

AUXILIAR #6: MÁQUINA C.C.

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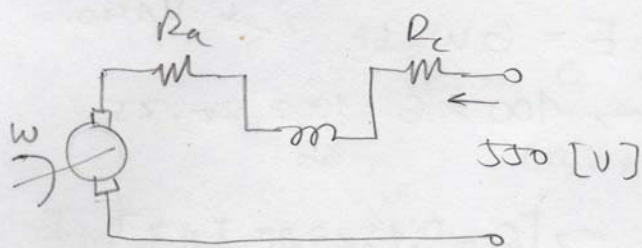
23 de Octubre de 2006.

PROBLEMA 1:

$$V = 550 \text{ [V]} \quad \eta = 750 \text{ rpm} \quad I = 74 \text{ [A]}$$

$$R_a = 0,35 \text{ [\Omega]} \quad R_c = 0,15 \text{ [\Omega]}$$

En este caso:



$$I = 74 \text{ [A]}$$

$$\Rightarrow E = 550 - R_c \cdot I - R_a \cdot I$$

$$\Rightarrow E = 513 \text{ [V]}$$

Wego: $P_{mec} = E \cdot I = 37962 \text{ [W]}$

Asi: $T = \frac{P_{mec}}{\omega} = \frac{37962}{\frac{750 \cdot 2\pi}{60}} = 483,347 \text{ [Nm]}$

$$\Rightarrow [T = 483,347 \text{ [Nm]}]$$

Se pide determinar η cuando $T' = 2T = 966,694$.
con $I = 110 \text{ (A)}$ y $V = 550 \text{ [V]}$

$$\Rightarrow E = 550 - (0,5) \cdot 110 = 550 - 55 = 495 \text{ [V]}$$

Wego: $[P_{mec} = 495 \cdot 110 \text{ [A]} = 54450 \text{ [W]}]$

y: $T' = 966,694 = \frac{54450}{\omega} = \frac{P_{mec}}{\omega}$

$$\Rightarrow \omega = 56,326 \text{ [rad/s]}$$

$$\Rightarrow \eta = \frac{\omega \cdot 60}{2\pi} = 537,873 \text{ [rpm]}$$

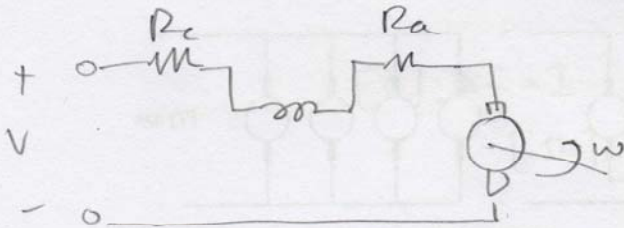
$$\Rightarrow [\eta = 537,873 \text{ [rpm]}]$$

PROBLEMA 2:

a) Motor CC serie $N_{\text{pole}} [\text{km/h}] = n/8 \quad n [\text{rpm}]$.

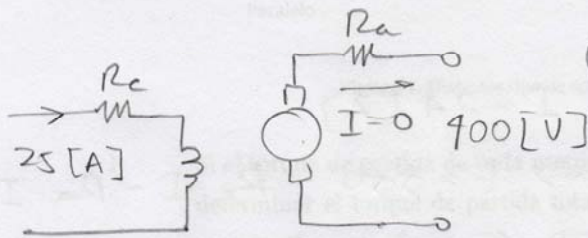
Resistato: $0 \rightarrow 10 [\Omega]$

$$\tau_p = 100 + 10\omega \quad \omega [\text{rad/s}].$$



PRUEBAS:

① $R_c + R_a = 0,2 [\Omega]$

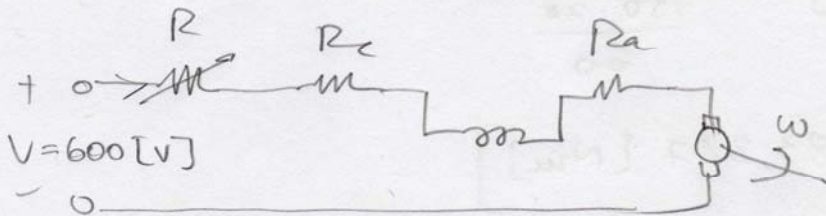


② $E = G\omega \cdot I_c \rightarrow V_{\text{Año.}}$

$$400 = G \cdot \frac{1000}{60} \cdot 25$$

$$\Rightarrow [G = 0,152789 [\text{H}]]$$

Wego:



$$R_c + R_a = 0,2$$

$$G = 0,152789 [\text{H}]$$

Calculamos el torque

$$E = 600 - I \cdot (R + 0,2)$$

$$P = E \cdot I$$

$$\tau = \frac{E \cdot I}{\omega}$$

$$E = G \cdot \omega \cdot I_c$$

$$I_c = I$$

Finalmente: $G \cdot \omega \cdot I = 600 - I(R + 0,2)$

$$\Rightarrow I(G\omega + R + 0,2) = 600 \Rightarrow I = \frac{600}{0,2 + R + G\omega}$$

$$\Rightarrow \tau = \frac{G \cdot \omega \cdot I^2}{\omega} = G \cdot I^2 = \frac{G \cdot 600^2}{(0,2 + R + G\omega)^2} = 100 + 10\omega$$

$$\Rightarrow R = 0 \Rightarrow \omega = 57,6898 [\text{rad/s}] \rightarrow n = 550,897 [\text{rpm}]$$

$$R = 10 \Rightarrow \omega = 20,7609 [\text{rad/s}] \rightarrow n = 198,252 [\text{rpm}]$$

Wego:

$$V_{TPOLE} = \begin{cases} 68,8621 \text{ [km/h]} \rightarrow R = 0 \text{ } [\Omega] \\ 24,7815 \text{ [km/h]} \rightarrow R = 10 \text{ } [\Omega] \end{cases}$$

b) $\Rightarrow R = 10 \text{ } [\Omega]$

Como se vio: $I = \frac{600}{0,2 + R + 6 \cdot \omega} \xrightarrow{\omega=0} \frac{600}{0,2 + 10} = 58,8235 \text{ [A]}$

$$\tau = \frac{6 \cdot 600^2}{(0,2 + 10)^2} = 528,682 \text{ [Nm]}$$

Finalmente:

$$\tau_{AC} = \tau_t - \tau_R = 528,682 - 100$$

$$\Rightarrow \tau_{AC} = 428,682 \text{ [Nm]}$$

I_{nom} ?

$$\eta = \frac{P_{OUT}}{P_{IN}} \Rightarrow P_{IN} = \frac{P_{OUT}}{\eta} = \frac{50.746}{0,85} = V_{nom} \cdot I_{nom}$$

$$\Rightarrow I_{nom} = \frac{50.746}{0,85 \cdot 600} = 73,1373 > I_{PARTIDA}$$

PREGUNTA 3:

4 motores CC. 1. 160 HP, 750 V, 3000 rpm nominales

i.) Torque nominal: $\tau_{nom} = \frac{160 \cdot 746}{2\pi \cdot 50} = 38 \text{ [Nm]}$

¿ Torque Partida?

$$T_p = 3.380 = 1140 \text{ [Nm]}$$

En la conexión serie: $I_c = I_a = I \Rightarrow T = 6 \cdot I^2$

Weg.

$$V = E + (R_a + R_c) I = G \omega I + (R_a + R_c) I$$

$$\Rightarrow V = (G \omega + R_a + R_c) I$$

$$\Rightarrow \left[I = \frac{V}{G \omega + R_a + R_c} \right]$$

Así:

$$T = \frac{G \cdot V^2}{(G \omega + R_a + R_c)^2} \xrightarrow{\omega=0} T_p = \frac{G V^2}{(R_a + R_c)^2}$$

Con lo que:

$$T_p = K V^2$$

$$\text{con } K = \frac{1 \cdot G}{(R_a + R_c)^2}$$

① PARALELO:

$$T_p = 4 \cdot T_{p1}(V) = 4 \cdot 1140 = 4560 \text{ [Nm]}$$

② SERIE

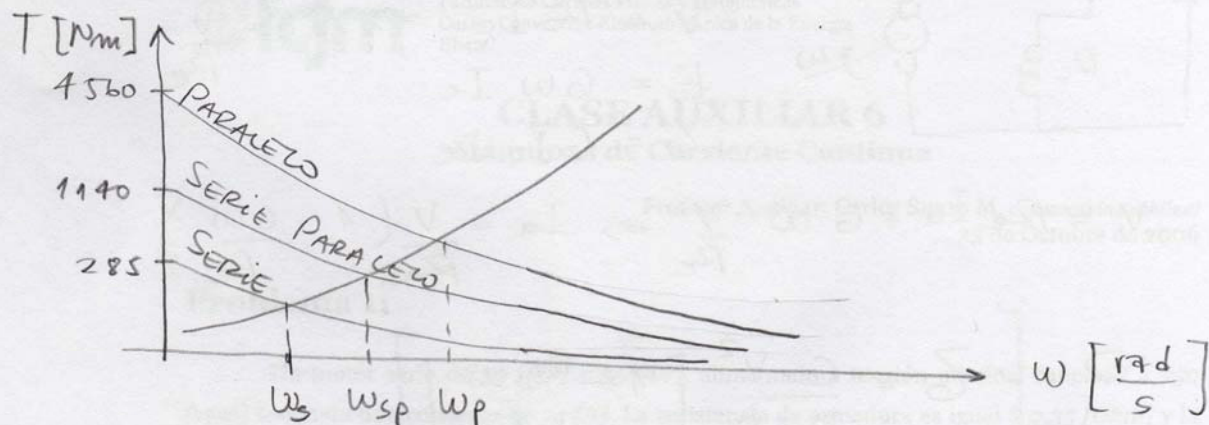
$$T_p = 4 \cdot T_p(V_{nom}/4) = 4 \cdot \frac{1}{4^2} \cdot 1140 = 285 \text{ [Nm]}$$

③ SERIE PARALELO:

$$T_p = 4 \cdot T_p(V_{nom}/2) = 4 \cdot \frac{1}{2^2} \cdot 1140 = 1140 \text{ [Nm]}$$

ii) Cuando $\omega \rightarrow \infty \rightarrow T \rightarrow 0$

Así:



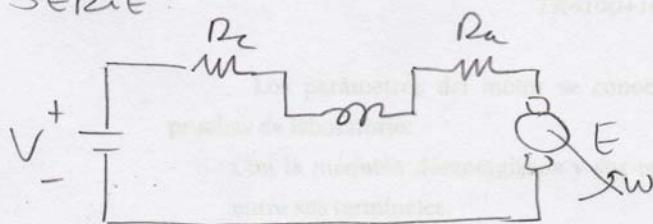
ORDEN:

- (1) PARTIDA SUAVE \Rightarrow SERIE ($T_{ACEL} = T - T_R$ REDUCIDO).
- (2) SERIE - PARALELO
- (3) PARALELO.

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CONEXIONES:

SERIE:



CONEXIÓN SERIE MOTOR CC.

Ecuaciones:

$$V = (R_c + R_a) I + E$$

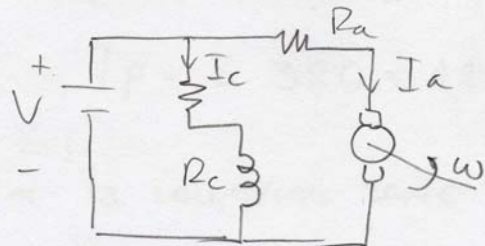
$$E = G \omega I$$

$$\Rightarrow I = \frac{V}{R_a + R_c + G \omega}$$

$$P_m = E \cdot I = G \omega I^2 = \frac{G V^2 \omega}{(R_a + R_c + G \omega)^2}$$

$$\tau = \frac{G V^2}{(R_a + R_c + G \omega)^2}$$

• PARALELO o SHUNT



$$V = R_a I_a + E$$

$$V = R_c I_c \Rightarrow I_c = \frac{V}{R_c}$$

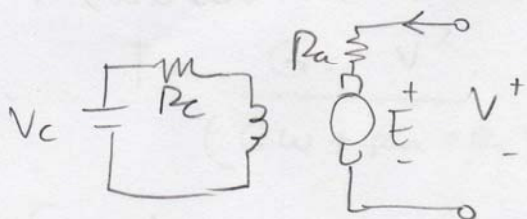
$$E = G \omega \cdot I_c$$

$$\mathcal{G} = G I_a I_c$$

$$\Rightarrow V = R_a I_a + G \omega \cdot \frac{V}{R_c} \Rightarrow I_a = \frac{V}{R_a} \left(1 - \frac{G \omega}{R_c} \right)$$

$$\Rightarrow \left[\mathcal{G} = \frac{G \cdot V^2}{R_a R_c} \left[1 - \frac{G \omega}{R_c} \right] \right]$$

• EXCITACIÓN INDEPENDIENTE:



$$V_c = R_c I_c$$

$$V = E + R_a I_a$$

$$E = G \omega I_c$$

$$\mathcal{G} = G I_a I_c$$

} Motor!