

Class Study (09.12.2024) – Group 1

Q1) (50P) **Signals:** Create a step function (heaviside) and an exponentially decaying signal.

Task:

- Define a unit step function starting at $t=0$.
- Define an exponentially decaying signal of the form e^{-5t} .
- Use a time range of $t=0$ to $t=10$, with a step size of 0.2 seconds initially.
- Compute the convolution of these two signals.
- Plot the result and observe how it changes when you decrease the step size to 0.02 seconds.
- And plot all the figures using subplot function. (for $t=0.2$ and $t=0.02$)
- Give correct name to the axis, legend.
- Use comments for the explanation of the code.
- Use grid function to grid all the figures.

Q2) (50P)

Task:

- Correct the below code. And fill the empty comments with dots (%...)
- Explain the code with your comments.
- If you change the “f_sine” to 20 Hz. What is changing and why? Explain using comment.

```
clc;
clar;
close all;

Fs = 50; % ...
T = 1/Fs; % ...
L = 500; % ...
t = (0:L-1)*T; % ...

%No need for correction starts
f_sine = 10; % ...
sine_wave = sin(2*pi*f_sine*t); %...

rect_pulse = (t >= 0.1 & t <= 0.6); % ...

fft_sine = fft(sine_wave); %...
P2_sine = abs(fft_sine/L);
P1_sine = P2_sine(1:L/2+1);
P1_sine(2:end-1) = 2*P1_sine(2:end-1);
f_sine_fft = Fs*(0:(L/2))/L;

fft_rect = fft(rect_pulse);
P2_rect = abs(fft_rect/L);
P1_rect = P2_rect(1:L/2+1);
P1_rect(2:end-1) = 2*P1_rect(2:end-1);
f_rect_fft = Fs*(0:(L/2))/L;
%No need for correction ends

% ...
figure;
subplot(2,1,1);
plot(t, sine_wave, 'r', 'LineWidth', 1.5);
title('Sine Wave (Time Domain)');
xlabel('Time (s)');
ylabel('Amplitude');

subplot(2,1,);
plot(f_sine_fft, P1_sine, 'b', 'LineWidth', 25);
title('?');
xlabel('?');
ylabel('? ');

% ...
figure;
subplot(2,2,1);
plot(t, rect_pulse, 'k', 'LineWidth', 1.5);
tite('Rectangular Pulse (Time Domain)');
xlabel('?');
ylabel('?');

subplot(2,1,2);
plot(f_rect_fft, P1_rect, 'm', 'LineWidth', 1.5);
title('Rectangular Pulse (Frequency Domain)');
xlabel('?');
ylael('? ');
```