$U_n := 230V \qquad I_n := 26.0A \qquad \omega_n := 150\frac{rad}{s} \qquad R_a := 1.1\Omega \qquad L_a := 0.01H$

$\Sigma J := 0.32kg\cdot m^2$

$U_b := U_n \qquad I_b := I_n \qquad \omega_b := \omega_n \qquad 0.667\cdot\omega_b = 100.05\cdot\frac{rad}{s} \qquad \Psi_{fn} := \frac{U_n - R_a\cdot I_n}{\omega_n}$

$\Psi_{fn} = 1.343\,Wb$

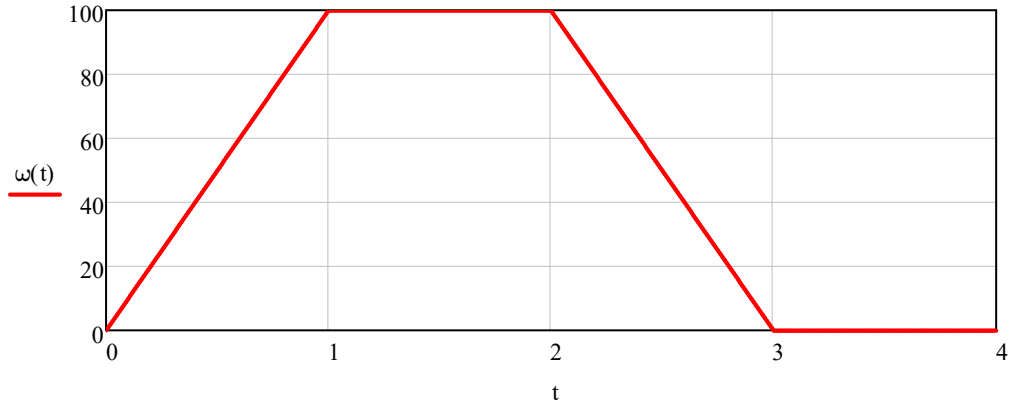
$M_{en} := \Psi_{fn}\cdot I_n = 34.909\cdot N\cdot m \qquad m_{mo} := 0.3\cdot M_{en} = 10.473\cdot N\cdot m \qquad k := 0.0\cdot\frac{M_{en}}{\omega_n} \qquad k = 0$

Željeni dijagram brzine: Vreme nije normalizovano.

$$\omega(t) := \begin{cases} 0 & \text{if } t < 0s \\ \left(100\cdot\frac{rad}{s^2}t\right) & \text{if } 0s \le t < 1s \\ 100\frac{rad}{s} & \text{if } 1s \le t < 2s \\ \left[100\frac{rad}{s} - 100\cdot\frac{rad}{s^2}\cdot(t - 2s)\right] & \text{if } 2s \le t < 3s \\ 0 & \text{if } t \ge 3s \end{cases}$$

$m_m(t) := 0.3\cdot M_{en} + k\cdot\omega(t)$

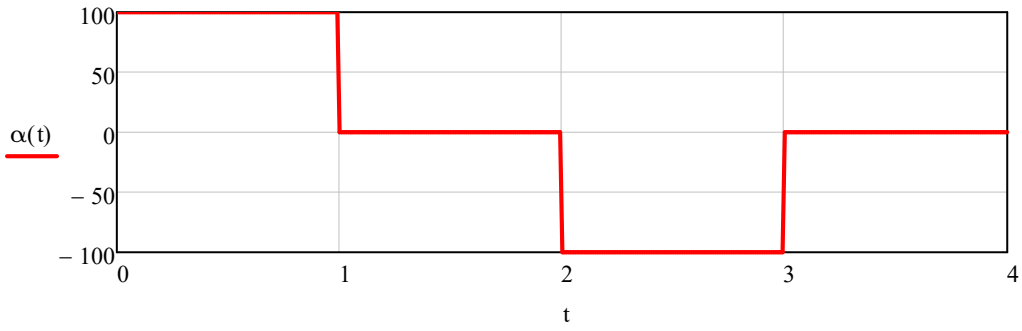
$t := 0s, 0.01s .. 4s$



Moment ima statički i dinamičku komponentu. Dinamička komponenta je proporcionalna ubrzanju.

$$\alpha(t) := \begin{cases} 0 \quad \text{if } t < 0s \\ \left(100 \frac{rad}{s^2}\right) \quad \text{if } 0s \le t < 1s \\ 0 \quad \text{if } 1s \le t < 2s \\ \left(-100 \frac{rad}{s^2}\right) \quad \text{if } 2s \le t < 3s \\ 0 \quad \text{if } t \ge 3s \end{cases}$$

$$\alpha(t) := \frac{d}{dt}\omega(t)$$



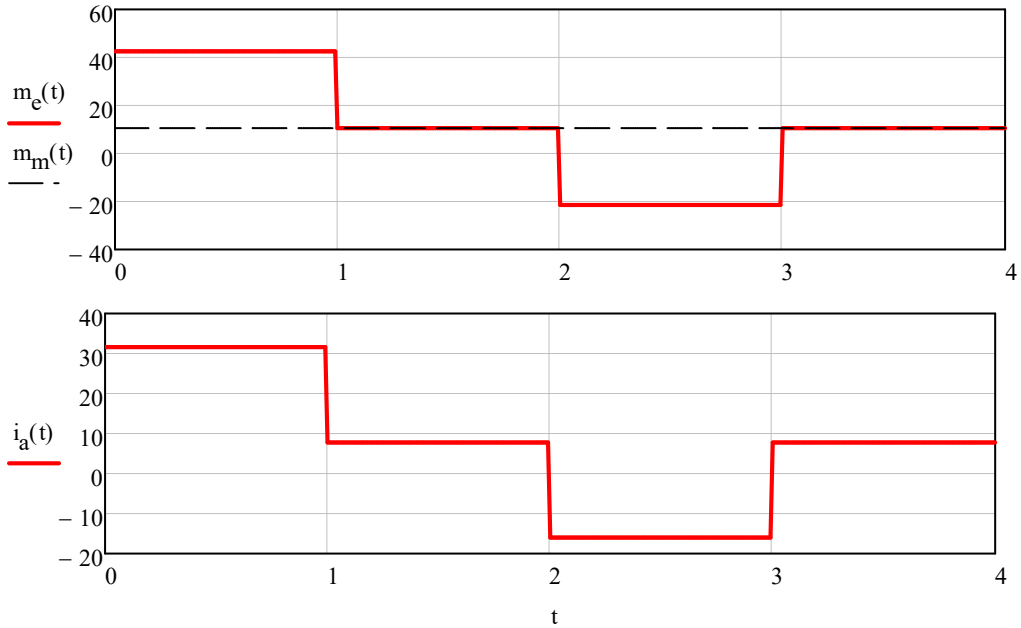
$$m_e(t) := m_m(t) + \Sigma J \cdot \alpha(t) \qquad i_a(t) := \frac{m_e(t)}{\Psi_{fn}}$$

$m_e(0 \cdot s) = 42.473 \cdot N \cdot m$ $m_e(0.99 \cdot s) = 42.473 \cdot N \cdot m$ $m_e(1 \cdot s) = 10.473 \cdot N \cdot m$ $m_e(1.99 \cdot s) = 10.473 \cdot N \cdot m$

$m_e(2 \cdot s) = -21.527 \cdot N \cdot m$ $m_e(2.99 \cdot s) = -21.527 \cdot N \cdot m$ $m_e(3 \cdot s) = 10.473 \cdot N \cdot m$ $m_e(3.99 \cdot s) = 10.473 \cdot N \cdot m$

$i_a(0 \cdot s) = 31.633 \cdot A$ $i_a(0.99 \cdot s) = 31.633 \cdot A$ $i_a(1.0 \cdot s) = 7.8 \cdot A$ $i_a(1.99 \cdot s) = 7.8 \cdot A$

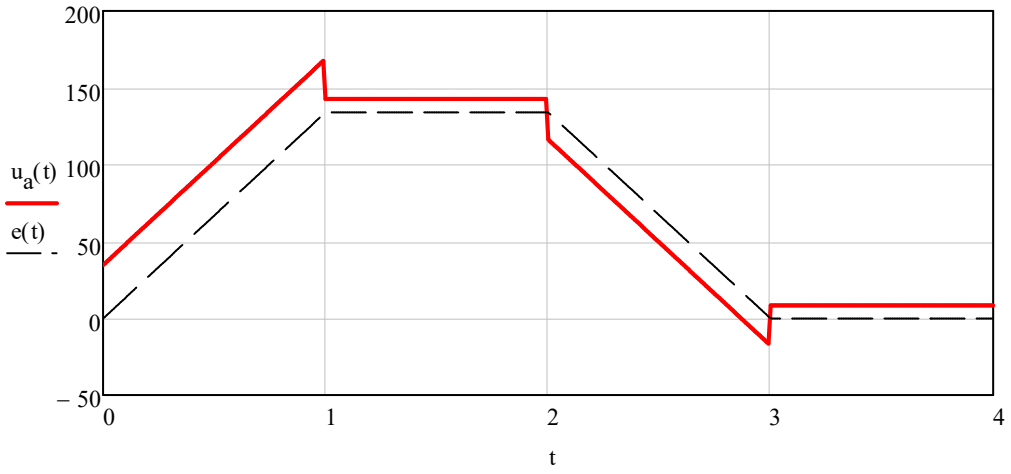
$i_a(2.0 \cdot s) = -16.033 \cdot A$ $i_a(2.99 \cdot s) = -16.033 \cdot A$ $i_a(3.0 \cdot s) = 7.8 \cdot A$ $i_a(3.99 \cdot s) = 7.8 \cdot A$



$e(t) := \omega(t) \cdot \Psi_{fn}$ $u_a(t) := \omega(t) \cdot \Psi_{fn} + R_a \cdot i_a(t)$

$u_a(0) = 34.796\,V \quad u_a(0.999 \cdot s) = 168.929\,V \quad u_a(1 \cdot s) = 142.847\,V \quad u_a(1.99 \cdot s) = 142.847\,V$

$u_a(2.0 \cdot s) = 116.63\,V \quad u_a(2.99 \cdot s) = -16.294\,V \quad u_a(3.0s) = 8.58\,V \quad u_a(3.99s) = 8.58\,V$



C)

$$i_{aC}(t) := \begin{cases} 7.8A & \text{if } t < 2s \\ 0 & \text{if } t \geq 2s \end{cases}$$

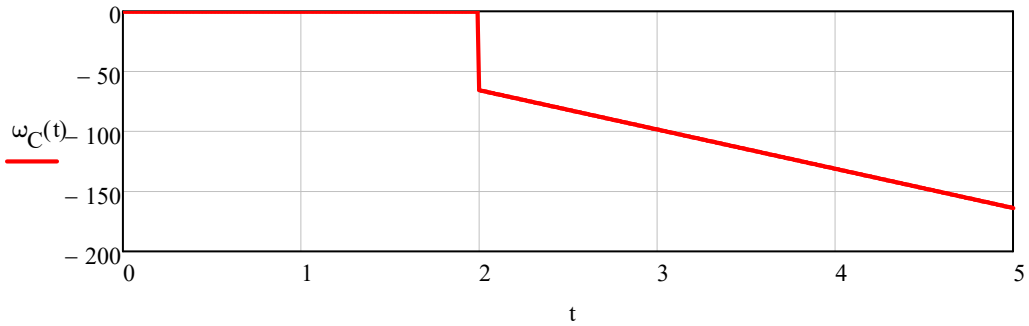
$$m_{eC}(t) := \begin{cases} \Psi_{fn} \cdot i_{aC}(t) & \text{if } t < 2s \\ 0 & \text{if } t \geq 2s \end{cases}$$

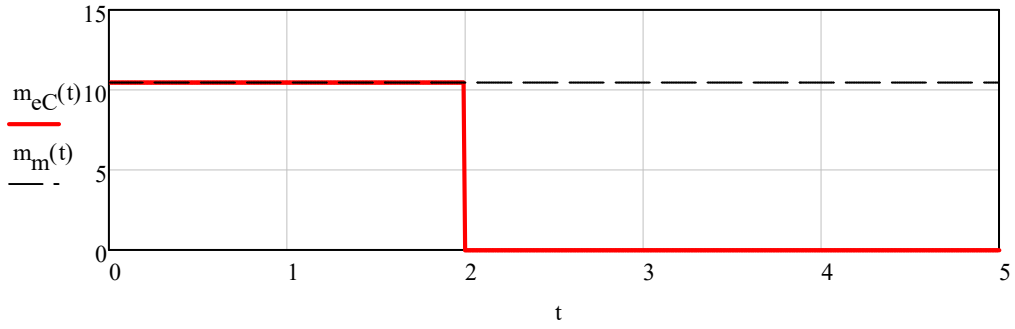
$$\alpha C(t) := \begin{cases} 0 & \text{if } t < 2s \\ -\dfrac{m_m(t)}{\Sigma J} & \text{if } t \geq 2s \end{cases}$$

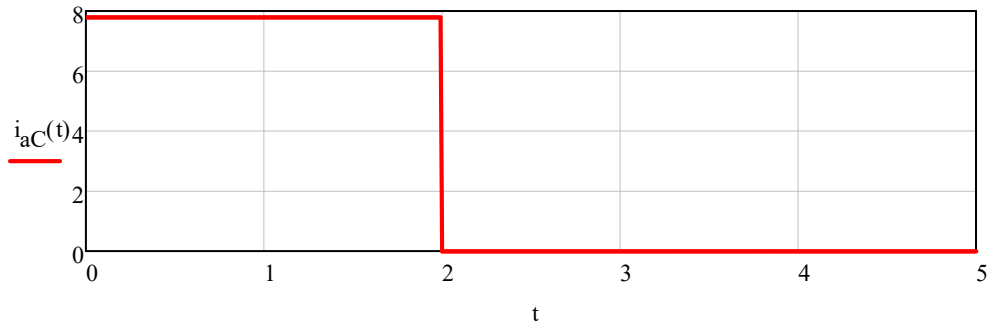
$$\omega_C(t) := \alpha C(t) \cdot t$$

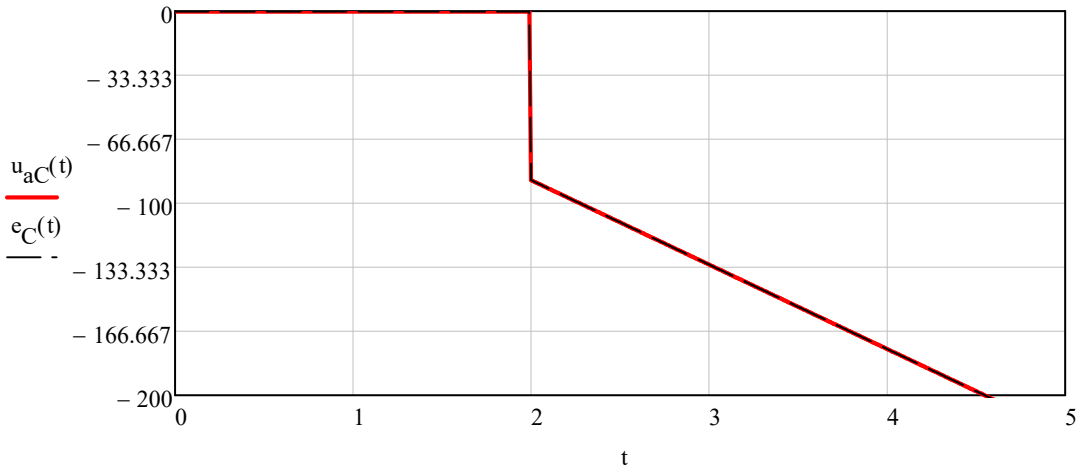
$$e_C(t) := \omega_C(t) \cdot \Psi_{fn} \qquad u_{aC}(t) := e_C(t)$$

$t := 0s, 0.01s .. 5s$









$u_{aC}(4.5s) = -197.74\ V$

$U_{sn} := 220V$ $f_{sn} := 50Hz$ $\omega_{sn} := 2\cdot\pi\cdot f_{sn}$ $o \equiv 2\cdot\pi\ rad$

$R_r := 2.5\Omega$ $\lambda_s := 8.8mH$ $\lambda_r := \lambda_s$ $s_n := \frac{1500 - 1400}{1500} = 0.0667$ $P := 2$

$\omega_b := \omega_{sn}$ $U_b := U_{sn}$ $J := 1kg\cdot m^2$

$$I_n := \frac{U_{sn}}{\sqrt{\left(\frac{R_r}{s_n}\right)^2 + \omega_{sn}^2\cdot(\lambda_s + \lambda_r)^2}} = 5.8039\ A \qquad M_b := \frac{3\cdot U_b\cdot I_n}{\frac{\omega_b}{P}} = 24.3863\cdot N\cdot m$$

$T_m := J\cdot\frac{\omega_b}{M_b} = 12.8826\ s$ $Z_b := \frac{U_b}{I_n} = 37.9054\ \Omega$ $L_b := \frac{Z_b}{\omega_b}$

$\lambda_e := \frac{\lambda_s + \lambda_r}{L_b} = 0.1459$ $R_r := \frac{R_r}{Z_b} = 0.066$ $\omega_n := \frac{1400}{1500} = 0.9333$ $\omega_n\cdot\frac{\omega_b}{P} = 146.6077\cdot\frac{rad}{s}$

$\omega_{rpr} := \frac{R_r}{\lambda_e} = 0.4521$ $\omega_{rpr}\cdot\omega_b = 142.0455\cdot\frac{rad}{s}$ $m_{pr} := \frac{1}{2\cdot\lambda_e} = 3.4277$ $m_{pr}\cdot M_b = 83.59\cdot N\cdot m$

$$U_s(\omega_s) := \begin{cases} \left(\frac{U_{sn}}{\omega_{sn}}\cdot\omega_s\right) & \text{if } 0 < \omega_s < \omega_{sn} \\ U_{sn} & \text{otherwise} \end{cases} \qquad U_s(\omega_s) := \begin{cases} \omega_s & \text{if } 0 < \omega_s < 1 \\ 1 & \text{otherwise} \end{cases}$$

$$m_e(\omega_s, \omega_r) := \frac{R_r\cdot\omega_r}{R_r^2 + \omega_r^2\cdot(\lambda_e)^2} \qquad i_s(\omega_s, \omega_r) := \frac{U_s(\omega_s)}{\sqrt{\left(R_r\cdot\frac{\omega_s}{\omega_r}\right)^2 + \omega_s^2\cdot\lambda_e^2}} \qquad I_s(\omega_s, \omega_r) := \frac{U_s(\omega_s)}{R_r\cdot\frac{\omega_s}{\omega_r} + i\cdot\omega_s\cdot\lambda_e}$$

$\omega_{sA} := \frac{30Hz}{50Hz} = 0.6$ $\omega_r := -2, -1.99 .. 1$ $\omega_{rn} := 1 - \omega_n = 0.0667$ $\omega_{rn}\cdot\omega_b = 20.944\cdot\frac{rad}{s}$

$M_{en} := m_e(1, \omega_{rn}) = 0.9893$ $M_{en}\cdot M_b = 24.1254\cdot N\cdot m$ $\omega_{sA}\cdot\frac{\omega_b}{P} = 900\cdot\frac{o}{min}$

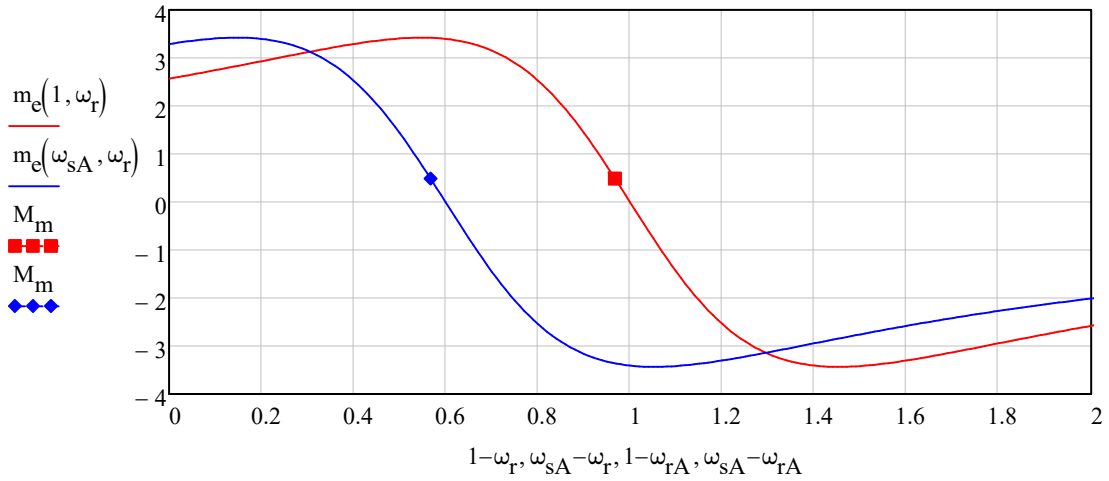
$M_m := \frac{1}{2}\cdot M_{en}$ $M_m\cdot M_b = 12.0627\cdot N\cdot m$ $M_m = 0.4947$

$\omega_{rx} := 0.001$ Given $m_e(\omega_{sn}, \omega_{rx}) = M_m$ $\omega_{rA} := \text{Find}(\omega_{rx}) = 0.0328$

Rešava se kvadratna jednačina.

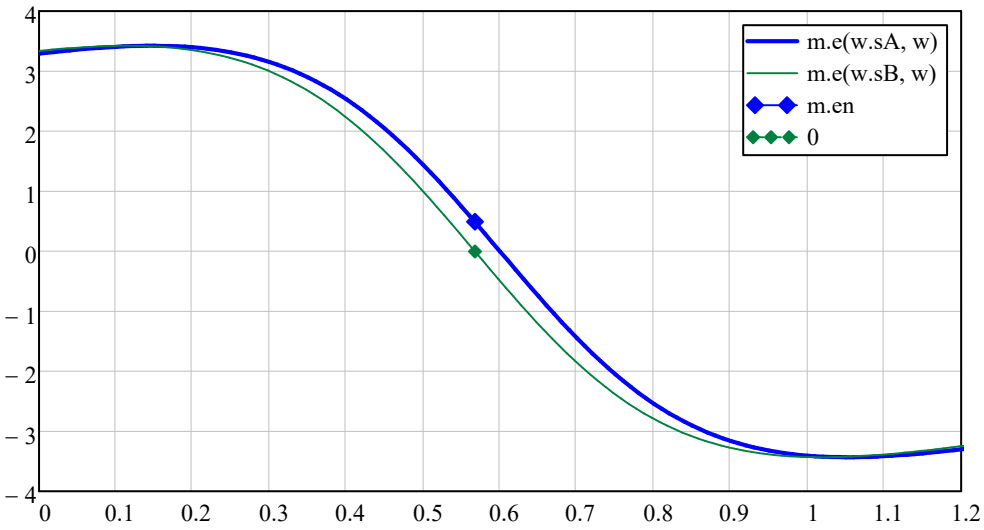
$\omega_A := \omega_{sA} - \omega_{rA} = 0.5672$ $\omega_A\cdot\frac{\omega_b}{P} = 89.0962\cdot\frac{rad}{s}$ $\omega_A\cdot\frac{\omega_b}{P} = 850.8064\cdot\frac{o}{min}$

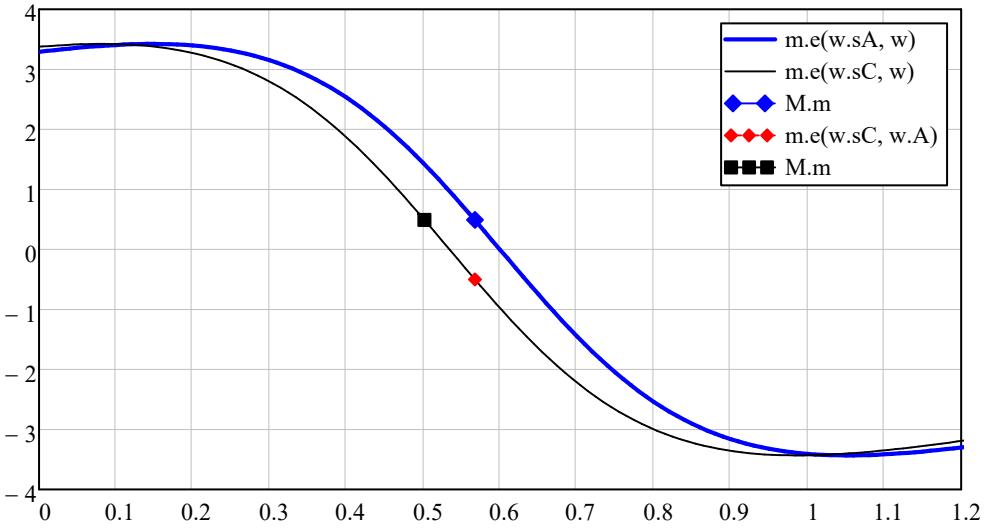
$i_{sA} := i_s(\omega_{sA}, \omega_{rA}) = 0.496$ $i_{sA}\cdot I_n = 2.8785\ A$ $U_s(\omega_{sA}) = 0.6$ $U_s(\omega_{sA})\cdot U_{sn} = 132\ V$

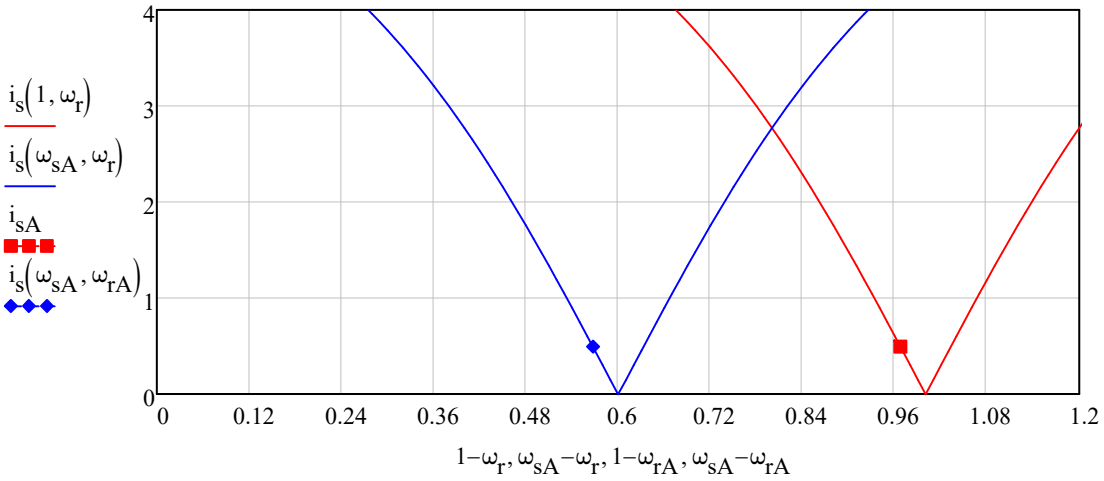


$\Delta\omega_{s.min} := \omega_{rA}$ $\Delta\omega_{s.min}\cdot\omega_b = 10.3031\cdot\frac{rad}{s}$ $\Delta\omega_{s.min}\cdot 50Hz = 1.6398\cdot Hz$

$\omega_{sB} := \omega_{sA} - \Delta\omega_{s.min} = 0.5672$ $\omega_{sC} := \omega_{sA} - 2\Delta\omega_{s.min} = 0.5344$ $\omega_C := \omega_{sC} - \omega_{rA} = 0.5016$







$f_{sA} := 35Hz$ $f_{sB} := f_{sA} - \Delta\omega_{s.min} \cdot f_{sn} = 33.3602 \cdot Hz$

$\omega_{sC} \cdot \omega_b = 167.8894 \cdot \frac{rad}{s}$ $m_e(\omega_{sC}, \omega_{sC} - \omega_A) \cdot M_b = -12.0627 \cdot N \cdot m$ $m_e(\omega_{sC}, \omega_{sC} - \omega_C) \cdot M_b = 12.0627$