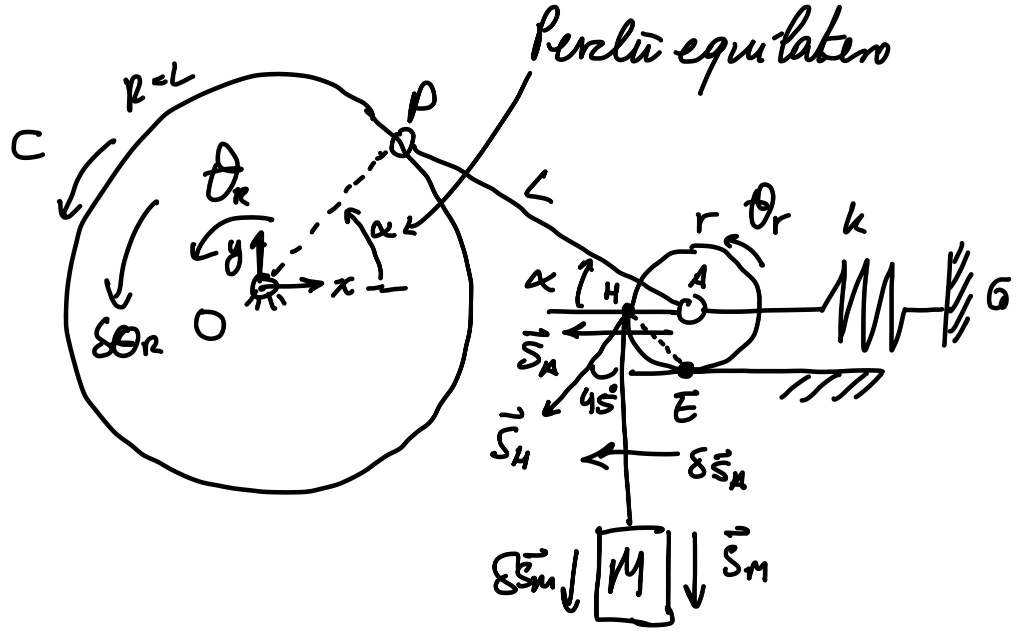
Esercitazione 11 - Corredato e non Tarsi

Statica (PLV) da Temi d'E

1) Esercizio 1.1 TdE 6/2/2023

Statica PLV



Dati: $\alpha_0 = 0$ angolo PA per molla scarica

$\alpha_{eq} = 30°$

Trovare $C_{eq} = ?$

a) Legami Cinematici

In questo caso È comodo studiare tutto in base al punto O

$$\vec{S}_A = 2L\cos\alpha\,(-\hat{i})$$

↳ Perché tutti e due stanno girando nello stesso modo

$$\vec{\theta}_r = \left|\frac{\vec{S}_A}{r}\right|(+\hat{k}) = \frac{2L\cos\alpha}{r}(+\hat{k})$$

$$\vec{\theta}_R = \alpha\,(+\hat{k})$$

$$|\vec{S}_H| = |\vec{\theta}_r|\,(\underbrace{\sqrt{2}\,r}_{\overline{HE}}) = 2\sqrt{2}\,L\cos\alpha$$

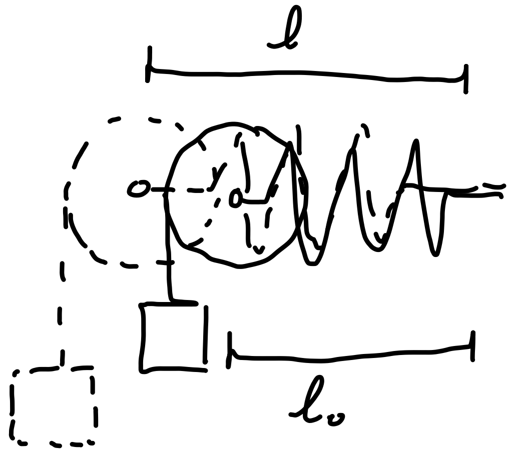
$$\vec{S}_M = 2\sqrt{2}\,L\cos\alpha\,\cos 45\,(-\hat{j}) = 2L\cos\alpha\,(-\hat{j})$$

$$\delta\vec{S}_A = \left|\frac{\partial\vec{S}_A}{\partial\alpha}\right|\delta\alpha = 2L\sin\alpha\,(-\hat{i})\,\delta\alpha$$

$$\delta\vec{S}_M = \left|\frac{\partial\vec{S}_M}{\partial\alpha}\right|\delta\alpha = 2L\sin\alpha\,(-\hat{j})\,\delta\alpha$$

$$\delta\vec{\theta}_R = \left|\frac{\partial\vec{\theta}_R}{\partial\alpha}\right|\delta\alpha = \delta\alpha\,(+\hat{k})$$

Ora manca solo la molla

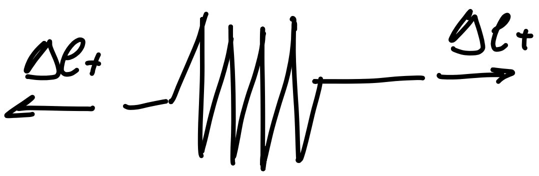


$$\Delta l = l - l_0 =$$

$$= (\overline{OL} - 2L\cos\alpha) - (\overline{OG} - 2L\cos\alpha_0) =$$

$$= \cancel{\overline{OG}} - 2L\cos\alpha - \cancel{\overline{OG}} + 2L\cos\alpha_0 =$$

$$= 2L - 2L\cos\alpha$$



b) Applicare PLV

$$\delta L = 0 =$$

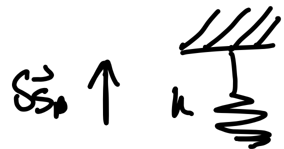
$$= \vec{C} \cdot \delta\vec{\theta}_R + Mg \cdot \delta\vec{s}_M + \vec{F}_{el} \cdot \delta\vec{s}_A = 0$$

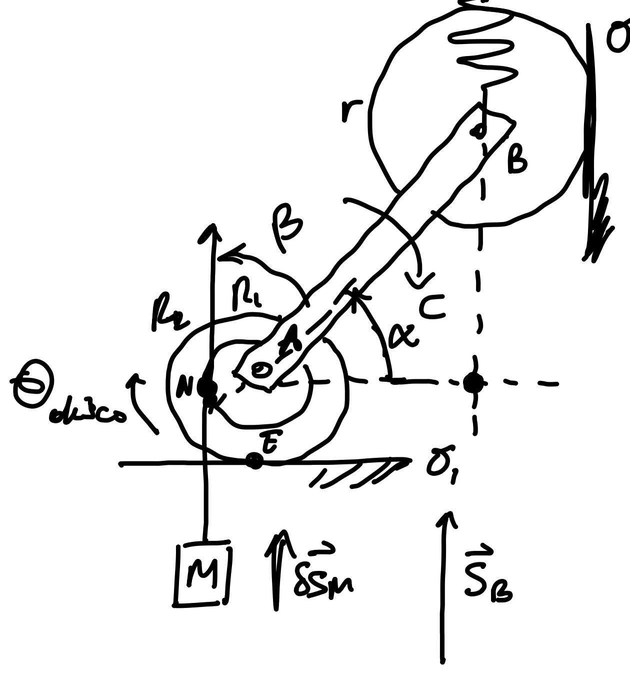
$$\vec{C}(+\hat{k}) \cdot \cancel{\delta}\alpha(+k) + Mg(-\hat{j}) \cdot 2L\sin\alpha(-\hat{j})\cancel{\delta}\alpha + k\Delta l(\hat{i}) \cdot$$
$$2L\sin\alpha(-\hat{i})\,\cancel{\delta}\alpha$$

$$\vec{C} + Mg \cdot 2L\sin\alpha - k \cdot 2L(1-\cos\alpha) \cdot 2L\sin\alpha = 0$$

$\Rightarrow$ RICAVO $C(\alpha_{eq})$

2) Esercizio 1.1 TdE 14/06/2023





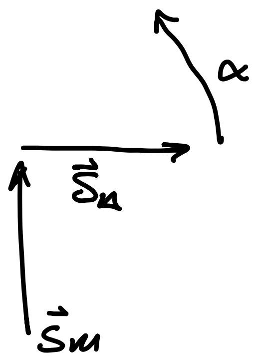
Dati:

$\alpha_0 = 90°$

$\alpha_{eq} = 30°$

GEOMETRIE DI SOLITO NOTE

Trovare C per eq



$$\vec{S}_A = L\cos\alpha(\hat{i})$$

$$\vec{S}_B = L\sin(+\hat{j})$$

$$\Theta_{disco} = S_A / R_2 \cdot (-\hat{k}) = \frac{L\cos\alpha}{R_2}(-\hat{k})$$

$$\overline{EN} = \sqrt{R_1^2 + R_2^2}$$

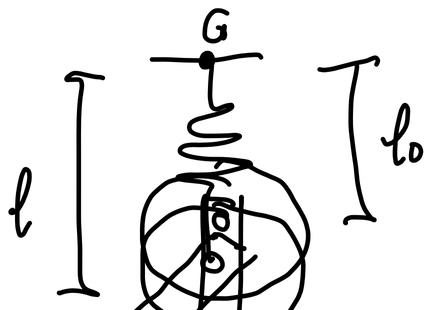
$$\cos\beta = \frac{R_1}{\overline{EN}} = \frac{R_1}{\sqrt{R_1^2 + R_2^2}}$$

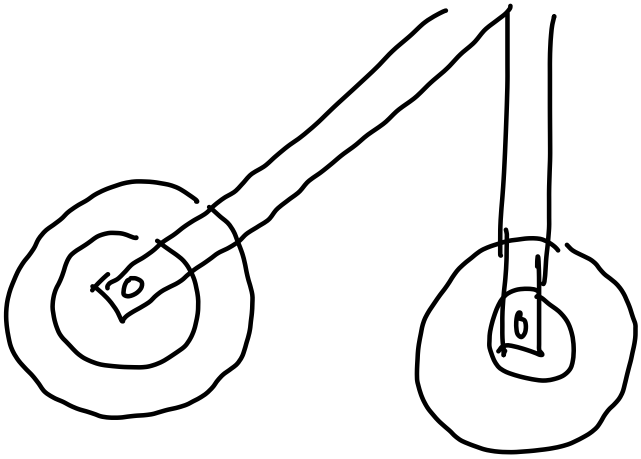
$$|\vec{S}_N| = |\vec{\Theta}_{disco}| \cdot \overline{EN} = \frac{L\cos\alpha}{R_2} \cdot \sqrt{R_1^2 + R_2^2}$$

$$\vec{S}_M = |\vec{S}_N|\cos\beta = \frac{L\cos\alpha}{R_2} \cdot \cancel{\sqrt{R_1^2 + R_2^2}} \cdot \frac{R_1}{\cancel{\sqrt{R_1^2 + R_2^2}}}$$

$$= L\cos\alpha \cdot \frac{R_1}{R_2}$$

Molla:





$\Delta l = l - l_0 =$
$(\overline{AG} - L\sin\alpha)$
$- (\overline{AG} - L\sin\alpha_0) =$
$= \overline{AG} - L\sin\alpha - \overline{AG}$
$+ \underbrace{L\sin\alpha_0}_{\to 1} = L - L\sin\alpha$

$$\delta\vec{S}_B = \frac{\partial|\vec{S}_B|}{\partial\alpha}\delta\alpha = L\cos\alpha\,(+\hat{j})\,\delta\alpha$$

$$\delta\vec{S}_M = \frac{\partial|\vec{S}_M|}{\partial\alpha}\delta\alpha = \left|-L\frac{R_1}{R_2}\sin\alpha\right|(+\hat{j})\,\delta\alpha$$

b) Applico PLV

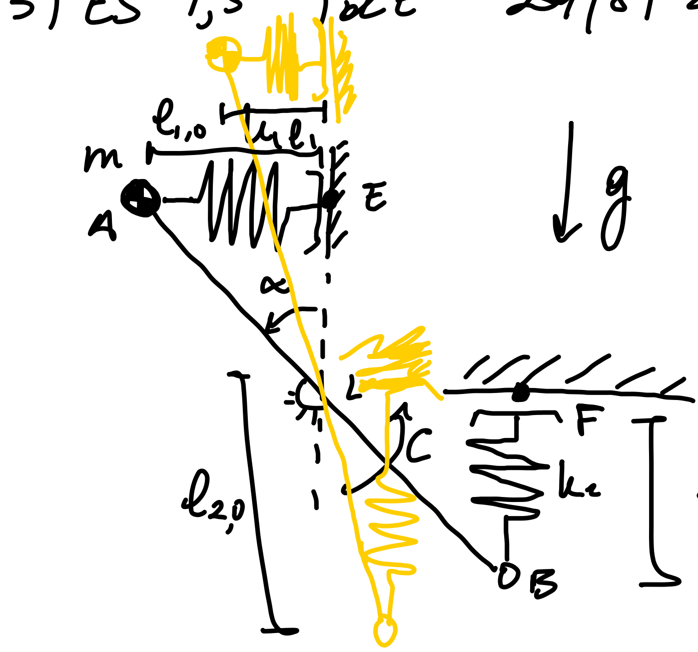
$$\delta L = 0$$

$$Mg(-\hat{j}) \cdot L\frac{R_1}{R_2}\sin\alpha\,(+\hat{j})\,\delta\alpha + ((-\hat{u}^{M}) \cdot \delta\alpha\,(\hat{u}) + \underbrace{k(L - L\sin\alpha)(+\hat{j})}_{F_{el}} \cdot \underbrace{L\cos\alpha\,\delta\alpha}_{\delta s_B}$$

$$-MgL\frac{R_1}{R_2}\sin\alpha\,\delta\alpha - c\,\delta\alpha + kL^2(1-\sin\alpha)\cos\alpha\,\delta\alpha = 0$$

$\Rightarrow$ RICAVO $c(\alpha_{eq})$

3) ES 1,3 TdE 29/8/2022



Dati: $\alpha_0 = 20°$
$\alpha_{eq} = 45°$

Trovare C per equilibrio?

a) Analisi di legami

$$\vec{S}_{Ay} = \frac{L}{2}\cos\alpha\,(-\hat{j})$$

$$\vec{S}_{B} = \frac{L}{2}\cos\alpha\,(+\hat{j})$$

$$\vec{S}_{Ay} = \frac{L}{2}\sin\alpha\,(-\hat{i})$$

$$\Delta l_1 = l_1 - l_{10} = \frac{L}{2}\sin\alpha - \frac{L}{2}\sin\alpha_0$$

$$\Delta l_2 = l_{20} - l_2 = \frac{L}{2}\cos\alpha_0 - \frac{L}{2}\cos\alpha$$

$$\delta\vec{S}_{Ay} = \frac{\partial|\vec{S}_{Ay}|}{\partial\alpha}\delta\alpha = \left|-\frac{L}{2}\sin\alpha\right|(-\hat{j})\,\delta\alpha$$

$$\delta\vec{S}_{By} = \frac{\partial|\vec{S}_{By}|}{\partial\alpha}\delta\alpha = \left|-\frac{L}{2}\sin\alpha\right|(+\hat{j})\,\delta\alpha$$

$$\delta\vec{S}_{Ax} = \frac{\partial|\vec{S}_{Ax}|}{\partial\alpha}\delta\alpha = \frac{L}{2}\cos\alpha\,\delta\alpha$$

b) Applico il PLV

$$\delta L = 0$$

$$\vec{F}_{el,1}\cdot\delta\vec{s}_{Ax} + m\vec{g}\cdot\delta\vec{s}_{Ay} + \vec{C}\cdot\delta\alpha + F_{el,2}\cdot\delta\vec{s}_B = 0$$

$$\underbrace{k_1\overbrace{\left(L/2\sin\alpha - \frac{L}{2}\sin\alpha_0\right)}^{\Delta l_1}}_{F_{el,1}}(\hat{i})\cdot\frac{L}{2}\cos\alpha(-\hat{i})\delta\alpha + mg(-\hat{y})\cdot\frac{L}{2}\sin\alpha(-\hat{y})\cdot\frac{L}{2}\sin\alpha\,\delta\alpha$$

$$+C\cdot\delta\alpha + k_2\left(\frac{L}{2}\cos\alpha_0 - \frac{L}{2}\cos\alpha\right)\cdot\frac{L}{2}\sin\alpha\,\delta\alpha = 0$$

$$C\cancel{\delta\alpha} - k_1\left(\frac{L}{2}\sin\alpha - \frac{L}{2}\sin\alpha_0\right)\cdot\frac{L}{2}\sin\alpha\,\cancel{\delta\alpha} + mg\frac{L}{2}\sin\alpha\,\cancel{\delta\alpha} - k_2\left(\frac{L}{2}\cos\alpha_0 - \frac{L}{2}\cos\alpha\right)\cdot\frac{L}{2}\sin\alpha\,\cancel{\delta\alpha} = 0$$

$\Rightarrow$ RICAVO $C(\delta_{eq})$

Impostiamo ultimo

4) Numeri Complessi

Primo passo, scegliere il centro del piano