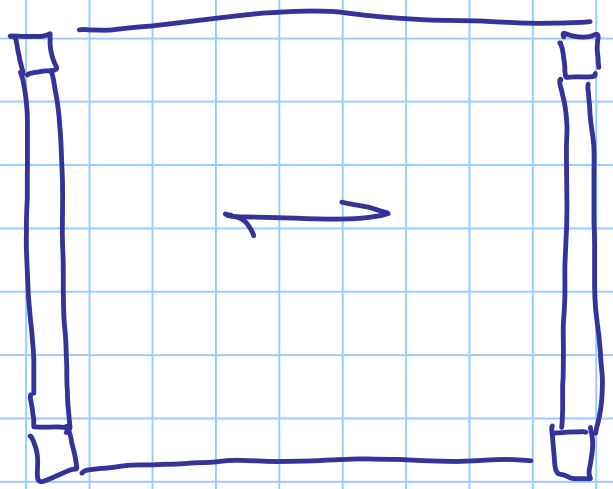
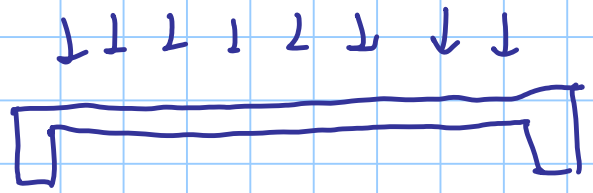
TORSIONE

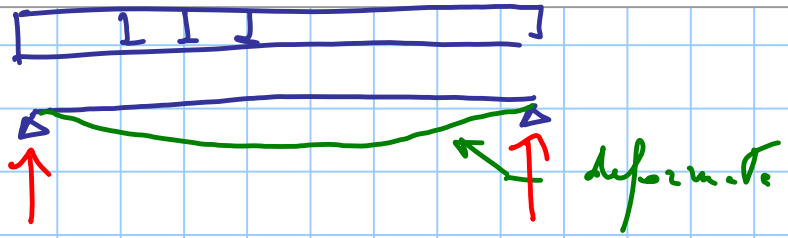
Titolo nota 20/12/2016

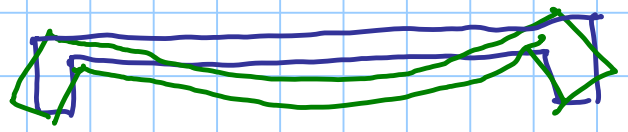


CARPENTERIA



SEZIONE



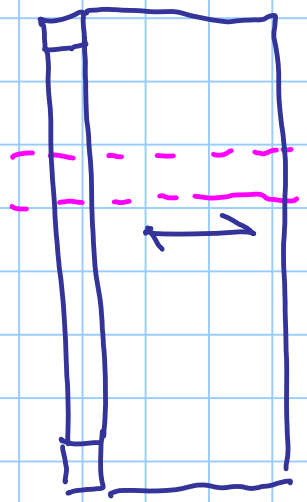


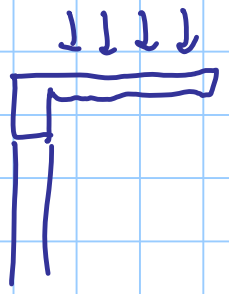
per congruenza le travi hanno rotazioni torsionali

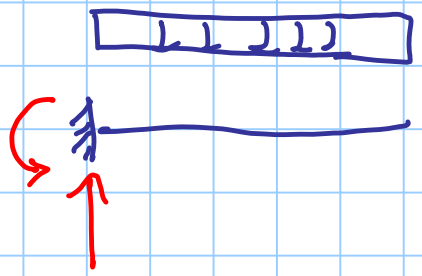
le travi non vincolate agli estremi

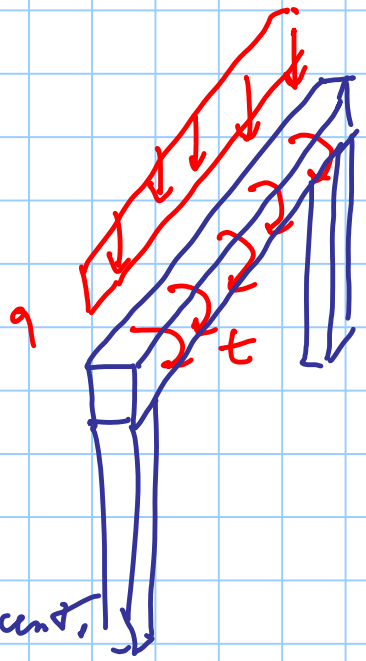
⇓

nasce torsione "per congruenza"



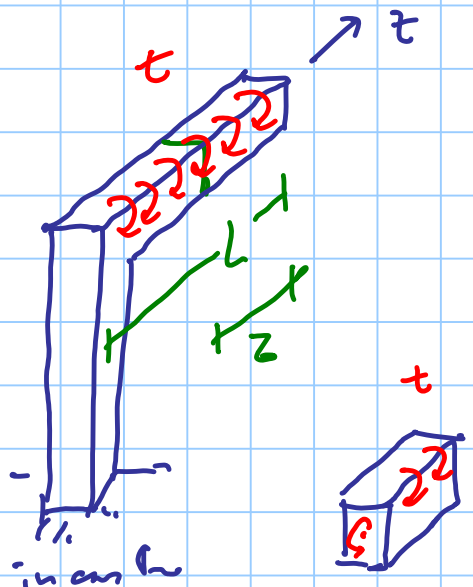




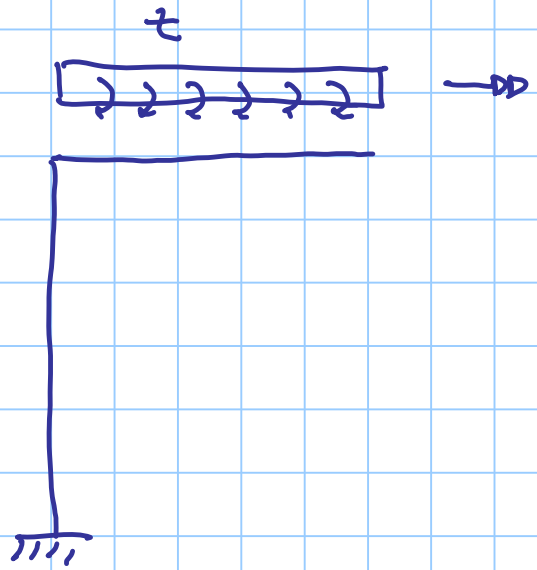


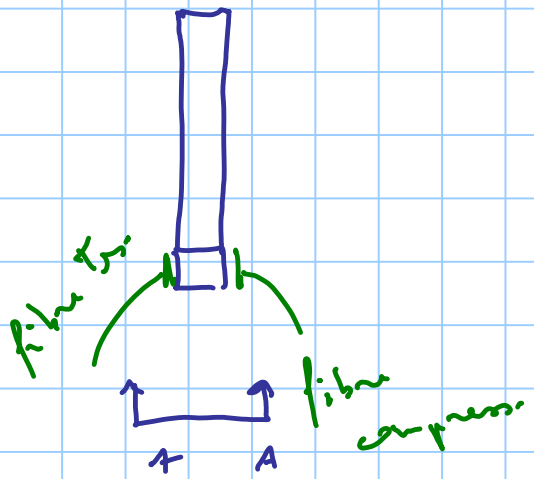
Sulla trave agisce anche un carico torcente, t [kNm/m]

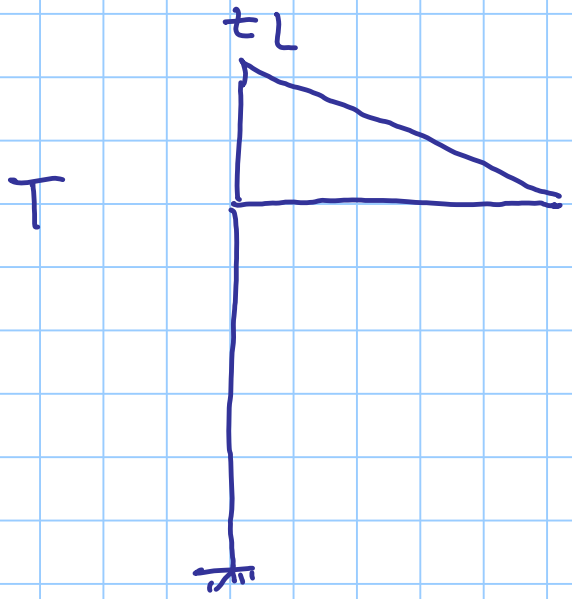
Nella trave nasce Torsione "per equilibrio."

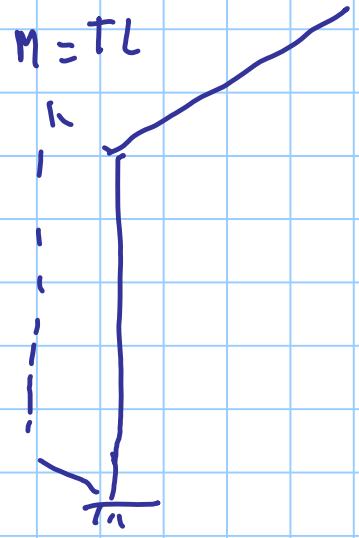


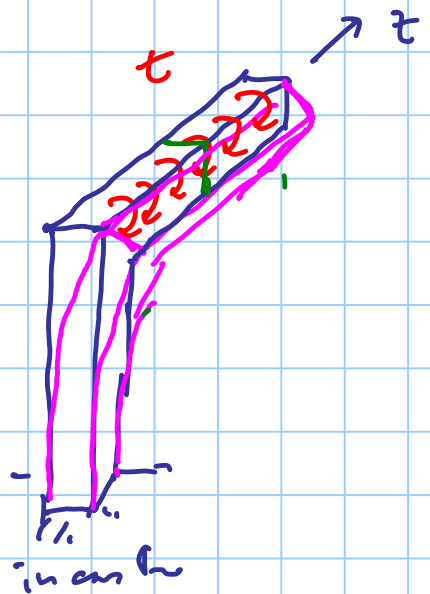
$T = t z$

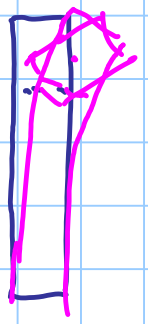










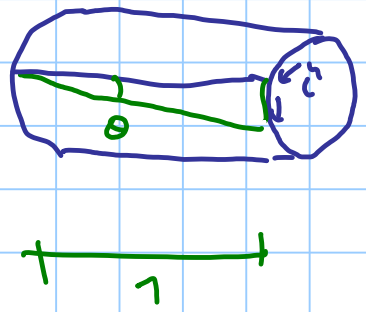


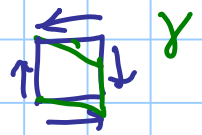
A-A

STATO TENSIONALE

$\tau = G\gamma$

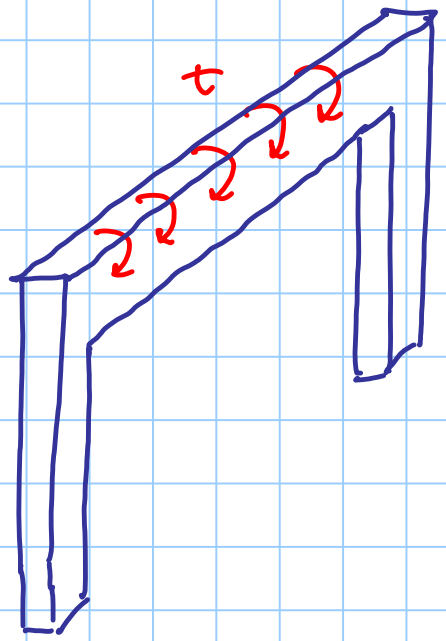
γ

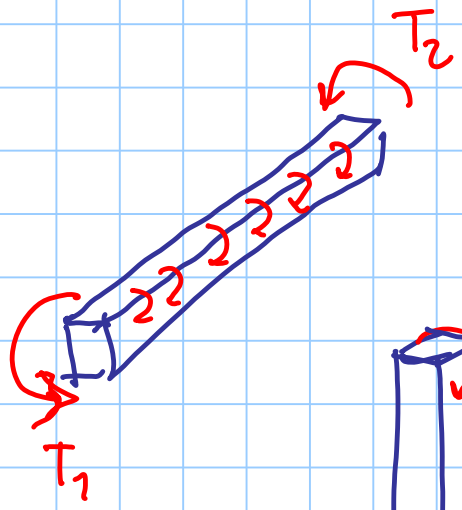


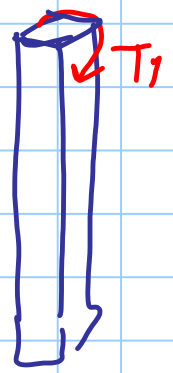


$$\tau = \frac{T}{I_p} r$$

$$T_1 + T_2 = t\,L$$



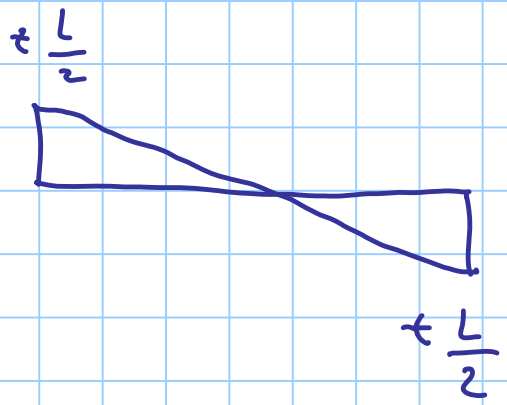


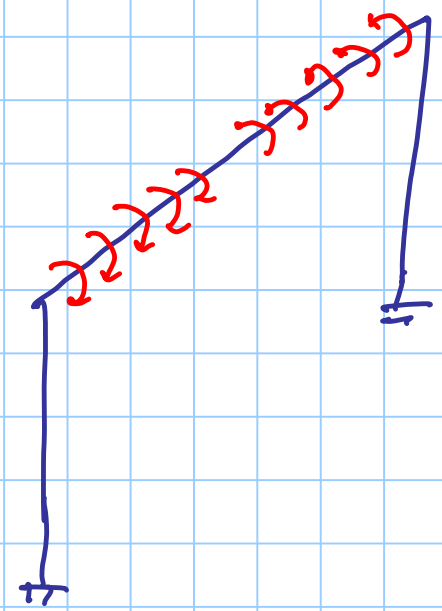


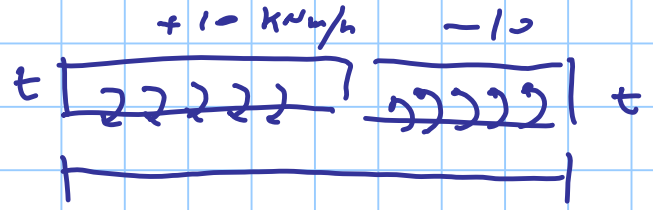
se i pilastri sono uguali

(schema simmetrico)

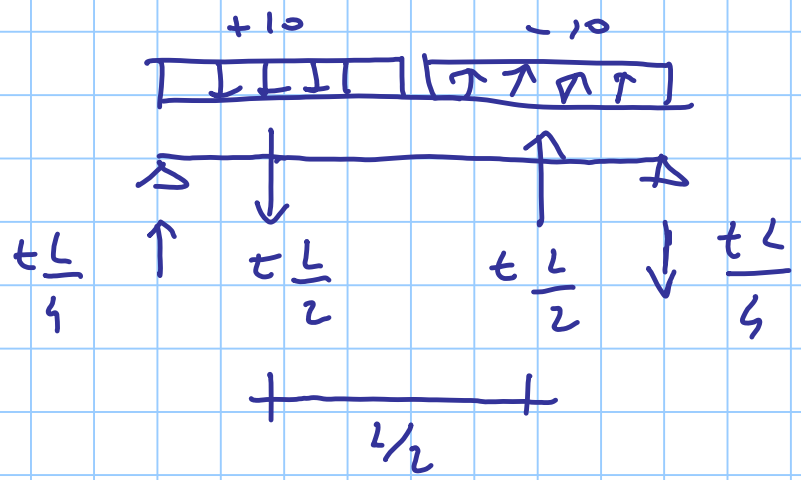
$$T_1 = T_2 = t\,\frac{L}{2}$$







ANALOGIA :



τ_{max} τ

$\tau = \frac{T}{I_p} r$

$T = \int \tau r \, dA$

r: distanza del baricentro bracci

τ_{min}

τ_{max}

a

b

$a \geq b$

$\psi \simeq 3 + \frac{1.8}{a/b}$

$\tau_{max} = \frac{\psi T}{a b^2}$

t

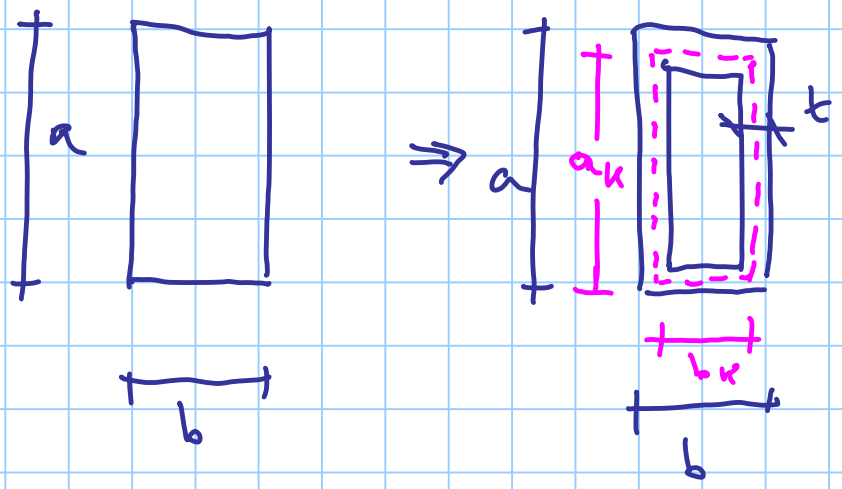
τ

A_k

$\tau = \frac{T}{2 A_k t}$

formula di Bredt

$\tau t = \cos T_{am} T_e$



$$a_k = a - t$$

$$b_k = b - t$$

$$A_k = a_k \, b_k$$

$$A = ab$$

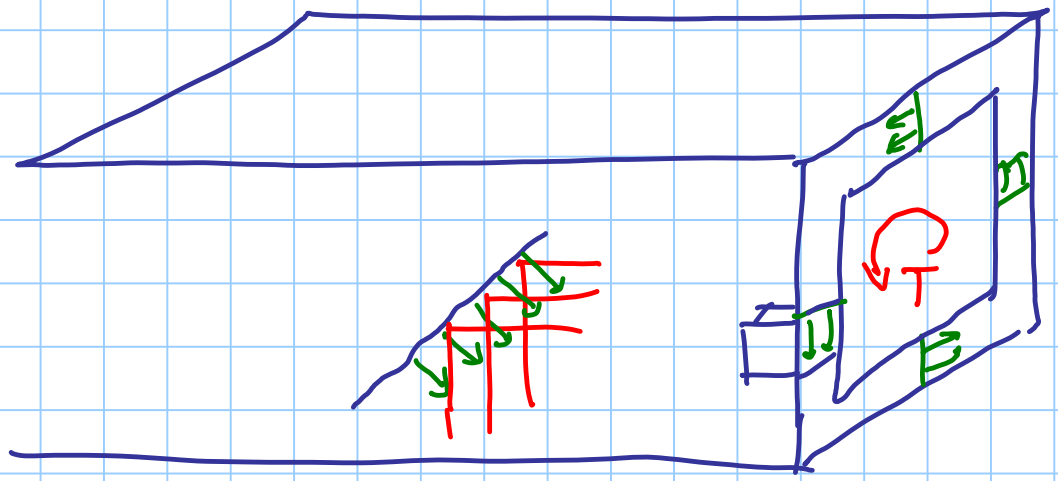
$$u = 2(a+b)$$

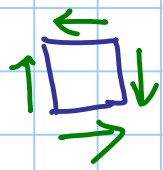
$$t = \frac{ab}{2(a+b)} \geq 2c$$

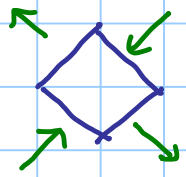
$$t = MAX\left(\frac{A}{u} \; ; \; 2c\right)$$

Ejemplo 30×50

$$t = \frac{30 \times 50}{2(30+50)} = 9.38 \text{ cm} \geq 2c$$


T





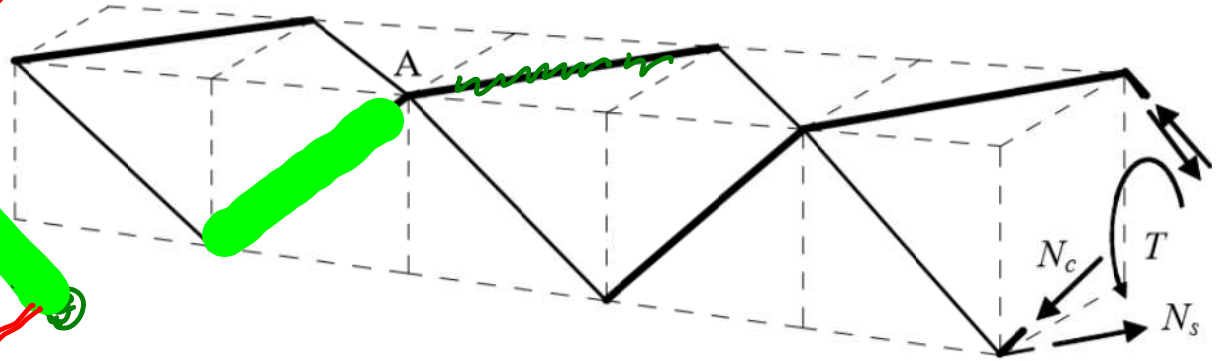


Fig. 7. Traliccio spaziale, in presenza di barre a 45°

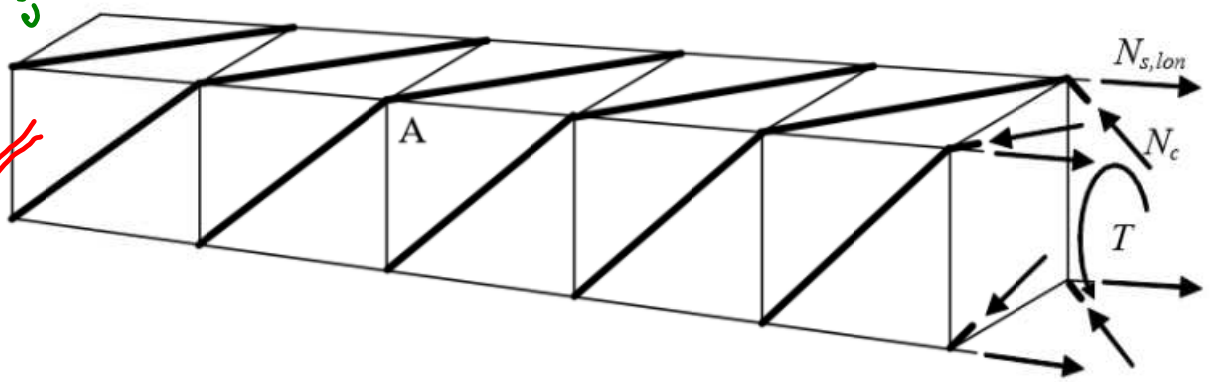
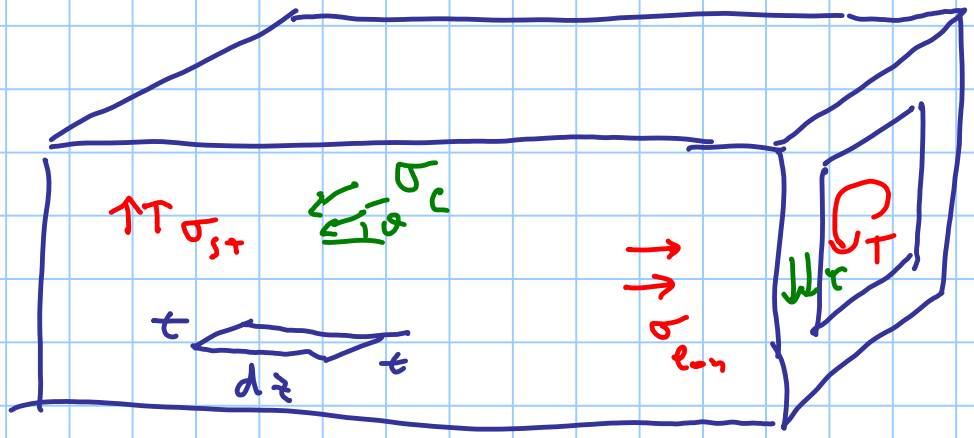
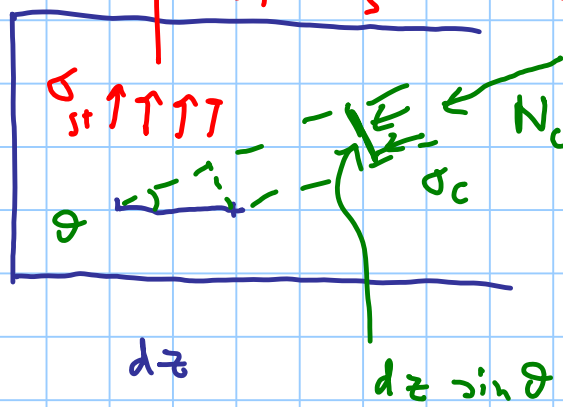


Fig. 9. Traliccio spaziale, in presenza di staffe e barre longitudinali



$$\tau = \frac{T}{2 A_m t}$$

staffe $\frac{A_{st}}{s}$



$$N_{c,vert} = N_{c1} \sin\vartheta = \sigma_c\ dz \sin^2\vartheta\ t$$

equilibri- $N_{s1} = N_{c1\,vert}$

$$\frac{A_{st}}{s}\,\cancel{dz}\;\sigma_{st} = \sigma_c\,\cancel{dz}\,\sin^2\theta\; t$$

A_{long} = area Tens. Total

$$\frac{A_{long}}{u_K}$$

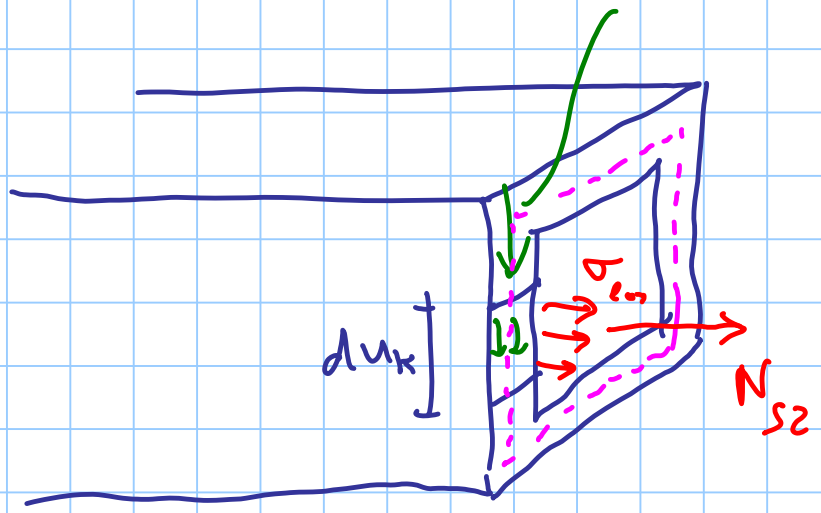
$$\tau\, du_K\, t = \frac{T}{2A_K}\, du_K$$

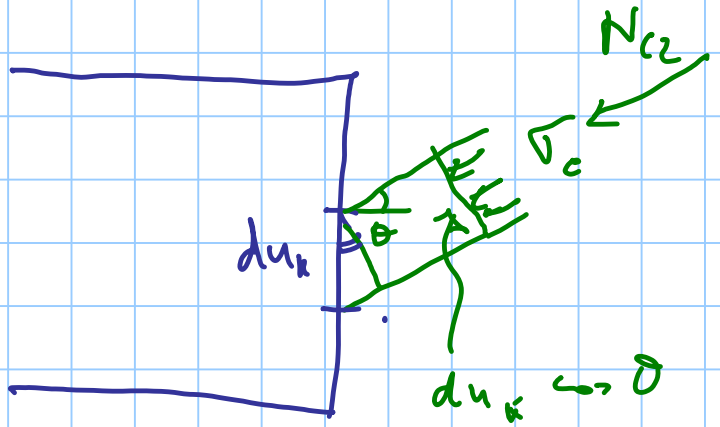
$$N_{c2} = \sigma_c\, du_K \cos\theta\, t$$

$$N_{c2\,vert} = \sigma_c\, du_K \sin\theta \cos\theta\, t$$

$$N_{c2\,orr} = \sigma_c\, du_K \cos^2\theta\, t$$

$$\tau = \frac{T}{2A_K t}$$





$$N_{S2} = \frac{A_{long}}{u_K}\, du_K\, \sigma_{long}$$

equilibri. vert

$$N_{c2\,vert} = \frac{T}{2A_K}\, d_{uK} \; ; \quad \sigma_c \cancel{d_{uK}} \sin\theta \cos\theta\, t = \frac{T}{2A_K} \cancel{d_{uK}}$$

$$\sigma_c = \frac{T}{2A_K \sin\theta \cos\theta\, t}$$

$$\sigma_{st} = \sigma_c \frac{t \sin^2\theta}{A_{st}/s} = \frac{T}{2A_K \cancel{\sin\theta} \cos\theta \cancel{t}} \frac{\cancel{\theta} \sin^{\cancel{2}}\theta}{A_{st}/s} = \frac{T}{2A_K \cot\theta \dfrac{A_{st}}{s}}$$

equilibrio orizzontale

$$N_{cz,oc} = N_{sz}$$

$$\sigma_c \cancel{A_{on}} \cos^2\theta \; t = \frac{A_{lon}}{n_K} \cancel{n_K} \; \sigma_{lon}$$

$$\sigma_{lon} = \frac{\sigma_c \cos^2\theta \; t}{A_{lon}/n_K}$$

$$\sigma_{lon} = \frac{T}{2 A_K \sin\theta \cancel{\cos\theta} \; \cancel{t}} \; \frac{\cancel{\cos^2\theta} \; \cancel{t}}{A_{lon}/n_K} = \frac{T \cot\theta}{2 A_K \; A_{lon}/n_K}$$

$$\sigma_c = \frac{T}{2 A_k \sin\theta \cos\theta \, t} \leq 0.5 f_{cd}$$

$$T_{Rd,max} = 0.5 f_{cd} \; 2 A_k t \sin\theta \cos\theta$$

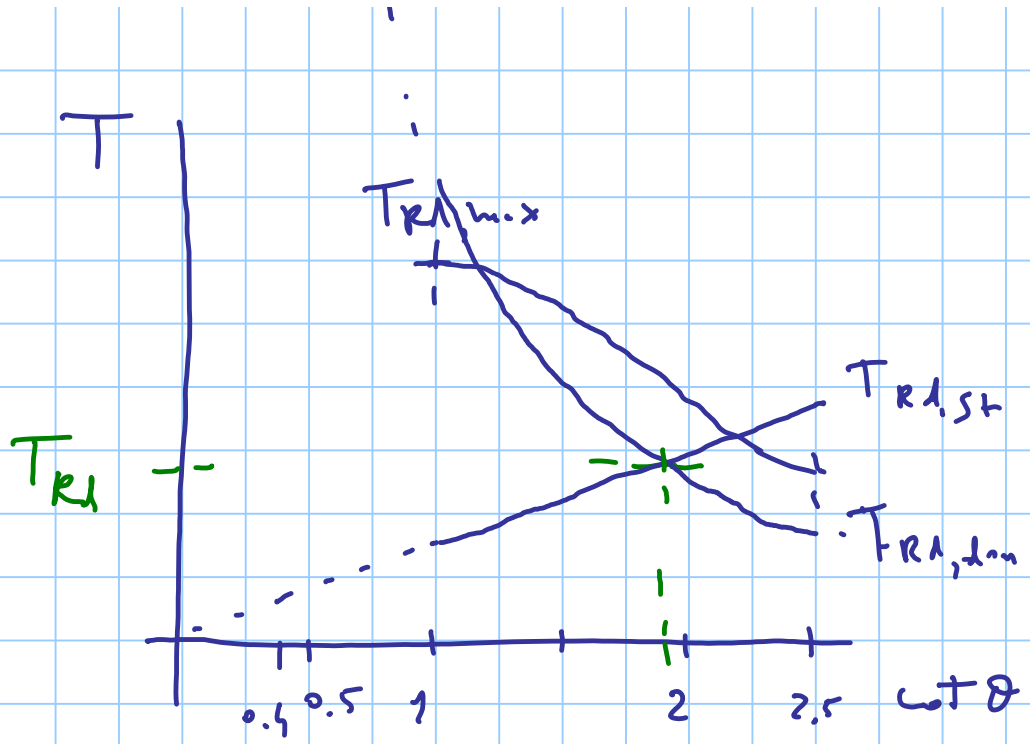
$$= 2 A_k t \, 0.5 f_{cd} \frac{\cot\theta}{1 + \cot^2\theta}$$

$$\sigma_{st} = \frac{T}{2\, A_k\, c_1 T \vartheta\, \frac{A_{st}}{s}} \leq f_{yd}$$

$$T_{Rd,st} = \frac{A_{st}}{s} \cdot 2\, A_k\, f_{yd}\, \cot\vartheta$$

$$\sigma_{lm} = \frac{T \cot\vartheta}{2\, A_k\, A_{lm}/u_k} \leq f_{yd}$$

$$T_{Rd,lm} = \frac{A_{lm}}{u_k}\, 2 A_k\, \frac{f_{yd}}{\cot\vartheta}$$


T
$T_{R1,max}$
$T_{R1,st}$
T_{R1}
$T_{R1,dyn}$
0.4
0.5
1
2
2.5
$\omega t + \vartheta$