Vector Voltmeter using Synchronous detection

- What is *Synchronous Detection*?

If the unknown voltage ***x(t)*** is complex in nature, i.e., when it contains fundamental and other harmonic components as well as some uncorrelated random noise etc**, synchronous or coherent detection allows extraction of fundamental component in vector form from the complex wave.**

$$x(t) = C_{1m}\sin(\omega t + \phi_1) + \sum_{i=2}^{\infty} C_{im}\sin(i\omega t + \phi_i)$$

$$r(t) = R_m \sin(\omega t)$$

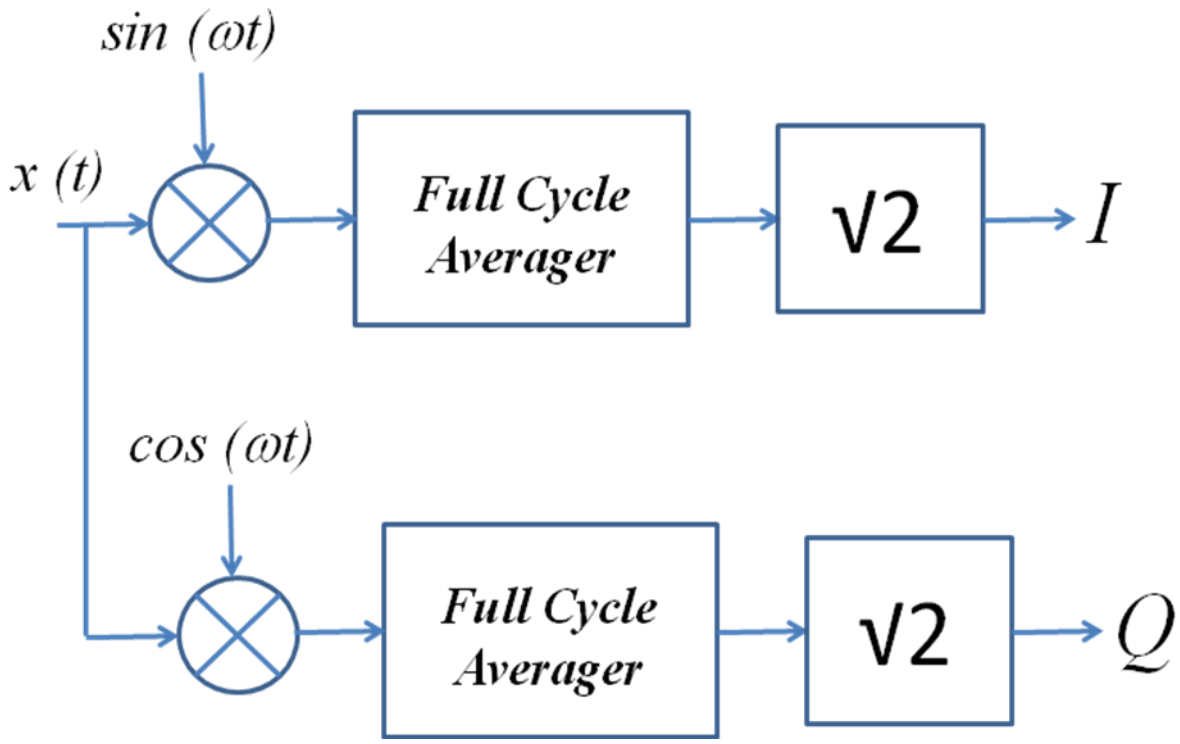
C_{1m} is the amplitude and φ_1 is the phase
C_{im} as amplitude and φ_i as phase for the i^{th} harmonic

Let ***I*** and ***Q*** be the r.m.s. amplitudes representing the in-phase and quadrature components of fundamental of ***x(t)*** wrt the reference voltage. Then ***I*** and ***Q*** may be estimated as:

$$I = \sqrt{2}\left[\frac{1}{T}\int_0^T x(t)\sin\omega t dt\right]$$

$$Q = \sqrt{2}\left[\frac{1}{T}\int_0^T x(t)\cos\omega t dt\right]$$

Where, $T = \frac{2\pi}{\omega}$



Implementation using FS