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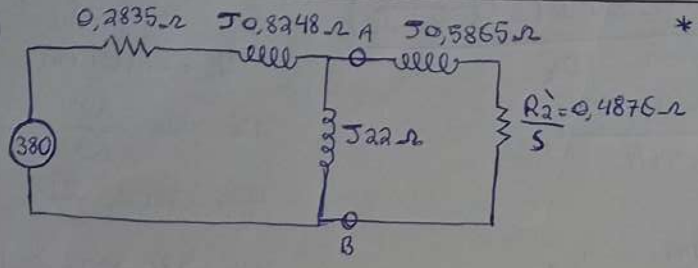
Lista 4 - Questão Única

01)



* mit ligado em Delta

a) $ZTH = (R_1 + Jx_1) \parallel Jxm$

$ZTH = (0,2835 + J0,8248) \parallel J22$

$ZTH = 0,8722 \angle 71,0311° \parallel 22 \angle 90°$

$$ZTH = \frac{0,8722 \angle 71,0311° \times 22 \angle 90°}{0,8722 \angle 71,0311° + 22 \angle 90°}$$

$$ZTH = \frac{19,1884 \angle 161,0311°}{22,8266 \angle 89,2884°}$$

$$VTh = \frac{VF \cdot Jxm}{R_1 + (Jx_1 + Jxm)}$$

$$VTH = \frac{380 \cdot 22 \angle 90°}{0,2835 + J22,8248}$$

$$VTH = \frac{8360 \angle 90°}{22,8266 \angle 89,2884°}$$

$VTH = 366,2394 \angle 0,7116°$ V

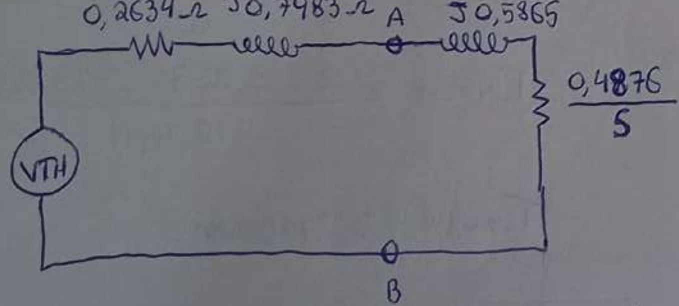
$|VTH| = 366,2394$ V

$ZTH = 0,8406 \angle 71,7421°\ \Omega = 0,2634 + J0,7983\ \Omega$

$RTH = 0,2634$

$XTH = J0,7983\ \Omega$

b) * Momento da Partida



$$S\_Partida = \frac{3600 - 0}{3600} = 1,0000$$

$Ztotal = (RTH + JxTH) + \left(\frac{R\grave{2}}{S}\right) + Jx\grave{2}$

$Ztotal = (0,2634 + J0,7983) + 0,4876 + J0,5865$

$Ztotal = 0,7510 + 1,3848J$

$Ztotal = 1,5753 \angle 61,5283°\ \Omega$

$|Ztotal| = 1,5753\ \Omega$

$$I_2\_partida = \frac{|VTH|}{|Z total|} = \frac{366,2394}{1,5753} = 232,4887\ A$$

$$Ns = \frac{120F}{P}$$

$$Ns = \frac{120 \cdot 60}{2}$$

$$Ns = 3600\ RPm$$

$$ws = Ns \cdot \frac{2\pi}{60}$$

$$ws = 3600 \cdot \frac{2\pi}{60}$$

$$ws = 376,9911\ rad/s$$

$$conjugado\_partida = \frac{3 \cdot |I_2\_partida|^2 \cdot \left(\frac{R2'}{S\_partida}\right)}{ws}$$

$$T\_partida = \frac{3 \cdot 54050 \cdot 0,4876}{376,9911}$$

$$T\_partida = 209,7285\ Nm$$

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c)

Para o momento em Vazio

$$S\_vazio = \frac{Ns - NR}{Ns} = \frac{3600 - 3594,60}{3600} = 0,0015$$

DADOS:

$ZTH = 0,8406 \angle 71,7421^\circ\ \Omega$

$RTH = 0,2634\ \Omega$

$XTH = 0,7983\ \Omega$

$|VTH| = 366,2394\ V$

$$I_2\_vazio = \frac{|VTH|}{|Z total|}$$

$$I_2\_vazio = \frac{366,2394}{325,3330}$$

$$I_2\_vazio = 1,1257\ A$$

$$Z total = (RTH + JXTH) + \left(\frac{R2'}{S\_vazio}\right) + JX2'$$

$$Z total = (0,2634 + J0,7983) + \left(\frac{0,4876}{0,0015}\right) + 0,5865J$$

$$Z Total = 325,3301 + 1,3848J$$

$$Z total = 325,3330 \angle 0,2439^\circ\ \Omega$$

$$|Z total| = 325,3330\ \Omega$$

$$T\_vazio = \frac{3 \cdot |I_2\_vazio|^2 \cdot \left(\frac{R2'}{S\_vazio}\right)}{ws}$$

$$T\_vazio = \frac{3 \cdot 1,2672 \cdot 325,0667}{376,9911}$$

$$T\_vazio = 3,2780\ Nm$$

d)

DADOS: $Z_{TH} = 0,8406 \angle 71,7421°$

$R_{TH} = 0,2634\ \Omega$

$X_{TH} = 0,7983\ \Omega$

$|V_{TH}| = 366,2394\ V$

$\omega_s = 376,9911\ rad/s$

* Para o momento de velocidade nominal

$$S\_nominal = \frac{n_s - n_R}{n_s} = \frac{3600 - 3456}{3600} = 0,0400$$

$$Z_{total} = (R_{TH} + jX_{TH}) + \left(\frac{R_2'}{S\_nominal}\right) + jX_2'$$

$$Z_{total} = (0,2634 + j0,7983) + \left(\frac{0,4876}{0,0400}\right) + j0,5865$$

$$Z_{total} = 12,4534 + j1,3848$$

$$Z_{total} = 12,5302 \angle 6,3451°\ \Omega$$

$$|Z_{total}| = 12,5302\ \Omega$$

$$I_{2}\_nominal = \frac{|V_{TH}|}{|Z_{total}|} = \frac{366,2394}{12,5302} = 29,2285\ A$$

$$T\_nominal = \frac{3 \cdot |I_2\_nominal|^2 \cdot \left(\frac{R_2'}{S\_nominal}\right)}{\omega_s}$$

$$T\_nominal = \frac{3 \cdot 854,3073 \cdot 12,1900}{376,9911}$$

$$T\_nominal = 82,8720\ Nm$$

e)

$$S_{Tmáx} = \frac{R_2'}{\sqrt{R_{TH}^2 + (X_{TH} + X_2')^2}}$$

$$S_{Tmáx} = \frac{0,4876}{\sqrt{0,2634^2 + (1,3848)^2}}$$

$$S_{tmáx} = \frac{0,4876}{\sqrt{0,0694 + 1,9177}}$$

$$S_{tmáx} = \frac{0,4876}{1,4096} = 0,3459$$

f)

$$T_{máx} = \left(\frac{1}{\omega_s}\right) \cdot \left\{ \frac{1,5 \cdot |V_{TH}|^2}{R_{TH} \cdot \sqrt{R_{TH}^2 + (X_{TH} + X_2')^2}} \right.$$

$$\left(\frac{1}{}\right) \left\{ \frac{1,5 \cdot (366,}{} \right.$$

b)

$$T\_máx = \left(\frac{1}{\omega_s}\right) \cdot \left\{\frac{1,5 \cdot |V_{TH}|^2}{R_{TH} + \sqrt{R_{TH}^2 + (X_{TH} + X_2')^2}}\right]$$

$$T\_máx = \left(\frac{1}{376,9911}\right) \cdot \left\{\frac{1,5 \cdot (366,2394)^2}{0,2634 + \sqrt{0,2634^2 + (0,7983 + 0,5865)^2}}\right]$$

$$T\_máx = 0,0027 \cdot \left\{\frac{201196,9472}{0,2634 + 1,4096}\right]$$

$$T\_máx = 0,0027 \cdot \left(\frac{201196,9472}{1,6730}\right)$$

$$T\_máx = 0,0027 \cdot 120261,1759$$

$$T\_máx = 324,7052 \text{ Nm}$$

g)

$$S_{Tmáx} = 0,3459$$

$$Z\_{Tmáx} = \left(R_{TH} + \frac{R_2'}{S_{Tmáx}}\right) + \left(Jx_{TH} + Jx_2'\right)$$

$$Z\_{tmáx} = (0,2634 + 1,4097) + (0,7983J + 0,5865J)$$

$$Z\_{tmáx} = 1,6731 + J1,3848 = 2,1719 \angle 39,6141^{\circ}\ \Omega$$

$$|Z\_{tmáx}| = 2,1719\ \Omega$$

$$|I_2\_{tmáx}| = \frac{|V_{TH}|}{|Z\_{tmáx}|} = \frac{366,2394}{2,1719} = 168,6263\ A$$

$$T\_{máx} = \frac{3 \cdot |I_2\_{tmáx}|^2 \cdot \left(\frac{R_2'}{S_{Tmáx}}\right)}{\omega_s}$$

$$T\_{máx} = \frac{3 \cdot 28434,8291 \cdot 1,4097}{376,9911}$$

$$T\_{máx} = 318,9830\ Nm$$

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h)

$$\frac{I_p}{I_n} = \frac{232,4887}{29,2285} = 7,9542$$