Example C-6: For the case where $x(t) = A\cos(\omega_0 t + \varphi)$, the average power integral

$$P_s = \frac{1}{T_0}\int_0^{T_0} |A\cos(\omega_0 t + \varphi)|^2 dt$$

can be evaluated directly, by using the trigonometric identity $|\cos\theta|^2 = \cos^2\theta = \frac{1}{2}(1+\cos 2\theta)$ to simplify the integrand

$$P_s = \frac{1}{T_0}\int_0^{T_0} \tfrac{1}{2}A^2 dt + \underbrace{\frac{1}{T_0}\int_0^{T_0} \tfrac{1}{2}A^2\cos(2\omega_0 t + 2\varphi)dt}_{\text{integral over two periods is zero}} = \tfrac{1}{2}A^2$$

Note that the average power depends only on the amplitude of the sinusoidal signal.

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