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 $y(t)$

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

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

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

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

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

c) Comment on the relation between the spectrum $\boldsymbol{M(\omega)}$ **and** $\boldsymbol{R(\omega)}$

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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