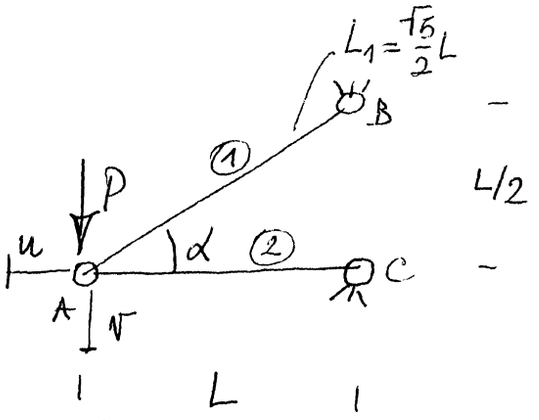
Calcolo di spostamenti di strutture isostatiche in presenza di sola variazione assiale.

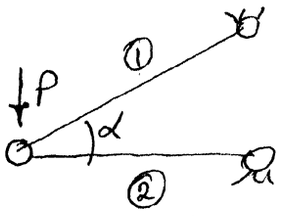


$\alpha = 30°$

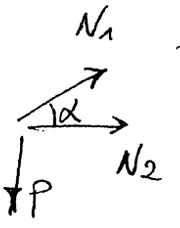
$\sin\alpha = \frac{1}{2}$

$\cos\alpha = \frac{\sqrt{3}}{2}$

sistema reale:



$\Rightarrow$



Equilibrio del nodo A

$\rightarrow R_x = 0 \quad N_1\cos\alpha + N_2 = 0$

$\uparrow R_y = 0 \quad N_1\sin\alpha - P = 0$

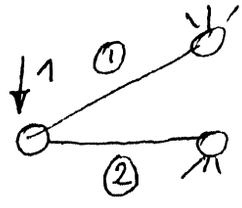
$N_1 \cdot \frac{1}{2} = P \Rightarrow N_1 = 2P$

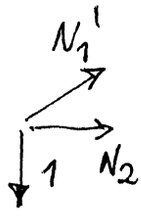
$N_2 = -N_1\frac{\sqrt{3}}{2} \Rightarrow N_2 = -\sqrt{3}P$

$$\Rightarrow \begin{cases} \varepsilon_1 = \frac{N_1}{EA} = \frac{2P}{EA} \\ \varepsilon_2 = \frac{N_2}{EA} = -\frac{\sqrt{3}P}{EA} \end{cases}$$, spostamento v o u

Calcolo dello spostamento verticale.

Sistema ausiliario per spostamento verticale





Equilibrio del nodo A c.s.

$N_1' = 2 \cdot 1$

$N_2' = -\sqrt{3} \cdot 1$; forze verticali

P.L.V:

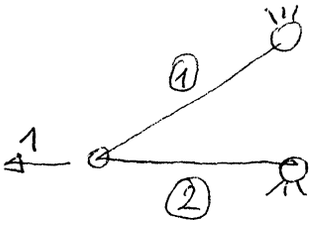
$$1 \cdot v = \int_0^{\frac{\sqrt{5}}{2}L} N_1' \cdot \varepsilon_1 \, dx_1 + \int_0^{L} N_2' \cdot \varepsilon_2 \, dx_2$$

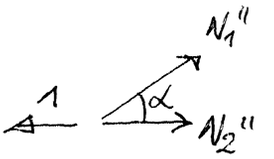
$$1 \cdot v = \int_0^{\frac{\sqrt{5}}{2}L} 2 \cdot \frac{2P}{EA} \, dx_1 + \int_0^{L} -\sqrt{3} \cdot \frac{-\sqrt{3}P}{EA} \, dx_2 = \frac{\sqrt{5}}{2}\frac{4P}{EA}L + \frac{3P}{EA}L$$

$$\Rightarrow v = \frac{PL}{EA}\left(2\sqrt{5} + 3\right)$$

Calcolo dello spostamento richiesto

Sistema ausiliario per spostamento richiesto





Equilibrio al nodo t:

$\rightarrow R_x = 0 \quad -1 + N_2'' + N_1'' \cos\alpha = 0$

$\uparrow R_y = 0 \quad N_1'' \sin\alpha = 0$

$N_1'' \cdot \frac{1}{2} = 0 \quad \Rightarrow N_1'' = 0$

$N_2'' = 1 \quad \Rightarrow N_2'' = 1$

P.L.V.

$$1 \cdot u = \int_0^{\frac{\sqrt{5}}{2}L} N_1'' \cdot \varepsilon_1 \, dx_1 + \int_0^{L} N_2'' \cdot \varepsilon_2 \, dx_2$$

$$1 \cdot u = \int_0^{\frac{\sqrt{5}}{2}L} 0 \cdot \frac{2P}{EA} \, dx_1 + \int_0^{L} 1 \cdot \left(\frac{-\sqrt{3}P}{EA}\right) dx_2 = 0 + \left(-\frac{\sqrt{3}P}{EA} L\right)$$

$$\Rightarrow u = \frac{PL}{EA}(-\sqrt{3})$$

cioè u è diretto verso destra.