

EE103L  
Visualizing signal in Matlab  
Assignment 2

1. For the following function:

$$g(t) = 3\pi \sin(8\pi t + 1.3) \cos(4\pi t - 0.8)e^{\sin(12\pi t)}$$

create an m-file that plots the function within the window  $t \in [-1, 1]$  in a 3-by-1 subplot with steps of  $t$  equal to 0.1, 0.01, and 0.001. What is the period of this signal?

2. For the following function

$$x(t) = \begin{cases} -2|t| + 10, & t \in [-5, 5) \\ 10, & t \in [5, 10) \\ 0, & \text{elsewhere} \end{cases}$$

create an m-file that plots the function  $x(t)$  within the window  $t \in [-10, 15]$ . Also create a separate figure that has 4 subplots in 2-by-2 arrangement with the following signals:

(a)  $x(t+2)$

(b)  $x(t-3)$

(c)  $x(-t)$

(d)  $-3x(-t+4)$

3. Consider the signal  $x(t) = te^{-0.15t}$ ,  $-20 \leq t \leq 20$ . Plot

(a) The signal  $x(t)$

(b) The even decomposition  $x_e(t)$  of  $x(t)$

(c) The odd decomposition  $x_o(t)$  of  $x(t)$

(d) The signal  $y(t) = x_e(t) + x_o(t)$

4. For the signal  $g(x)$  in problem 1, calculate the energy of the signal in the window  $t \in [0.25, 0.75]$ . Also calculate the power of the signal.

5. Suppose  $N$  different musicians in an orchestra are trying to play a pure tone, a sinusoid of frequency 160 Hz. Assume the  $N$  players while trying to play the pure tone (160 Hz) end up playing tones separated by  $\Delta$  Hz, so the overall sound they produced is:

$$y(t) = \sum_{i=1}^N 10 \cos(2\pi f_i t)$$

where the  $f_i$  are the frequencies from 159 to 161 Hz. Generate the signal  $y(t)$ ,  $0 \leq t \leq 200$  sec considering that each musician is playing a unique frequency. First assume the number of musicians to be  $N = 51$  with  $\Delta = 0.04$  Hz, and then  $N=101$  with  $\Delta = 0.02$  Hz. Plot  $y(t)$  for the two cases on the same figure.