Elektromotorni pogoni

1. DZ - 2007/08

1. zadatak

(a)

$$M = 0$$

(b)

$$M = Fr\sin\alpha = \frac{FD}{2}\sin\alpha = 25\sqrt{3}Nm = 43.3Nm$$

(c)

$$M = Fr = \frac{FD}{2} = 50Nm$$

2. zadatak

Obzirom da je jedan puni okretaj, onda je $\varphi = 2\pi$.

$$W = Fs = Fr\varphi = 2\pi F\frac{D}{2} = \pi FD$$

(a)

$$W_a = \pi FD_a = 706.858J$$

(b)

$$W_b = \pi FD_b = 1413.7167J$$

3. zadatak

$$\omega = \frac{v}{r}$$

$$\omega_a = \frac{2v_a}{D_a} = 204\frac{rad}{s} \qquad \omega_b = \frac{2v_b}{D_b} = 102\frac{rad}{s}$$

$$P = M\omega = Fr\omega$$

$$P_a = Fr_a\omega_a = 22950W \qquad P_b = Fr_b\omega_b = 22950W$$

Isto se moglo dobiti i formulom $P = Fv$, pa obzirom da je obodna brzina u oba slučaja ista, a ista je i sila, dobije se ista snaga.

4. zadatak

$$\omega = \frac{n\pi}{30} \rightarrow \omega_a = \omega_b = 50\pi \frac{rad}{s}$$

$$P_a = Fr_a\omega_a = 17.671kW$$

$$P_b = Fr_b\omega_b = 35.342kW$$

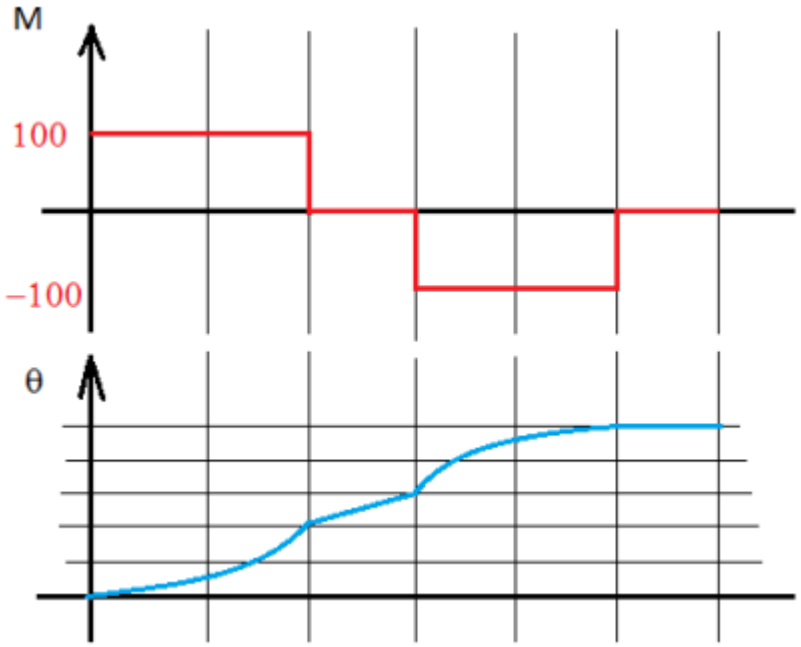
5. zadatak

$$W = \Delta E = \frac{1}{2}J\omega^2 = \frac{J}{2}\left(\frac{n\pi}{30}\right)^2$$

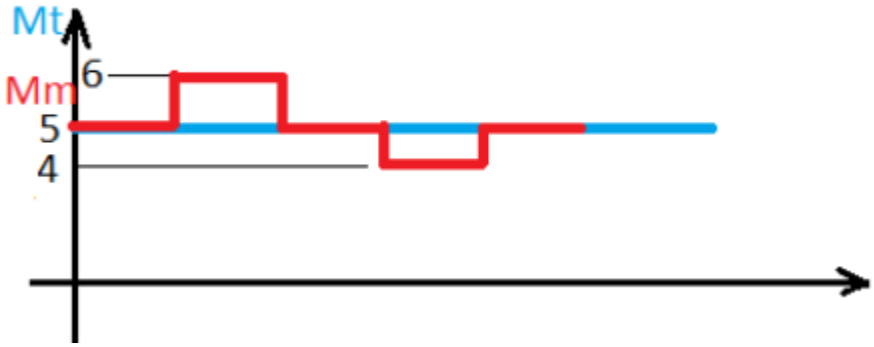
$$W_1 = 6031.425J$$

$$W_2 = 13570.7J$$

6. zadatak



7. zadatak



8. zadatak

$$P_{osovina} = M\omega = M\frac{n\pi}{30} = 13927.72743W$$

$$P_{tr,v} = P - P_{osovina} = 1472.272569W$$

$$M_{tr,v} = M_{zaustavljanja} = J\frac{d\omega}{dt} = J\frac{\pi}{30}\frac{dn}{dt}$$

$$M_{tr,v} = \frac{Ptr,v}{\frac{n\pi}{30}}$$

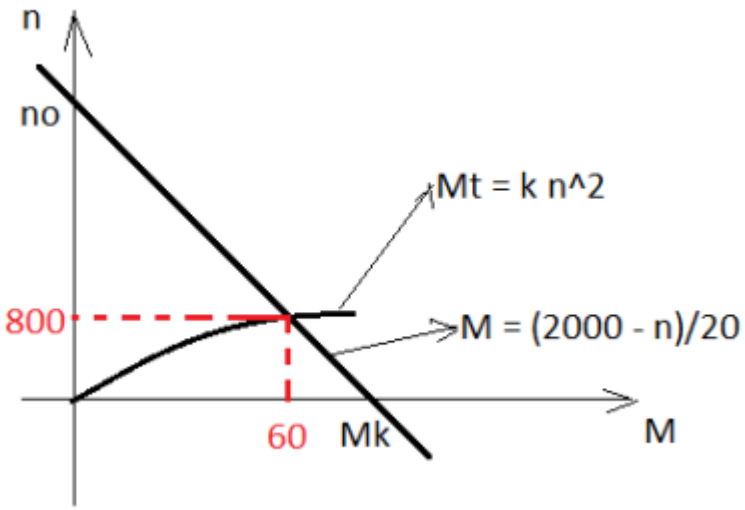
Iz svega proizlazi da je:

$$dt = \frac{n \cdot dn \cdot J}{P_{tr,v}} \left(\frac{\pi}{30}\right)^2$$

odnosno:

$$\Delta t = \frac{n \cdot \Delta n \cdot J}{P_{tr,v}} \left(\frac{\pi}{30}\right)^2 = \frac{1400 \cdot 1400 \cdot 0.3}{1472.272569} \left(\frac{\pi}{30}\right)^2 = 4.38s$$

9. zadatak



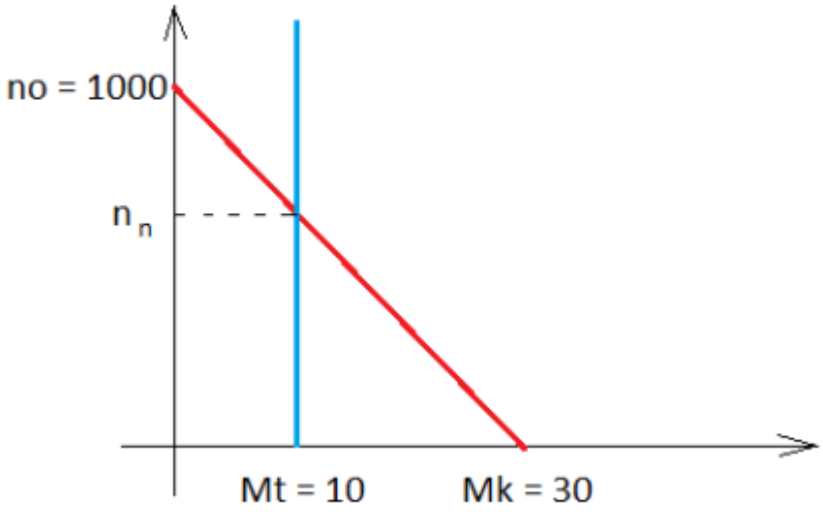
Nađemo sjecište karakteristika:

$$\frac{2000-n}{20} = kn^2 \rightarrow 20 \cdot 9.375 \cdot 10^{-5} n^2 + n - 2000 = 0$$

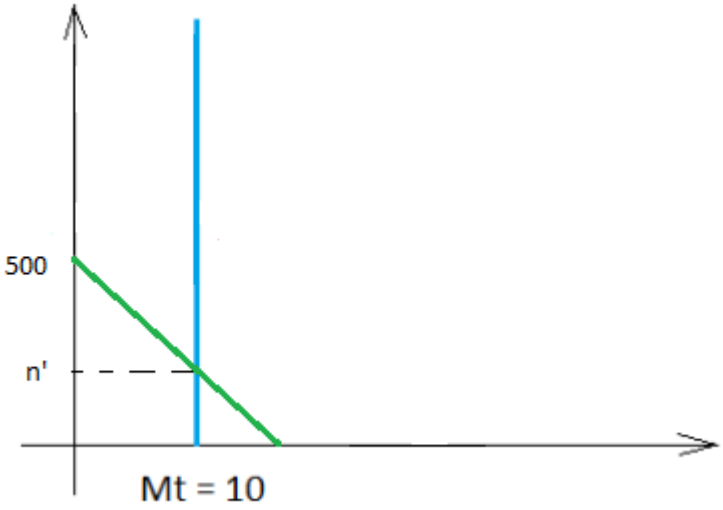
iz čega je $n = 800\frac{r}{min}$. Nakon što tu brzinu uvrstimo u $M = \frac{2000-n}{20}$, dobije se $M = 60Nm$.

10. zadatak

Karakteristika prije promjene napona:



Karakteristika poslije promjene napona:



Napon se smanji za 50 posto pa je nova karakteristika paralelan pravac spušten prema dolje.

Ako je jednadžba početne karakteristike jednaka

$$n = 1000 - \frac{1000}{30}M$$

onda je jednadžba nove karakteristike

$$n = 500 - \frac{1000}{30}M$$

Da bismo dobili n', uvrstimo $M = 10Nm$ i dobijemo $n' = 166.67\frac{rad}{s}$.