

MEKANİZMA TEKNİĞİ (8. Hafta)

Mekanizmaların Kuvvet Analizi (Kinetik)

a) Atalet Kuvvet

$\Sigma F - ma = 0 \Rightarrow \Sigma F = ma$

b) Atalet Momenti

$\Sigma M - I\alpha = 0 \Rightarrow \Sigma M = I\alpha$

I: Kütleli Atalet Momenti (kg.m²)

c) Atalet Dairesi:

$I\alpha = m a_G \cdot e$

$e = \frac{I\alpha}{m a_G}$ (Atalet dairesi)

d) Ayrılık Mekanizma İcmesi:

Örnek 1

Daha önceden çözdüğümüz örnek üzerinde devam edelim. Mekanizmanın mafsal noktalarındaki kuvvetleri ve A noktasına bağlanacak motor gücünü bulalım.

| | \vec{r}_2 | \vec{r}_3 | \vec{r}_4 |
|---|-------------|-------------|-------------|
| r | 10 | 20 | 28 |
| θ | 30° | 44° | 180° |

| | \vec{r}_2 | \vec{r}_3 | \vec{r}_4 |
|-----------------|-------------|-------------|-------------|
| \ddot{r} | 0 | 0 | -4600 |
| $\ddot{\theta}$ | 0 | 8259 | 0 |

Bu değerler daha önceden hesaplanmıştı (Konum, hız, ivme)

$\theta_2 = 30^\circ$
 $\omega_2 = 200 \text{ rad/s}$
 $AB = 10 \text{ cm}$
 $BC = 20 \text{ cm}$
 $BG_3 = 10 \text{ cm}$
 $P = 500 \text{ N}$
 $m_4 = 0,6 \text{ kg}$
 $m_3 = 3 \text{ kg}$
 $I_3 = 0,1 \text{ kg.m}^2$

- A noktasına bağlanacak motorun gücünü bulunuz.
 - Mafsal noktalarına gelen kuvvetleri bulunuz.

* Sistemi iki parça halinde çözelim

(A)

(B)

A Görüşü

$-T_1 + F_{32} \cos 46^\circ = 0,1 m$

$F_{32} = F_{23} = F_{43} = F_{34}$

$(500 + 0,6 \cdot 4600)$

$mg = 0,6 \cdot 9,81$

$F_{34} \cdot \cos 14^\circ = 500 + 0,6 \cdot 4600$

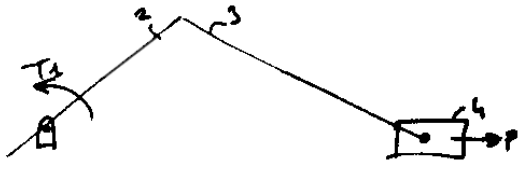
$F_{34} = 3359 \text{ N} = F_{32}$

$T_1 = F_{32} \cdot \cos 46^\circ \cdot 0,1$

$T_1 = 3359 \text{ N} \cdot \cos 46^\circ \cdot 0,1 \text{ m}$

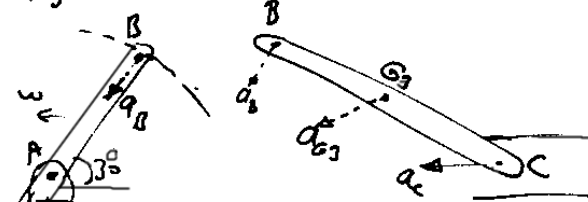
$T_1 = 233 \text{ Nm}$

B Görüşü

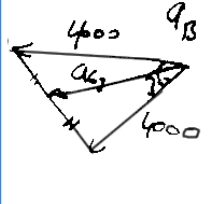
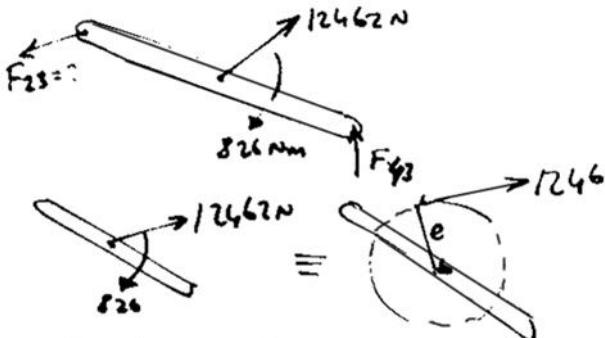


A Görünüşü
 $m_4 \neq 0, p \neq 0, m_3 = 0, I_3 = 0 \Rightarrow T_2 = 233 \text{ Nm}$

B Görünüşü
 $m_3 \neq 0, I_3 \neq 0, m_4 = 0, p = 0$
 Ağırlık merkezini bulunabiliriz.

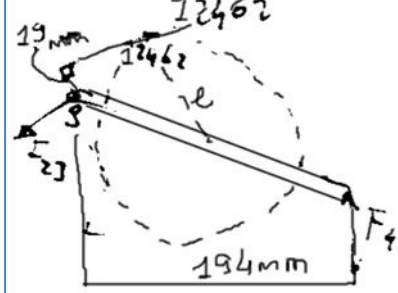


$a_B = r_2 \cdot \omega_2^2 = 0,2 \text{ m} \cdot 200^2 \text{ rad/s}^2$
 $a_B = 4000 \text{ m/s}^2$
 $a_C = 4600 \text{ m/s}^2$
 $a_{G3} = 4154 \text{ m/s}^2$

$M_3 a_{G3} = 3 \cdot 4154 \text{ kg} \cdot \text{m/s}^2 = 12462 \text{ N}$
 $a_{G3} = 4154$
 $I_3 a_3 = 0,2 \cdot 8259 = 826 \text{ kgm}^2 \cdot \text{m/s}^2 = 826 \text{ Nm}$

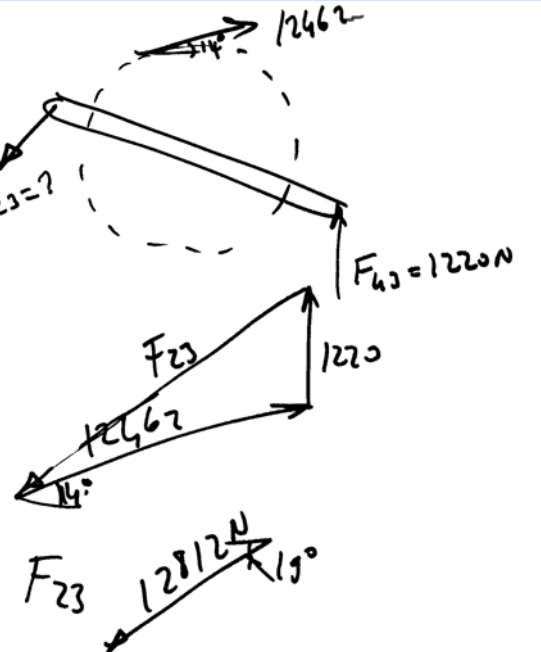
$I_3 a_3 = m_3 \cdot a_{G3} \cdot e$
 $e = \frac{826}{12462} = 0,0662 \text{ m}$

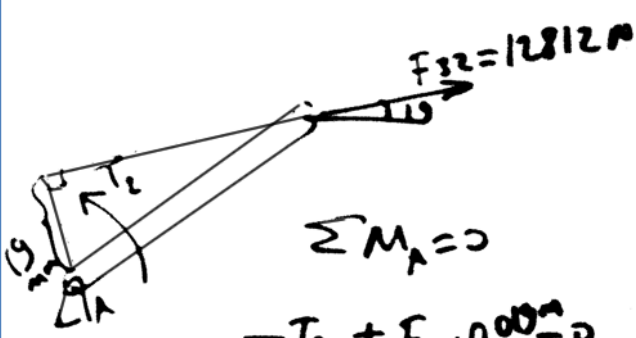


$\sum M_p = 0$

$12462 \cdot 19 \text{ mm} - F_{43} \cdot 194 \text{ mm} = 0$

$F_{43} = 1220 \text{ N}$





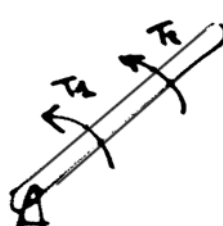
$F_{32} = 12812 \text{ N}$

$\Sigma M_A = 0$

$-T_2 + F_{32} \cdot 0,009 = 0$

$T_2 = 12812 \text{ N} \cdot 0,009$

$T_2 = 243 \text{ Nm}$



$T = T_1 + T_2$

$= 233 + 243$

$T = 476 \text{ Nm}$

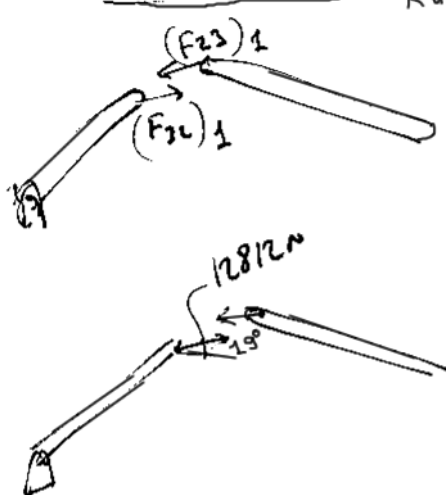
$P = M \cdot \omega$

$P = 476 \text{ Nm} \cdot 200 \frac{\text{rad}}{\text{s}}$

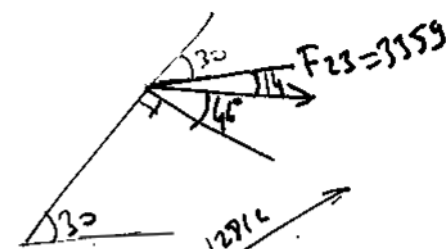
$= 95200 \frac{\text{Nm}}{\text{s}} \text{ (Watt)}$

$= 95,2 \text{ kW}$

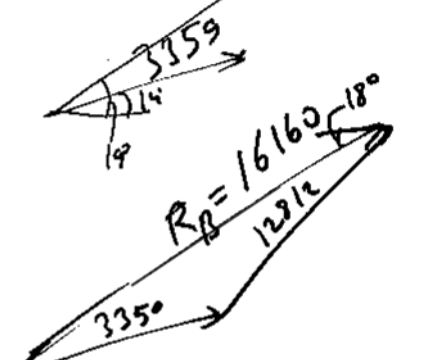
β -Mafsalıma gelen kuvvet



$F_{23} = 12812 \text{ N}$



$F_{23} = 3359 \text{ N}$



$R_B = 16160 \text{ N}$