

Final Project

Part I (Handwritten and MATLAB)

It is required to perform the following tasks using both handwritten analysis and MATLAB simulation:

1-

- a) Generate the following function

$$y(t) = e^{-|t|/5} [u(t+1) - u(t-3)]$$

- b) Generate the following signal, defined in terms of $y(t)$

$$y_1(t) = y(3t), \quad y_2(t) = y(t+2), \quad y_3(t) = y(4-2t)$$

- c) Use "subplot(.)" to plot $y(t), y_1(t), y_2(t), y_3(t)$ in a 2×2 figure

2-

- a) Find and plot the Fourier transform of the following signal

$$m(t) = \text{sinc}^2(10^{-3}t)$$

- b) Find and plot the following signal, as well as its Fourier transform

$$r(t) = m(t)\cos(2\pi 10^5 t)$$

- c) Comment on the relation between the spectrum $M(\omega)$ and $R(\omega)$

3-

- a) Find the Fourier series coefficients of the following periodic signal

$$x(t) = e^{-t}, 0 < t < \pi \text{ (periodic with period } \pi)$$

- b) Plot the magnitude and the phase of the Fourier series coefficients obtained in the previous step.

Deliverables

Deliver, electronically, the following in a single PDF report:

- 1) Handwritten solutions of all problems
- 2) Source codes (.m files) of all problems
- 3) Figures requested by each part. Label your figures properly

Part II (MATLAB) :

General signal generator

It is required to implement a general signal generator that has the following specifications:

1. When the program starts the program asks the user for the following parameters:
 - a. Sampling frequency of signal.
 - b. Start and end of time scale
 - c. Number of the break points and their positions (i.e. the points that the signal definition rule changes).

Example: The signal is defined from -2:0 as a DC signal and from 0:2 as ramp the user will enter that the number of break points =1 and the position at $t=0$.

2. According to the number of break points the program asks the user at each region to enter the specifications of the signal at this region which are:

- a. **DC signal**: Amplitude.
- b. **Ramp signal**: slope – intercept.
- c. **General order polynomial**: Amplitude-power – intercept.
- d. **Exponential signal**: Amplitude – exponent.
- e. **Sinusoidal signal**: Amplitude – frequency – phase.

3. Display the resulting signal in time domain
4. the program asks the user if he wants to perform any operation on the signal
 - a. **Amplitude Scaling**: scale value.
 - b. Time reversal.
 - c. **Time shift**: shift value.
 - d. **Expanding the signal**: expanding value
 - e. **Compressing the signal**: compressing value
 - f. **None**
5. Display the new signal in time domain

Required:

Make any assumptions and generate signals covering all program options (at least 10 signals with different number of break points and signal specifications).

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