

Fourier Series Representation
From complex exponential form \rightarrow Trigo. form. combine

$$x(t) = \sum_{k=-\infty}^{\infty} C_k e^{+jk\Omega_0 t} \quad ; \quad C_k = C_{-k}^*$$

C_k usually complex $= |C_k| e^{j\theta_k}$
 \nearrow magnitude \searrow phase

For a given "k"

$$\begin{aligned} & C_{-k} e^{-jk\Omega_0 t} + C_k e^{+jk\Omega_0 t} \\ &= |C_k| e^{-j\theta_k} e^{-jk\Omega_0 t} + |C_k| e^{+j\theta_k} e^{+jk\Omega_0 t} \\ &= |C_k| e^{-j(k\Omega_0 t + \theta_k)} + |C_k| e^{+j(k\Omega_0 t + \theta_k)} \\ &= |C_k| \left[e^{-j(k\Omega_0 t + \theta_k)} + e^{+j(k\Omega_0 t + \theta_k)} \right] \end{aligned}$$

Remember: $e^{j\theta} = \cos \theta + j \sin \theta$
 $+ e^{-j\theta} = \cos \theta - j \sin \theta$

 $= 2 \cos \theta$

$$C_{-k} e^{-jk\Omega_0 t} + C_k e^{+jk\Omega_0 t} \\ \therefore = |C_k| 2 \cos(k\Omega_0 t + \theta_k)$$

$$\therefore \boxed{x(t) = \sum_{k=-\infty}^{\infty} C_k e^{+jk\Omega_0 t}} \quad \text{Complex Exponential Form}$$

$$= C_0 + \sum_{k=1}^{\infty} (C_k e^{+jk\Omega_0 t} + C_{-k} e^{-jk\Omega_0 t})$$

$$\boxed{x(t) = C_0 + 2|C_k| \cos(k\Omega_0 t + \theta_k)}$$

combine Trigo Form.

where $C_k = |C_k| e^{j\theta_k}$ *