دانشگاه صنعتی امیرکبیر
(پلی تکنیک تهران)

Signals and Systems

Assignment 3

Fall 2019 - Group 1

Contact: MohammadKhalaji76@gmail.com
Telegram Channel: @SignalsAndSystems98Fall

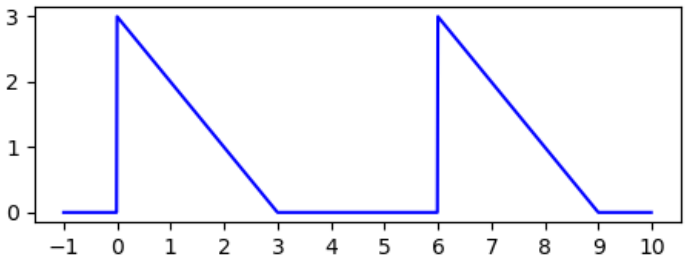
Question 1

Determine the Fourier Series coefficients a_k for the following periodic signals:

(a) $x(t) = 2cos(\frac{2\pi t}{3} + \frac{\pi}{6})$

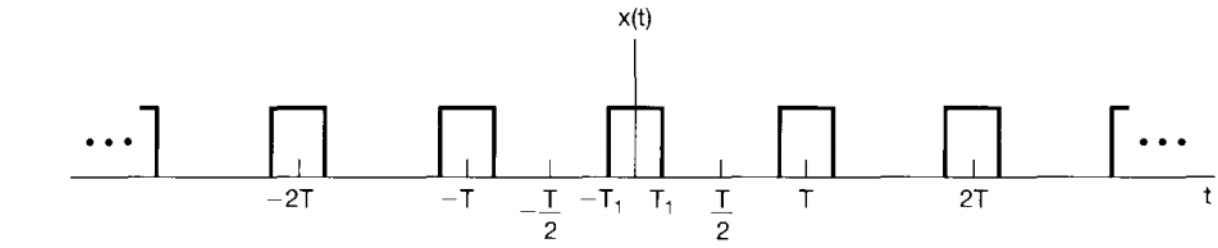
(b) $x(t) = 2cos(\frac{2\pi t}{3} + \frac{\pi}{6}) + 5sin(\frac{2\pi t}{6})$

(c) (Plotting the result is incorporated in your programming questions)



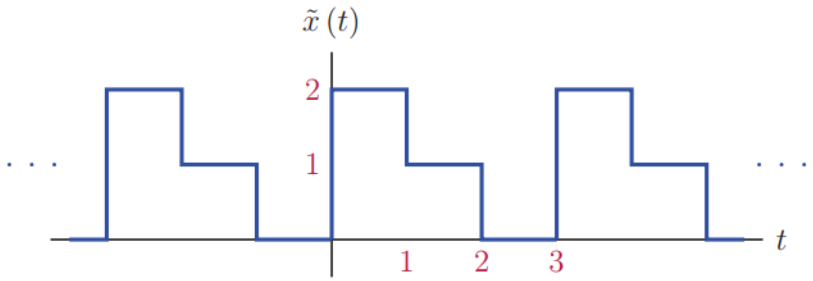
Question 2

Determine the Fourier Series coefficients a_k for $x(t)$:

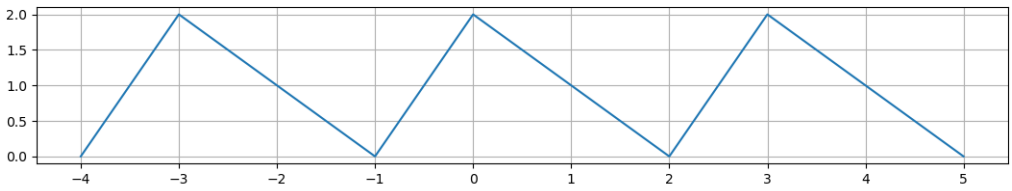


Now use a_k to determine the Fourier Series coefficients for the following periodic signals:

(a) .



(b) .



Question 3

(Textbook Section 3.8 - Fourier Series and LTI Systems)

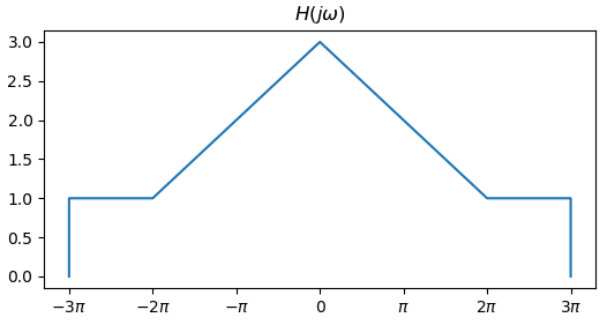
Imagine we have a signal $x(t)$ with Fourier Series representation like this:

$$a_{-2} = a_2 = \frac{1}{4}$$

$$a_{-1} = a_1 = \frac{1}{2}$$

$$a_0 = 1$$

And otherwise $a_k = 0$. Keep in mind that $T = 2$. Consider a LTI System with frequency response $H(j\omega)$ as plotted below.



(a) Determine the output $y(t)$, and its Fourier Series coefficients b_k, if we apply $x(t)$ as input.

(b) Using Parseval's relation, determine the average power of $y(t)$.

Matlab Question 1

Verify your answer for Question 1.c with plotting following signal for $K = 2, 5, 10, 20$ separately.

$$x_{FS}(t) = \sum_{k=-K}^{K} a_k e^{jk\omega_0 t}$$

$(\omega_0 = \frac{2\pi}{6} = \frac{\pi}{3})$