ECE250: Signals and Systems
Practice Sheet 6

Instructions

- Use Matlab to solve these problems.
- For solutions, you have to bring .m file along with output in the tutorial class (01/10/2022)

1. (CO1,CO2) Consider that a rectangular pulse $p(t)$ is defined using the relation as below:

$$p(t) = \begin{cases} A, & t_1 \leq t \leq t_2 \\ 0, & otherwise \end{cases}$$

where A denotes the amplitude of the signal. The signal can also be defined in terms of unit step ($u(t)$) functions as:

$$p(t) = A[u(t - t_1) - u(t - t_2)]. \tag{1}$$

(a) Plot a rectangular pulse $p_1(t)$ with amplitude 2 units, $t_1 = -2$ and $t_2 = 2$.
(b) Apply time scaling on $p_1(t)$ using a scaling factor of 2 and plot the signal.
(c) Apply time scaling on $p_1(t)$ using a scaling factor of 0.5 and plot the signal.
(d) Using the rectangular pulses, generate the signal $p_4(t)$ as shown in Fig 1.
(e) Convolve signal $p_1(t)$ and $p_4(t)$ and plot the result.

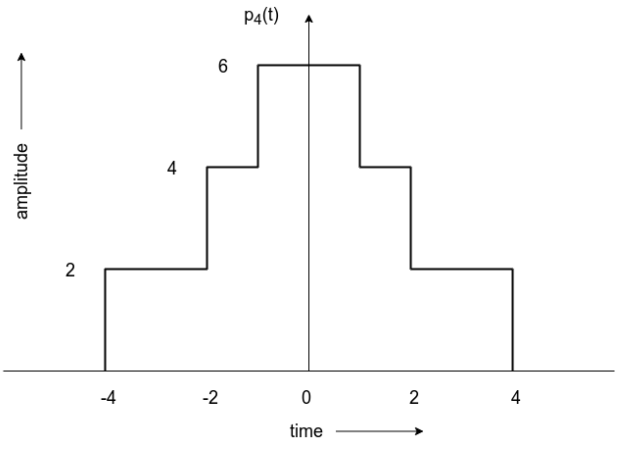

Figure 1: $p_4(t)$

2. (CO1) A sinusoidal signal is defined using the following relation:

$$s(t) = Asin(2\pi ft), \tag{2}$$

where A denotes the amplitude of the signal, and f denotes the frequency of the signal.

a) Plot a sinusoidal signal $s_1(t)$ of frequency 10 Hz with magnitude 4 units.
b) Plot a sinusoidal signal $s_2(t)$ of frequency 100 Hz with magnitude 4 units.
c) Plot signal $s_3(t) = s_1(t) + s_2(t)$.
d) Plot signal $s_4(t) = s_1(t) - s_2(t)$.
e) Plot signal $s_5(t) = s_1(t)s_2(t)$.
f) Plot the time-shifted signal $s_6(t) = s_3(t - 0.05)$

3. (CO1) Plot a ramp signal $r_1(t)$ with slope 1.

   (a) Apply time shifting (advancement and delay) on the signal $r_1(t)$ and plot the signals.
   (b) Perform time reversal.

4. (CO1) The normalized sinc function is commonly defined for $x \neq 0$ by:

$$sinc(t) = \frac{sin(\pi t)}{\pi t} \tag{3}$$

   Plot the normalized sinc function for $t \in [-10, 10]$.

5. (CO1,CO2) There are two sinusoidal signals as below:

   - $x_1(t)$ of frequency 1 Hz with magnitude 5 units clipped in range $t \in [-1, 1]$.
   - $x_2(t)$ of frequency 2 Hz with magnitude 10 units clipped in range $t \in [-1, 1]$.

   Compute the convolution of signals $x_1(t)$ and $x_2(t)$ and plot the results.