Lab #1
ECE-2026 Spring-2025
LAB COMPLETION REPORT

Name: RUDRA Goel Date of Lab: 1/13/2024

Part 3.1 Write the string reversal output below and show it to the instructor.

leoG ardUR

Part 3.2 Replace the inner `for` loop with only one or two lines of vectorized MATLAB code. Write the MATLAB code in the space below:

```
%% Your code here
ccsum2 = zeros(1,500);
tt2 = dt*[1:1:500]; % generate the timestamps

for kx = 1:length(XX)

    Ak = abs(XX(kx));
    phik = angle(XX(kx));

    ccsum2 = Ak*cos(2*pi*freq*tt2 + phik);
```

Part 3.3 Show the plot of a decaying sinusoid.

See Following Pages

Part 3.4 Read in a voice file and plot a section. Locate a vowel region containing a quasi-periodic waveform with higher amplitude than neighboring consonant sections. Measure the pitch period, which is the duration of a period in the vowel sound. The inverse of it is called pitch which is a vibrating frequency of a speaker's glottis when pronouncing the vowel. We will come back to this issue later in Lab #3.

$t_{p1} = .3459$

$t_{p2} = .3385$

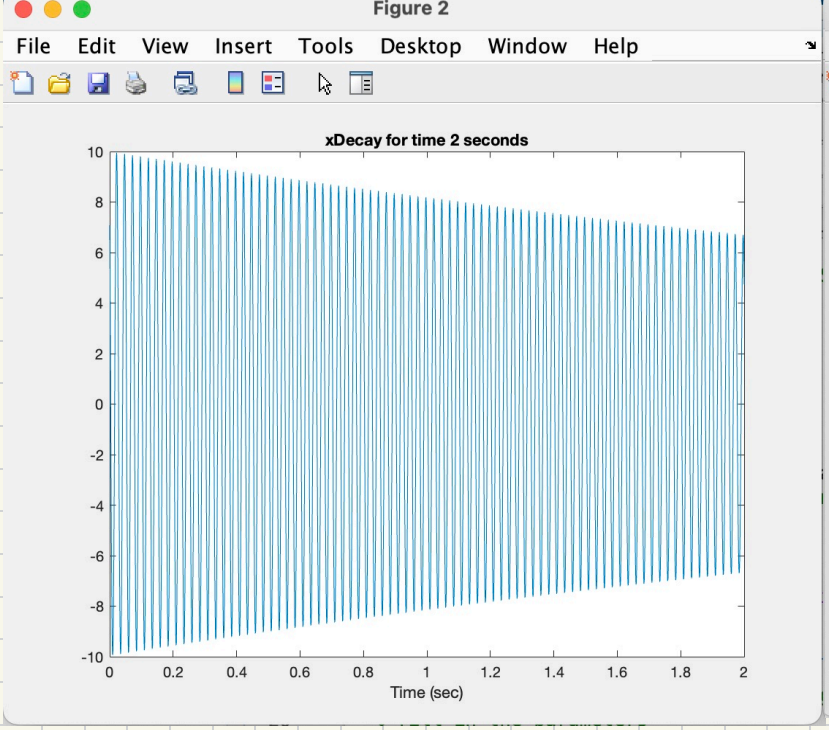
$t_{p2} - t_{p1} = \text{Pitch Period} = .0074s$

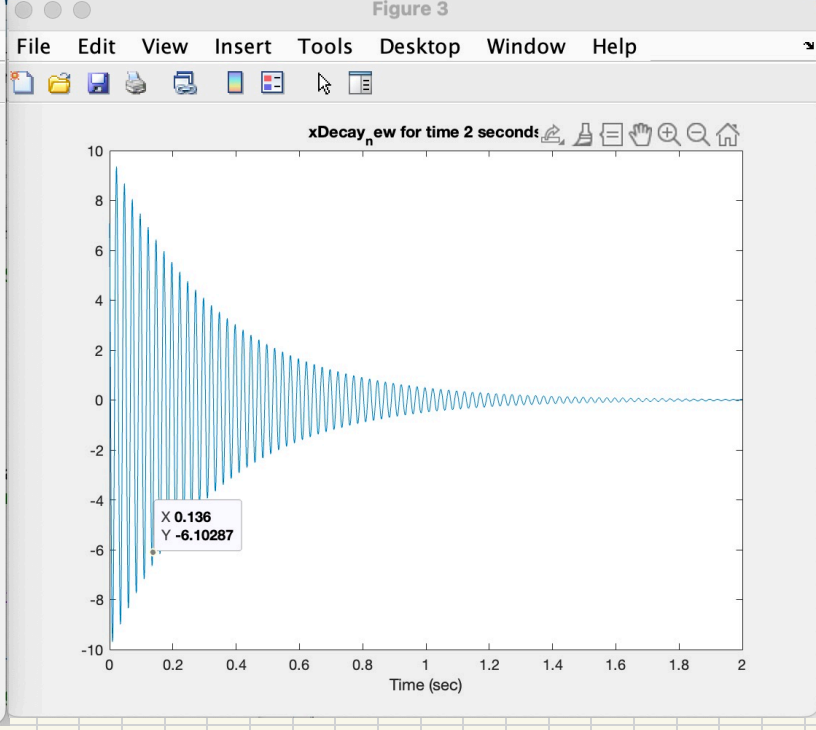
$\Delta t_{p21} = .0074$

$(\Delta t_{p21})^{-1} = 135.14\ Hz$

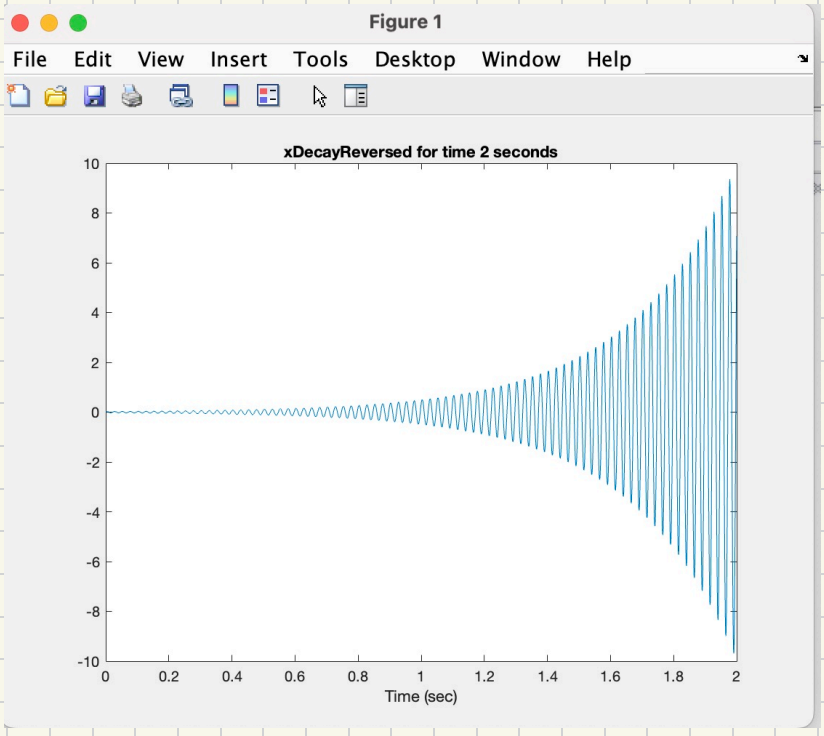
Part 3.5.1 Show the plot of a time-reversed decaying sinusoid.

See following Pages





P 3.3



P 3.5.1

Code For Lab 1

Part I

```
%%
%3.1 string reversal
% You are asked to write the functionality into a function
% and test the function with your full name.
my_name = 'Rudra Goel';     %fill in your name
disp(revstring(my_name));       %finish the revstring function
below

%%
function y = revstring(x)
% a function that reverses the input string
% x: input string
% y: output string
% Write your command below:
y = x(end:-1:1)

end
```

```
Part II
%% 3.2 Vectorization
% Change the following code without using the inner for loop
%% With For Loops
%--- make a plot of sum of cosines
dt = 1/800;
XX = rand(1,3).*exp(2i*pi*rand(1,3)); %--Random amplitude and
phases
freq = 20;
ccsum = zeros(1,500);
for kx = 1:length(XX)
    for kt = 1:500
        t = kt*dt;
        Ak = abs(XX(kx));
        phik = angle(XX(kx));
        ccsum(kt) = ccsum(kt) + Ak*cos(2*pi*freq*t  + phik);
        tt(kt) = t;
    end
end
plot(tt,ccsum) %-- Plot the sum sinusoid
grid on, zoom on, shg


%% Your code here
ccsum2 = zeros(1,500);
tt2 = dt*[1:1:500]; % generate the timestamps

for kx = 1:length(XX)

    Ak = abs(XX(kx));
    phik = angle(XX(kx));

    ccsum2 = Ak*cos(2*pi*freq*tt2 + phik);

end
figure
plot(tt2,ccsum2) %-- Plot the sum sinusoid
grid on, zoom on, shg
```

```
Part III

%%
%3.3 Generating Sinusoids and Decaying Sinusoids
% testing the given code in lab report
amp = 6;
freq = 80;
pha = pi/6;
fs = 8000;
tsta = 0;
tend = 3; %a 3-sec long signal
xs = mySinusoid(amp, freq, pha, fs, tsta, tend);
%<--- plot first three cycles of the generated sinusoid
ts = tsta:1/fs:tsta+3/freq;
Lt = length(ts);
plot( ts, xs(1:Lt), 'b-', ts, 2*xs(1:Lt), 'r--' ), grid on
title('TEST PLOT of TWO SINUSOIDS (scaling by 2)')
xlabel('TIME (sec)')

%%
% test decaying sinusoid with 2 decaying factor
% fill in the parameters
Amp = 10;
b = .2; %decay parameter
fs = 1000; %sampling freq
freq = 40; % given freq
w = 2*pi*freq; %omega
s = 0; %Start time
e = 2; % End time
phase = pi/4; %phase
tt = s:1/fs:e; %time vector

xDecay = myDecayingSinusoid(Amp, b, w, phase, fs, s, e);
%finish function below

figure;
plot(tt, xDecay); title('xDecay for time 2 seconds');
xlabel('Time (sec)');

figure;
b = 3; %set new decay parameter
xDecay_new = myDecayingSinusoid(Amp, b, w, phase, fs, s, e);
plot(tt, xDecay_new); title('xDecay_new for time 2 seconds');
xlabel('Time (sec)');
save('Lab_1_decay.mat');
%%
function xs = mySinusoid(amp, freq, pha, fs, tsta, tend)
```

```
% amp = amplitude
% freq = frequency in cycle per second
% pha = phase, time offset for the first peak
% fs = number of sample values per second
% tsta = starting time in sec
% tend = ending time in sec
tt = tsta : 1/fs : tend; % time indices for all the values
xs = amp * cos( freq*2*pi*tt + pha );
end

function X = myDecayingSinusoid(A, b, omega, phi, fs, tStart,
tEnd)
%A=starting amplitude
%b=decay rate
%omega=frequency
%phi=phase
%fs=frequency
%tStart=start time
%tEnd=end time

%% write your command below:
tt = tStart:1/fs:tEnd;
X = A*exp(-b*tt).*cos(omega*tt+phi);
End
```

```
Part IV
%%
%3.4 Reading WAV File into MATLAB and Playing an Array
% access the 'sample.wav' and plot it from 0.25 to 0.5
[xx, fs] = audioread('sample.wav'); %fill in your file name
dur = length(xx)/fs; %duration of sound file
len = length(xx); %length of sound array
tt1 = .25:1/fs:.5; %time array for plot
figure;
plot(tt1, xx(2000:4000));
title('Sound wave from 0.25 to 0.5 seconds'); xlabel('Time
(sec)');
```

Part V

```
%%
%3.5.1 Time reversal
% Here we reverse the decaying sinusoid from 3.3
% Please finish 3.3 first
load('Lab_1_decay.mat');
len = length(xDecay_new); %length of decaying sin
xDecayReverse = xDecay_new(len:-1:1); %reverse decaying sin
figure;
plot(tt,xDecayReverse);
title('xDecayReversed for time 2 seconds'); xlabel('Time
(sec)');
```