Day-2

- Power factor (Till 1996) = $\cos\phi$ → displacement P.F

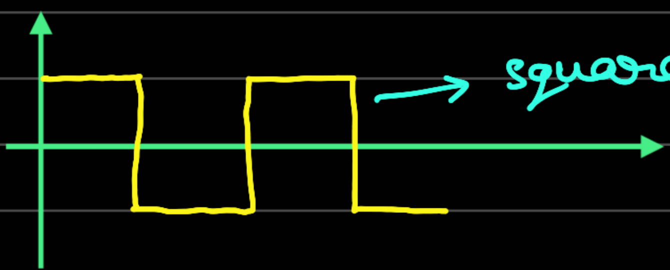
Since power electronics,

$$P.F. = \cos\phi \times (\text{Distortion Factor}) = \frac{P}{S}$$

- <u>Fourier Series</u> –

$f(t) \rightarrow$ Periodic

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nt + \sum_{n=1}^{\infty} b_n \sin nt$$



$$\int_0^{2\pi} \sin mt \sin nt \, dt = \begin{cases} 0, & m \neq n \\ \pi, & m = n \end{cases}$$

$$\int_0^{2\pi} \cos mt \cos nt \, dt = \begin{cases} 0, & m \neq n \\ \pi, & m = n \end{cases}$$

$$\int_0^{2\pi} \sin mt \cos nt \, dt = 0$$

$$\int_0^{2\pi} f(t)\sin mt\,dt$$

$$= \int_0^{2\pi}\left[\frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nt + \sum_{n=1}^{\infty} b_n \sin nt\right]\sin mt\,dt$$

$$= b_m \pi$$

$$\Rightarrow \boxed{b_m = \frac{1}{\pi}\int_0^{2\pi} f(t)\sin mt\,dt}$$

$$\int_0^{2\pi} f(t)\cos mt\,dt = a_m \pi$$

$$\Rightarrow \boxed{a_m = \frac{1}{\pi}\int_0^{2\pi} f(t)\cos mt\,dt}$$

So $\boxed{a_0 = \frac{1}{\pi}\int_0^{2\pi} f(t)\,dt}$

→ $f(t) = \begin{cases} 1, & 0 < t < \pi \\ 0, & \pi < t < 2\pi \end{cases}$

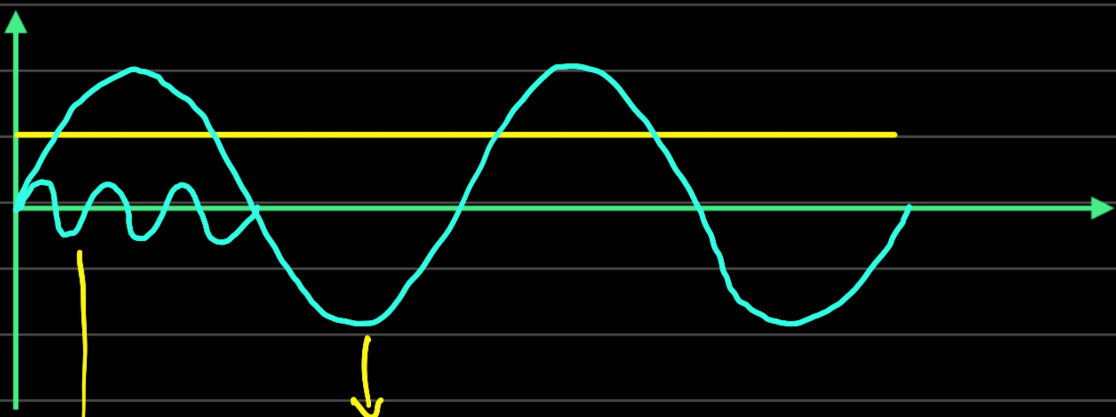
Find a_0, a_m, a_n

Ans) $a_0 = 1$ $\qquad b_m = \frac{2}{m\pi}$, $m \in$ odd

$a_m = 0$ $\qquad = 0$, $m \in$ even

So $f(t) = \frac{1}{2} + \sum_{n \in odd} \frac{2}{n\pi} \sin nt\,dt$

$$= \text{avg. value} + \frac{2}{\pi}\sin t + \frac{2}{3\pi}\sin 3t + \frac{2}{5\pi}\sin 5t + \frac{2}{7\pi}\sin 7t + \dots$$



Fundamental frequency $(n=1)$

Other harmonics ⟶ wastes energy