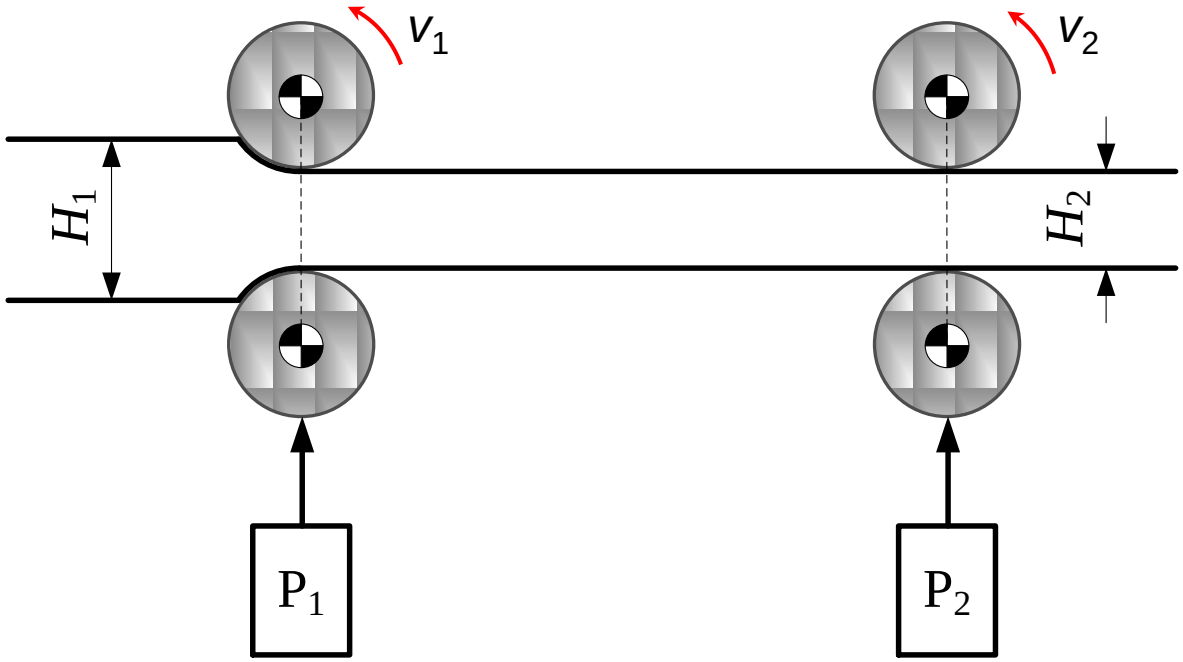
Višemotorni pogoni sa izrazito viskoznom osobinom mehaničke veze pogonskih vratila

- *Višemotorni pogoni u funkciji plastične deformacije*
- *Višemotorni pogoni sa nezavisnim funkcijama obrade*

Konstanta elastičnosti se može zanemariti!

Plastična deformacija materijala pomoću višemotornih pogona



$$L_1 \cdot H_1 \cdot S = L_2 \cdot H_2 \cdot S$$

$L1$ i $L2$	Dužina materijala pre i posle prvog para valjaka;
$H1$ i $H2$	Debljina materijala pre i posle prvog para valjaka;
S	Širina materijala.

$$H_1 > H_2 \qquad L_1 < L_2 \qquad \nu_1 < \nu_2$$

$$\frac{H_1}{H_2} = \frac{L_2}{L_1}$$

$$\frac{\nu_2}{\nu_1} = \frac{H_1}{H_2} = \frac{L_2}{L_1}$$

$$\Delta\nu = \frac{H_1 - H_2}{H_2}\nu_1 = \frac{\Delta H}{H_2}\nu_1$$

$$f_c = B \cdot \Delta\nu$$

Prvi pogon

$$\frac{dm_{ei1}^{*}}{dt} = \frac{1}{T_{\omega 1}}\left(\omega^{*} - \omega_1\right)$$

$$m_{e1}^{*} = K_{\omega 1}\left(\omega^{*} - \omega_1\right) + m_{ei1}^{*}$$

$$\frac{dm_{e1}}{dt} = \frac{K_{p1}}{T_{e1}}\left(m_{e1}^{*} - \cdot m_{e1}\right)$$

Drugi pogon

$$\frac{dm_{ei2}^{*}}{dt} = \frac{1}{T_{\omega 2}}\left(\omega^{*} + \Delta\omega_2^{*} - \omega_2\right)$$

$$m_{e2}^{*} = K_{\omega 2}\left(\omega^{*} + \Delta\omega_2^{*} - \omega_2\right) + m_{ei2}^{*}$$

$$\frac{dm_{e2}}{dt} = \frac{K_{p2}}{T_{e2}}\left(m_{e2}^{*} - m_{e2}\right)$$

Njutnove jednačine

$$\frac{d\omega_1}{dt} = \frac{1}{J_1}\left(m_{e1} - K_{tr1}\cdot\omega_1 + m_c\right)$$

$$\frac{d\omega_2}{dt} = \frac{1}{J_2}\left(m_{e2} - K_{tr2}\cdot\omega_2 - m_c\right)$$

Moment sprezanja

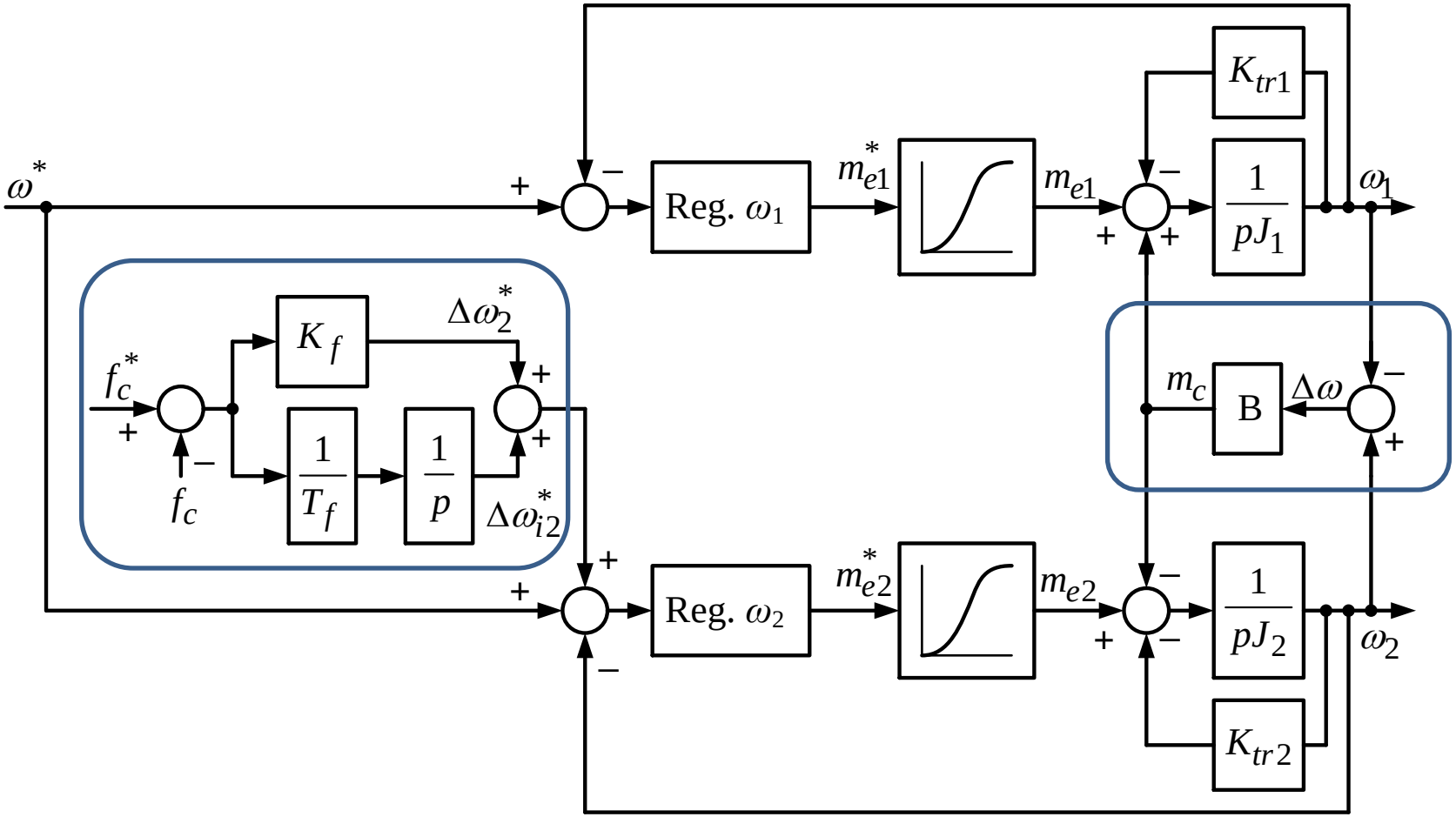
$$m_c = B\cdot\left(\omega_2 - \omega_1\right)$$

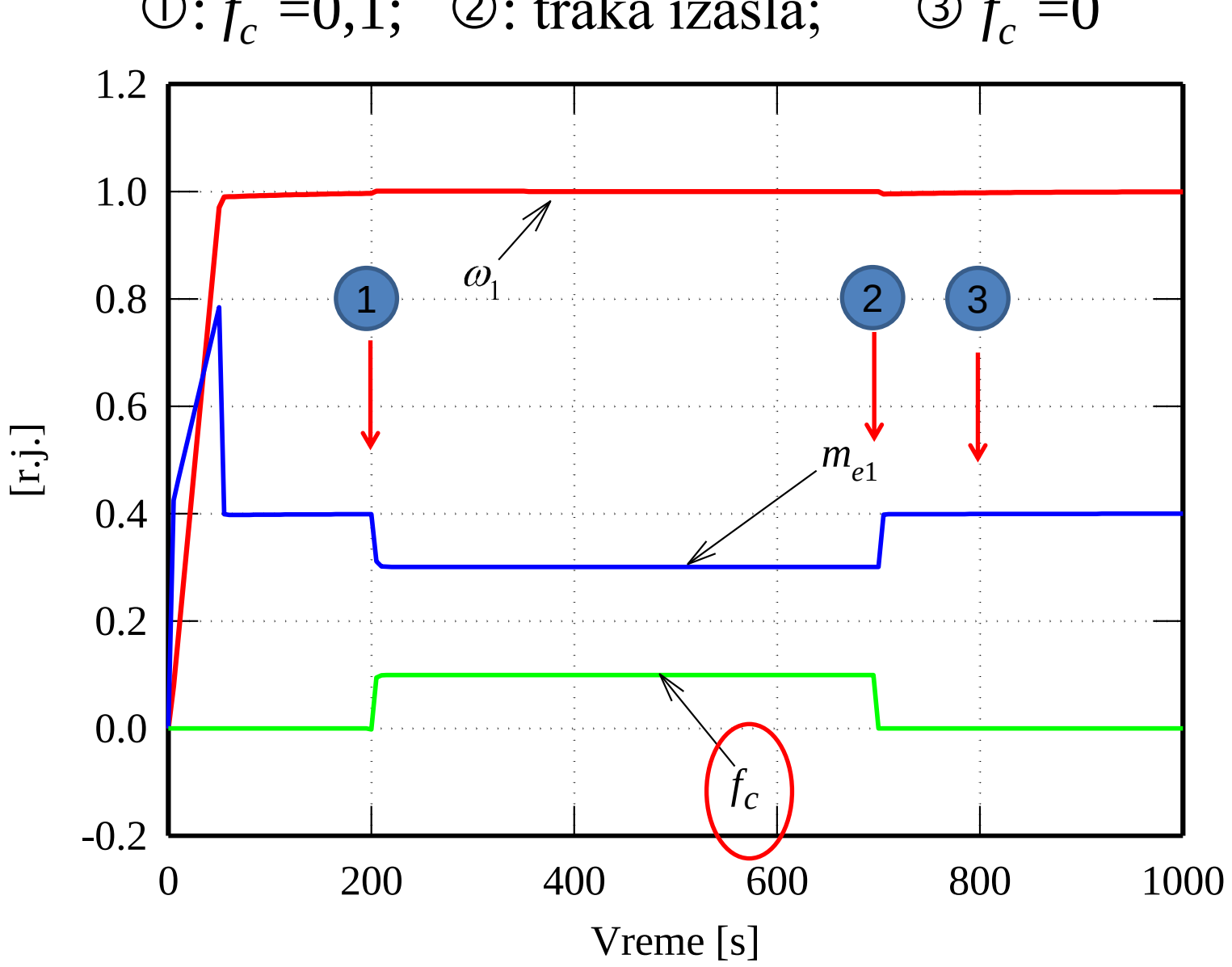
Regulator sile

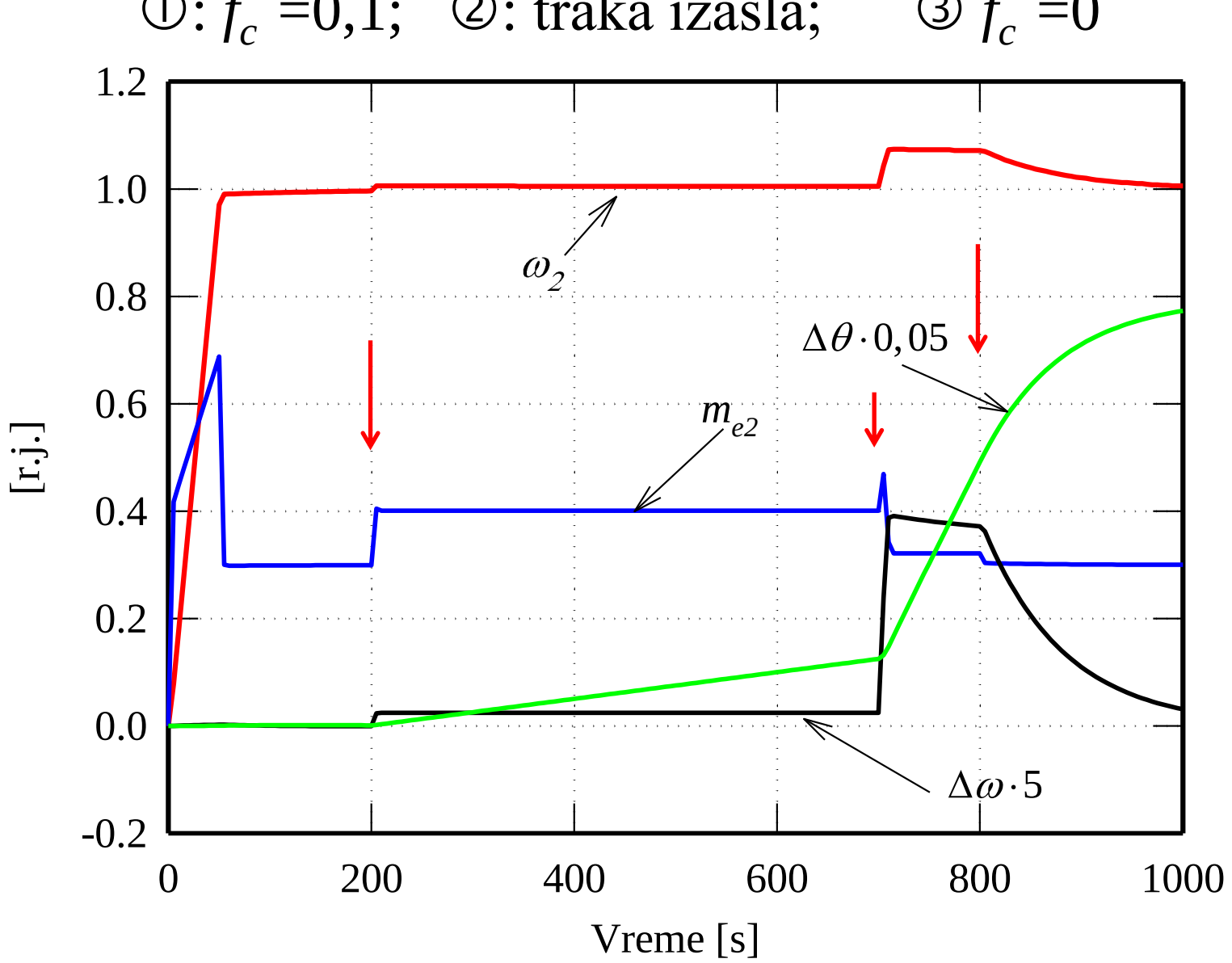
$$\frac{d\Delta\omega_{i2}^*}{dt} = \frac{1}{T_f}\left(f_c^* - f_c\right)$$

$$\Delta\omega_2^* = K_f\left(f_c^* - f_c\right) + \Delta\omega_{i2}^*$$

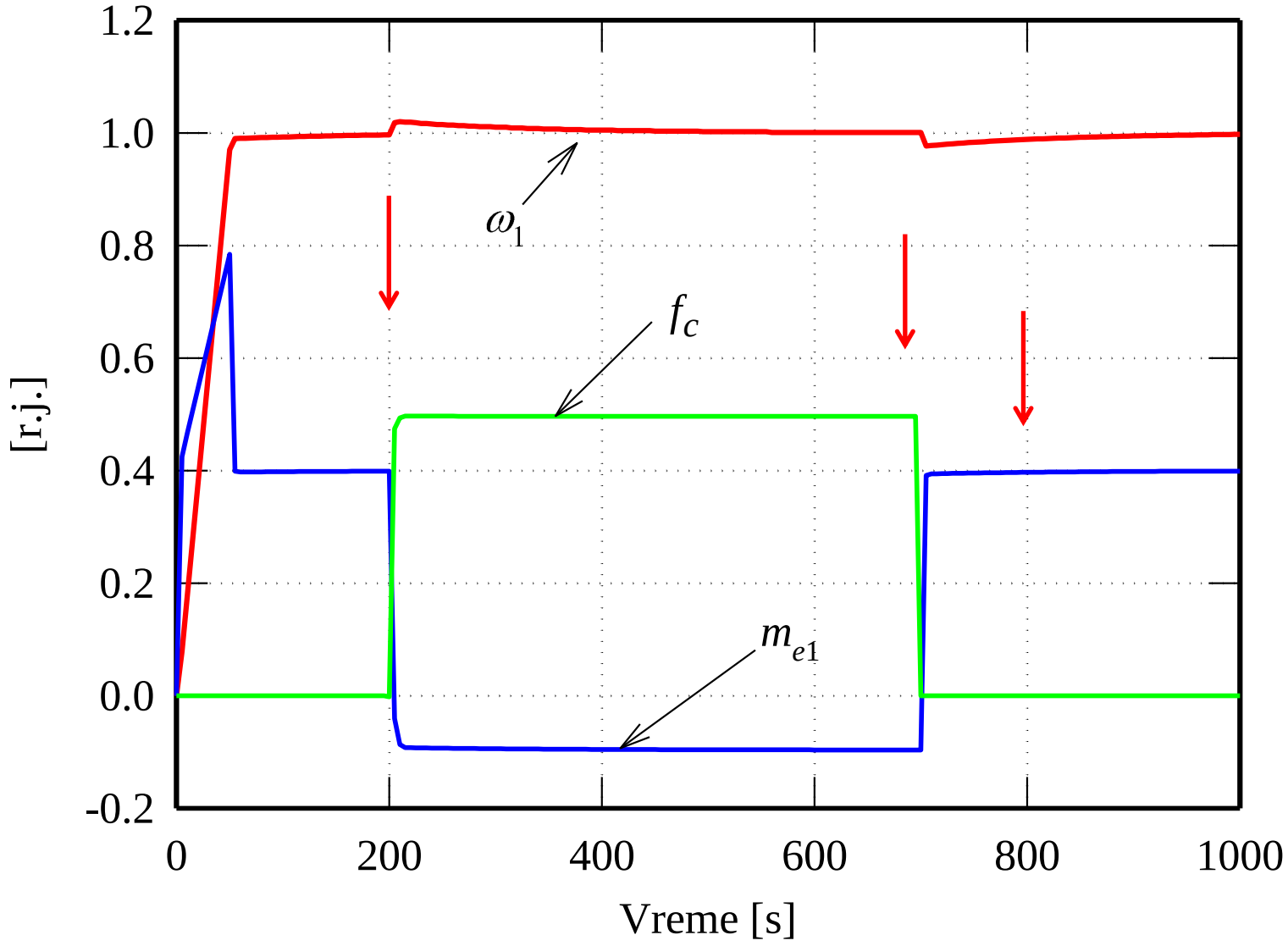
Blok dijagram spregnutih pogona



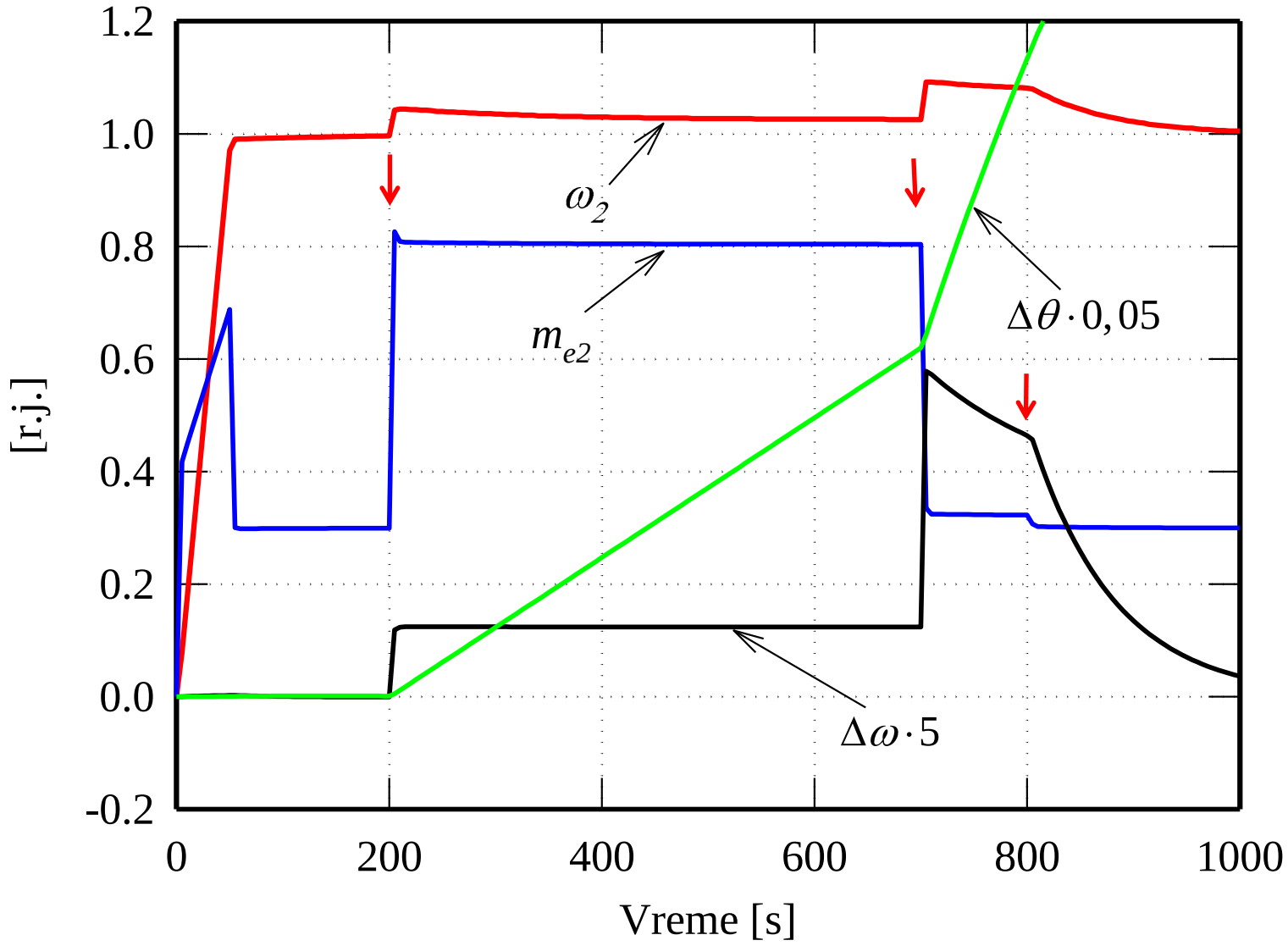

①: f_c^*=0,1; ②: traka izašla; ③ f_c^*=0
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
[r.j.]
0
200
400
600
800
1000
Vreme [s]
1
2
3
ω_1
m_{e1}
f_c


①: f_c^*=0,1; ②: traka izašla; ③ f_c^*=0
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
[r.j.]
0
200
400
600
800
1000
Vreme [s]
ω_2
m_{e2}
$\Delta\theta \cdot 0,05$
$\Delta\omega \cdot 5$

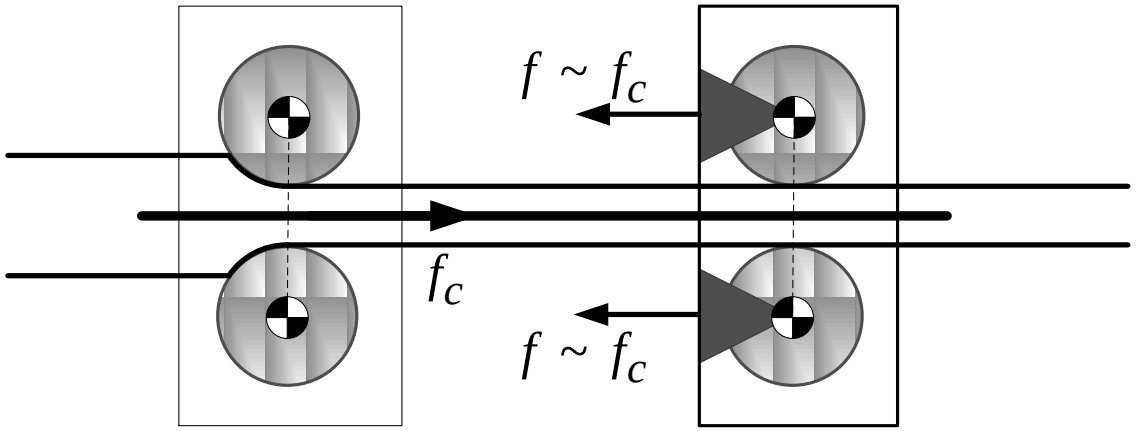
$f_c^* = 0,5\,\text{r.j.}$


1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
[r.j.]
0
200
400
600
800
1000
Vreme [s]
ω_1
f_c
m_{e1}

$f_c^* = 0,5\,\text{r.j.}$


1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
[r.j.]
0
200
400
600
800
1000
Vreme [s]
ω_2
m_{e2}
$\Delta\theta \cdot 0,05$
$\Delta\omega \cdot 5$

Direktno merenje sile



Indirektno određivanje sile

U ustaljenom stanju važe relacije:

$$m_{e1} = K_{tr1} \cdot \omega_1 - m_c$$

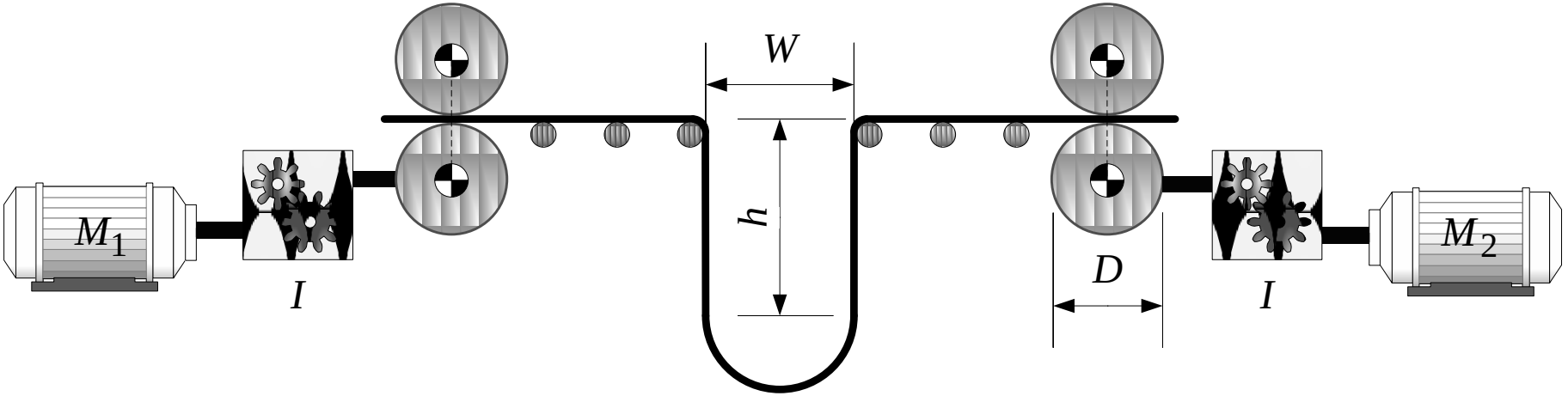
$$m_{e2} = K_{tr2} \cdot \omega_2 + m_c$$

$$m_c = \frac{1}{2}\left(K_{tr1} \cdot \omega_1 - K_{tr2} \cdot \omega_2 - m_{e1} + m_{e2} \right)$$

Estimirana vrednost sile: $\omega_1 \approx \omega_2$

$$\hat{f}_c = \frac{I}{D}\left[\left(K_{tr1} - K_{tr2} \right) \cdot \omega_1 - \left(m_{e1} - m_{e2} \right) \right]$$

Višemotorni pogoni sa nezavisnim funkcijama obrade



$$\Delta\theta = \frac{I}{\pi D}\left(2h + \frac{\pi W}{2}\right)$$

Vrste akumulatora trake

Da bi se obrada materijala mogla obavljati bez prekida, potrebni su akumulatori trake.

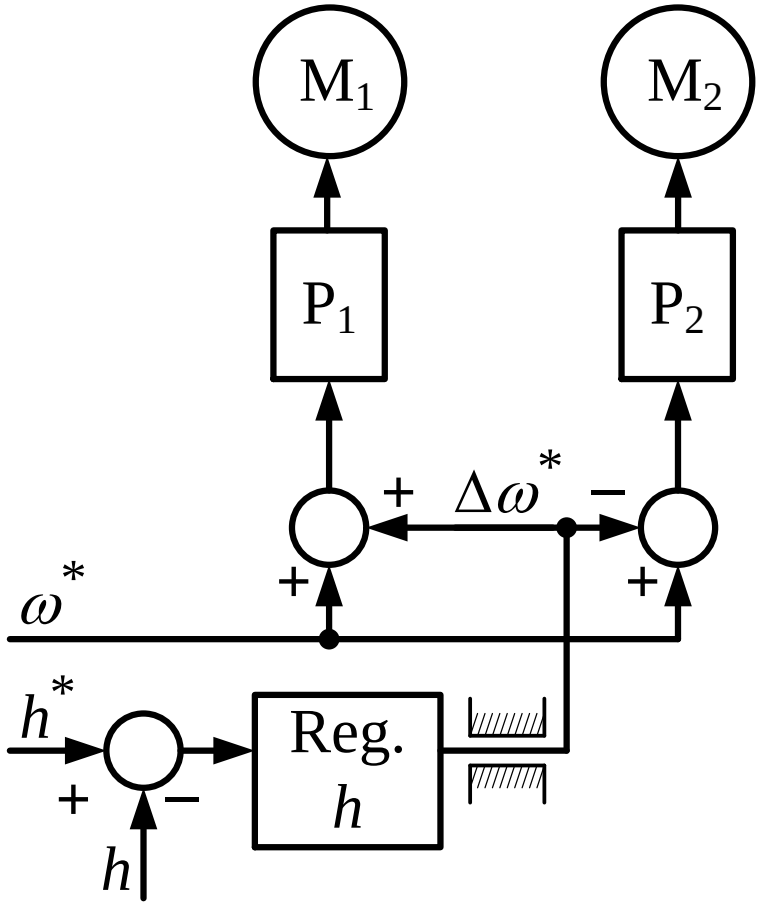
Akumulator sa “jamom”

(engl. pit)

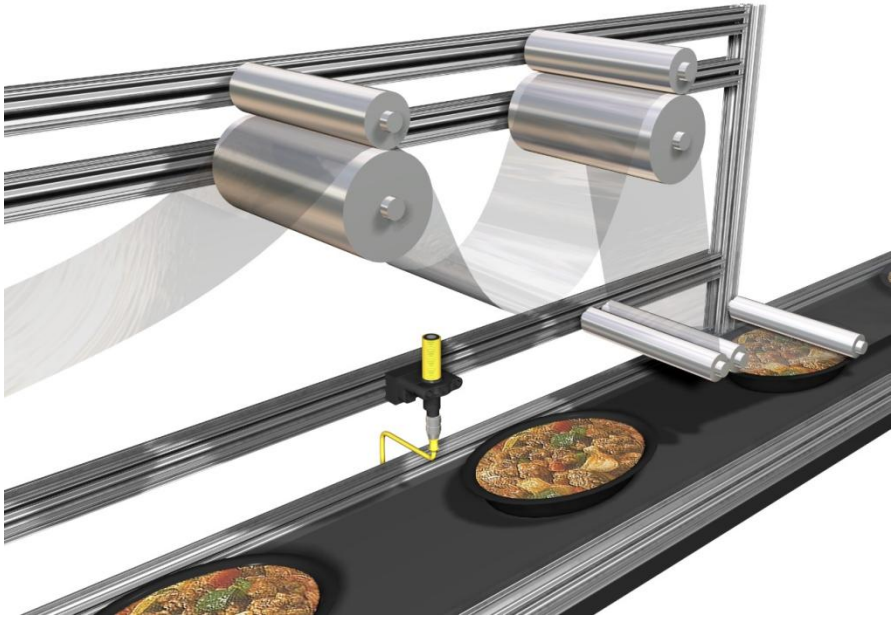
Toranjski tip akumulatora

(engl. festoon)

Regulacija dužine petlje-pogoni u tandemu



Merenje dužine petlje (merenje visine, razdaljine)



Ultrazvučno merenje dubine (visine dna) petlje

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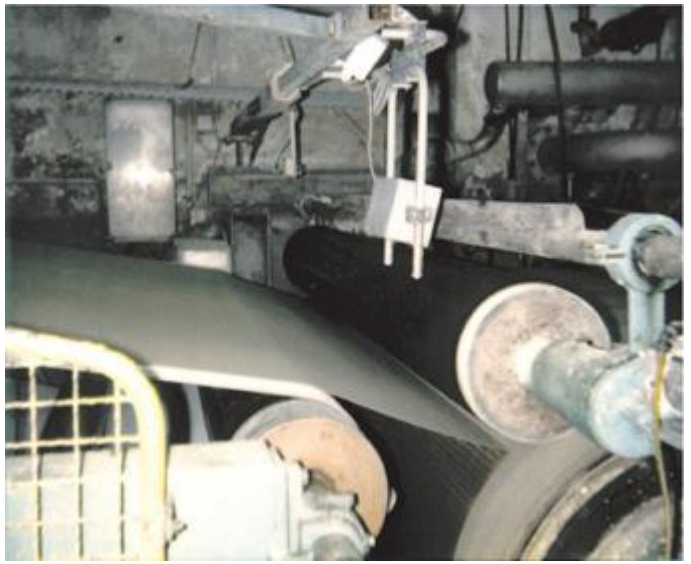
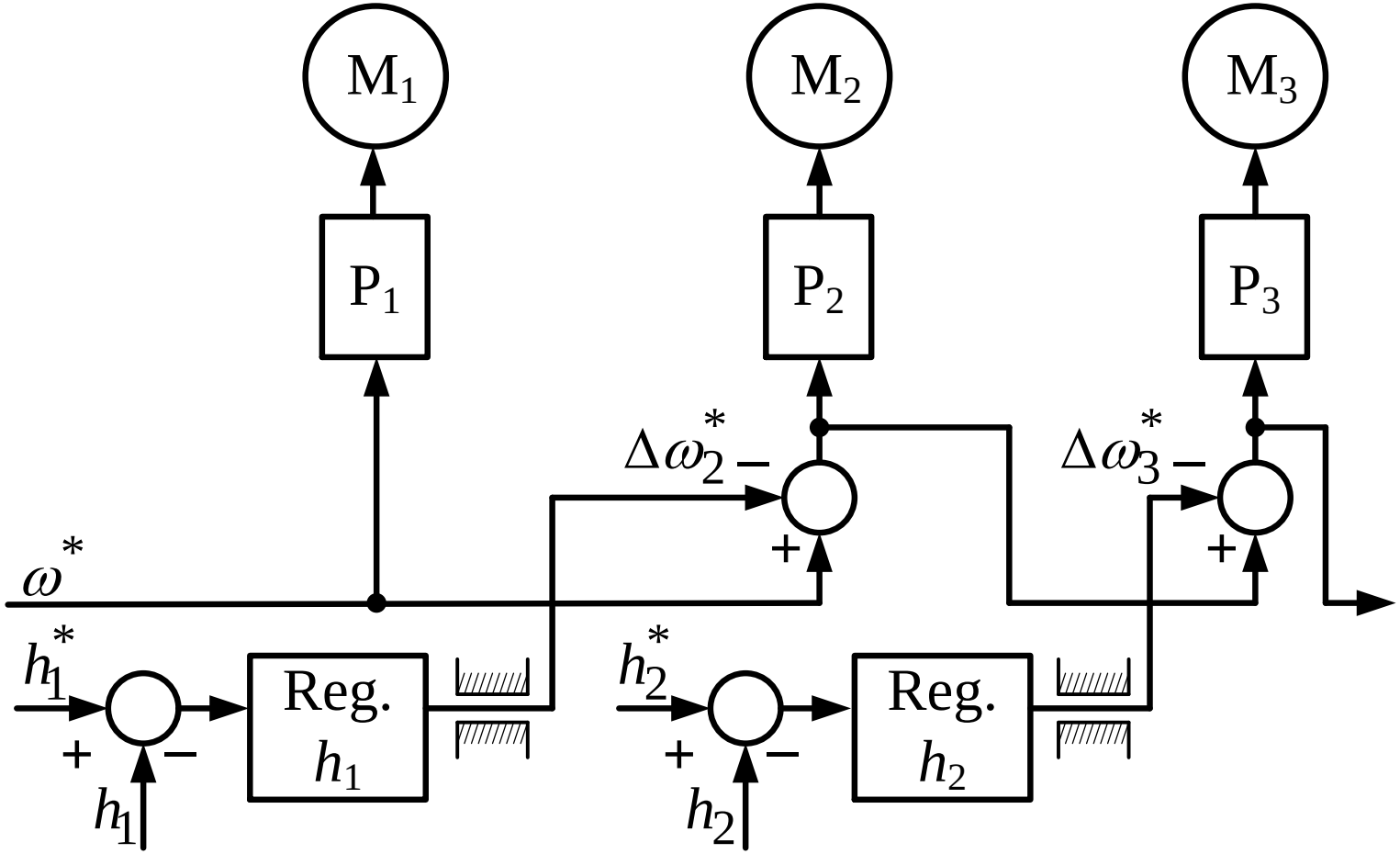


Lasersko merenje razdaljine

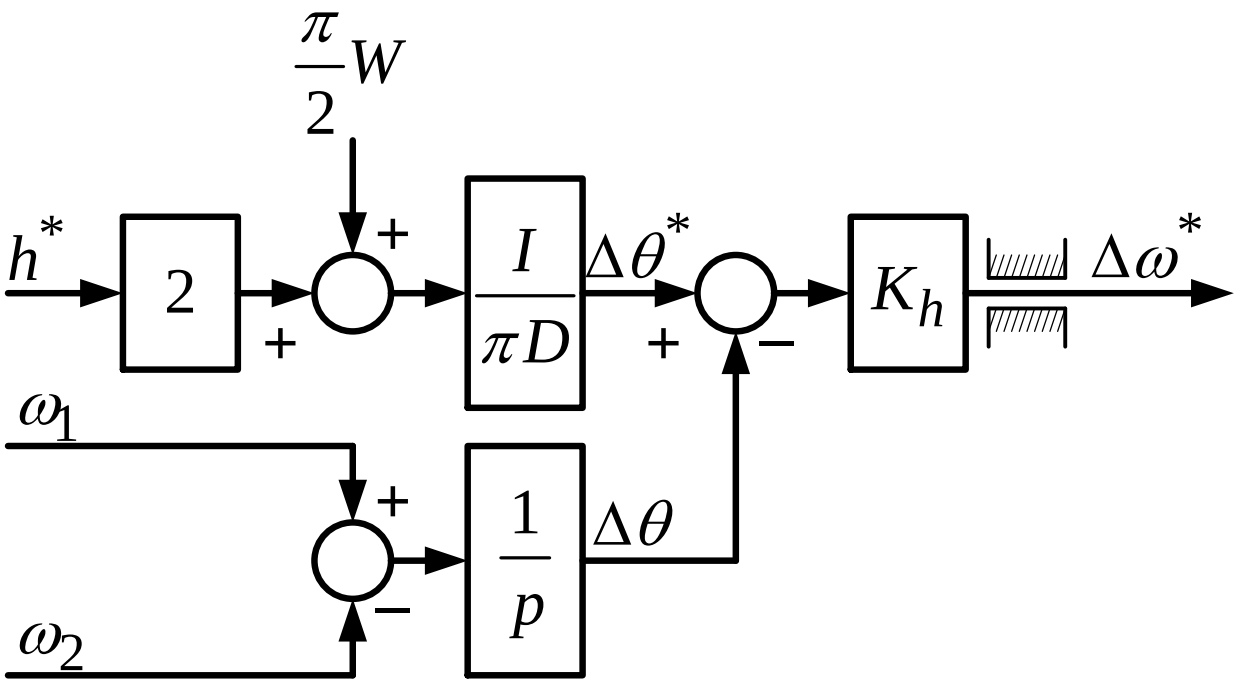
MICRO-EPSILON

Regulacija dužine petlje-pogoni u kaskadi

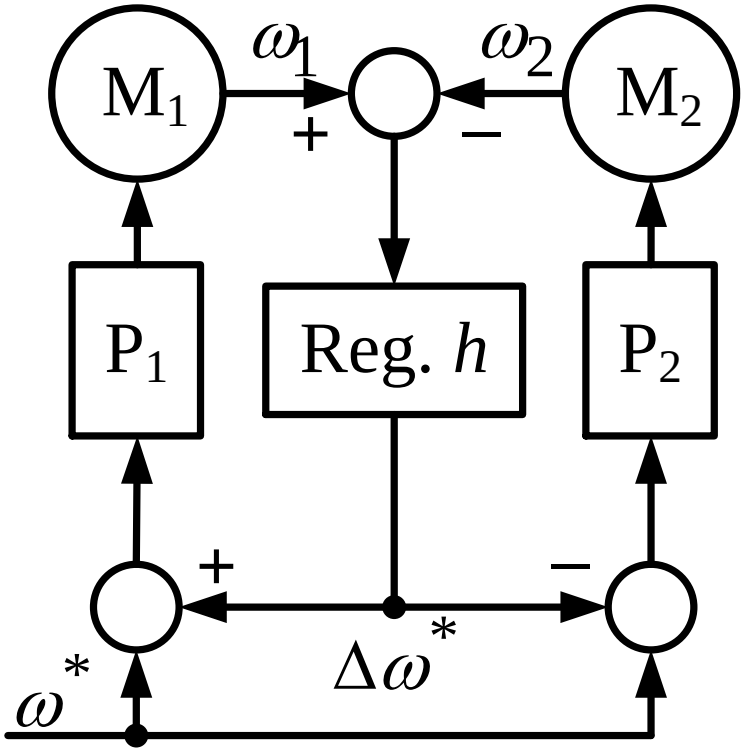


Posredna regulacija dužine petlje

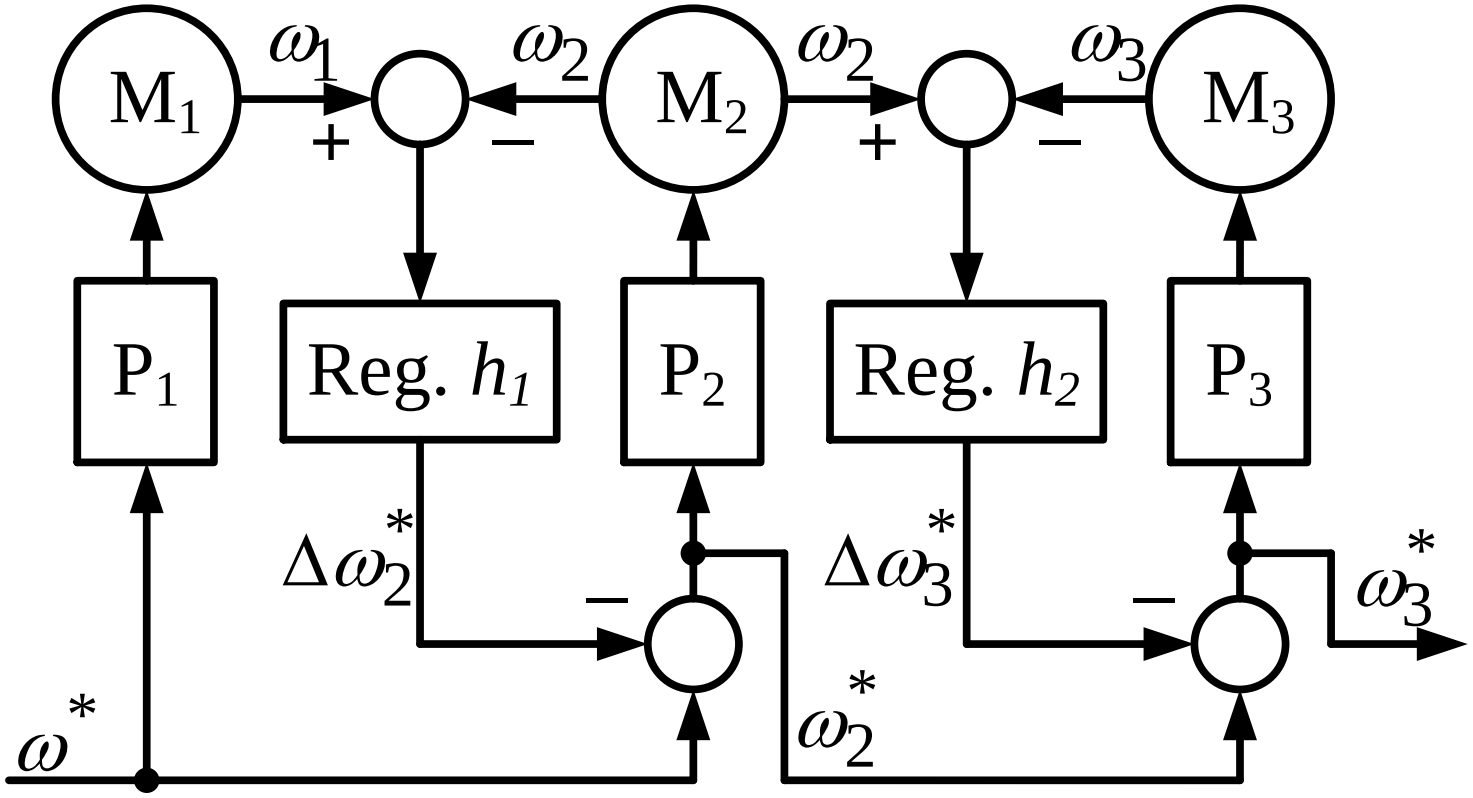
regulator razlike pozicija



Posredna regulacija dužine petlje – pogoni u tandemu



Posredna regulacija dužine petlje – pogoni u kaskadi



Opšti model dva pogona sa petljom

Prvi pogon

$$\frac{dm_{ei1}^{*}}{dt} = \frac{1}{T_{\omega 1}}\left(\omega^{*} + \Delta\omega^{*} - \omega_1\right)$$

$$m_{e1}^{*} = K_{\omega 1}\left(\omega^{*} + \Delta\omega^{*} - \omega_1\right) + m_{ei1}^{*}$$

$$\frac{dm_{e1}}{dt} = \frac{K_{p1}}{T_{e1}}\left(m_{e1}^{*} - m_{e1}\right)$$

$$\frac{d\omega_1}{dt} = \frac{1}{J_1}\left(m_{e1} - K_{tr1}\cdot\omega_1\right)$$

Drugi pogon

$$\frac{dm_{ei2}^{*}}{dt} = \frac{1}{T_{\omega 2}}\left(\omega^{*} - \Delta\omega^{*} - \omega_2\right)$$

$$m_{e2}^{*} = K_{\omega 2}\left(\omega^{*} - \Delta\omega^{*} - \omega_2\right) + m_{ei2}^{*}$$

$$\frac{dm_{e2}}{dt} = \frac{K_{p2}}{T_{e1}}\left(m_{e2}^{*} - m_{e2}\right)$$

$$\frac{d\omega_2}{dt} = \frac{1}{J_2}\left(m_{e2} - K_{tr2}\cdot\omega_2\right)$$

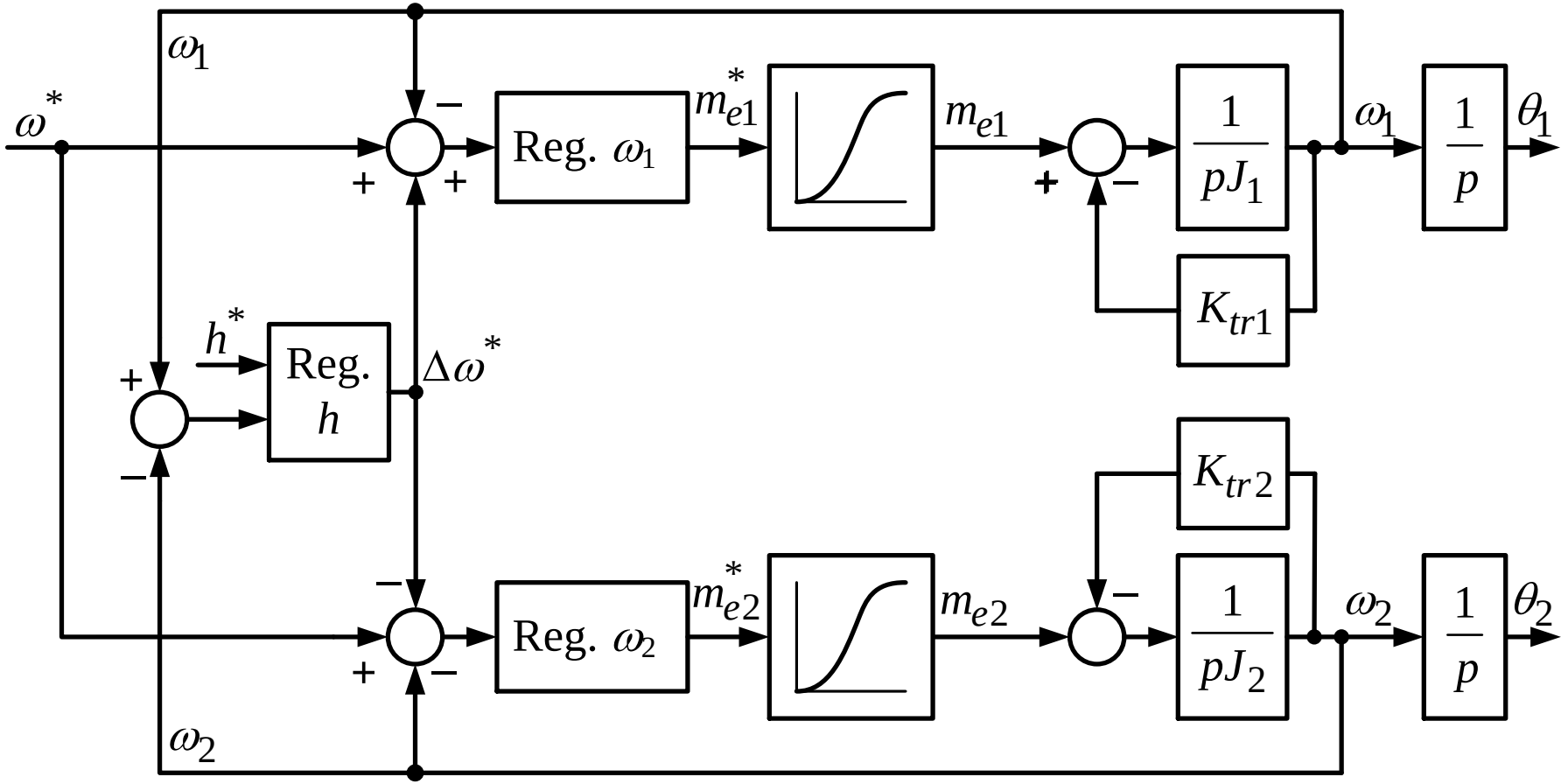
Model regulatora razlike pozicija-dužine petlje

$$\frac{d\Delta\theta}{dt} = \omega_1 - \omega_2$$

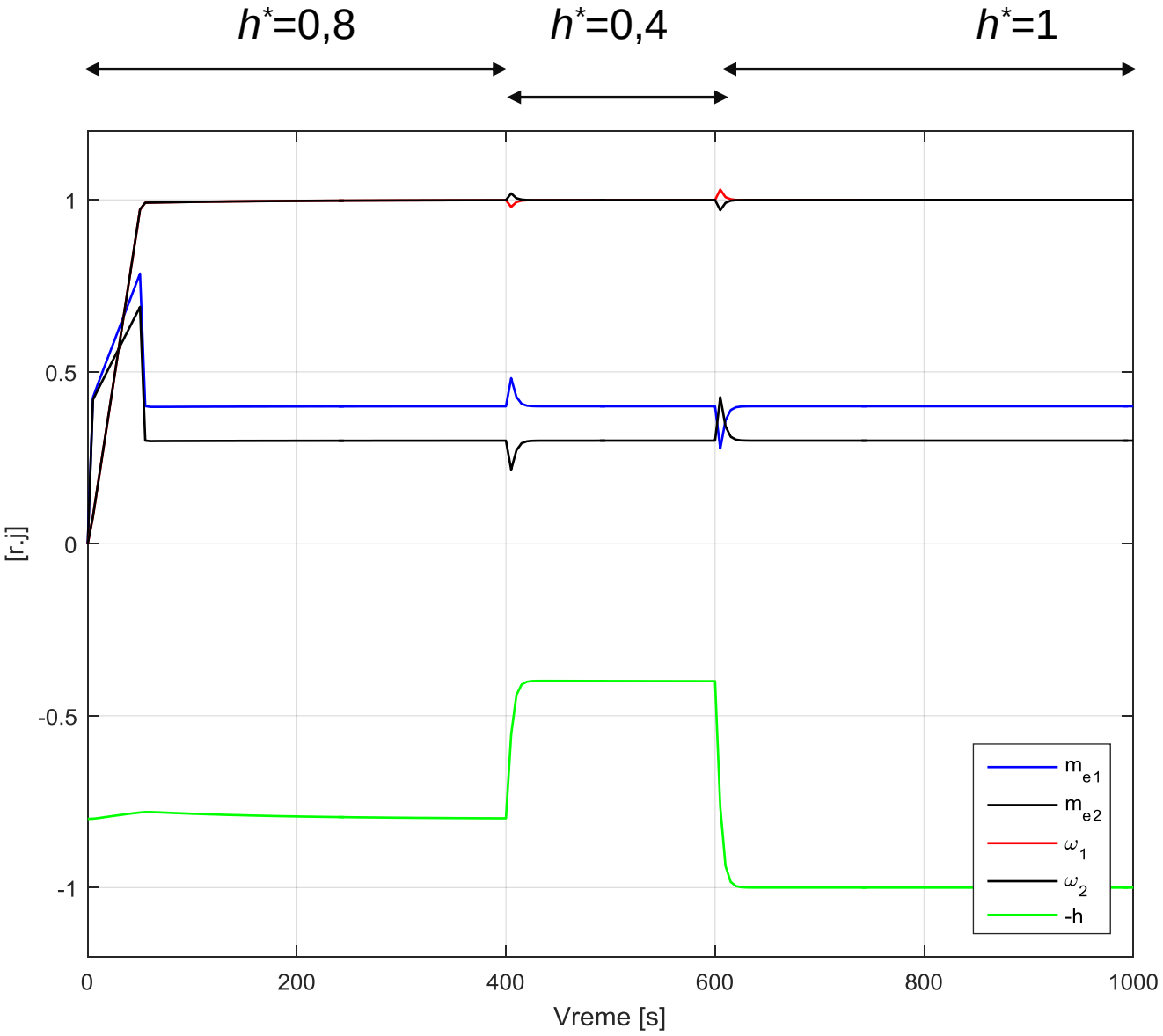
$$\Delta\omega^* = K_h \left[\frac{I}{\pi D} \left(2h^* + \frac{\pi W}{2} \right) - \Delta\theta \right]$$

Proporcionalni regulator dužine petlje.
Videti knjigu, prilog 5.3.

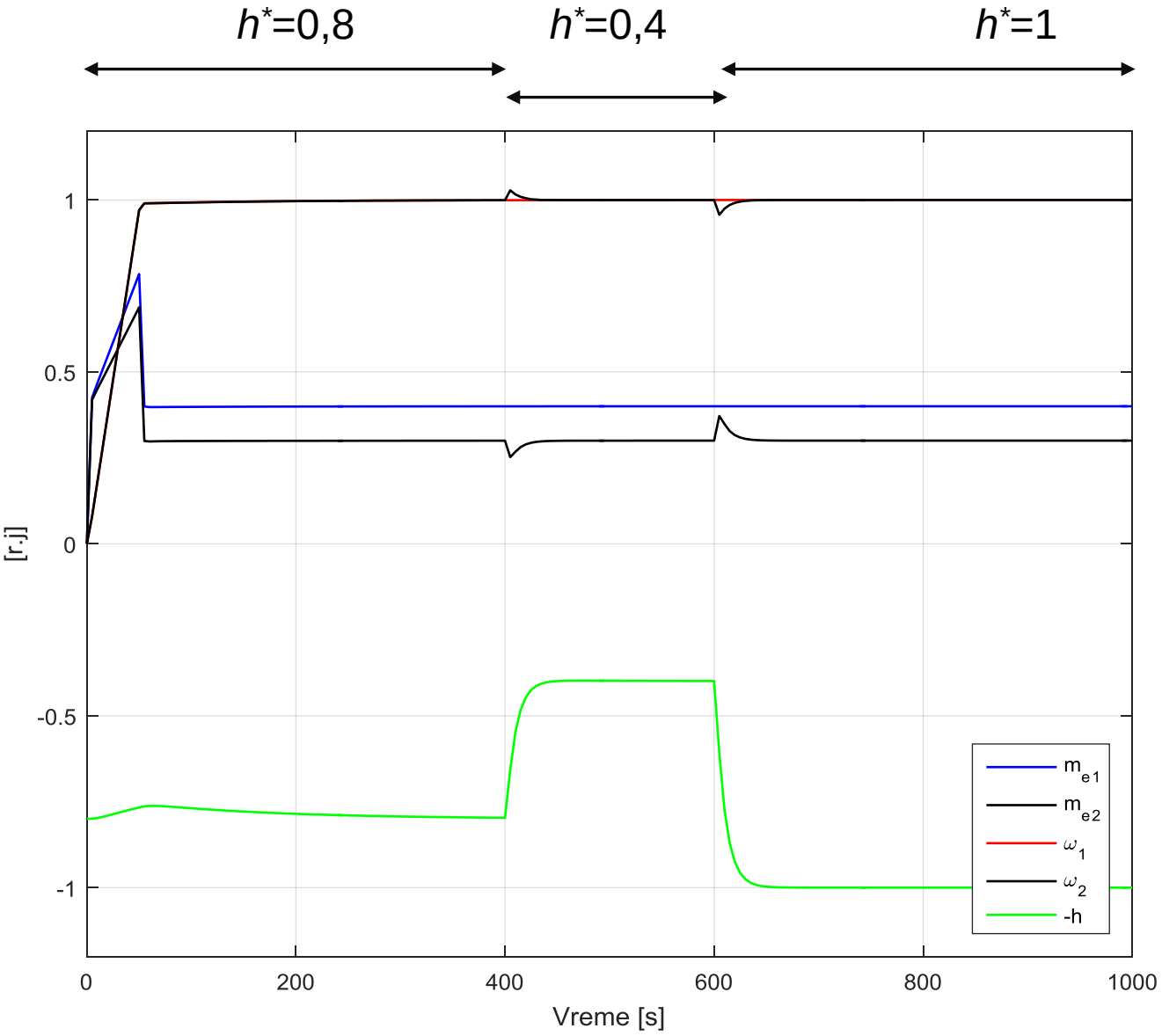
Blok dijagram dva pogona u tandemu



Posredna regulacija dužine petlje deluje na oba pogona



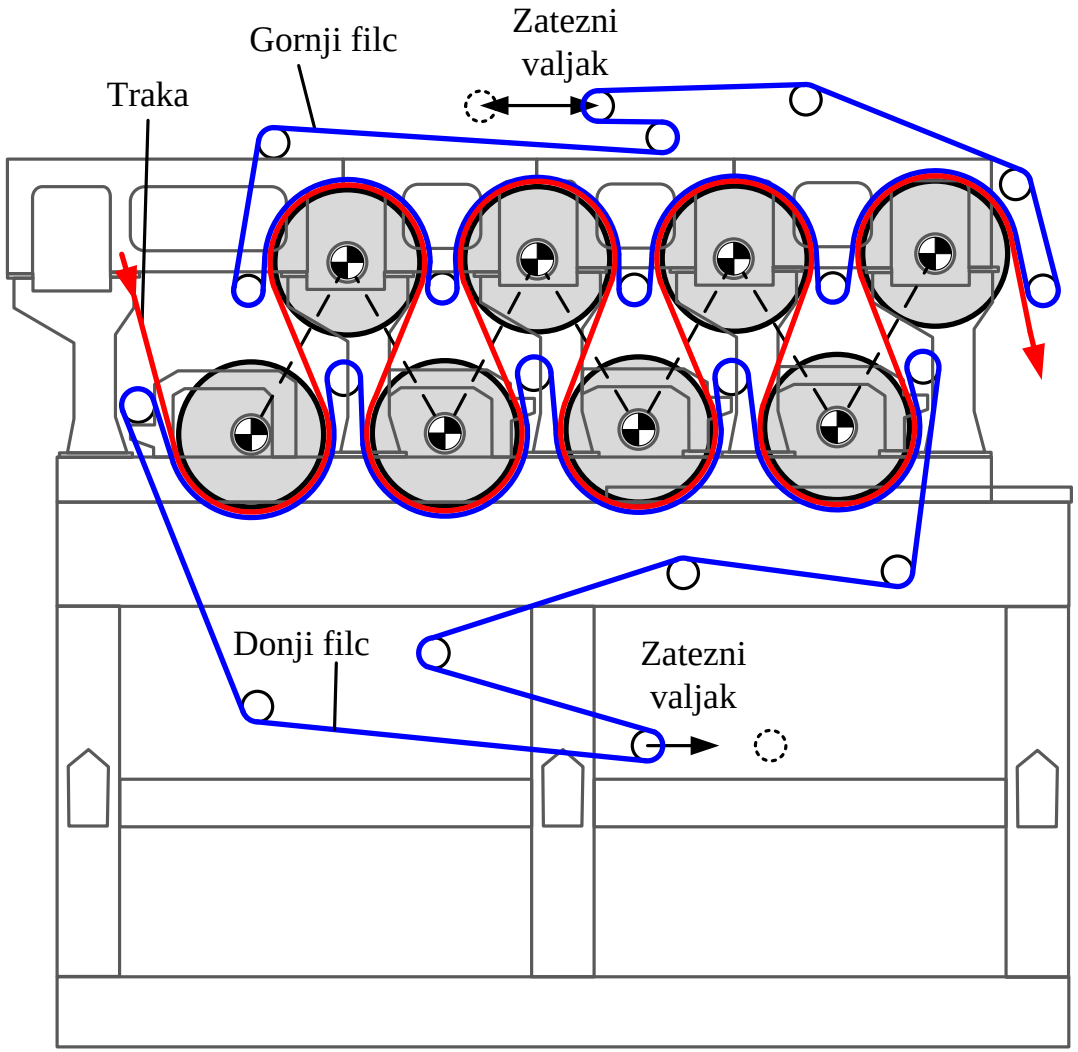
Posredna regulacija dužine petlje deluje samo na drugi pogon



Pogon karton mašine – partija presa

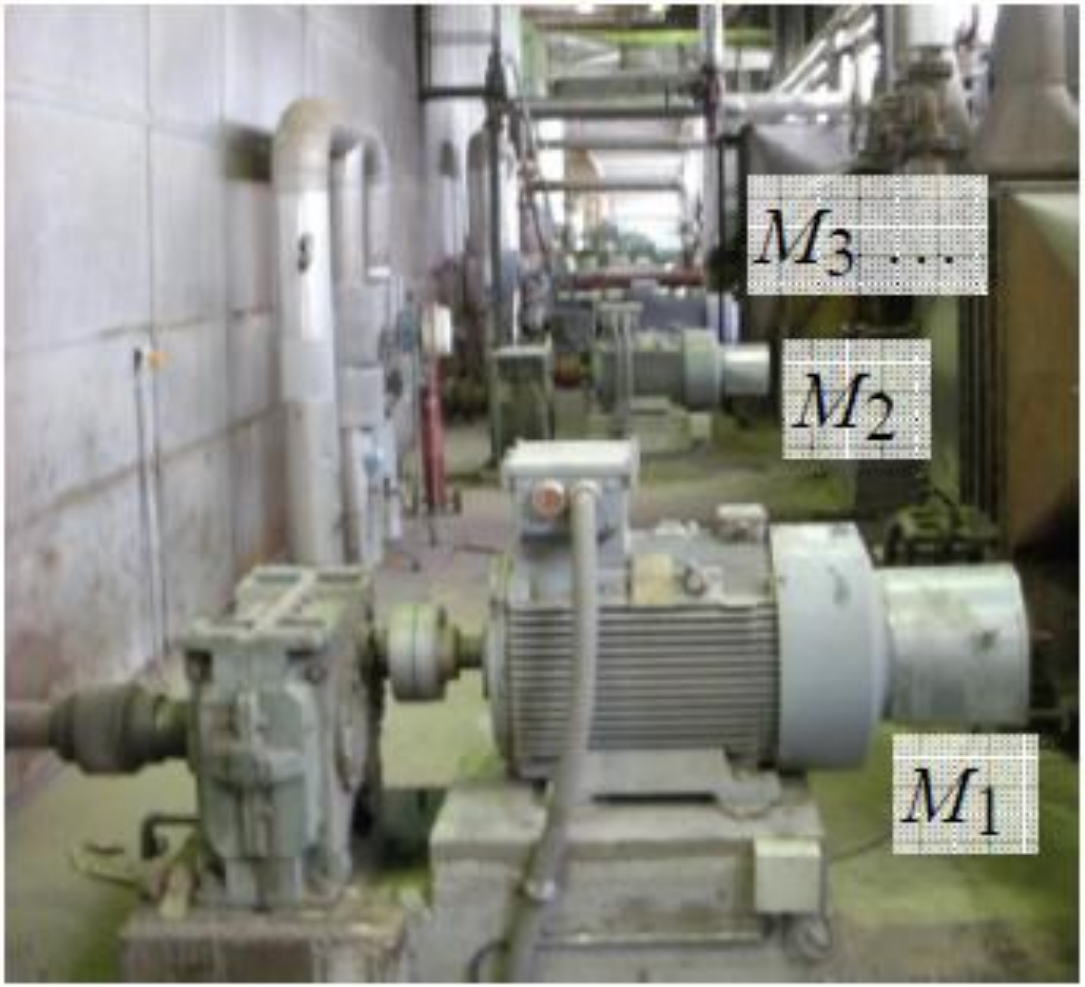
Pogon karton mašine – partija presa

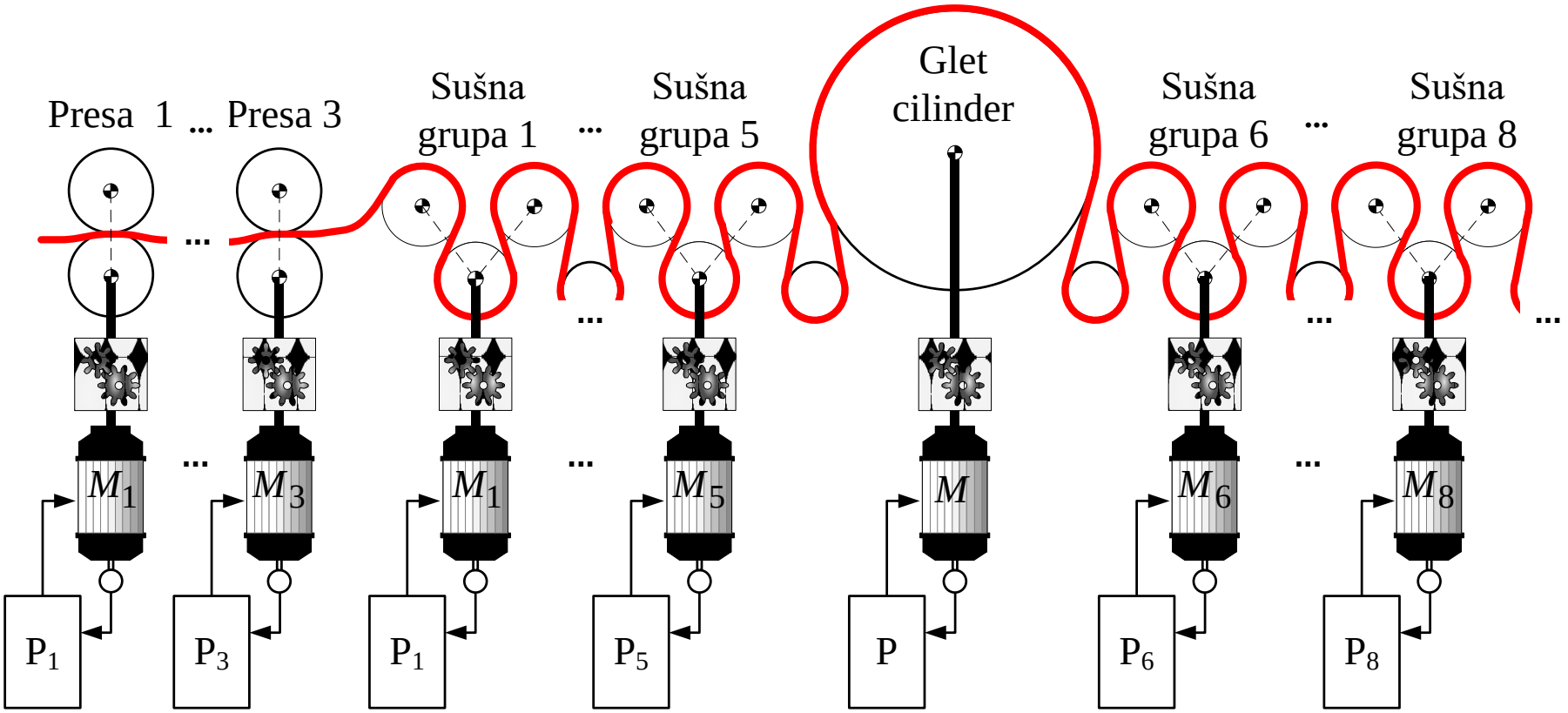
Pogon karton mašine – sušna grupa



Pogon karton mašine – sušna grupa

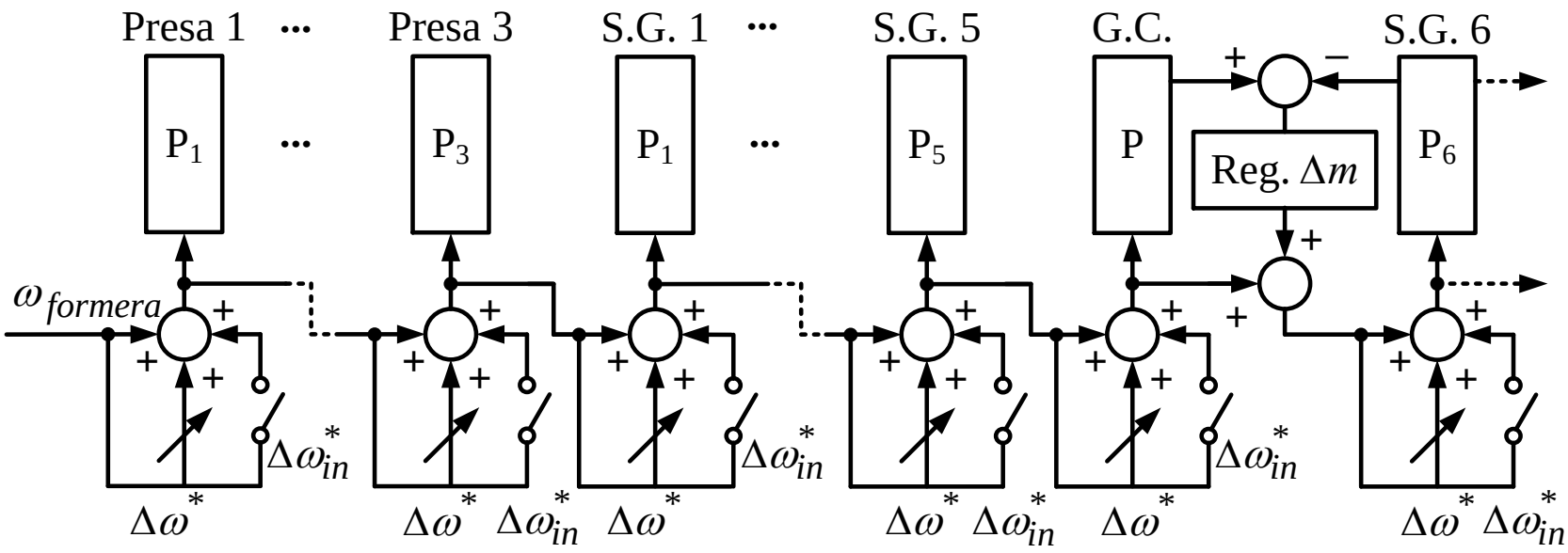
Pogon papir mašine – sušne grupe




Presa 1
Presa 3
Sušna grupa 1
Sušna grupa 5
Glet cilinder
Sušna grupa 6
Sušna grupa 8
M1
M3
M1
M5
M
M6
M8
P1
P3
P1
P5
P
P6
P8

Viskozna karakteristika sprege

Elastična karakteristika sprege



Hvala na pažnji