

In this EE207 project assignment students work in groups made of two students with serial numbers s_1 and s_2 ($s_1 < s_2$). You may ask questions up to the end of week 10.

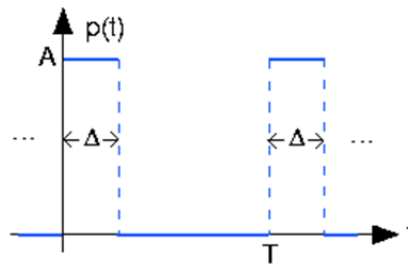
1. Write a MATLAB program to generate and plot the following signals as functions of time with at least 1000 points (on the time axis)

$$x_1(t) = -s_1 r(t - s_2) \text{ for } t \in [-10, 40]$$

$$x_2(t) = s_1 \cos(s_1 \pi t) + s_2 \sin(s_2 \pi t) \text{ show four cycles}$$

$$x_3(t) = s_2 e^{-\frac{t}{s_1}} u(t)$$

2. Write a MATLAB program to generate and plot the following periodic signal as function of time with exactly 1000 points. Consider plotting 4 periods and choose A , T and Δ such that $A = s_1$, $\Delta = s_2$ is the serial number of the other student and $T = s_1 + s_2$ is the sum of the two serial numbers. (Example, if two students are working together with serial numbers 5 and 16, you may choose $A=5$, $\Delta=16$ and $T=21$)



3. For a specific system the impulse response is $h(t) = s_2 e^{-\frac{t}{s_1}} u(t)$

Use the “conv” function in MATLAB to find the output, $y(t) = x(t) * h(t)$, if the input, $x(t)$, is:

- a) Unit step function, $u(t)$, (hint: your output will be the step response).
- b) The periodic signal you have constructed in part 2

For every case show the input, the impulse response, and the output. (use “subplot” command)

4. The impulse response of a linear time invariant system is given by:

$$h(t) = [3e^{-0.5t} + 4e^{-4t}]u(t)$$

- a) Plot $h(t)$ as a function of time over a proper interval and use proper increment.
- b) Find the theoretical Fourier transform $H(\omega)$.
- c) Plot the magnitude and phase of $H(\omega)$ as a function of ω . Take proper interval and increment for ω . Use the log scale for the frequency.
- d) Generate the sinusoid with the following frequencies
 - a. $w_1 = 0.1 \text{ rad/sec}$
 - b. $w_2 = 100 \text{ rad/sec}$
- e) For each sinusoid find $H(w_i)$ change the magnitude and of input sinusoidal accordingly, and plot the input and the output signal on the same plot. Take proper time interval with proper increments.

5. Using MATLAB **symbolic toolbox**, write an M-file to perform the following:

a. Find the Laplace Transform of

i. $(e^t - e^{-st})u(t)$

ii. $\cos(10\pi t)$

b. Find the inverse Laplace Transform of

iii. $\frac{1}{(s + s_1)(s + s_2)^2}$

iv. $\frac{9s^2 + 22s + s_2}{[(s+1)^2 + 4](s+2)}$

You have to use the following MATLAB functions: *syms, laplace, ilaplace, pretty*

6. Using MATLAB, find and plot the step response applied to the following system transfer function, for 10 seconds:

$$H_1(s) = \frac{s}{s + s_1 + s_2}$$

Note that you should display the transfer functions in the command window, i.e, don't put a semicolon after *tf(...)*.

You have to use the following MATLAB functions: *tf, step, plot, xlabel, ylabel, title, grid*

Hints:

1. Writing style and organization are very important (Quality not Quantity!)
2. **Your serial numbers should be clearly presented on the first page and as a comment in the code.**
3. A group of two students work together and submit one report.
4. You should make your output clear and nice. Use commands like (axis, xlabel, ylabel, title, legend, text)
5. Remember to use (**help, lookfor**) commands.
6. This assignment accounts for **5%** of your total grade.
7. Projects are to be submitted during class time. Any late submission will result in zero or low grade. If you have exams during that period please plan to do it before.
8. Here is a list of excuses. " I have finished but the printer is not working".. "I do not know how to use Matlab", "My laptop was stolen", "I feel overwhelmed and I panic at quizzes and deadlines", "....." ☺.. , You can Google for more excuses .. but none of them will make you a better engineer.
9. Comments and conclusions are very important (they carry some weight)

Good luck, **Dr. Ali Muqaiel**