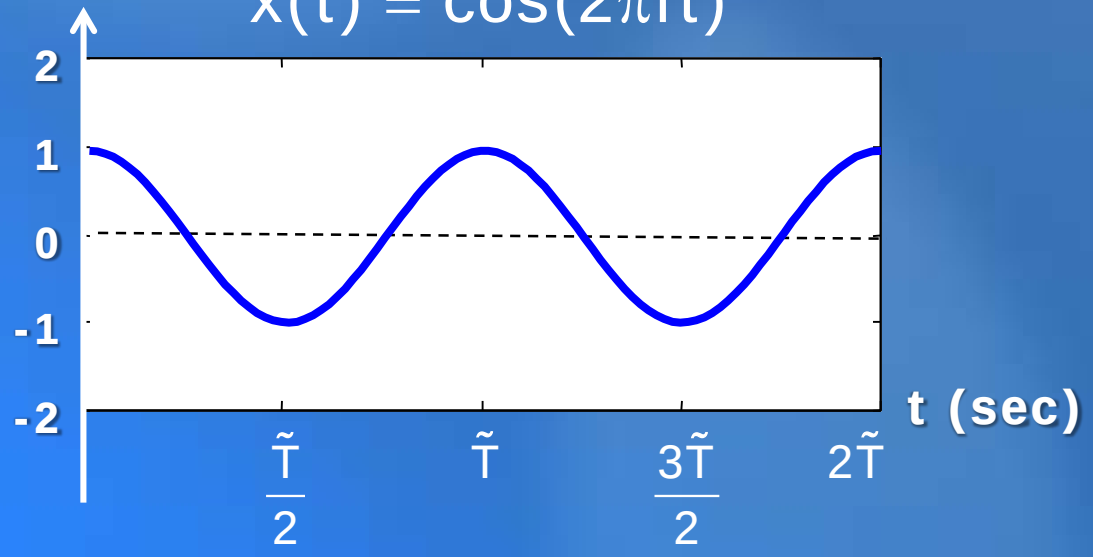
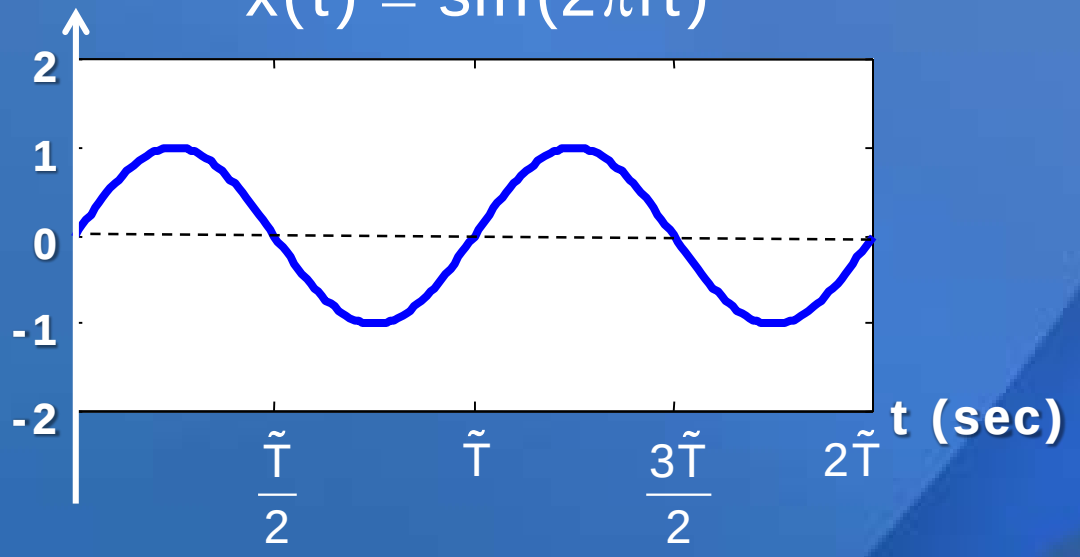
Continuous-time sinusoids

Sinusoids

$x(t) = \cos(2\pi\tilde{f}t)$



$x(t) = \sin(2\pi\tilde{f}t)$



Parameters:

$\tilde{T}$ = period (in seconds)

$\tilde{f}$ = frequency in Hertz (cycles per second)

$\tilde{\omega}$ = frequency in radians per second

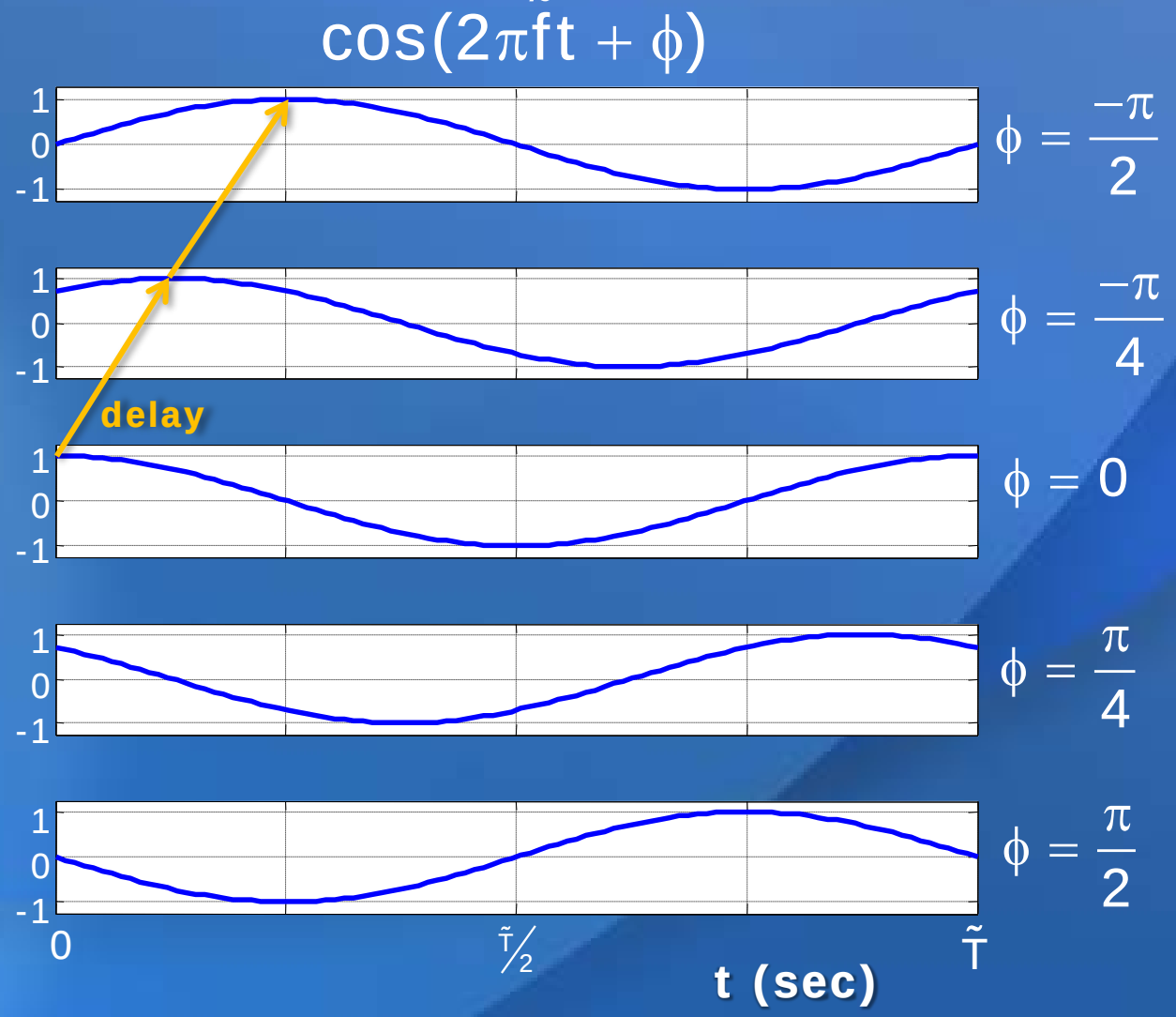
Note: '~' indicates continuous time parameters

$$\tilde{f} = \frac{1}{\tilde{T}}$$

$$\tilde{\omega} = 2\pi\tilde{f}$$

We only need cosines

$$\sin(2\pi\tilde{f}t) = \cos\left(2\pi\tilde{f}t - \frac{\pi}{2}\right) \Leftarrow$$



A phase shift introduces

a delay of $d = \frac{-\phi}{2\pi\tilde{f}} = \frac{-\phi\tilde{T}}{2\pi}$

Proof:

$$\cos(2\pi\tilde{f}t + \phi) = \cos\left(2\pi\tilde{f}\left(t - \frac{-\phi}{2\pi\tilde{f}}\right)\right)$$

$$= \cos\left(2\pi\tilde{f}\left(t - d\right)\right)$$

General Form

$$x(t) = A\cos(2\pi\tilde{f}t + \phi)$$

A = amplitude

$\tilde{f}$ = frequency

ϕ = phase