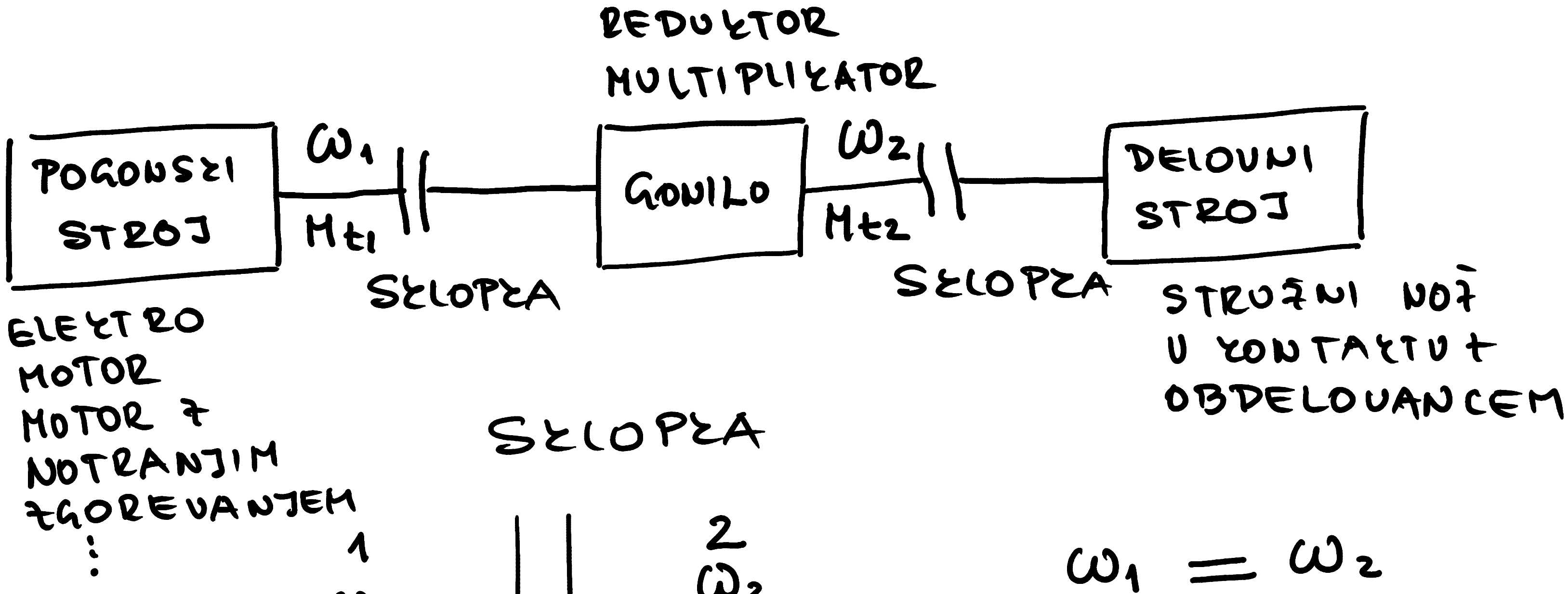
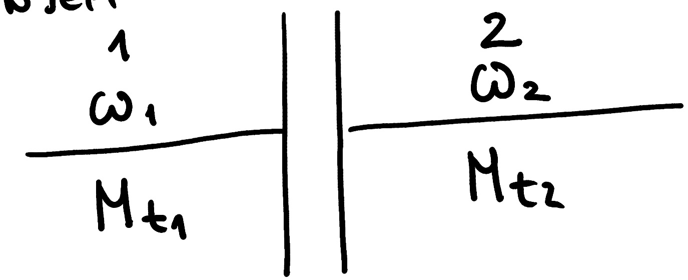
SKLOPKE



SKLOPKA



$$\omega_1 = \omega_2$$
$$\omega_1 \neq \omega_2$$
$$M_{t1} = M_{t2}$$
$$M_{t1} \neq M_{t2}$$

SKLOPKE

- ZA STALNO ZVEZO
  - TOGE
    - Z MUFO
    - KOLUTNA
  - IZRAVNALNE
    - ELASTIČNE
    - NEELASTIČNE
      - OLDHAMOVA
      - ZOBATA
      - KARDANSKI ZGLOB
      - HOMOKINETIČNI ZGLOB
- ZA VKLAPLJANJE
  - OBLIKOVNE
  - TORNE
    - LAMELNA

- MOMENTNE
  - ZAGONSKE — CENTRIFUGALNA
  - VARNOSTNE
- ZA PROSTI TEK
  - ZAPORE — ZAPORA Z ZASKOČKO
  - ENOSMERNE
- HIDRODINAMIČNE
  - NEKRMILJENE
  - KRMILJENE

FUNKCIJA SKLOPK

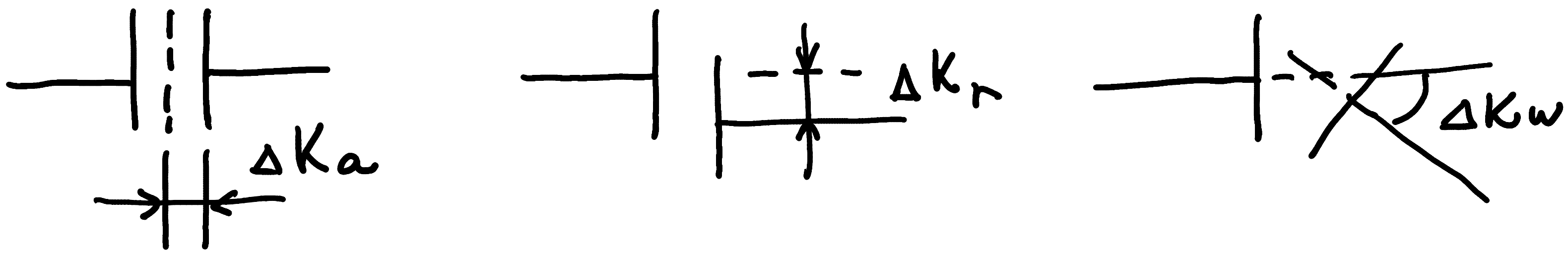
NI ZA IZPIT

ZA STALNO ZVEZO TOGE : POVEZOVANJE GREDI 1 IN 2

$\omega_1 = \omega_2$, $M_{t1} = M_{t2}$

GREDI 1 IN 2 STA KOLINEARNI

ZA STALNO ZVEZO IZRAVNALNE : POVEZOVANJE GREDI 1 IN 2 TER SOČASNO ODPRAVLJANJE NEPRAVILNOSTI LEGE GREDI 1 IN 2



AKSIALNA NEPRAVILNOST

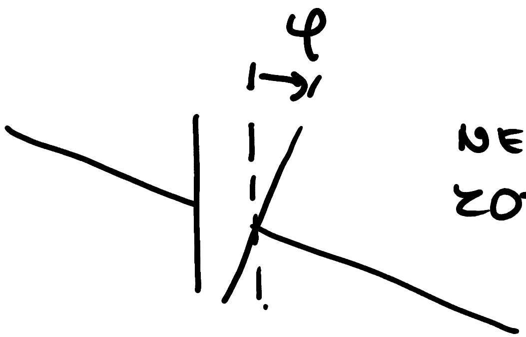
RADIALNA NEPRAVILNOST

KOTNA NEPRAVILNOST

$\omega_1 = \omega_2$ $M_{t1} = M_{t2}$

$\omega_1 \neq \omega_2$ $M_{t1} \neq M_{t2}$

ΔK_a, ΔK_r IN ΔK_w KOMPENZIRAMO Z NEELASTIČNIMI IN ELAST. IZRAVNALNIMI SKLOPKAMI



NEPRAVILNOST KOTA ZASUKA — KOMPENZIRAMO Z ELASTIČNIMI IZRAVNALNIMI SKLOPKAMI

SKLOPKE ZA VKLAPLJANJE: POVEZOVANJE GREDI 1 IN 2

IZENAČENJE VRTILNIH HITROSTI GREDI 1 IN 2

VKLAPLJANJE V MIROVANJU ALI V GIBANJU

VČASIH ZAHTEVAMO SINHRONIZACIJO VRTILNIH HITROSTI ω_1 IN ω_2 PRED VKLOPOM

NI ZA IZPIT

MOMENTNE SKLOPKE :

VARNOSTNE VARUJEJO PRED PREOBREMENITVIJO
PREOBREMENITEV LAHKO RAZUMEMO KOT MAKSIMALNI DOPUSTNI MOMENT ALI KOT MAKSIMALNA DOPUSTNA KOTNA HITROST

ZAGONSKE OMOGOČAJO POSTOPNO IZENAČITEV KOTNE HITROSTI GREDI 2 S KOTNO HITROSTJO GREDI 1 IN S TEM ZNIŽANJE MOMENTOV POSPEŠEVANJA
POVEZOVANJE GREDI 1 IN 2

ZA PROSTI TEK :

VRTILNI MOMENT PRENAŠAJO PRI VRTENJU V ENO SMER, V DRUGO SMER PA TEČEJO PROSTO
POVEZOVANJE GREDI 1 IN 2

NI ZA IZPIT

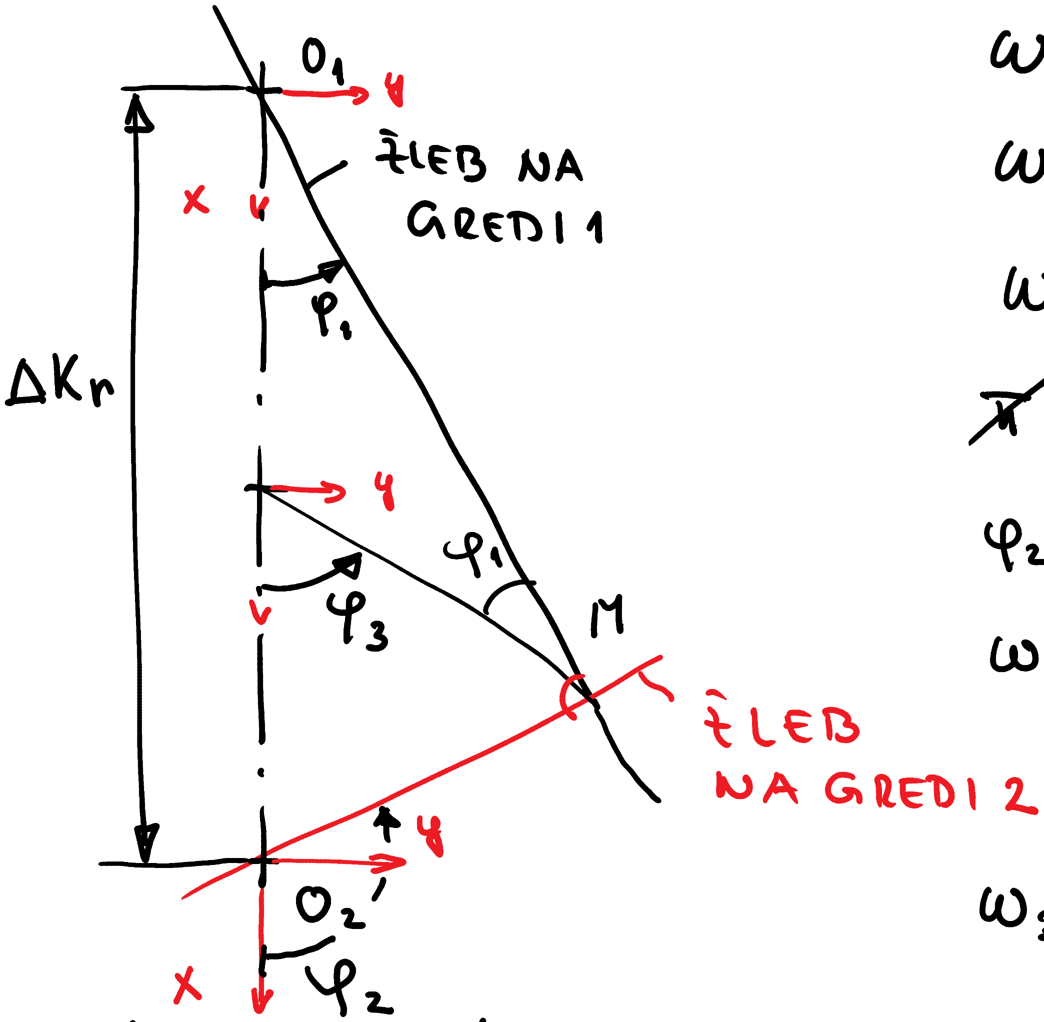
HIDRODINAMIČNE SKLOPKE: OMOGOČAJO PRENOS VRTILNIH MOMENTOV IN KOTNIH HITROSTI PREKO FLUIDA

POVEZOVANJE GREDI 1 IN 2

LAHKO JIH KRMILIMO

NI ZA IZPIT

OLDHAMOVA SKLOPKA



$$\omega_1 = const$$

$$\omega_1 = \frac{d\varphi_1}{dt}$$

$$\omega_2 = \frac{d\varphi_2}{dt}$$

$$\cancel{\pi} = \varphi_1 + \frac{\pi}{2} + \cancel{\pi} - \varphi_2$$

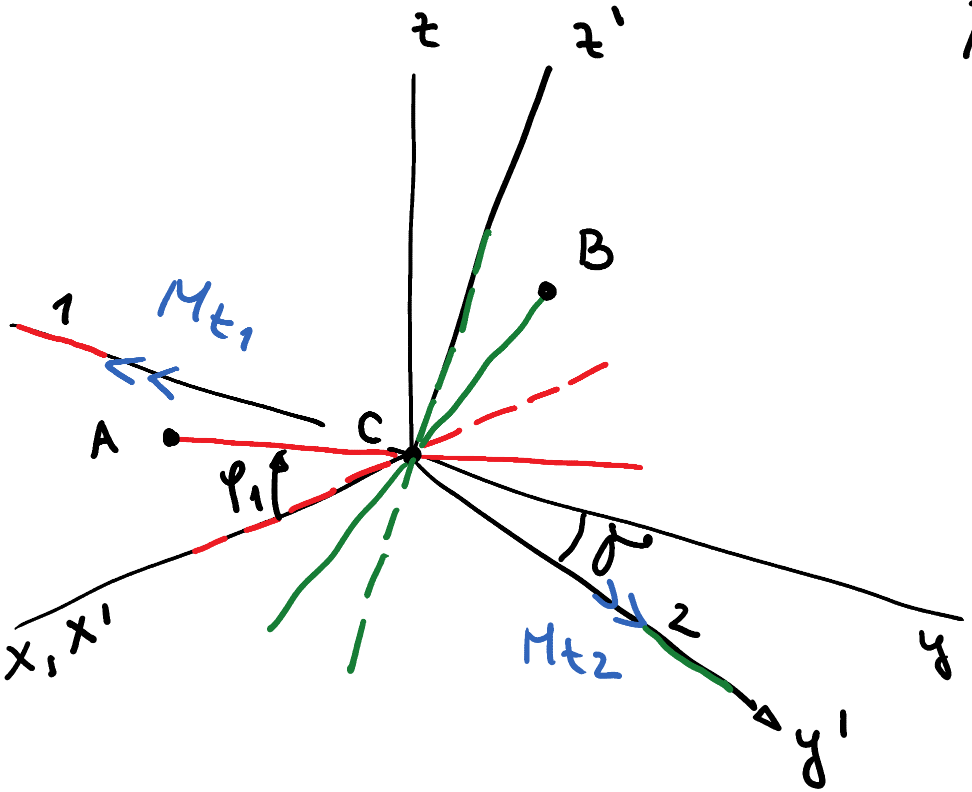
$$\varphi_2 = \varphi_1 + \frac{\pi}{2}$$

$$\omega_2 = \frac{d\varphi_1}{dt} = \omega_1$$

$$\omega_3 = \frac{d\varphi_3}{dt} = 2\frac{d\varphi_1}{dt} = 2\omega_1$$

$$\cancel{\pi} = 2\varphi_1 + \cancel{\pi} - \varphi_3 \Rightarrow \varphi_3 = 2\varphi_1$$

KARDANSKI ZGLOB



$$\overline{AC} = \overline{BC} = a$$

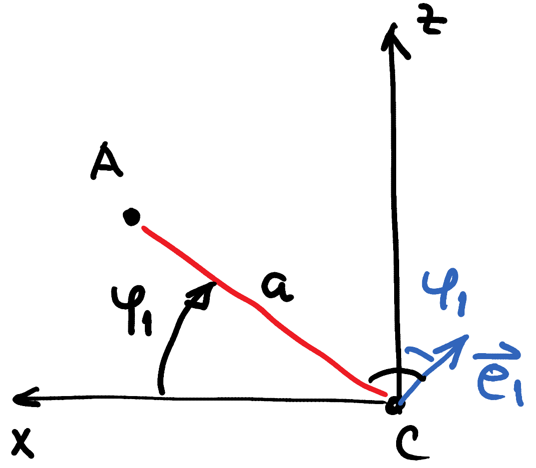
$$\omega_1 = const$$

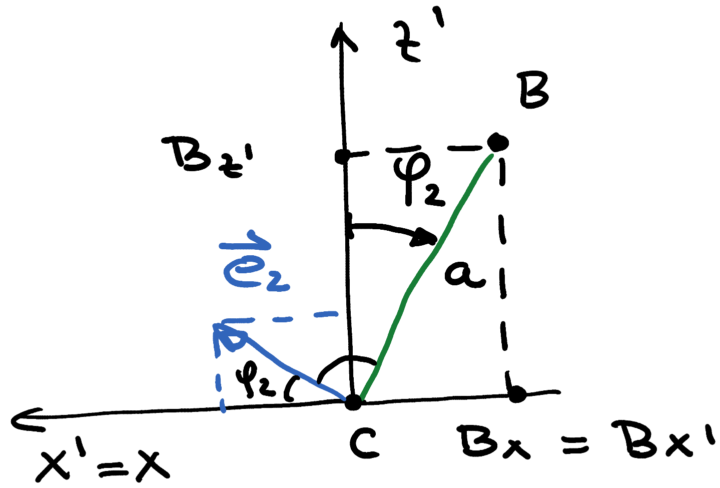
$$M_{t1} = const$$

$$\omega_1 = \frac{d\varphi_1}{dt}$$

C – CENTER KARDANSKEGA KRIŽA

$$\gamma = \Delta K_w$$





$$A = (a\cos\varphi_1,\ \emptyset,\ a\sin\varphi_1)$$

$$B_x = -a\sin\varphi_2$$

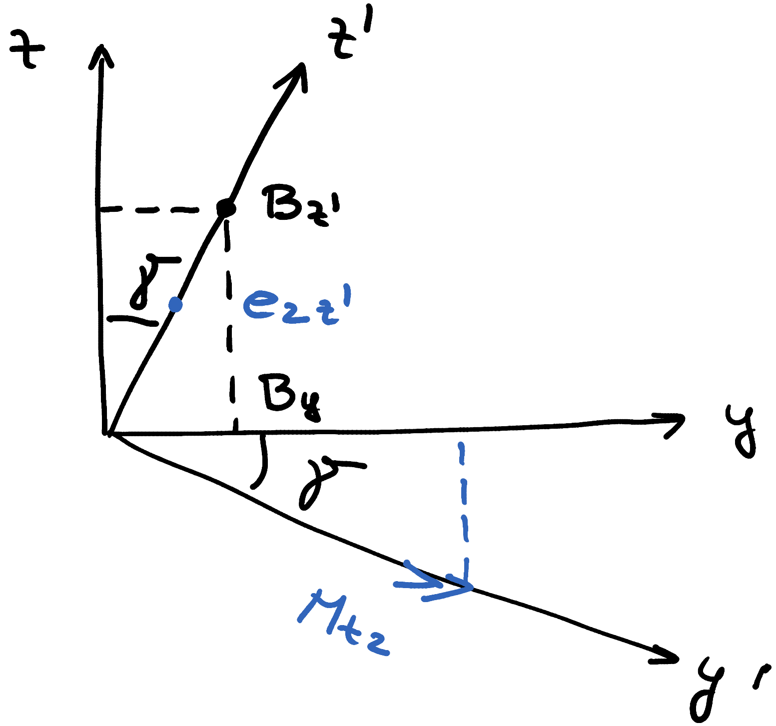
$$B_{z'} = +a\cos\varphi_2$$

$$\vec{e}_1 = (-\sin\varphi_1,\ \emptyset,\ \cos\varphi_1)$$

$$e_{2x'} = e_{2x} = \cos\varphi_2$$

$$e_{2z'} = \sin\varphi_2$$

$$\vec{e}_2 = (\cos\varphi_2,\ e_{2z'}\sin\gamma,\ e_{2z'}\cos\gamma)$$



$$B_{z'} = a \cos\varphi_2$$

$$B = (-a\sin\varphi_2,\ B_{z'}\sin\gamma,\ B_{z'}\cos\gamma)$$

$$B = (-a\sin\varphi_2,\ a\cos\varphi_2\sin\gamma,\ a\cos\varphi_2\cos\gamma)$$

$$\overline{AB}^2 = 2a^2 = (a\cos\varphi_1 + a\sin\varphi_2)^2 + (0 - a\cos\varphi_2\sin\gamma)^2$$
$$+ (a\sin\varphi_1 - a\cos\varphi_2\cos\gamma)^2$$

$$a = 1$$

$$2 = \cos^2\varphi_1 + 2\cos\varphi_1\sin\varphi_2 + \sin^2\varphi_2 + \cos^2\varphi_2\sin^2\gamma + \sin^2\varphi_1$$
$$-2\sin\varphi_1\cos\varphi_2\cos\gamma + \cos^2\varphi_2\cos^2\gamma$$

$$0 = \cancel{2}\cos\varphi_1\sin\varphi_2 - \cancel{2}\sin\varphi_1\cos\varphi_2\cos\gamma$$

$$\sin\varphi_1\cos\varphi_2\cos\gamma = \cos\varphi_1\sin\varphi_2 \quad \Big| \cdot \frac{1}{\cos\varphi_1\cos\varphi_2}$$

$$\mathrm{tg}\,\varphi_1\cos\gamma = \mathrm{tg}\,\varphi_2$$

$$\varphi_2 = \mathrm{atan}(\mathrm{tg}\,\varphi_1\cos\gamma)$$

$$\omega_2 = \frac{d\varphi_2}{dt} = \frac{1}{1 + tg^2\varphi_1 \cos^2\gamma} \cos\gamma \frac{1}{\cos^2\varphi_1} \frac{d\varphi_1}{dt}$$

$$= \frac{\cos\gamma}{\cos^2\varphi_1 + \sin^2\varphi_1 \cos^2\gamma}\,\omega_1 = \frac{\cos\gamma}{\cos^2\varphi_1 + \sin^2\varphi_1 (1 - \sin^2\gamma)}\,\omega_1$$

$$\omega_2 = \frac{\cos\gamma}{1 - \sin^2\varphi_1 \sin^2\gamma}\,\omega_1$$

MOMENTI

$P_1 = P_2$ PREDPOSTAVIMO, DA NI IZGUB

$$M_{t1} \cdot \omega_1 = M_{t2} \cdot \omega_2$$

$$M_{t2} = M_{t1} \cdot \frac{\omega_1}{\omega_2}$$

$$\vec{M}_{t1} = (\emptyset, -M_{t1}, \emptyset)$$

$$\vec{M}_{t2} = (\emptyset, M_{t2} \cos\gamma, -M_{t2} \sin\gamma)$$

$$\vec{M}_{t1} + \vec{M}_{U1} = \vec{M}_{t2} + \vec{M}_{U2}$$

$$\vec{M}_{t1} + \vec{e}_1 M_{U1} = \vec{M}_{t2} + \vec{e}_2 M_{U2}$$

$$x: \quad \emptyset - M_{U1} \sin\varphi_1 = \emptyset + M_{U2} \cos\varphi_2$$

$$M_{U2} = - M_{U1} \frac{\sin\varphi_1}{\cos\varphi_2}$$

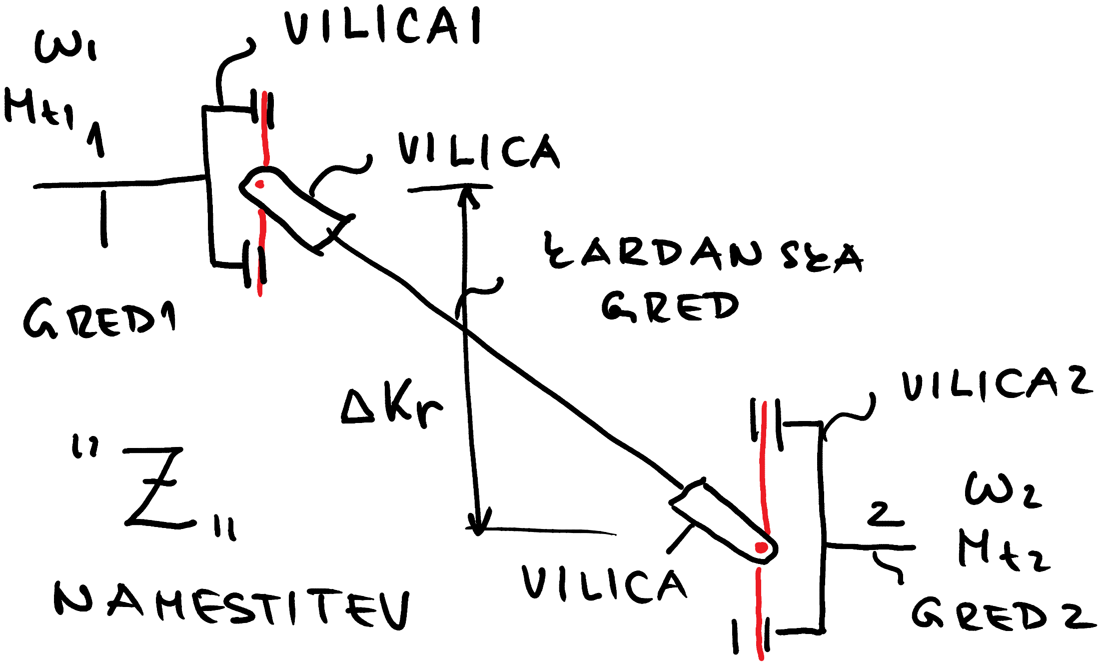
$$y: - M_{t1} = M_{t2} \cos\gamma + M_{U2} \sin\varphi_2 \sin\gamma$$

$$M_{U2} = \frac{- M_{t1} - M_{t2}\cos\gamma}{\sin\varphi_2 \sin\gamma}$$

$$M_{U1} = - M_{U2} \frac{\cos\varphi_2}{\sin\varphi_1}$$

DN: NARIŠITE $M_{t2}(\varphi_1)$, $M_{U1}(\varphi_1)$, $M_{U2}(\varphi_1)$, $\omega_2(\varphi_1)$

$\varphi_1 = \emptyset, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi$, $\gamma = 30°$



"Z" NAMESTITEV

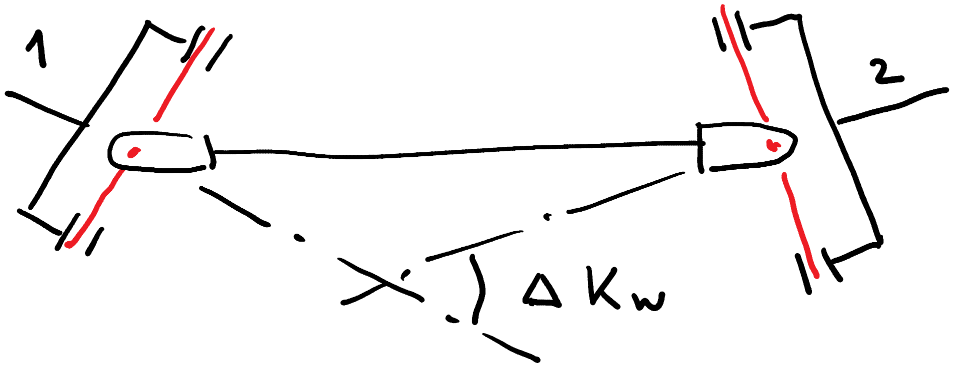
$\omega_1 = const$

$M_{t1} = const$

$\omega_2 = \omega_1$

$M_{t2} = M_{t1}$

"W"

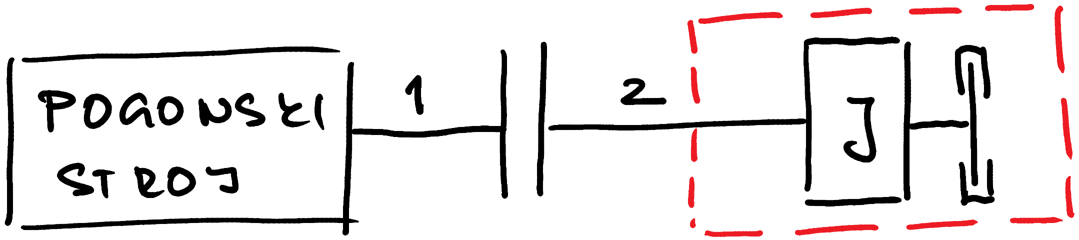


$\omega_2 = \omega_1$

$M_{t2} = M_{t1}$

ZAGONSKA SKLOPKA

OD TU K2



ASINHRONI ELEKTROMOTOR — ZAGONSKA SKLOPKA — ZAVORA — M_{ko} KORISTNI MOMENT

ω_1, M_{t1} $\qquad$ $\omega_2 \neq \omega_1$

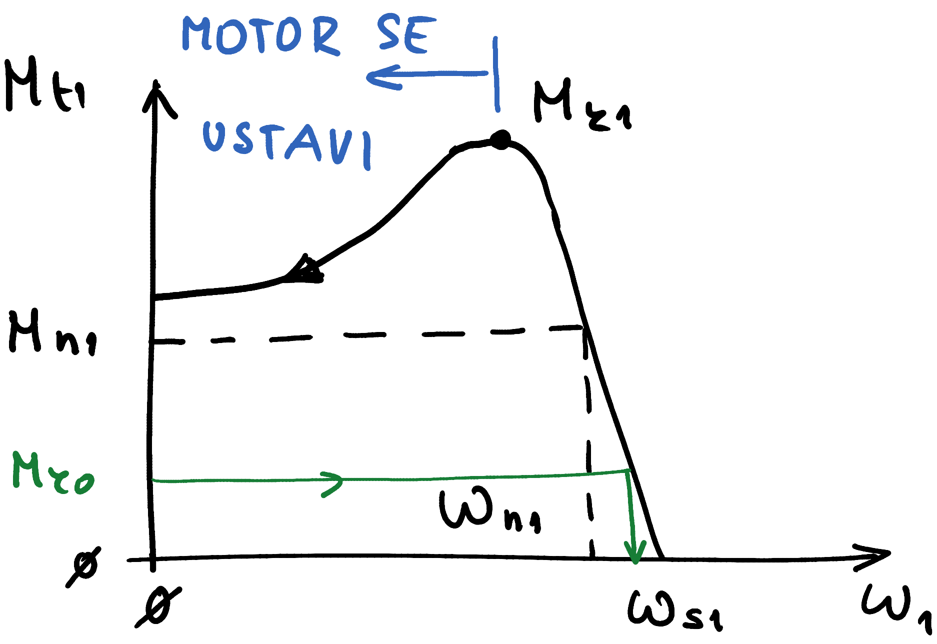
J REDUCIRANI MASNI VZTRAJNOSTNI MOMENT ELEMENTOV DELOVNEGA STROJA

$M_{po} = J\alpha_2$ MOMENT POSPEŠEVANJA

J ✓

M_{ko} ✓

$M_{t1}(\omega_1)$ ✓ KARAKTERISTIKA ASINHRONEGA ELEKTROMOTORJA



$$\omega_{s1} = \frac{2\pi n_{s1}}{60} \; Hz$$

$$\omega_{n1} = \frac{2\pi n_{n1}}{60}$$

$$n_{n1} = 1470 \; vrt/min$$

M_{k1} PREKUCNI MOMENT

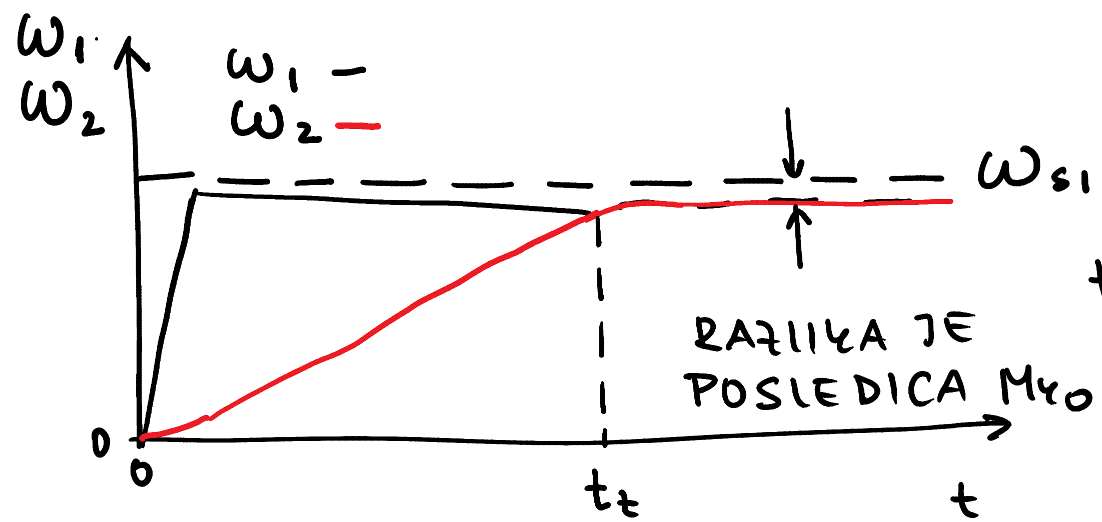
M_{n1} IMENSKI MOMENT

$$n_{s1} = \frac{f \cdot 60}{p} = \frac{50 \cdot 60}{2} = 1500 \; vrt/min$$

f - FREKVENCA OMREŽJA 50Hz

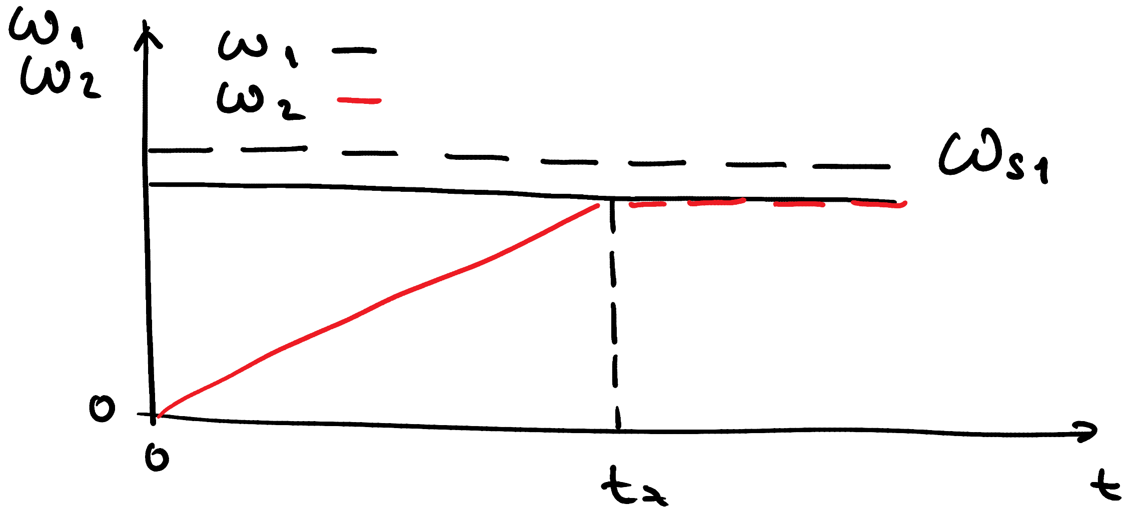
p - ŠTEVILO POLOV AS. ELEKTROMOTORJA $p = 2$

KOTNE HITROSTI

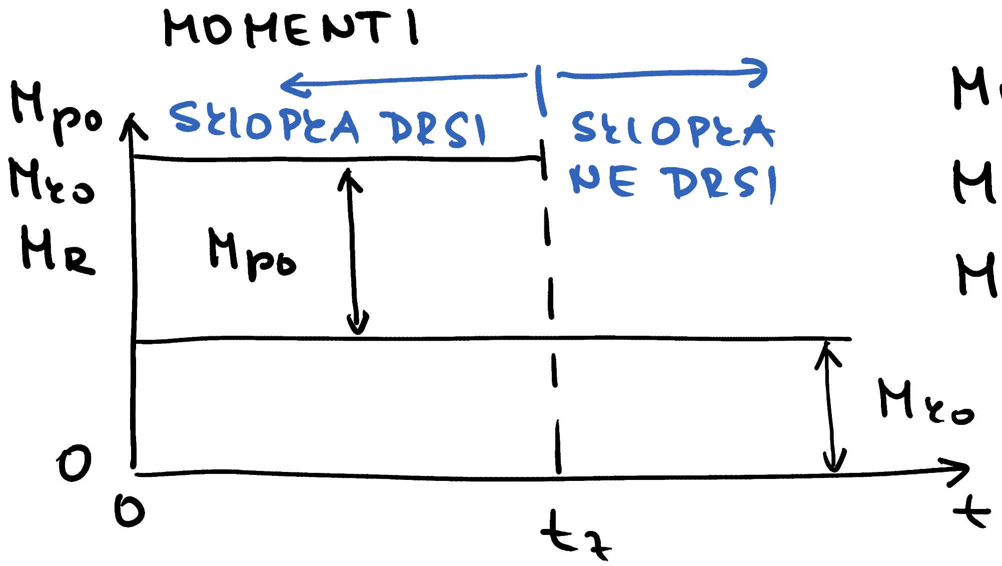


DEJANSKO STANJE

t_z ČAS ZAGONA



POENOSTAVLJENO STANJE



M_R MOMENT TRENJA

$$M_R = M_{to} + M_{po} = const$$

$$M_{po} = const$$

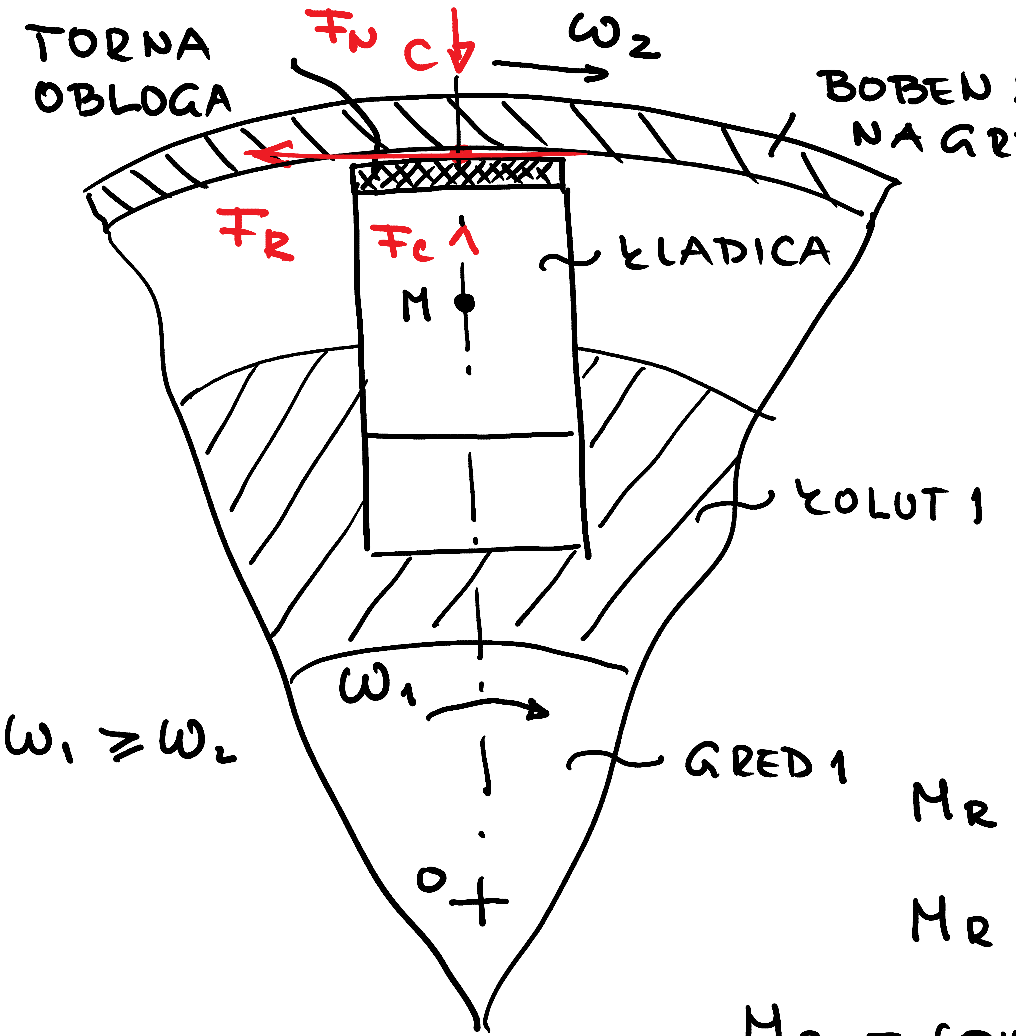
$$M_{t_1} = M_R$$

$$M_{po} = J\alpha_2 = J \cdot \frac{d\omega_2}{dt}$$

$$\omega_2 = \frac{t}{t_z}\omega_1 \ ; \ \frac{d\omega_2}{dt} = \frac{\omega_1}{t_z}$$

$$M_{po} = \frac{J\omega_1}{t_z}$$

CENTRIFUGALNA ZAGONSKA SKLOPKA



$\overline{OM} = r$

$\overline{OC} = \frac{D}{2}$

$F_c = m \cdot i\, \omega_1^2 r$

m MASA KLADICE

i ŠTEVILO KLADIC

M TEŽIŠČE KLADICE

$F_c = F_N$

$F_R = F_N \cdot \mu = m \cdot i \omega_1^2 r \mu$

$M_R = F_R \cdot \frac{D}{2}$

$M_R = m i \omega_1^2 r \mu \cdot \frac{D}{2}$

$M_R = \text{const}$

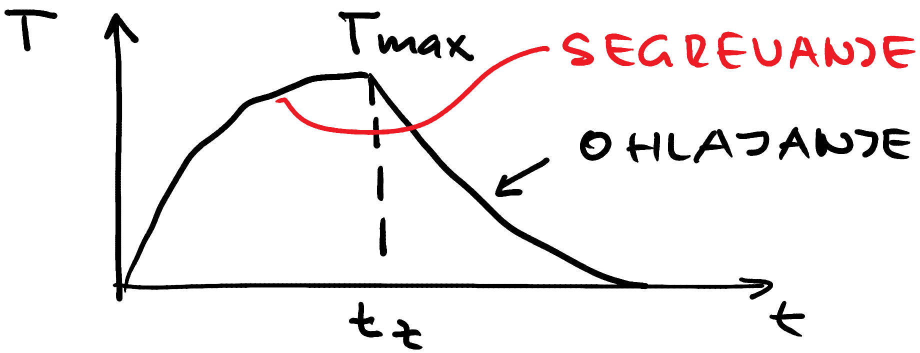
DELO TRENJA

$$W_R = \int_0^{t_z} P_R \cdot dt = \int_0^{t_z} M_R(\omega_1 - \omega_2)\,dt$$

$$= M_R \int_0^{t_z} \left(\omega_1 - \frac{t}{t_z}\omega_1\right) dt = M_R\,\omega_1 \int_0^{t_z} \left(1 - \frac{t}{t_z}\right) dt$$

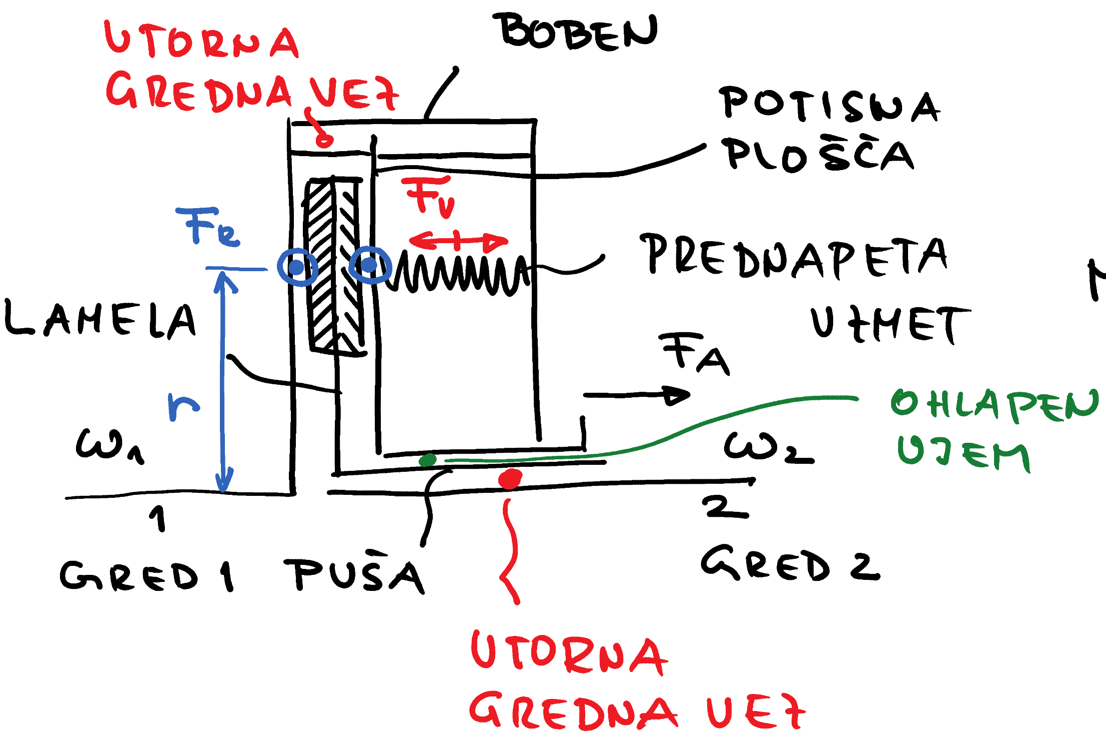
$$= M_R\,\omega_1 \left(t_z - \frac{t^2}{2t_z}\Big|_0^{t_z}\right) = M_R\,\omega_1 \left(t_z - \frac{t_z}{2}\right)$$

$$W_R = \frac{M_R\,\omega_1\,t_z}{2} = Q \quad \text{TOPLOTA}$$



$$T_{max} \leq T_{dop}$$

LAMELNA SKLOPKA



$$M_R = F_R \cdot r \cdot 2$$ ZA ENO LAMELO

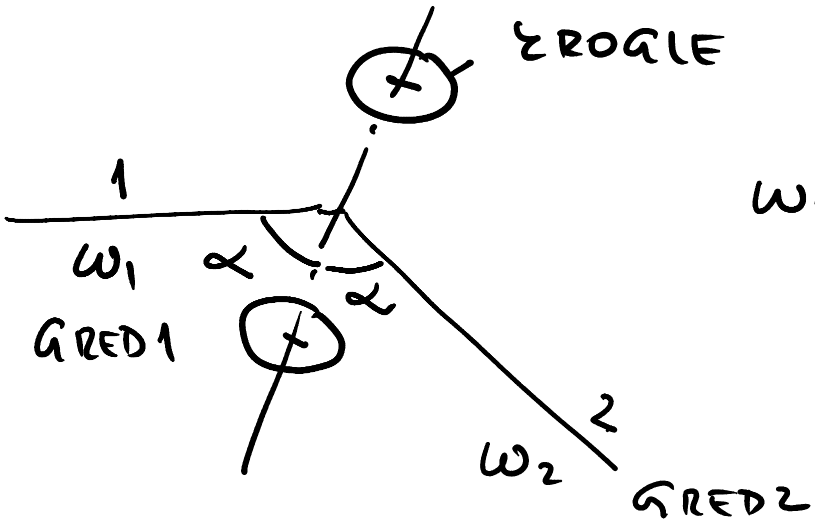
$$= F_V \cdot \mu \cdot r \cdot 2$$

$$M_R = i \, F_V \cdot \mu \cdot r \cdot 2$$ ZA VEČ LAMEL

i – ŠTEVILO LAMEL

$F_A = F_V$ SILA POTREBNA ZA IZKLOP SKLOPKE

HOMOKINETIČNI ZGLOB



$$\omega_1 = \omega_2$$