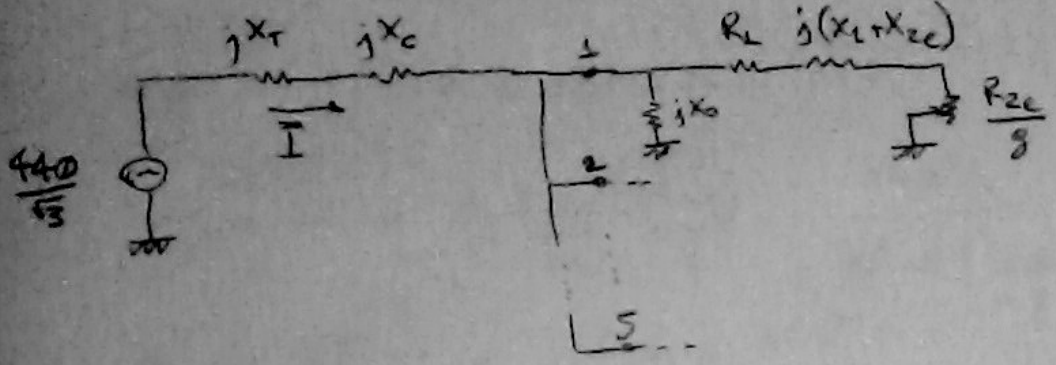
SOLUCIÓN PROBLEMA 1



$$X_T = 0.12 \cdot \frac{.44^2}{.5} = \underline{0.04646\ \Omega}$$

$$X_c = 3.5 \cdot .025 = \underline{0.0875\ \Omega}$$

$$X_0 = \frac{440}{20\sqrt{3}} = \underline{12.70\ \Omega}$$

$$\frac{X_1 + X_{1c}}{R_1 + \frac{R_{2c}}{g_n}} = tg\ \text{arccos}\ 0.91 = 0.4546 \quad , \quad R_L = R_{2c} \quad , \quad P_N = 3R_1\frac{(1-g_n)}{g_n}I_{2c}^2$$

$$I_{2cn}^2 = \frac{440^2/3}{R_1^2\left(1+\frac{1}{g_n}\right)^2\left(1+0.4546^2\right)}$$

$$\Rightarrow R_L = \frac{440^2}{P_N} \cdot \frac{1-g_n}{g_n} \cdot \frac{1}{\left(1+\frac{1}{g_n}\right)^2} \cdot \frac{1}{1+0.4546^2} =$$

$$= \frac{440^2}{P_N} \cdot \frac{g_n(1-g_n)}{(1+g_n)^2} \cdot \frac{1}{1+0.4546^2} = \underline{0.04030\ \Omega = R_L = R_{2c}}$$

$P_N = 75k$

$g_n = 0.02 = \frac{1000-980}{1000}$

$$X_L + X_{2c} = 0.4546 - 0.0403\left(1+\frac{1}{0.02}\right) = \underline{0.9343\ \Omega}$$

b)

Cálculo de g de los motores en marcha:

m = nº de motores en régimen.

$$X = X_T + X_C = 0.1340\ \Omega$$

$$m C_r \omega = 3 \frac{R_{2c}}{m} \frac{(1-g)}{g} \cdot \frac{440^2/3}{X^2 + \left(\frac{R_{2c}}{mg}\right)^2}$$

$$m C_r \frac{2\pi}{60} n_s = \frac{m R_{2c}\, g\, 440^2}{(mgX)^2 + R_{2c}^2}$$

$$g^2 \left[m^3 C_r \frac{2\pi}{60} n_s X^2 \right] - g \left[m R_{2c} 440^2 \right] + m C_r \frac{2\pi}{60} n_s R_{2c}^2 = 0$$

$$g^2 \underbrace{\left[m^2 C_r \frac{2\pi}{60} n_s X^2 \right]}_{1346} - g \underbrace{\left[R_{2c} 440^2 \right]}_{7802} + \underbrace{C_r \frac{2\pi}{60} n_s R_{2c}^2}_{121.8} = 0$$

$$g = \frac{7802 \pm \sqrt{7802^2 - 4 \times 121.8 \times 1346 \times m^2}}{2 \times 1346 \times m^2}$$

$m = 3$: $g_3 = 0.01600$

$m = 4$: $g_4 = 0.01635$

$m = 5$: $g_5 = 0.01683$

Impedancia de armadura en λ de un motor:

$$\overline{Z}_A = 3(R_1 + R_{2c}) + j3(X_1 + X_{2c}) = (0.2418 + j\,2.803)\,\Omega$$

$$= \frac{\bar{V} - \bar{V}_1}{jX} = \frac{\bar{V}_1}{\bar{Z}_a/(5-m)} + \frac{\bar{V}_1}{R_{ze}/m g_m}$$

$$\bar{V}_1 \left(\frac{5-m}{\bar{Z}_a} + \frac{m g_m}{R_{ze}} + \frac{1}{jX} \right) = \frac{\bar{V}}{jX}$$

$$\bar{V}_1 = \begin{cases} 229.3 \angle -8.723^\circ \text{ V}, & m = 3 \\ 237.3 \angle -11.94^\circ \text{ V}, & m = 4 \\ 244.6 \angle -15.63^\circ \text{ V}, & m = 5 \end{cases}$$

$$\bar{I} = \begin{cases} 330.1 \angle -38.25^\circ \text{ A}, & m = 3 \\ 401.1 \angle -24.01^\circ \text{ A}, & m = 4 \\ 510.8 \angle -15.66^\circ \text{ A}, & m = 5 \end{cases}$$

$\Rightarrow$ El cable debe soportar 510.8 A en el peor caso, que corresponde a los 5 motores trabajando en régimen.