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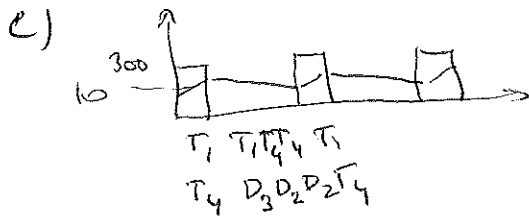
b) $P_{\text{magn}} = 300 \cdot 1 = 300 \text{ W}$
 $P_{\text{ra}} i_a^2 = 200 \text{ W}$

$P_{\text{Fe}} = P_{\text{hyst}} + P_{\text{whom}}$

$P_{\text{gr}} : T_{\text{cu}} - T_{\text{med}} = \varphi \cdot i - \frac{P_{\text{h}}}{\omega} = 1 \cdot 10 - \frac{2400}{2\pi \cdot n/60}$

$P_{\text{grc}} = P_{\text{in}} - P_{\text{ut}} = 300 + 300 \cdot 10 - 2400 = 960 \text{ W}$

$\Rightarrow P_{\text{Fe}} + P_{\text{gr}} = 400 \text{ W}$



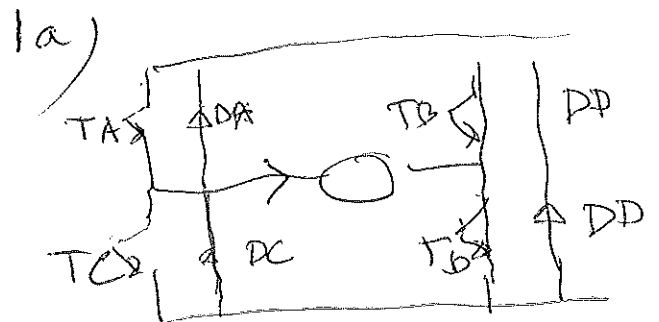
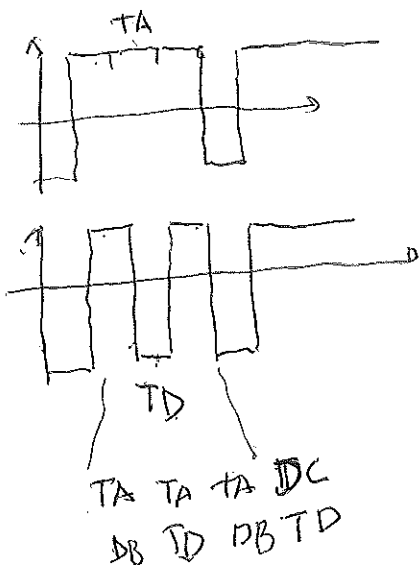
$u_a = \frac{300}{4} \Rightarrow \frac{t_p}{T} = 0,25$

$\Delta i = \frac{300 - 20 - 75}{10 \cdot 10^{-3}} \cdot 0,25 \cdot \frac{1}{f_{\text{sw}}} = 5,125 \text{ A}$

d) $i_a = -10 \text{ A}$

$u_a = \frac{300}{4} \text{ V} \quad e = u_a - R_a i_a = \frac{300}{4} + 20 = 95 \text{ V}$

$\omega = 95 \text{ rad/s} = 907 \text{ rpm}$

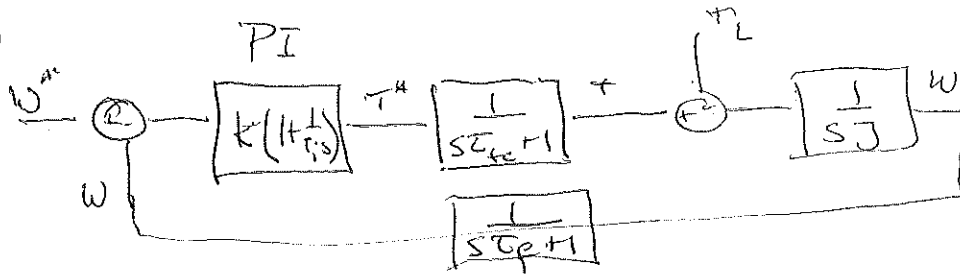


I) Rotorspannungssteuerung
 II) Faltsteuerung

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2)

a)



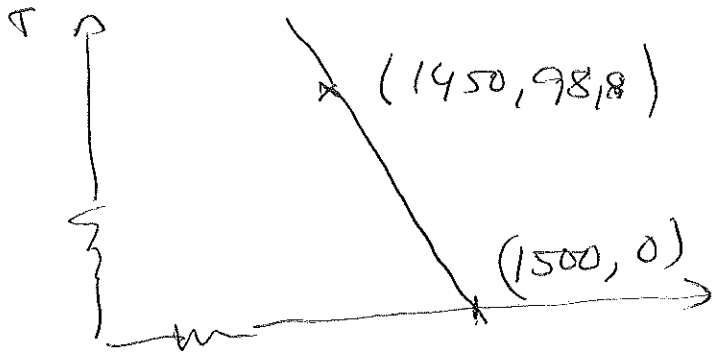
b)

Se ferdész.

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3 a) 4 pölar 1500 rpm

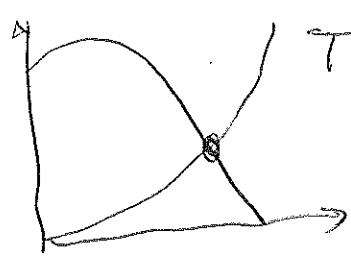
b) $T_n = \frac{15000}{\frac{1450 \cdot 2\pi}{60}} = 98,8 \text{ Nm}$



$y = kx + l : 98,8 = k \cdot 1450 + l$
 $0 = k \cdot 1500 + l$
 $98,8 = k \cdot 1450 - k \cdot 1500$
 $k = -\frac{98,8}{50} ; l = \frac{1500 \cdot 98,8}{50}$

$y = -\frac{98,8}{50} \cdot x + \frac{1500}{50} \cdot 98,8$
 $T = -\frac{98,8}{50} \cdot n + \frac{1500}{50} \cdot 98,8$

c)



$T_L = k \cdot n^2$
 $T = -1,976 \cdot n + 2964$

$46 = k \cdot 1000^2 \Rightarrow T_L = \frac{46}{1000^2} \cdot n^2$

$\frac{46}{1000^2} \cdot n^2 = -\frac{98,8}{50} \cdot n + \frac{1500}{50} \cdot 98,8$

$\frac{46}{1000^2} \cdot n^2 + \frac{98,8}{50} \cdot n - \frac{1500}{50} \cdot 98,8 = 0$

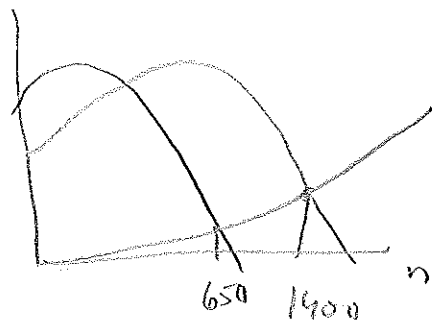
$n^2 + \frac{98,8}{50} \cdot \frac{1000^2}{46} \cdot n - \frac{1500}{50} \cdot \frac{98,8}{46} \cdot 1000^2 = 0$

$n = -\frac{98,8}{100} \cdot \frac{1000^2}{46} \pm \sqrt{\left(\frac{98,8}{100} \cdot \frac{1000^2}{46}\right)^2 + \frac{1500 \cdot 98,8}{50 \cdot 46} \cdot 1000^2}$

$n = -\frac{1,976}{2 \cdot 46 \cdot 10^{-6}} \pm \sqrt{\left(\frac{1,976}{2 \cdot 46 \cdot 10^{-6}}\right)^2 + \frac{2964}{46 \cdot 10^{-6}}}$ = 13157 rpm

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4.a)



$$P = T \cdot \omega = k \cdot \omega^3$$

$$\frac{P_1}{P_2} = \left(\frac{\omega_1}{\omega_2}\right)^3$$

$$\omega_2 = \omega_1 \cdot \sqrt[3]{\frac{P_2}{P_1}}$$

$$\omega_2 = \omega_1 \cdot \left(\frac{P_2}{P_1}\right)^{1/3} = 1400$$

$$n_2 = n_1 \cdot \left(\frac{P_2}{P_1}\right)^{1/3} = 1400 \cdot \left(\frac{120}{1200}\right)^{1/3} = 650 \text{ rpm}$$

$$T_1 = 8,2 \text{ Nm}$$

$$n_1 = 1400 \text{ rpm}$$

$$V_1 = 400 \text{ V}$$

$$T_2 = \frac{P_2}{\omega_2} = \frac{3 \cdot R_2 \cdot i^2}{2\pi \cdot 50/2} = 45 \text{ Nm}$$

alt:

$$s_1 = \frac{1500 - 1400}{1500} = 0,07$$

$$i_1 = \sqrt{\frac{8,2 \cdot 50 \cdot 0,07}{3 \cdot 1,2}}$$

$$\text{alt } i_1 = \frac{400/\sqrt{3}}{1,2 + j1,8/0,07 + j3} = 11,5 \text{ A}$$

$$\text{alt } i_1 = \sqrt{\frac{1200}{3 \cdot 1,2 \cdot (1 - \frac{1}{11})}} / \frac{1}{14} = 4,88 \text{ A}$$

$$c) \text{ } \varphi_2 / \omega: \frac{P_2}{\omega} = \frac{650}{1400} = 696 \text{ W}$$

$$\frac{696}{0,8} = 870 \text{ W}$$

$$696 \cdot 24 = 16,7 \text{ kWh/day}$$

$$T_1 = \frac{P_1}{\omega_1} = \frac{1200}{2\pi \cdot 1400/60} = 8,2 \text{ Nm}$$

$$P_2 = 120 \text{ W}$$

$$T_2 = \frac{120}{\omega_2}$$

$$\frac{T_2}{T_1} = \left(\frac{\omega_1}{\omega_2}\right)^2$$

$$T_2 = \frac{P_2}{\omega_2} = \frac{120}{2\pi \cdot 650/60} =$$

$$n_2 = 650 \text{ rpm}$$

$$V_2 = 400 \cdot \frac{650}{1400} = 187 \text{ V}$$

$$\frac{P}{\varphi_2} = 50 \cdot \frac{650}{1400} = 23,2 \text{ Hz}$$

$$n_{s2} = \frac{120 \cdot f_2}{P} = 696 \text{ rpm}$$

$$s_2 = \frac{696,3 - 650}{696,3} = 0,07$$

$$i_2 = \sqrt{\frac{P_2}{3 \cdot R_r \cdot \frac{1-s_2}{s_2}}} = 1,54 \text{ A}$$

$$\text{Further on: } \frac{P_2}{0,8} = \frac{120}{0,8} = 150 \text{ W}$$

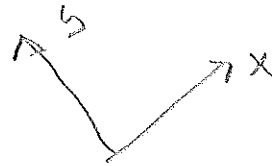
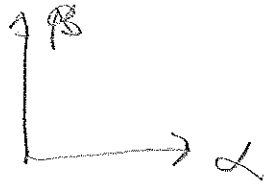
$$\frac{150}{0,9} = 167 \text{ W}$$

$$167 \cdot 24 = 4 \text{ kWh/day}$$

$$\text{Skillned: } (16,7 - 4) \cdot 2 = 25 \text{ kWh/day}$$

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5.a)

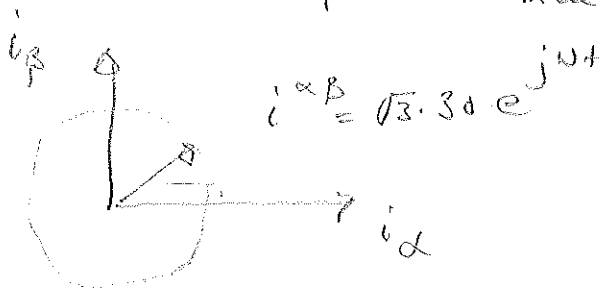


$$s^k y = s^{\alpha\beta} \cdot e^{-j\omega t}$$

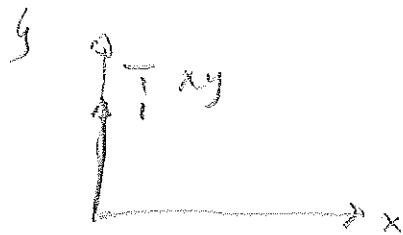
$$b) \quad i_a = 30A e^{j\omega t} \quad |I| = \sqrt{3} \cdot 30$$

$$n = 1000 \text{ rpm} = n_{\text{mech}}$$

$$\omega_{\text{mech}} = \frac{2\pi}{60} \cdot 1000 = 105 \text{ rad/s}$$



$$\omega_{\text{el}} = \frac{2\pi}{60} \cdot 2000 \cdot 2 = 209 \text{ rad/s}$$



$$i_{sy} = \sqrt{3} \cdot 30$$

$$c) \quad T = \psi_{mx} \cdot i_{sy} \quad |\vec{\psi}| = \sqrt{3} \cdot 0,6$$

$$T_{\text{el}} = \sqrt{3} \cdot 0,6 \cdot \sqrt{3} \cdot 30 = 54 \text{ Nm}$$

$$T_{\text{mech}} = \frac{P}{2} \cdot T_{\text{el}} = 108 \text{ Nm}$$

$$u_{sx} = R_s i_{sx} - \omega L_m i_{sy} - \omega \psi_{my} = 0 - \omega L_m i_{sy} - 0$$

$$u_{sy} = R_s i_{sy} + \omega L_m i_{sx} + \omega \psi_{mx} = R_s i_{sy} + 0 + \omega \cdot \psi_{mx}$$

$$u_{sx} = - \frac{2\pi}{60} \cdot 2000 \cdot 5 \cdot 10^{-3} \cdot \sqrt{3} \cdot 30 = -10\pi \cdot \sqrt{3} = -54 \text{ V}$$

$$u_{sy} = 0,3 \cdot 0,5 \cdot 30 + \frac{2\pi \cdot 2000}{60} \cdot \sqrt{3} \cdot \frac{1}{10} = 40\pi \cdot \sqrt{3} = 217 \text{ V}$$