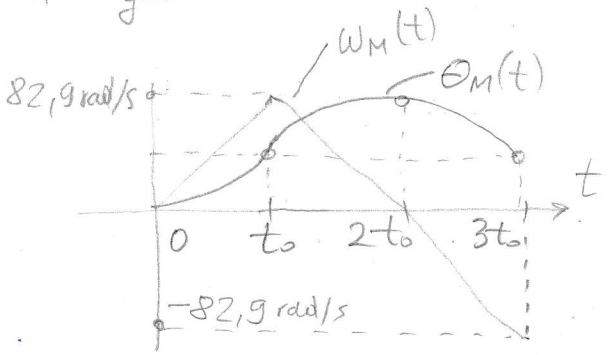
VH – 20180905

1 $J_{eq} = J_M + \left(\frac{\omega_L}{\omega_M}\right)^2 J_L = 2 + \left(\frac{1}{3}\right)^2 20 = 4{,}22\ kgm^2$

$\frac{\omega_L}{\omega_M} = \frac{n_M}{n_L} = \frac{1}{3}$



$T_M = 700\ Nm = J_{eq} \cdot \frac{d\omega_M}{dt}$ → S → 0

$\omega_M(t) = \frac{T_M}{J_{eq}} \cdot t + \omega_M(0)$

$\omega_M(t_0) = \frac{T_{M1}}{J_{eq}} \cdot t_0 = \frac{700}{4{,}22} 0{,}5 = 82{,}9\ rad/s$

$\omega_M(3t_0) = \omega_M(t_0) + \frac{T_{M2}}{J_{eq}}(3t_0 - t_0) = 82{,}9 - \frac{700}{4{,}22} \cdot 1 = -82{,}9\ rad/s$

$\theta_M(t_0) = \int_0^{t_0} \omega_M dt = \frac{\omega_M(t_0) \cdot t_0}{2} = \frac{82{,}9}{2} \cdot 0{,}5 = 20{,}725\ rad$

$\theta_M(3t_0) = \theta_M(t_0) + \int_{t_0}^{3t_0} \theta_M(t)\,dt = \theta_M(t_0) + \int_{t_0}^{2t_0} \theta_M(t)\,dt + \int_{2t_0}^{3t_0} \theta_M(t)\,dt = 20{,}725\ rad$

20,725 | 20,725 | − 20,725

2 $T_M = k_T I_M = 1{,}3 \cdot 10 = 13\ Nm.$

$T_{acc} = T_M - T_L = 13 - 3 = 10\ Nm.$

$V_M = R_a I_a + k_E \omega_M = 48\ V \Rightarrow \omega_M = \frac{V_M - R_a I_a}{k_E} = \frac{48 - 0{,}68 \cdot 10}{1{,}1} = 37{,}5\ \frac{rad}{s}$

$\frac{d\omega_M}{dt} = \frac{T_{acc}}{J_{eq}}$; $J_{eq} = J_M + J_L = 0{,}5 + 1{,}5 = 2\ kg\,m^2$

$\frac{d\omega_M}{dt} = \frac{10}{2} = 5\ \frac{rad}{s^2}$; $t_0 = \frac{\omega_M}{\frac{d\omega_M}{dt}} = \frac{37{,}5}{5} = 7{,}5\ s$

3 $S_0 = 1500 - 1460 = 40\ 1/min.$

$S_1 = 1{,}5 \cdot S_0 = 60\ 1/min.$ $n_1 = 1500 - 60 = 1440\ 1/min;$

$P_0 = 25\ kW$; $P_1 = 1{,}5\,P_0 = 37{,}5\ kW;$

$T_1 = \frac{P_1}{\omega_1} = \frac{37500}{150{,}8} = 248{,}7\ Nm$

$\omega_1 = \frac{2\pi}{60} \cdot n_1 = \frac{2\pi}{60} \cdot 1440 = 150{,}8\ rad/s$