Assignment 1

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1 PROBLEM(GATE 2019(EC) 21)

Consider the signal

$$f(t) = 1 + 2cos(\pi t) + 3sin\left(\frac{2\pi}{3}t\right) + 4cos\left(\frac{\pi}{2}t + \frac{\pi}{4}\right) \tag{1.0.1}$$

, where t is in seconds. Its fundamental time period in seconds, is

2 SOLUTION

Given,

$$f(t) = 1 + 2cos(\pi t) + 3sin\left(\frac{2\pi}{3}t\right) + 4cos\left(\frac{\pi}{2}t + \frac{\pi}{4}\right) \tag{2.0.1}$$

Individual fundamental frequencies of each term are

$$\omega_1 = \pi \tag{2.0.2}$$

$$\omega_2 = \frac{2\pi}{3} \tag{2.0.3}$$

$$\omega_3 = \frac{\pi}{2} \tag{2.0.4}$$

Let ω_0 be the fundamental frequency of the signal

$$\omega_0 = GCD\left(\omega_1, \omega_2, \omega_3\right) \tag{2.0.5}$$

$$= GCD\left(\pi, \frac{2\pi}{3}, \frac{\pi}{2}\right) \tag{2.0.6}$$

$$= GCD\left(\frac{6\pi}{6}, \frac{4\pi}{6}, \frac{3\pi}{6}\right) \tag{2.0.7}$$

$$= \frac{\pi}{6} \tag{2.0.8}$$

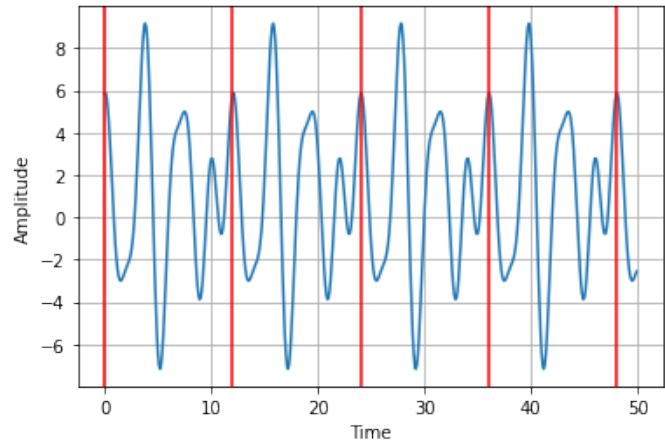Fundamental time period(T) of the signal

$$T = \frac{2\pi}{\omega_0} = 12sec \tag{2.0.9}$$

Fig. 0: Plot of the signal