Opterecenje je nezavisno od brzine i konstantno $o := 2\cdot\pi$

$m_m := 20N\cdot m$

Podaci asinhronog motora

$U_n := 220V$ $\omega_n := 1440\cdot\frac{o}{min}$ $P := 2$

$R_s := 1.54\Omega$ $R_r := 2.5\Omega$ $\omega_s := 2\cdot\pi\cdot 50Hz$

$\lambda_s := 0.0088H$ $\lambda_r := \lambda_s$

$s_n := \frac{\omega_s - P\cdot\omega_n}{\omega_s}$ $s_n = 4\cdot\%$ Nominalno klizanje

$s_p := \frac{R_r}{\sqrt{R_s^2 + \omega_s^2\cdot(\lambda_s + \lambda_r)^2}}$ $s_p = 43.55659\cdot\%$ Prevalno klizanje

$\omega_p := s_p\cdot\frac{\omega_s}{P}$ $\omega_p = 68.419\cdot\frac{rad}{s}$ $\omega_p = 653.349\cdot\frac{o}{min}$ Meh. prevalna brzina

$Z(s) := R_s + \frac{R_r}{s} + i\cdot\omega_s\cdot(\lambda_s + \lambda_r)$ Fazna impedansa

$I(s) := \frac{U_n}{Z(s)}$ $m_{AC}(s) := 3\cdot P\cdot\frac{R_r}{s}\cdot\frac{1}{\omega_s}\cdot\frac{U_n^2}{(|Z(s)|)^2}$

$I_n := \frac{U_n}{Z(s_n)}$ $I_n = (3.41 - 0.294i)\,A$ $|I_n| = 3.423\,A$ $\arg(I_n) = -4.935\cdot deg$

$\cos(\arg(I_n)) = 0.996$ Zanemarena struja magnećenja.

Podaci jednosmernog motora

$U_{an} := 440V$ $I_{an} := 100A$ $\omega_{DCn} := 2500\cdot\frac{o}{min}$ $R_a := 0.17\Omega$

$\Psi_{fn} := \frac{U_{an} - R_a\cdot I_{an}}{\omega_{DCn}}$ $\Psi_{fn} = 1.616\,Wb$

a) Koju će brzinu imati pogon ako je uključen samo jednosmerni pogon na nominalni napon, a koju ako je uključen samo asihroni?

$\omega_{aDC} := \frac{U_{an}}{\Psi_{fn}} - R_a\cdot\frac{m_m}{\Psi_{fn}^2} = 271.019\cdot\frac{rad}{s}$ $\omega_{aDC} = 2.588\times 10^3\cdot\frac{o}{min}$

$s_{poc} := 0.2$ Given $m_{AC}(s_{poc}) = m_m$ $s_a := \text{Find}(s_{poc}) = 0.059$

$$(1 - s_a)\cdot\frac{\omega_s}{P} = 147.809\cdot\frac{rad}{s} \qquad (1 - s_a)\cdot\frac{\omega_s}{P} = 1411.475\cdot\frac{o}{min}$$

b) Pr kojoj brzini će jednosmerni motor razvijati najveći momenat ako su oba motora uključena

$$\omega_b := \frac{\omega_s}{P}(1 + s_p) = 225.498\cdot\frac{rad}{s} \qquad \omega_b = 2.153\times 10^3\cdot\frac{o}{min} \qquad s_p = 0.436$$

$$m_{bAC} := m_{AC}(-s_p) = -110.053\cdot N\cdot m$$

$$m_{bDC} := m_m - m_{bAC} = 130.053\cdot N\cdot m$$

$$u_{bDC} := \Psi_{fn}\cdot\omega_b + R_a\cdot\frac{m_{bDC}}{\Psi_{fn}} = 378.03\,V \qquad I_{bDC} := \frac{m_{bDC}}{\Psi_{fn}} = 80.491\,A$$

c) Pri kojoj brzini će jednosmerni motor razvijati najmanji momenat ako su oba motora uključena

$$\omega_c := \frac{\omega_s}{P}(1 - s_p) = 88.661\cdot\frac{rad}{s} \qquad \omega_c = 846.651\cdot\frac{o}{min}$$

$$m_{cAC} := m_{AC}(s_p) = 63.49\cdot N\cdot m \qquad \Psi_{fn} = 1.616\,Wb$$

$$m_{cDC} := m_m - m_{cAC} = -43.49\cdot N\cdot m$$

$$u_{cDC} := \Psi_{fn}\cdot\omega_c + R_a\cdot\frac{m_{cDC}}{\Psi_{fn}} = 138.678\,V \qquad I_{cDC} := \frac{m_{cDC}}{\Psi_{fn}} = -26.916\,A$$

d) Uslov statičke stabilnosti u ovom pogonu kada rade oba motora. Opseg brzina?

$$\left(\frac{d}{d\omega}m_{dc}\right) + \left(\frac{d}{d\omega}m_{ac}\right) < \frac{d}{d\omega}m_m \qquad \left(\frac{d}{d\omega}m_m\right) = 0$$

e) Kako se moze ostvariti brzina jednaka 3/4 sinhrone brzine asinhronog motora, kada su oba motora ukljucena istovremeno.

$\omega_a := \frac{3}{4}\cdot\frac{\omega_s}{P}$ $\omega_a = 117.81\cdot\frac{rad}{s}$ $\omega_a = 1125\cdot\frac{o}{min}$ $s_a := \frac{1}{4}$

$m_{AC}(s_a) = 56.452\cdot N\cdot m$

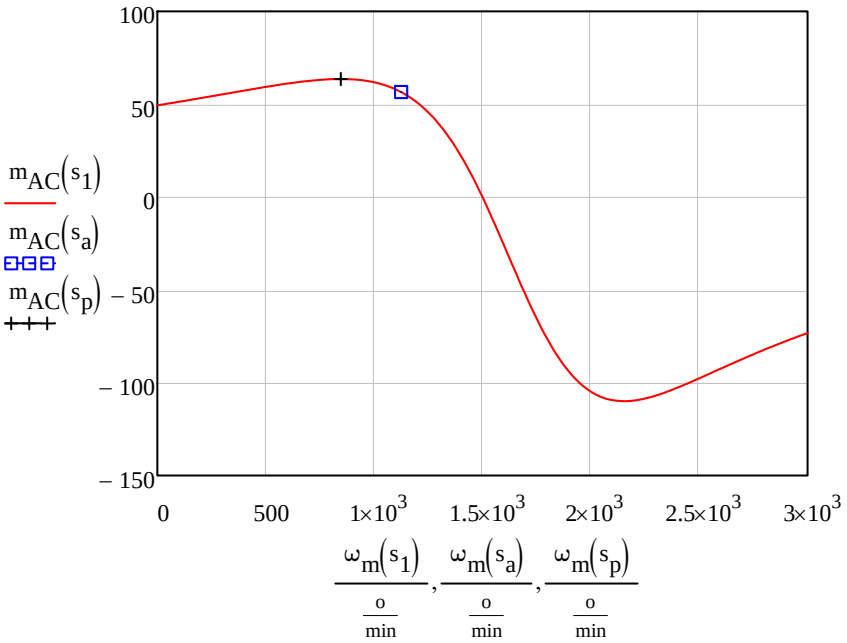
$m_{DC} := m_m - m_{AC}(s_a)$ $m_{DC} = -36.452\cdot N\cdot m$

$I_{DC} := \frac{m_{DC}}{\Psi_{fn}}$ $I_{DC} = -22.561\ A$

$U_{DC} := R_a\cdot I_{DC} + \omega_a\cdot\Psi_{fn}$ $U_{DC} = 186.515\ V$ $\frac{U_{DC}}{U_n} = 0.848$

$\omega_m(s) := \frac{\omega_s}{P}\cdot(1 - s)$

$s_1 := 1, 0.99 .. -1$



f) Da li je rezim rada asinhronog motora ekonomican?

$\omega_a = 1125 \cdot \frac{o}{min}$ $\omega_p = 653.349 \cdot \frac{o}{min}$

Posto je tacka sa brzinom vecom od prevalne, zadovoljen je uslov staticke stabilnisti.
Sa druge strane, fazna struja u tom rezimu je veca od nominalne, pa takav rezim ne moze da traje dugo sa stanovista gubitaka i zagrevanja.

$I(s_a) = (15.505 - 7.429i)\,A$ $\frac{|I(s_a)|}{|I_n|} = 5.023$

g) Sta ce se dogoditi ako se u ovom rezimu iskljuci jednosmerni motor, a sta ako se iskljuci asinhroni.

Iskljucenje jednosmernog motora:

$s_c := 0.1$

Pocetni pogodak.

Given

$m_{AC}(s_c) = m_m$

$s_c := \text{Find}(s_c)$ $s_c = 5.902 \cdot \%$

$\omega_c := \frac{\omega_s}{P} \cdot (1 - s_c)$ $\omega_c = 147.809 \cdot \frac{rad}{s}$ $\omega_c = 1411.475 \cdot \frac{o}{min}$

$I(s_c) = (4.933 - 0.621i)\,A$

$|I(s_c)| = 4.972\,A$

Iskljucenje asinhronog motora:

$m_{DC} := m_m$

$I_{DC} := \frac{m_{DC}}{\Psi_{fn}}$ $I_{DC} = 12.378\,A$

$\omega_{DC} := \frac{U_{DC} - R_a \cdot I_{DC}}{\Psi_{fn}}$ $\omega_{DC} = 114.134 \cdot \frac{rad}{s}$ $\omega_{DC} = 1089.9 \cdot \frac{o}{min}$