$$x(t) = |A\cos(2\pi F_0 t)|^2$$

$$x(t) = A^2\cos^2(2\pi F_0 t) \qquad \cos^2(x) = \frac{1+\cos 2x}{2}$$

$$= \frac{A^2(1+\cos(4\pi F_0 t))}{2}$$

$$= \frac{A^2}{2} + \frac{A^2\cos(4\pi F_0 t)}{2}$$

$$\frac{a_0}{2} + \sum_{n=0}^{N} a_n \cos(n w_0 t) + b_n \sin(n w_0 t)$$

$$a_0 = A^2 \qquad a_n = \frac{A^2}{2} \qquad b_n = 0$$

$$c_n = \frac{a_n - jb_n}{2} = \frac{\frac{A^2}{2} - 0}{2} = \frac{A^2}{4}$$

$$\tilde{x}(t) = \sum_{n=-N}^{N} c_n e^{jnw_0 t} = \sum_{n=-N}^{N} \frac{A^2}{4} e^{jnw_0 t}$$

$$d_n = \sqrt{a_n^2 + b_n^2} = \sqrt{\left(\frac{A^2}{2}\right)^2 + 0^2} = \frac{A^2}{2}$$

$$\phi_n = \tan^{-1}\left(\frac{-b_n}{a_n}\right) = 0$$

$$a_0 = \frac{2}{T_0}\int_{-\frac{T_0}{2}}^{T_0/2} \frac{A^2}{2} + \frac{A^2}{2}\cos(4\pi f_0 t)\,dt$$

$$a_0 = \frac{2}{T_0}\int \frac{A^2}{2}\left(1 + \cos(4\pi f_0 t)\right) dt$$

$$= \frac{2A^2}{T_0 2}\int_{-T_0/2}^{T_0/2} 1 + \cos(4\pi f_0 t)\,dt$$

$$= \frac{A^2}{T_0}\left[t + \frac{\text{Sen}(4\pi f_0 t)}{4\pi f_0}\right]_{-T_0/2}^{T_0/2}$$

$$= \frac{A^2}{T_0}\left[\frac{T_0}{2} + \frac{\text{Sen}(4\pi f_0 T_0/2)}{4\pi f_0} - \left(-\frac{T_0}{2} + \frac{\text{Sen}\left(4\pi f_0\left(-\frac{T_0}{2}\right)\right)}{4\pi f_0}\right)\right)$$

$$= \frac{A^2}{T_0}\left[\frac{T_0}{2} + \cancel{\frac{\text{Sen}(2\pi)}{4\pi f_0}}^{\,0} + \frac{T_0}{2} - \cancel{\frac{\text{Sen}(2\pi)}{4\pi f_0}}^{\,0}\right)$$

$$= \frac{A^2}{\cancel{T_0}}\left(\frac{\cancel{2}\,\cancel{T_0}}{\cancel{2}}\right) = \underline{\underline{A^2}}$$

$$a_n = \frac{1}{T}\int_{-T_0/2}^{T_0/2} \left(\frac{A^2}{2} + \frac{A^2}{2}\cos(4\pi f_0 t)\right)\left(\cos(n\omega_0 t)\right) dt$$

$$\omega_0 = \frac{2\pi}{T_0} = 2\pi f_0 \qquad \frac{1}{T_0} = \frac{2}{T_0}$$

$$a_n = \frac{2}{T_0}\int_{-T_0/2}^{T_0/2} \frac{A^2}{2}\left(1 + \cos(4\pi f_0 t)\right)\left(\cos(n 2\pi f_0 t)\right) dt$$

$$a_n = \frac{A^2}{T_0}\int_{-T_0/2}^{T_0/2} \left(1 + \cos(4\pi f_0 t)\right)\left(\cos(n 2\pi f_0 t)\right) dt \qquad n=2$$

$$a_n = \frac{A^2}{T_0}\int_{-T_0/2}^{T_0/2} \cos(4\pi f_0 t) + \cos^2(4\pi f_0 t)\, dt$$

$$a_n = \frac{A^2}{T_0}\left[\int_{-T_0/2}^{T_0/2} \cos(4\pi f_0 t) + \int_{-T_0/2}^{T_0/2}\left(\frac{1 + \cos(8\pi f_0 t)}{2}\right) dt\right]$$

$$a_n = \frac{A^2}{T_0}\left[\left[-\frac{\cos(4\pi f_0 t)}{4\pi f_0}\right]\Bigg|_{-T_0/2}^{T_0/2} + \frac{1}{2}\int_{-T_0/2}^{T_0/2}\left(1 + \cos(8\pi f_0 t)\right) dt\right]$$

$$a_n = \frac{A^2}{T_0}\left[\left(\cancel{-\frac{\cos(2\pi)}{4\pi f_0} + \frac{\cos(-2\pi)}{4\pi f_0}}\right) + \frac{1}{2}\left(t + \frac{\operatorname{Sen}(8\pi f_0)}{8\pi f_0}\right)\Bigg|_{-T_0/2}^{T_0/2}\right]$$

$$a_n = \frac{A^2}{T_0}\left[\frac{1}{2}\left(\frac{T_0}{2} + \frac{\cancel{\operatorname{Sen}(4\pi)}^{0}}{8\pi f_0} + \frac{T_0}{2} - \frac{\cancel{\operatorname{Sen}(-4\pi)}^{0}}{8\pi f_0}\right)\right]$$

$$a_n = \frac{A^2}{T_0}\left[\frac{1}{2}\left(\frac{T_0}{2} + \frac{T_0}{2}\right)\right] = \frac{A^2}{\cancel{T_0}}\left(\frac{\cancel{T_0}}{2}\right)$$

$$\boxed{a_n = \frac{A^2}{2}} \qquad \therefore \quad a_2 = \frac{A^2}{2}$$

$$bn = \frac{2}{T_0}\int_{-T_0/2}^{T_0/2}\left(\frac{A^2}{2}+\frac{A^2}{2}\cos(4\pi f_0 t)\right)\left(\mathrm{Sen}(n\omega_0 t)\right)dt \qquad \omega_0 = 2\pi f_0$$

$n = 2$

$$bn = \frac{2}{T_0}\int_{-T_0/2}^{T_0/2}\frac{A^2}{2}\left(1+\cos(4\pi f_0 t)\right)\left(\mathrm{Sen}(2\cancel{n}2\pi f_0 t)\right)dt$$

$$bn = \frac{A^2}{T_0}\int_{-T_0/2}^{T_0/2}\left(\mathrm{Sen}(4\pi f_0 t)+\underbrace{\cos(4\pi f_0 t)\,\mathrm{Sen}(4\pi f_0 t)}_{\frac{\mathrm{Sen}(8\pi f_0 t)}{2}}\right)dt$$

$$bn = \frac{A^2}{T_0}\int_{-T_0/2}^{T_0/2}\mathrm{Sen}(4\pi f_0 t)+\frac{1}{2}\mathrm{Sen}(8\pi f_0 t)\;dt$$

$$bn = \frac{A^2}{T_0}\left[-\frac{\cos(4\pi f_0 t)}{4\pi f_0}-\frac{\cos(8\pi f_0 t)}{8\pi f_0}\right]_{-T_0/2}^{T_0/2}$$

$$bn = \frac{A^2}{T_0}\left[-\frac{\cos(2\pi)}{4\pi f_0}-\frac{\cos(4\pi)}{8\pi f_0}-\left(-\frac{\cos(-2\pi)}{4\pi f_0}-\frac{\cos(4\pi)}{8\pi f_0}\right)\right]$$

$$bn = \frac{A^2}{T_0}\left[-\cancel{\frac{\cos(2\pi)}{4\pi f_0}}-\cancel{\frac{\cos(4\pi)}{8\pi f_0}}+\cancel{\frac{\cos(-2\pi)}{4\pi f_0}}+\cancel{\frac{\cos(4\pi)}{8\pi f_0}}\right]$$

$$\boxed{bn = 0} \qquad b_2 = 0$$