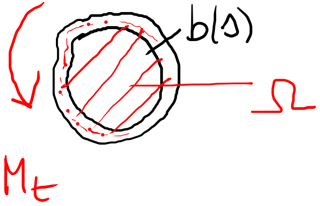
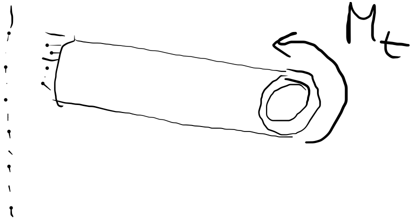
... TORSIONE PROFILI CHIUSI

16/12/22



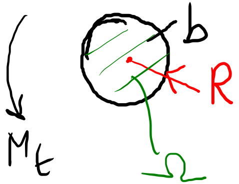
$$\tau(s) = \frac{M_t}{2\Omega b(s)}$$



$$\Theta = \frac{M_t}{G J_t}$$

$$J_t = \frac{4\Omega^2}{\oint \frac{ds}{b(s)}}$$

2° FORMULA DI BREDT

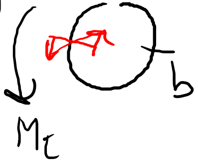


$$\tilde{\tau} = \frac{M_t}{2 \cdot \pi R^2 \cdot b}$$

$\tilde{\tau}$

$$\tilde{J}_t = \frac{4 \cdot (\pi R^2)^2}{\frac{1}{b} \, 2\pi R} = 2\pi R^3 b$$

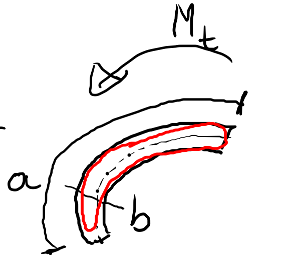
$\oint ds$



$$\tau_{max} = \frac{M_t}{J_t} b$$

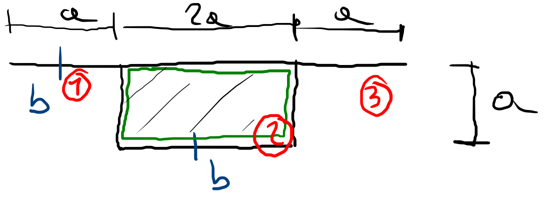
$$J_t = \frac{1}{3} 2\pi R b^3 \ll \tilde{J}_t$$

$$= \frac{3}{2} \frac{M_t}{\pi R b^2} \gg \tilde{\tau}$$



$$J_t = \frac{1}{3} a b^3$$

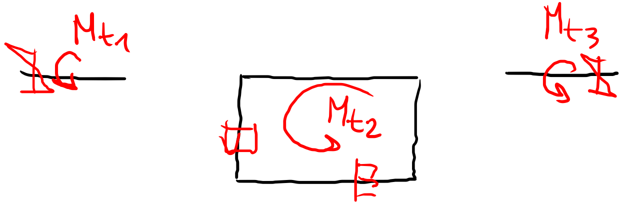
ES.



M_t

$M_{t1} = M_{t3}$?

M_{t2}



$$\Theta = \Theta_1 = \Theta_2 = \Theta_3$$

$$\frac{M_t}{GJ_t} = \frac{M_{t1}}{GJ_{t1}} = \frac{M_{t2}}{GJ_{t2}} = \frac{M_{t3}}{GJ_{t3}}$$

$$\Rightarrow \quad M_{ti} = M_t \frac{J_{ti}}{\sum_i J_{ti}}$$

COEFF. DI RIPARTIZ.

$$\tau_{MAX}^{(2)} = \frac{M_{t2}}{2\Omega b} = \frac{1}{4} 10^{-5} M_t$$

$$J_{t1} = J_{t3} = \frac{1}{3} a b^3$$

$$J_{t2} = \frac{4\Omega^2}{\frac{1}{b}\underbrace{\oint ds}_{\text{perim}}} = \frac{4 \cdot 4a^4}{\frac{1}{b} 6a} = \frac{8}{3} a^3 b$$

$$J_t = 2 \cdot \frac{1}{3} a b^3 + \frac{8}{3} a^3 b = \frac{2}{3} a b^3 + \frac{8}{3} a^3 b$$

$a = 100$ cm

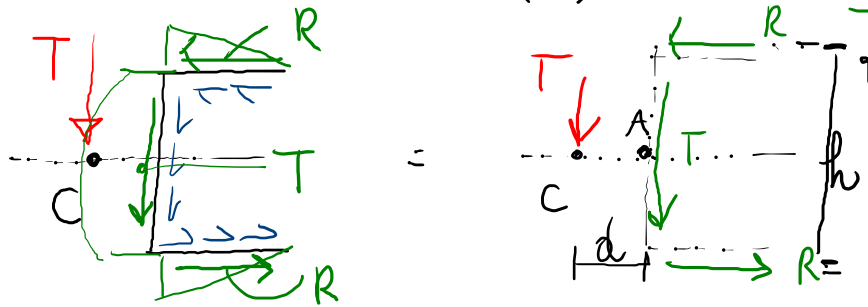
$b = 10$ cm

$$M_{t1} \cong \frac{3}{2672} M_t \simeq \frac{1}{1000} M_t$$

$$M_{t2} \cong \frac{2666}{2672} M_t \simeq 0.997.. M_t$$

$$\tau_{MAX}^{(1)} = \frac{M_{t1}}{J_{t1}} b = \frac{1}{3} 10^{-6} M_t$$

CENTRO DI TAGLIO (C)



$$\{R, R, T\} \doteq \{T\}$$

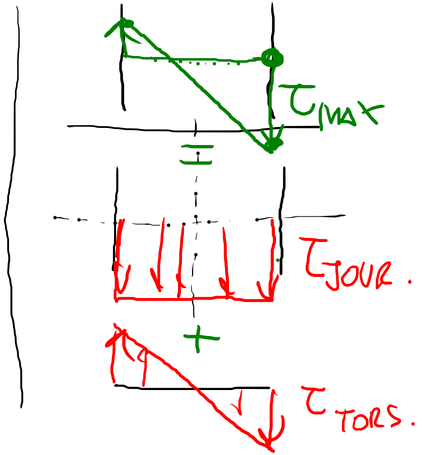
(pensati per C)

EQUIVALENZA : $\overset{\curvearrowleft}{A}$

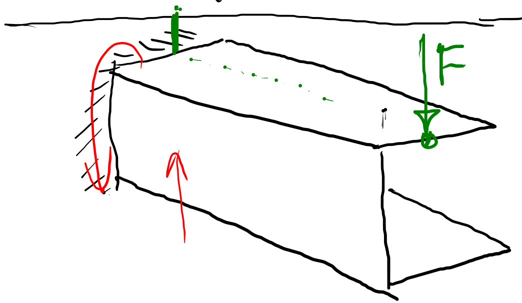
$$T d = R h$$

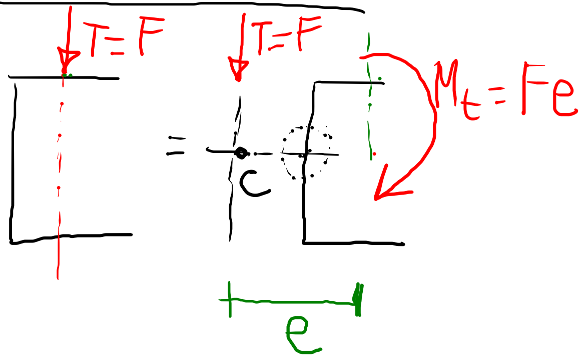
d !!

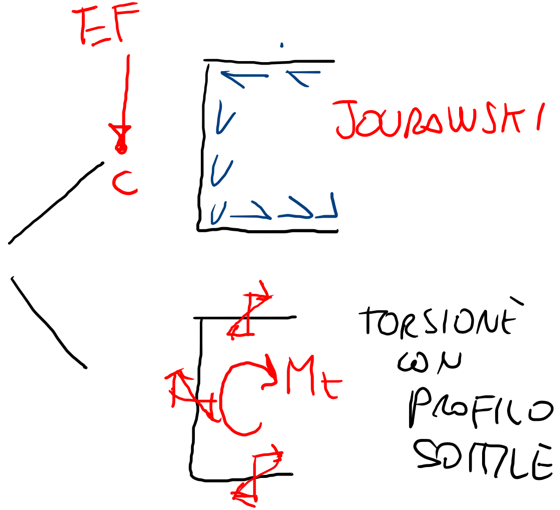
DIPENDE SOLO DALLA GEOM. DELLA SEZ.

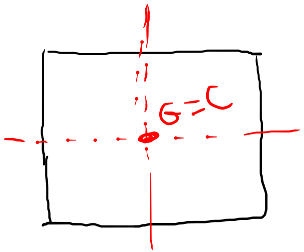


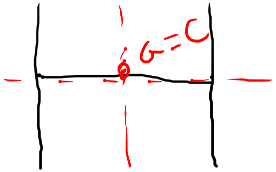
se T passa per C, allora le τ nel profilo sono solo quelle di JOURAWSKI

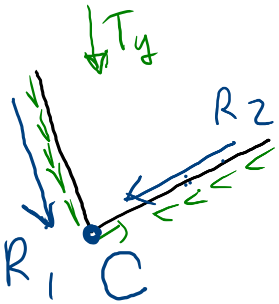


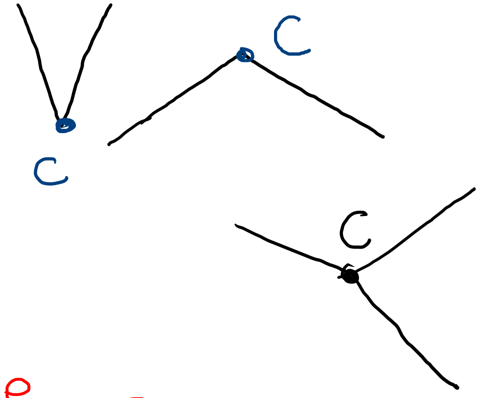


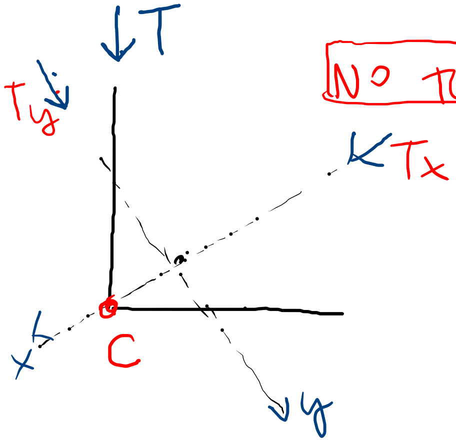




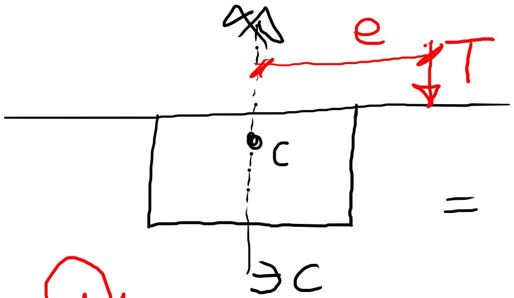


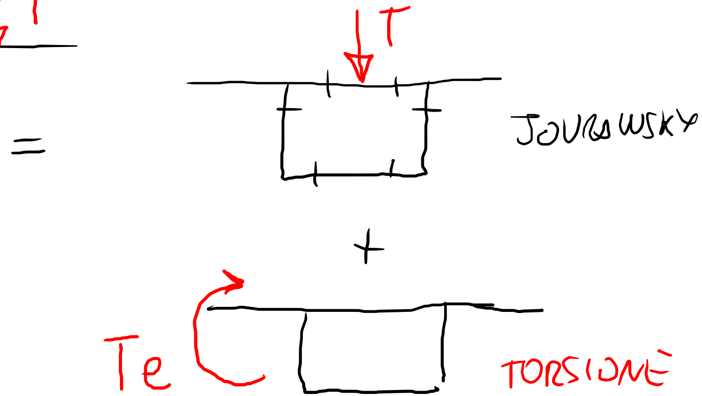


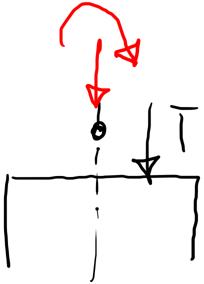




NO TORSIONE



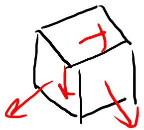




CRITERI DI RESISTENZA (SICUREZZA)

⇒ PERMETTONO DI DEFINIRE SE UNO STATO TENSIONALE È "SICURO" O MENO.

- materiali duttili (metallici)
- " fragili (ceramici)

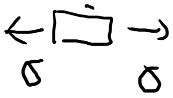


$\underset{\sim}{\sigma}(P)$ È SICURO O NO?

$\underset{\sim}{\sigma}(P)$ ha 6 DATI INDIPENDENTI

$\sigma_0 = \dfrac{\sigma_y}{S}$ → coeff di sicurezza > 1

TENSIONE MONOASSIALE



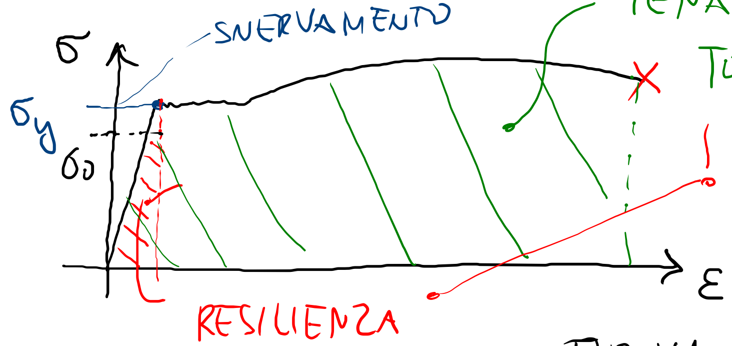
$|\sigma| \le \sigma_0$

CRITERIO DI SICUREZZA

$f(\underset{\sim}{\sigma}, K) \le 0$

parametri sperimentali

- MATERIALI DUTTILI



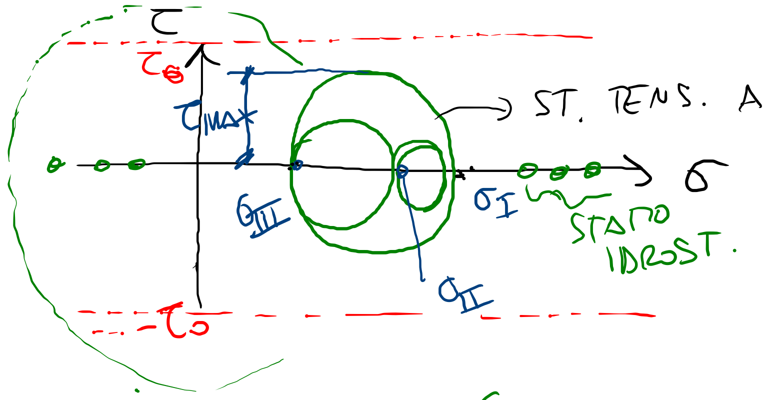
TENACITÀ
TOUGHNESS

ENERGIA x UNITÀ DI VOLUME

PROVA MONOASS. DI TRAZ.

CRITERIO DI TRESCA (UNO DEI CR. FOND. PER MAT. DUTTILI)

LA MASSIMA TENS. TANGENZIALE $\le \tau_0$



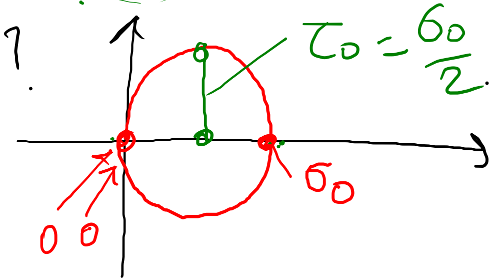
ST. TENS. AMMISS. $\tau_{MAX} < \tau_0$

$$\boxed{\frac{\sigma_I - \sigma_{III}}{2} \le \tau_0}$$

$$\boxed{\sigma_I - \sigma_{III} \le \sigma_0}$$

$$f = \underbrace{\max_{i,j=I,II,III} \{ |\sigma_i - \sigma_j| \}}_{\text{"MASSIMO DIAMETRO"}} - \sigma_0 \le 0$$

τ_0?

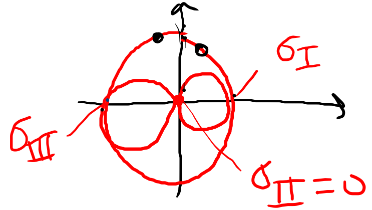


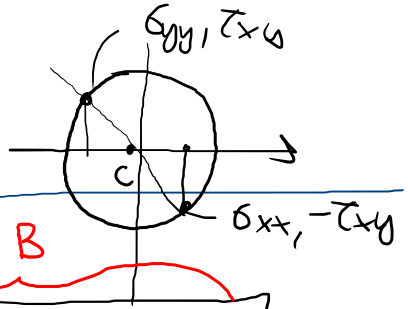
UNO STATO IDROSTATICO NON PRODUCA MAI LA "CRISI" DEL MATERIALE

$\Rightarrow$ CONTA SOLO LA PARTE "DEVIATORICA"

STATO PIANO DI TENSIONE:

$$\max\left\{|\sigma_I|, |\sigma_{III}|, |\sigma_I - \sigma_{III}|\right\} \leq \sigma_0$$



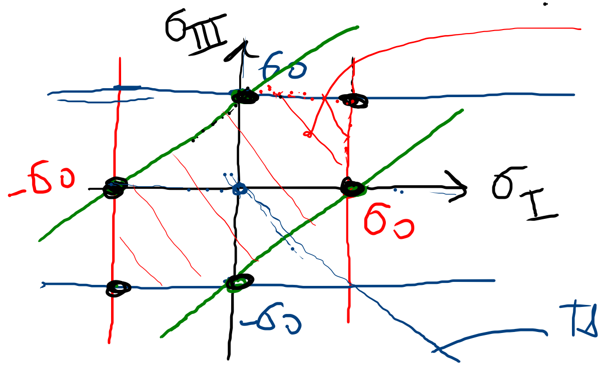


$$-\sigma_0 \leq \sigma_I \leq \sigma_0$$

$$-\sigma_0 \leq \sigma_{III} \leq \sigma_0$$

$$-\sigma_0 \leq \sigma_I - \sigma_{III} \leq \sigma_0$$

$$\left.\begin{matrix}\sigma_I \\ \sigma_{III}\end{matrix}\right\} = \overbrace{\frac{\sigma_{xx}+\sigma_{yy}}{2}}^{A} \pm \overbrace{\sqrt{\left(\frac{\sigma_{xx}-\sigma_{yy}}{2}\right)^2 + \tau_{xy}^2}}^{B}$$



DOMINIO DI TRESCA (ESAGONO)

TAGLIO PURO

$$|\sigma_I - \sigma_{III}| = |A+B-(A-B)| = |2B| =$$

$$= \sqrt{4\left(\frac{\sigma_{xx}^2+\sigma_{yy}^2-2\sigma_{xx}\sigma_{yy}}{4}\right)+4\tau_{xy}^2}$$

NELLE TRAVI

$\sigma_{xx} \neq 0, \ \tau_{xy} \neq 0; \ \sigma_{yy} = 0$:

$$|\sigma_I - \sigma_{III}| = \underbrace{\overbrace{\sqrt{\sigma_{xx}^2 + 4\tau_{xy}^2} \leq \sigma_0}^{\text{VERIFICA TRAVI}}}$$

PIANO DELLE TENSIONI PRINCIPALI (HAIGH-WESTERGAARD)

CRITERIO VON MISES (MAT. DUTTILI)

SI BASA SU METODI ENERGETICI : FORNISCE DEI LIMITI ALLA "ENERGIA ELASTICA DEVIATORICA" $\left(\varphi\left(\underset{\sim}{\sigma}^{DEV}\right)\right)$

"DISTORSIVA"

$$\sqrt{\sigma_I^2+\sigma_{II}^2+\sigma_{III}^2-\sigma_I\sigma_{II}-\sigma_I\sigma_{III}-\sigma_{II}\sigma_{III}} \le \sigma_0$$

NEL PIANO $(\sigma_{II}=0)$

$$\underbrace{\sqrt{\sigma_I^2+\sigma_{III}^2-\sigma_I\sigma_{III}}}_{\text{ELLISSE}} \le \sigma_0 \quad = \sigma_0$$

TRAVI $\sqrt{\sigma_{xx}^2+3\tau_{xy}^2} \le \sigma_0$