = 1; % Set
frame_index = 1; % Set
% Check if mmWave is 3D;
if ndims(mmWave) == 3
mmWave_data = mmWave(
else
mmWave_data = mmWave;
end
% Respiration: Compute and plot FFT for respiration data
resp_fft = fft(resp);
figure;
subplot(2,1,1);
plot(abs(resp_fft(1:end/2))); % Only positive frequencies
title('Magnitude Spectrum of Respiration Data');
Ln 93 Col 1


MATLAB R2018a
Figure 2
File Edit View Insert Tools Desktop Window Help
Magnitude Spectrum of EKG Data
Magnitude
Frequency
Phase Response of EKG Data
Phase (radians)
Frequency
Editor - C:\Users\User\OneDrive\Desktop\AUST\code.m
code.m
clear all;
close all;
clc;
% Read in the data files
% Define indices for anter
antenna_index = 1; % Set
frame_index = 1; % Set
% Check if mmWave is 3D;
if ndims(mmWave) == 3
mmWave_data = mmWave(
else
mmWave_data = mmWave;
end
% Respiration: Compute and plot FFT for respiration data
resp_fft = fft(resp);
figure;
subplot(2,1,1);
plot(abs(resp_fft(1:end/2))); % Only positive frequencies
title('Magnitude Spectrum of Respiration Data');
Ln 93 Col 1

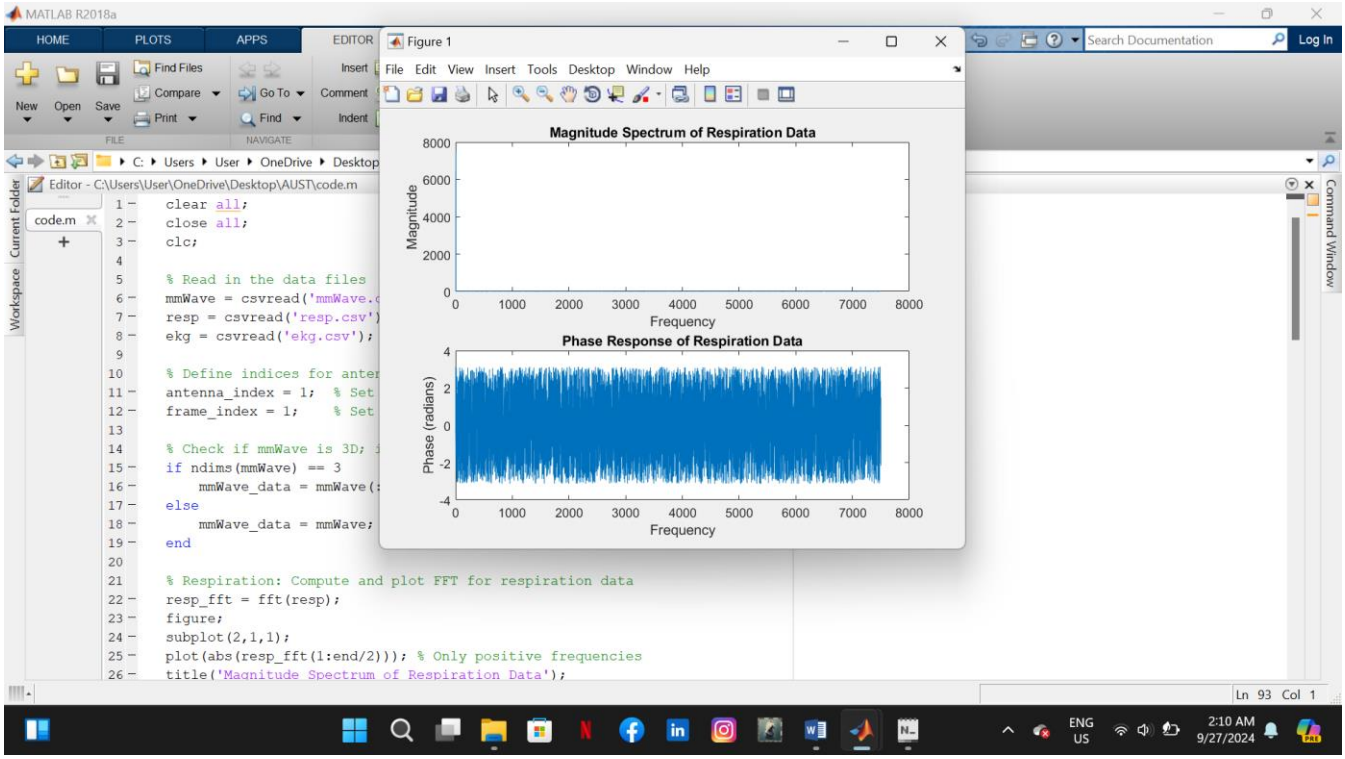

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Figure 1
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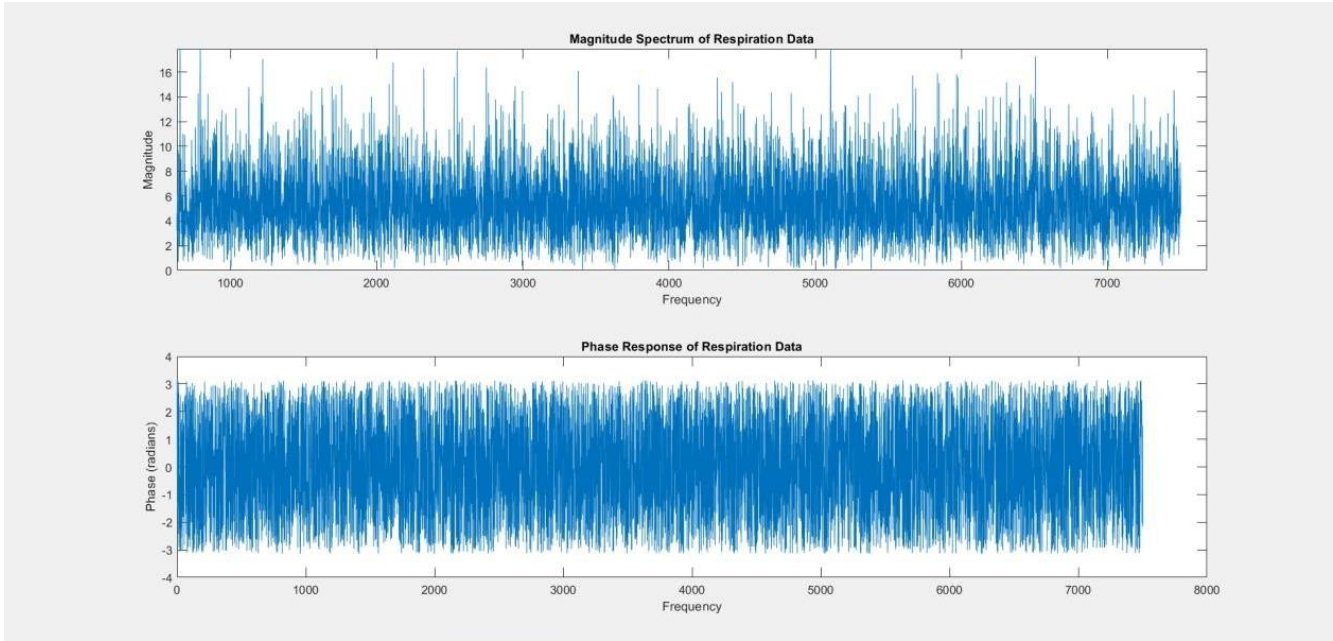
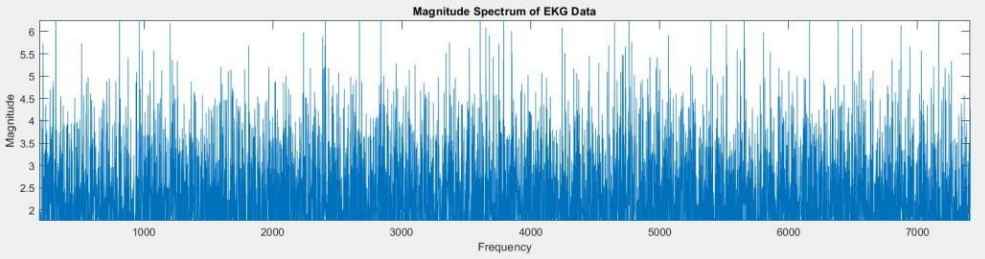
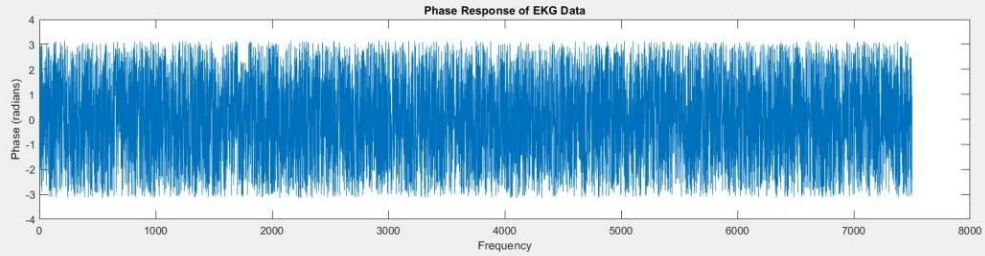
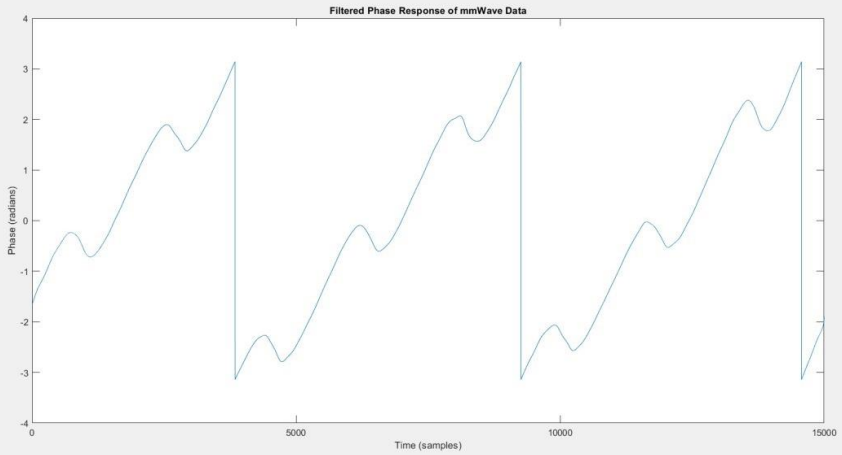
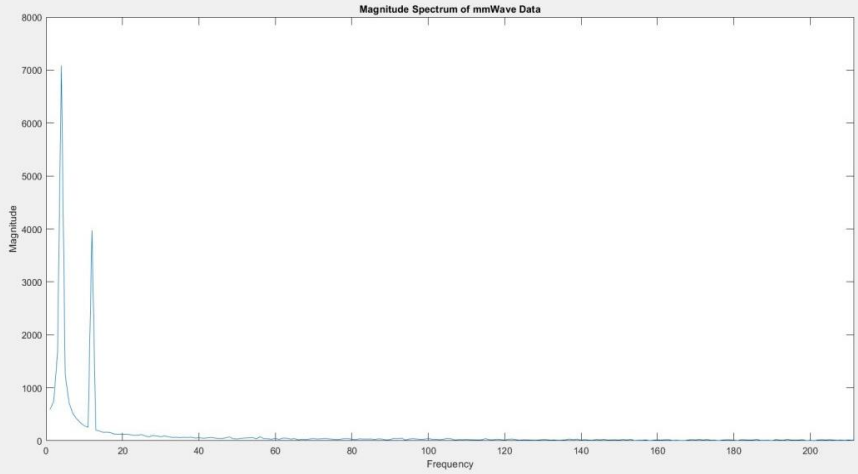
Magnitude Spectrum of Respiration Data
Magnitude
Frequency
Phase Response of Respiration Data
Phase (radians)
Frequency
Editor - C:\Users\User\OneDrive\Desktop\AUST\code.m
code.m
clear all;
close all;
clc;
% Read in the data files
% Respiration: Compute and plot FFT for respiration data
resp_fft = fft(resp);
figure;
subplot(2,1,1);
plot(abs(resp_fft(1:end/2))); % Only positive frequencies
title('Magnitude Spectrum of Respiration Data');


Magnitude Spectrum of Respiration Data
Magnitude
Frequency
Phase Response of Respiration Data
Phase (radians)
Frequency


Magnitude Spectrum of EKG Data
Magnitude
Frequency


Phase Response of EKG Data
Phase (radians)
Frequency


Filtered Phase Response of mmWave Data
Phase (radians)
Time (samples)


Magnitude Spectrum of mmWave Data
Magnitude
Frequency