

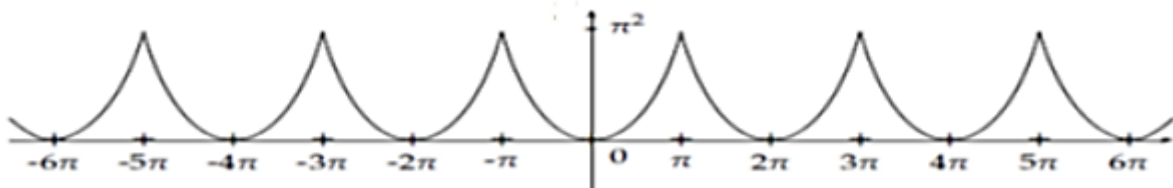
Serie N°. 2

(Fourier series & Fourier Transform)

Exercice 01 :

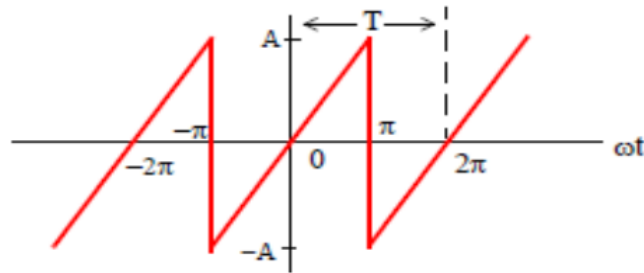
Let $s(t)$ be a signal with period 2π on \mathbb{R} such that $s(t) = t^2$ si $|t| \leq \pi$.

1. Determine the Fourier series of $s(t)$ in trigonometric form.
2. Plot the one-sided amplitude and phase spectrum up to order 4 of $s(t)$.



Exercice 2 :

1. Determine the Fourier series associated with the periodic signal ($T = 2\pi$) defined by the following figure:



2. Determine the Fourier series of this signal in harmonic form.

Exercice 03 : (additional)

Determine the parameters $\{A_k, \varphi_k\}$ of the cosine representation of the Fourier series of the following signal:

$$x(t) = 4 + 1.8 \cos\left(2\pi \cdot f_0 \cdot t + \frac{\pi}{3}\right) + 0.8 \sin(6\pi \cdot f_0 \cdot t); \quad f_0 = 1 \text{ kHz}$$

$$\sin(x) = \cos\left(x - \frac{\pi}{2}\right)$$

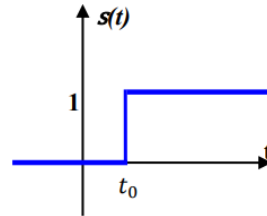
Fourier Transform

Exercise 01 :

Search for the amplitude and phase spectra of the unit step signal $s(t)$ in the following figure:

This signal is defined by :

$$s(t) = u(t - t_0) = \begin{cases} 1 & \text{pour } t > t_0 \\ 0 & \text{pour } t < t_0 \end{cases}$$

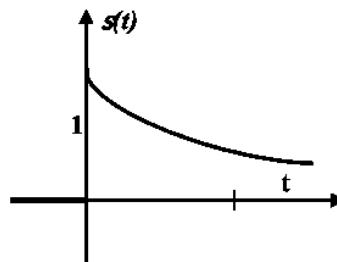


Exercise 2 :

We consider the signal $s(t)$ shown in the following figure: this signal is defined by

$$s(t) = \begin{cases} 0 & \text{pour } t < 0 \\ e^{-at} & \text{pour } t \geq 0 \text{ avec } a > 0 \end{cases}$$

-Calculate the total energy of this signal from its time-domain expression and verify Parseval's equality by calculating the same energy from its Fourier transform expression.



Exercise 3 : (additional)

Calculate the Fourier transform $F(\omega)$ of this signal

