

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 Δ 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.