CRiB Sheet 2026

$$\cos\alpha\cos\beta = \frac{\cos(\alpha+\beta)+\cos(\alpha-\beta)}{2}$$

$$\cos(-\alpha) = \cos\alpha$$

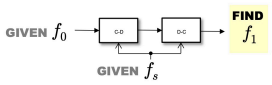
$$\sin\alpha = \cos(\alpha - \pi/2)$$

$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{j(2\pi)(k) f_0 t}$$ fourier coefficients

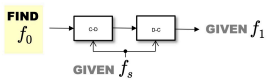
$$a_k = \frac{1}{T_0}\int_0^{T_0} x(t) e^{-j(2\pi)(k) f_0 t}\, dt$$ analysis fourier coefficients

$$f_0 = GCD(f_1, f_2, \dots, f_n)$$

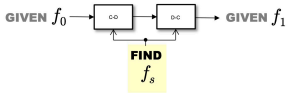
if f_n $\forall n \in \mathbb{R}$ is irrational $\Rightarrow$ Signal $x(t)$ is Non Periodic



$$f_1 = \min_\ell |f_0 - \ell f_s| = |f_0 - \ell^* f_s|$$



$$f_0 = \pm f_1 + \ell f_s$$



$$f_s = \frac{f_0 \pm f_1}{\ell} \geq 2f_1$$

if $x(t) = x(-t)$ (even) $\Rightarrow a_n \in \mathbb{R}$ $\forall k$

if $x(-t) = -x(t)$ (odd) $\Rightarrow a_k \in \mathbb{C}$ $\forall k$

$$f_i(t) = \frac{1}{2\pi}\frac{\partial \psi(t)}{\partial t}$$

$$\hat{\omega} = 2\pi(f/f_s); \quad \hat{\omega} \in (-\pi, \pi]$$

$$\hat{\omega} = \min(\hat{\omega} \pm 2\pi l)$$

$x[n] = \cos(\hat{\omega} n)$ Periodic when

1. $x[0] = x[N]$
2. $\hat{\omega} N = m 2\pi$, $m \in \mathbb{Z}$
3. $\hat{\omega} = 2\pi \frac{M}{N}$, $\frac{M}{N}$ is Rational

$x(t) \longrightarrow$ [ADC] $\longrightarrow x[n]$

$t = n/f_s$

$n = t f_s$

a system is linear when

$$\alpha x_1[n] + \beta x_2[n] = \alpha y_1[n] + \beta y_2[n]$$

a system is Time-invariant

$$x[n - n_0] = y[n - n_0]$$