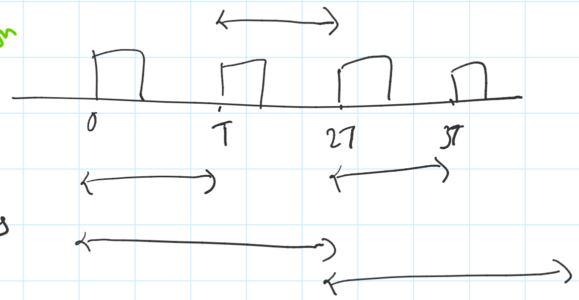
Monday, August 10, 2020 11:19 AM

Lecture 01 – Review of Fourier Series

F.S: continuous-time periodic signals :

$$x(t+T) = x(t) \quad \forall t \qquad \text{period - } T$$

Smallest period T is called fundamental period.



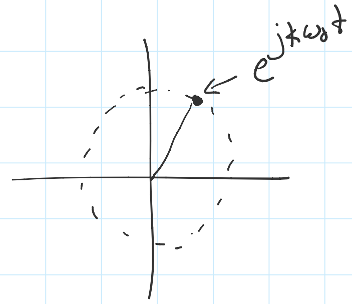
$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk\omega_0 t}$$

Linear combination

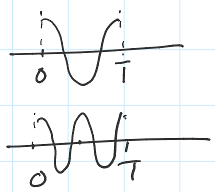
complex Fourier Series coefficients

Periodic, $T = \frac{2\pi}{\omega_0}$

$$e^{jk\omega_0 t} = \cos(k\omega_0 t) + j\sin(k\omega_0 t)$$



ω_0 : $\cos(\omega_0 t)$



$T = \frac{2\pi}{\omega_0}$

$2\omega_0$: $\cos(2\omega_0 t)$

all of these have period T

$k\omega_0$: $\cos(k\omega_0 t)$ → k-times

{ set of signals with same period T & their fundamental freq. are integer multiples of some ω_0 } → Harmonics

Ex. $\cos(k\omega_0 t)$; $k = 0, 1, 2, \dots$

Ex. $\sin(k\omega_0 t)$; $k = 0, 1, 2, \dots$

Ex. $e^{jk\omega_0 t}$; $k = 0, \pm 1, \pm 2, \pm 3, \dots$

F.S. represents periodic $x(t)$ using complex sinusoids.

For real signals : we can also have

$$x(t) = a_0 + \sum_{k=1}^{\infty} A_k \sin(k\omega_0 t) + \sum_{k=1}^{\infty} B_k \cos(k\omega_0 t)$$

How to Find a_k ?