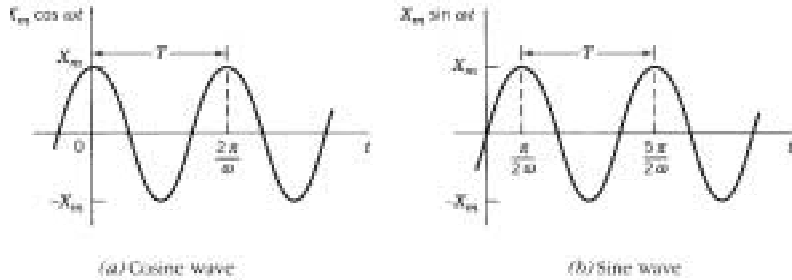
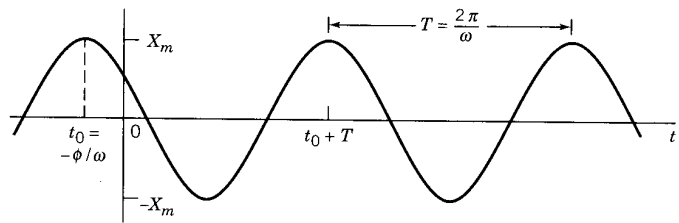


Sinusoidal Function

Sine and Cosine functions are periodic functions, *i.e.*, the waveform repeats in certain interval, called the period, T . Note that $\sin(\omega t)$ is the same as $\cos(\omega t - 90^\circ)$.



A sinusoidal function is made of a linear combination of Cosine and Sine functions: $A \cos(\omega t) + B \sin(\omega t)$ (where A and B are constants). In general, all sinusoidal functions can be written as a “phase-shifted” Sin or Cos function:



$$A \cos(\omega t) - B \sin(\omega t) = M \cos(\omega t + \phi)$$

$$\begin{cases} M = \sqrt{A^2 + B^2} \\ \phi = \tan^{-1} \left(\frac{B}{A} \right) \end{cases} \quad \text{or} \quad \begin{cases} A = M \cos(\phi) \\ B = M \sin(\phi) \end{cases}$$

As is seen, sinusoidal functions are defined by 3 parameters:

X_m : Amplitude

T : Period (s)

ϕ : Phase (radians or degrees)

The sinusoidal form includes ω which is related to T , as is shown in the graph, by $\omega T = 2\pi$. Denoting the number of periods in one second as f , we have:

$$f = \frac{1}{T} \quad \text{Frequency, Unit: Hz (or 1/s)}$$

$$\omega = \frac{2\pi}{T} = 2\pi f \quad \text{Angular Frequency, Unit: rad/s}$$