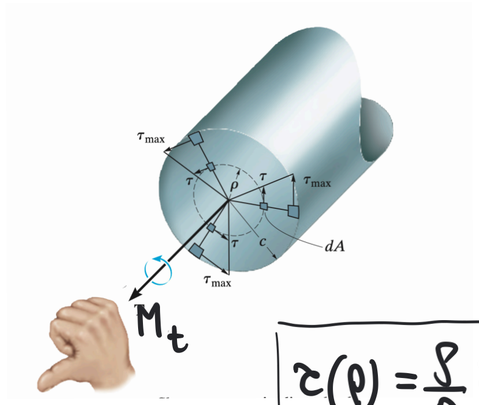
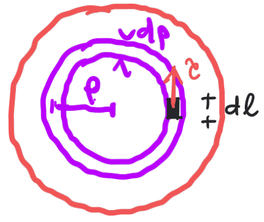
TORSIONE DI BARRE A SEZIONE CIRCOLARE



- Le tensioni tangenziali sono perpendicolari alla direzione radiale
- La loro intensità è proporzionale alla distanza dal centro.

$$\tau(\rho) = \frac{\rho}{R}\tau_{max}$$



$$dM_t = \oint \rho\,\tau\,d\rho\,d\ell = \rho\tau\,d\rho \oint d\ell$$

$$= \rho\tau\,d\rho\,2\pi\rho = 2\pi\rho^3/R\;\tau_{max}\,d\rho$$

$$M_t = \int_0^R dM_t = \int_0^R 2\pi\,\rho^3/R\;\tau_{max}\,d\rho = \frac{\tau_{max}}{R}\,2\pi\int_0^R \rho^3 d\rho$$

$$= \frac{\tau_{max}}{R}\,\frac{\pi}{2}\,R^4$$

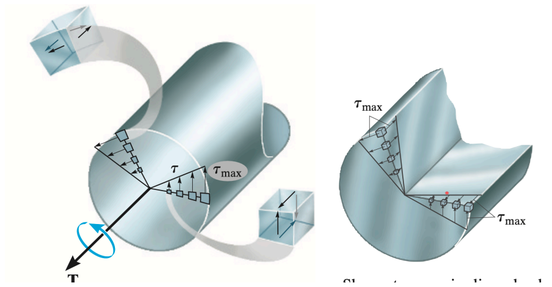
$$\tau_{max} = \frac{2}{\pi}\,\frac{1}{R^3}\,M_t$$

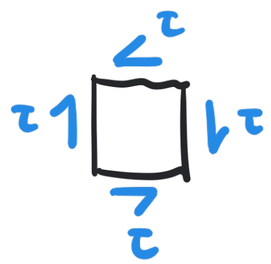
$$\tau(\rho) = \frac{\rho}{R^4}\,\frac{2}{\pi}\,M_t = \frac{\rho\,M_t}{\pi/2\,R^4} = \frac{\rho\,M_t}{I_p}$$

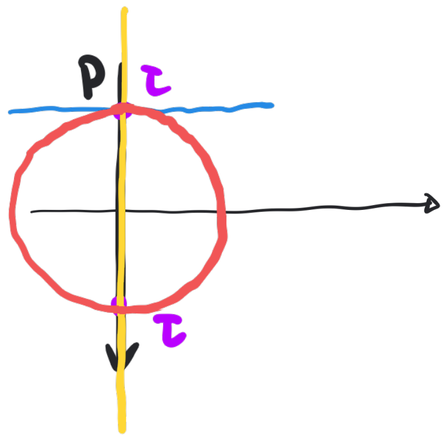
$$\pi/2\,R^4 = \int_A \rho^2 dA =: I_p$$

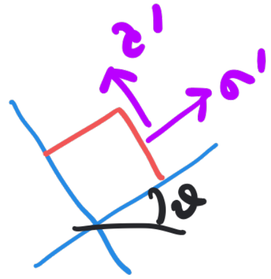
momento d'inerzia polare

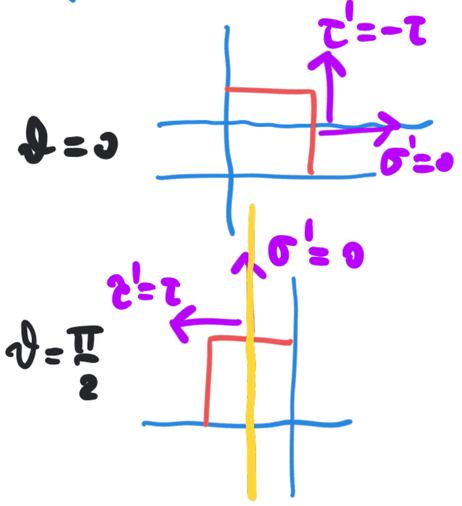
STATO TENSIONALE IN UNA BARRA DI TORSIONE



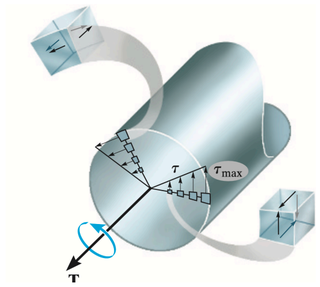


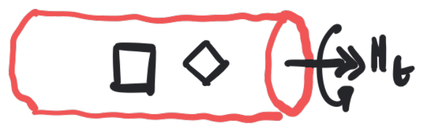


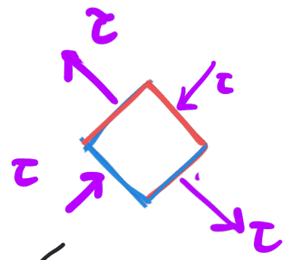


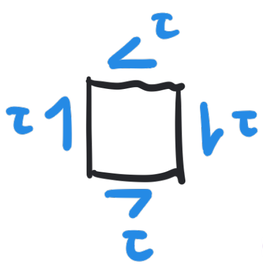


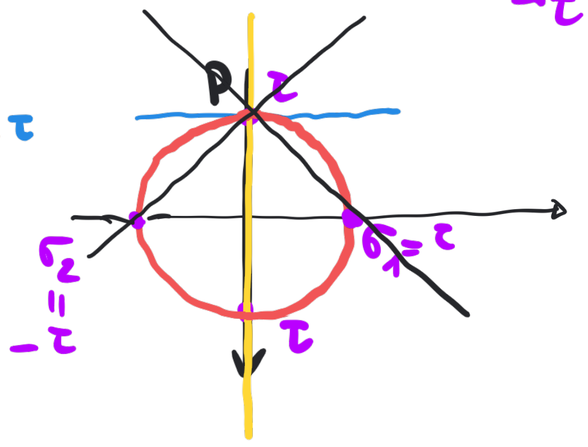
STATO TENSIONALE IN UNA BARRA DI TORSIONE

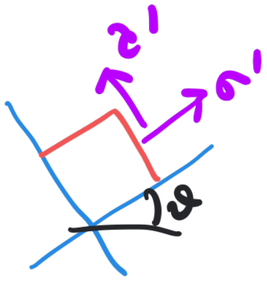


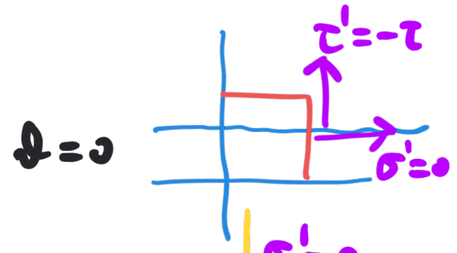


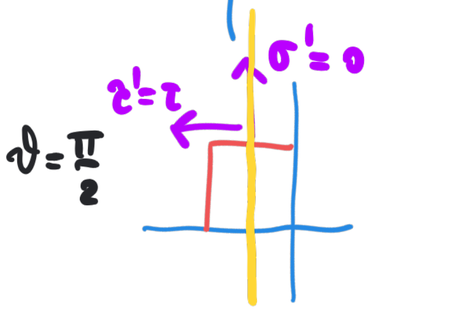




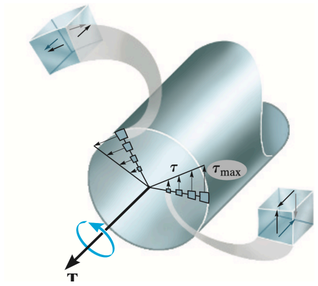


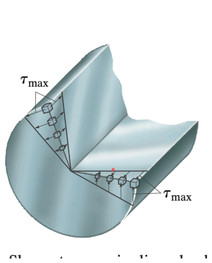


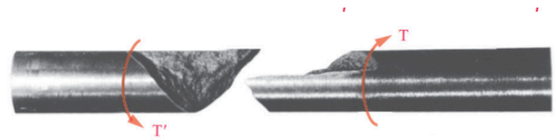




STATO TENSIONALE IN UNA BARRA DI TORSIONE

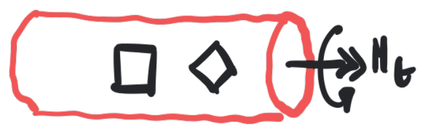


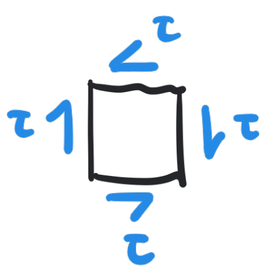


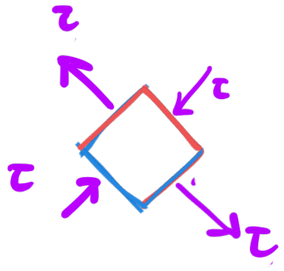


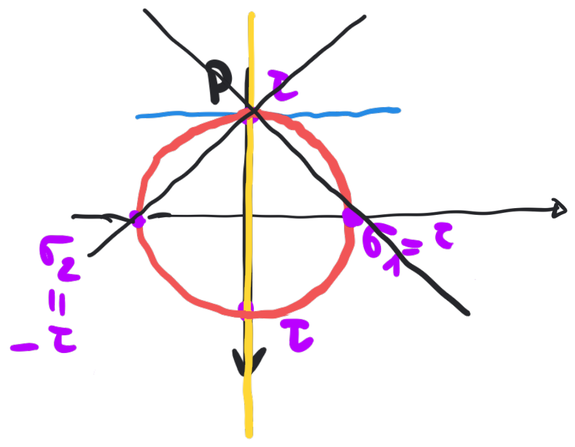
(b) Brittle Failure

Failure of a wooden shaft due to torsion.







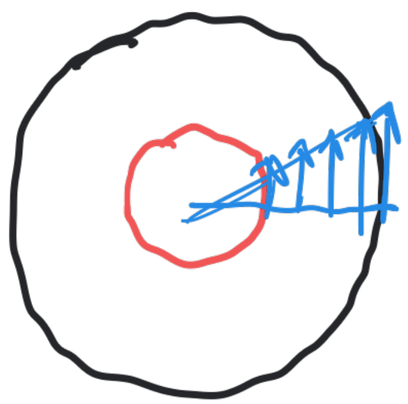


Sezioni cave

$$\tau = \frac{\rho}{R_2}\,\tau_{max}$$

$$M_t = \int_{R_1}^{R_2} 2\pi\rho\,\tau\,\rho\,d\rho = \frac{\tau_{max}}{R_2}\,2\pi\int_{R_1}^{R_2}\rho^3\,d\rho$$

$$= \frac{\tau_{max}}{R_2}\,\underbrace{\frac{\pi}{2}\left(R_2^4 - R_1^4\right)}_{I_{p_2} - I_{p_1}}$$



$+ R_2 f$

$+ R_1 f$

$$\Rightarrow \tau_{max} = \frac{R_2}{I_{p_2} - I_{p_1}}\,M_t$$

$$\Rightarrow \tau = \frac{M_t}{I_{p_2} - I_{p_1}}\,\rho$$