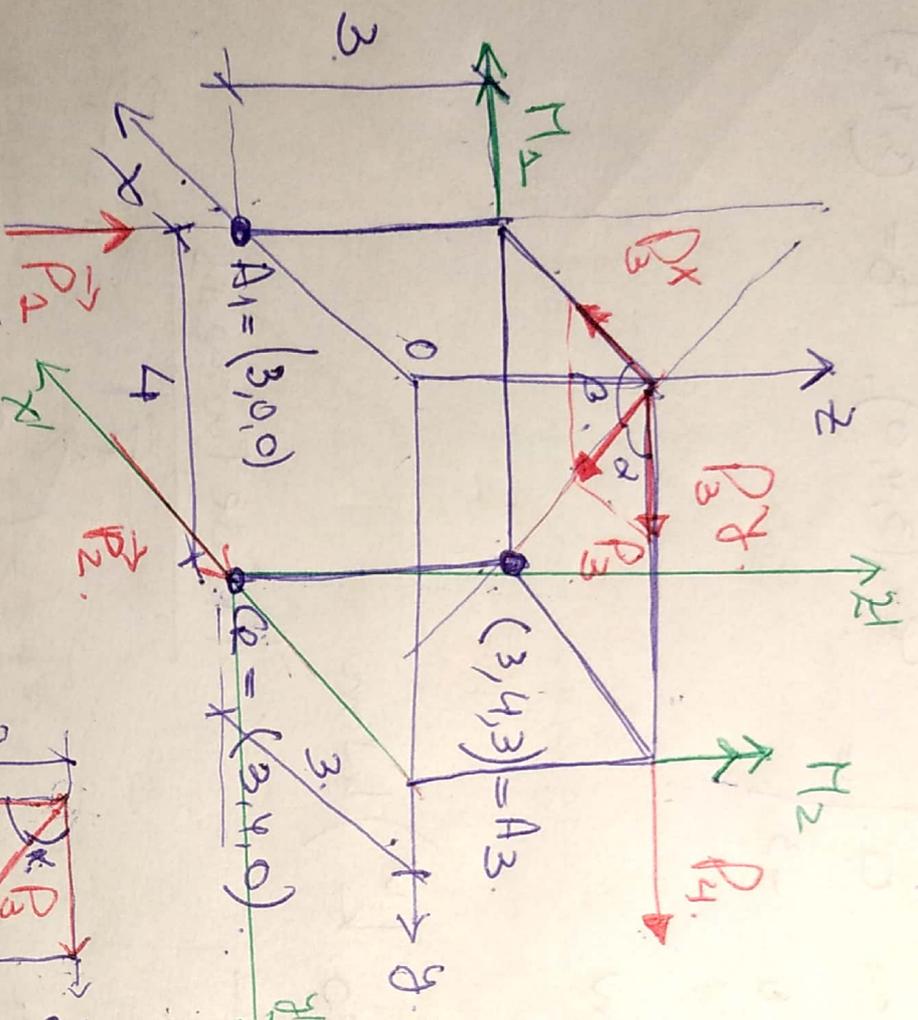
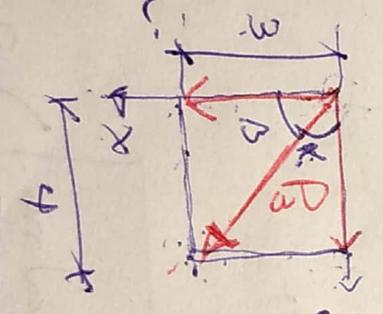


SISTEMAS DE FUERZAS ESPACIALES.

Reducir. El sistema al centro  $C_R$ .



- $P_1 = 10 \text{ kN}$
- $P_2 = 20 \text{ kN}$
- $P_3 = 30 \text{ kN}$
- $P_4 = 40 \text{ kN}$
- $M_1 = 20 \text{ kNm}$
- $M_2 = 30 \text{ kNm}$
- $M_3 = 0,8$
- $C_{\theta P_3} = 0,6$



$$\vec{R} = \sum_{i=1}^n \vec{P}_i$$

$$\vec{P}_1 = (0\vec{i} + 0\vec{j} + 10\vec{k}) \text{ kNm}$$

$$\vec{P}_2 = (-20\vec{i} + 0\vec{j} + 0\vec{k}) \text{ kNm}$$

$$\vec{P}_3 = (10\vec{i} + 20\vec{j} + 0\vec{k}) \text{ kNm}$$

$$\vec{P}_4 = (0\vec{i} + 40\vec{j} + 0\vec{k}) \text{ kNm}$$

$$\vec{R} = (-20\vec{i} + 60\vec{j} + 10\vec{k}) \text{ kNm}$$

$$\vec{M}_{CR} = \sum_{i=1}^n \vec{P}_i \times (\vec{r}_{CR} - \vec{r}_{A_i}) + \sum_{j=1}^n \vec{M}_j$$

$$(\vec{r}_{A_i} - \vec{r}_{C_R}) \times \vec{P}_i$$

$$C_R = (3, 4, 0) \quad A_1 = (3, 0, 0)$$

$$\vec{M}_{CR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & 0 & 10 \\ 0 & 4 & 0 \end{vmatrix} = (-40\vec{i} + 0\vec{j} + 0\vec{k}) \text{ kNm}$$

$$\vec{M}_{CR} = 0$$

15/04/2024

$$\vec{M}_{P_3}^{CA} = \vec{r}_3^x (C_R - A_B) = \begin{vmatrix} 18 & 24 & 0 \\ 0 & 0 & -3 \end{vmatrix} = C_R = (3, 4, 0) \quad A_B = (3, 4, 3)$$

$$\vec{M}_{P_3}^{CA} = (-12\hat{i} + 54\hat{j} + 0\hat{k}) \text{ kNm}$$

$$\vec{M}_{P_4}^{CA} = (-120\hat{i} + 0\hat{j} - 120\hat{k}) \text{ kNm}$$

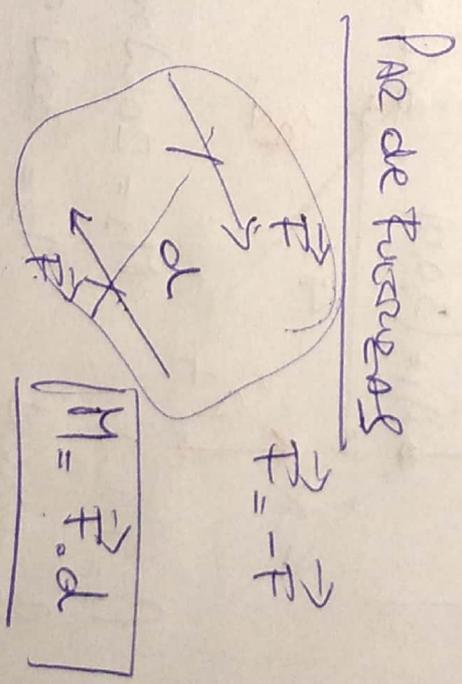
$$\vec{M}_2 = (0\hat{i} - 20\hat{j} + 0\hat{k}) \text{ kNm}$$

$$\vec{M}_2 = (0\hat{i} + 0\hat{j} + 30\hat{k}) \text{ kNm}$$

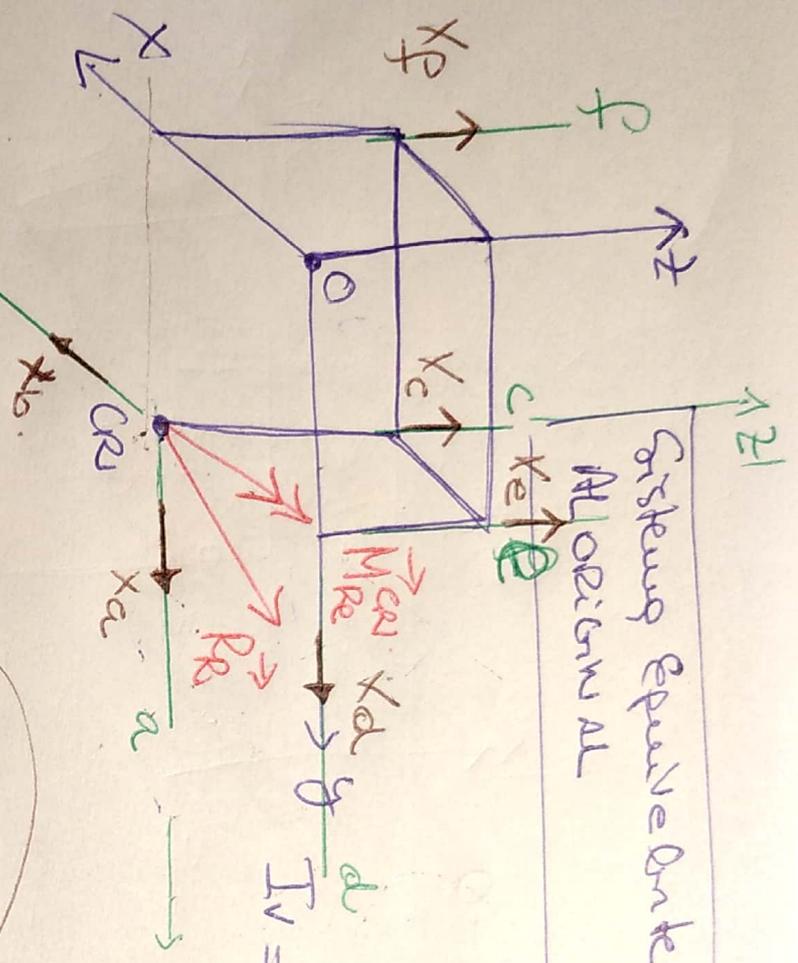
$$\vec{M}_{Re}^{CA} = (-232\hat{i} + 34\hat{j} - 90\hat{k}) \text{ kNm}$$

$$\vec{R}_e = (-2\hat{i} + 64\hat{j} + 10\hat{k}) \text{ kNm}$$

Resultado de Reducción



Systemeigene Punkte  
ALGORITHM 1



$$\vec{M}_{re}^O = \vec{r}_{CO} \times (0 - \vec{c}_c) + \vec{H}_{re}^c$$

$$\vec{r}_R = \vec{r}_E \quad \text{INVARIANTE VECTOREN}$$

$$\vec{I}_e = \vec{H}_{re}^O \cdot \frac{\vec{r}_E}{|\vec{r}_E|}$$

Gleichungssystem

$$\vec{R}_E' = 0 \quad \vec{M}_{re}^O = 0$$

$$R_x = -2 + x_b = 0 \quad \boxed{x_b = 2 \text{ m}}$$

$$R_y = 0 + x_a + x_d = 0$$

$$R_z = 10 + x_c + x_e + x_f = 0$$

$$\boxed{x_a = -34 \text{ kN}}$$

$$\boxed{x_c = 59,33 \text{ kN}}$$

$$\vec{M}_{re}^O = 0 \quad \boxed{x_f = -58 \text{ kN}}$$

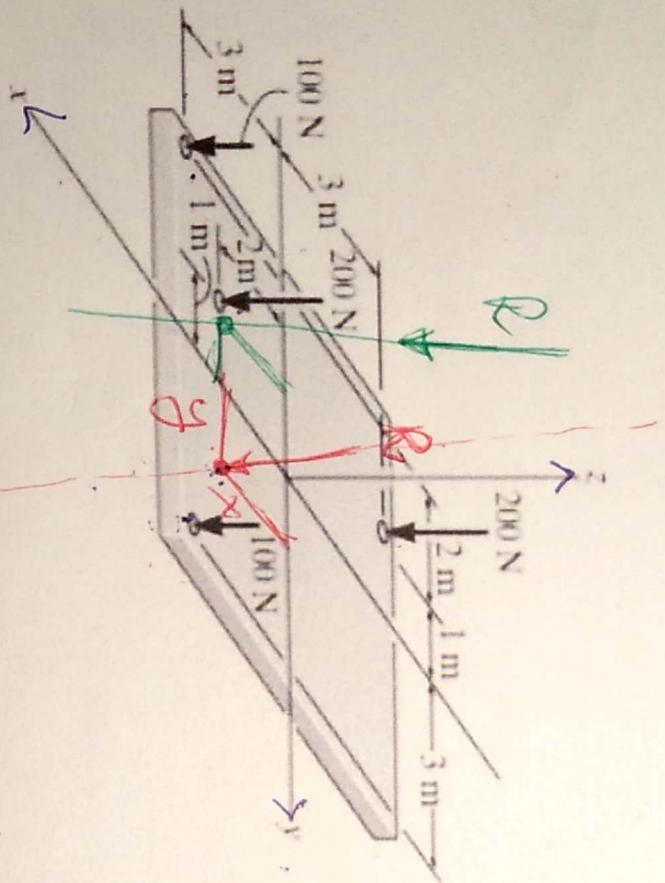
$$M_x = -232 - x_f \cdot 4 \text{ m} = 0 \quad \boxed{x_e = -11,5 \text{ kN}}$$

$$M_y = 34 + x_e \cdot 3 \text{ m} = 0 \quad \boxed{x_d = -30 \text{ kN}}$$

$$M_z = -90 - x_d \cdot 3 \text{ m} = 0$$

FE1  
15.10.17

Hallar la Resultante del Sistema y su Punto de Aplicación



$$R_z = -200N - 200N - 100N - 100N$$

$$R_z = -600N$$

$$\textcircled{1} M_x = -R_z y = -100N \cdot 3m + 100N \cdot 3m + 200N \cdot 1m + 200N \cdot 1m$$

$$\textcircled{2} M_y = R_z x = 100N \cdot 3m + 100N \cdot 3m + 200N \cdot 2m + 200N \cdot 3m$$

$$\text{de } \textcircled{1} -R_y = M_x$$

$$R_y = -600N$$

$$\text{de } \textcircled{2} R_x = M_y$$

$$R_x = +966.67m$$

15/09/2021