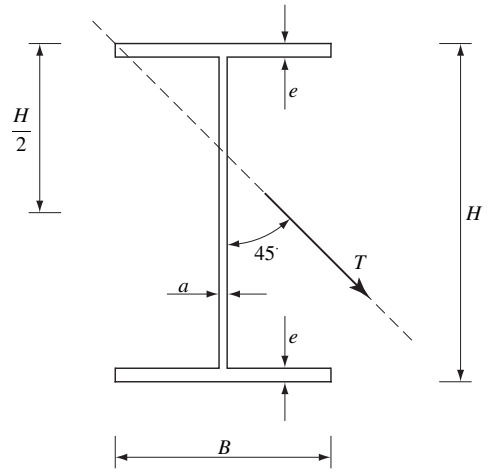
COMPITO N. 3 DEL 6 FEBBRAIO 2003

(LAUREA TRIENNALE)



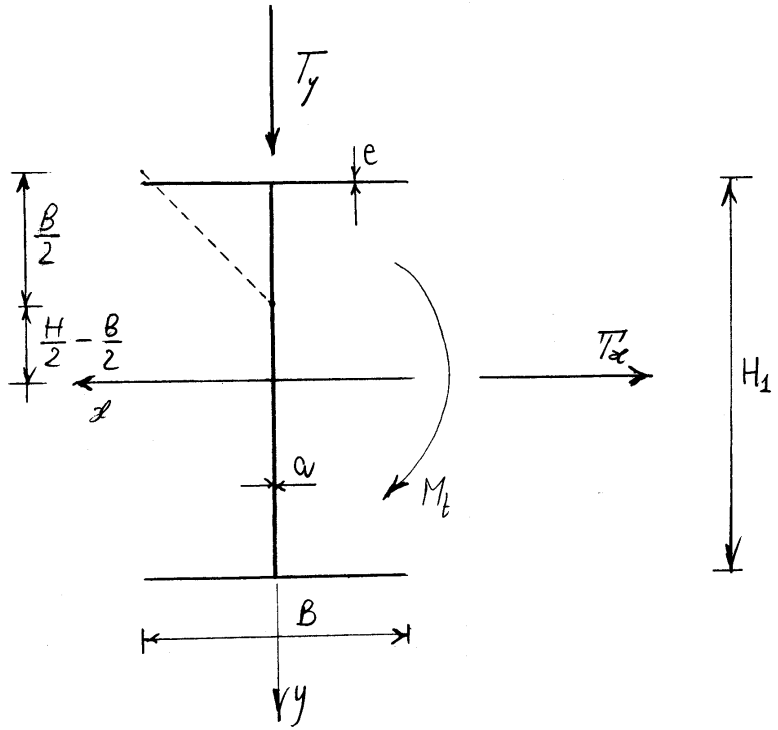
$T \times$ 50 kN
$B \times$ 100 mm
$H \times$ 165 mm
$a \times$ 8 mm
$e \times$ 15 mm

acciaio Fe430:
$\sigma_{adm} \times$ 190 N mm^2

Data la sezione a I di figura, soggetta ad un taglio T:

1. Tracciare i diagrammi delle tensioni tangenziali;
2. Quotare i diagrammi delle tensioni tangenziali;
3. Determinare l'asse neutro della flessione associata al taglio T;
4. Disegnare il diagramma qualitativo complessivo delle tensioni tangenziali dovute al taglio utilizzando la formula di Jourawski monomia;
5. Quotare il diagramma complessivo delle tensioni tangenziali ed eseguire la verifica di resistenza con il metodo delle tensioni ammissibili.

Caratteristiche della sollecitazione



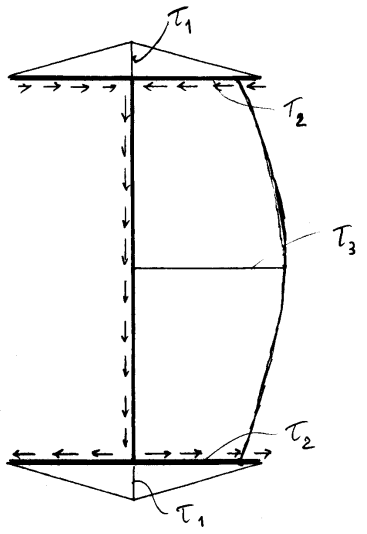
$H_1 = H - e = 150$ mm

$T_x = T/\sqrt{2} = 35.36$ KN

$T_y = T/\sqrt{2} = 35.36$ KN

$M_t = T_x\left(\frac{H}{2}-\frac{B}{2}\right) = 1149$ KN mm

Taglio T_y



$T_y = 28.28$ KN

$\tau = \frac{T_y S_x^*}{b J_x}$

$J_x = \frac{a H_1^3}{12} + 2eB\left(\frac{H_1}{2}\right)^2 = 1912.5\ cm^4$

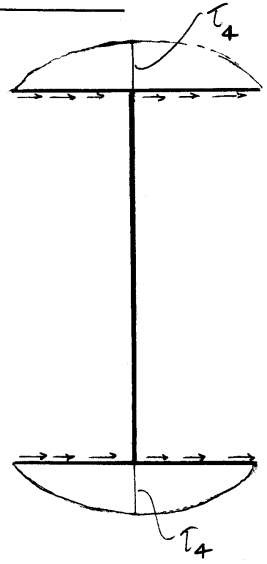
$S_{x1}^* = e\frac{B}{2}\frac{H}{2} = 56.25\ cm^3, \quad S_{x2}^* = eB\frac{H}{2} = 112.5\ cm^3$

$S_{x3}^* = eB\frac{H}{2} + a\frac{H}{2}\frac{H}{4} = 135\ cm^3$

$\tau_1 = \frac{T_y S_{x1}^*}{e J_x} = 6.93\ N/mm^2, \quad \tau_2 = \frac{T_y S_{x2}^*}{a J_x} = 26\ N/mm^2$

$\tau_3 = \frac{T_y S_{x3}^*}{a J_x} = 31.20\ N/mm^2$

Taglio T_x



$T_x = 35.36\ KN$

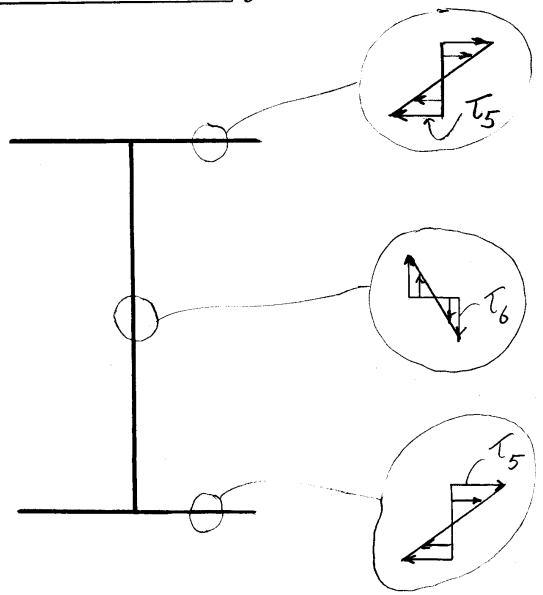
$$\tau = \frac{T_x S_y^*}{b J_y}$$

$$J_y = 2\,\frac{e B^3}{12} = 250\ cm^4$$

$$S_{y4}^* = e\left(\frac{B}{2}\right)\left(\frac{B}{4}\right) = 18.75\ cm^3$$

$$\tau_4 = \frac{T_x S_{y4}^*}{e J_y} = 17.68\ N/mm^2$$

Momento torcente M_t



$M_t = 1149\ KN\,mm$

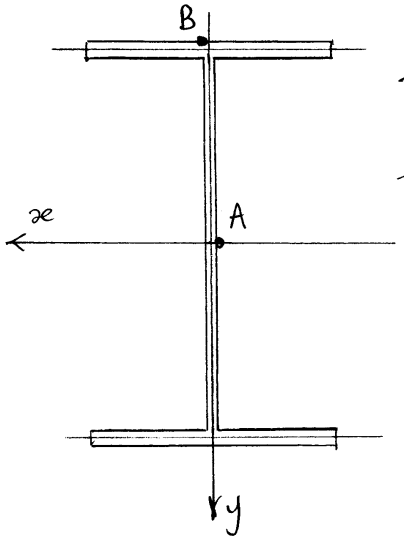
$$J_t = \frac{1}{3}\left(2Be^3 + H_1 a^3\right) = 25.06\ cm^4$$

$$\tau = \frac{M_t}{J_t} b$$

$$\tau_5 = \frac{M_t}{J_t} e = 68.78\ N/mm^2$$

$$\tau_6 = \frac{M_t}{J_t} a = 36.68\ N/mm^2$$

Verifiche di resistenza



$\tau_A = \tau_3 + \tau_6 = 67.88\ N/mm^2$

$\tau_B = \tau_1 + \tau_4 + \tau_5 = 93.39\ N/mm^2$

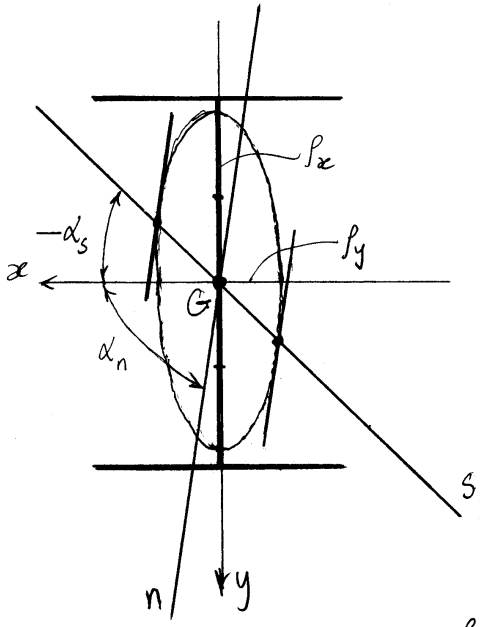
Tresca :

$\sigma_{id} = 2 \cdot \tau_B = 186.78\ N/mm^2$

Huber-von Mises:

$\sigma_{id} = \sqrt{3}\ \tau_B = 161.76\ N/mm^2$

Asse neutro



$A = 2eB + aH_1 = 4200\ mm^2$

$\rho_x = \sqrt{\frac{J_x}{A}} = 67.48\ mm$

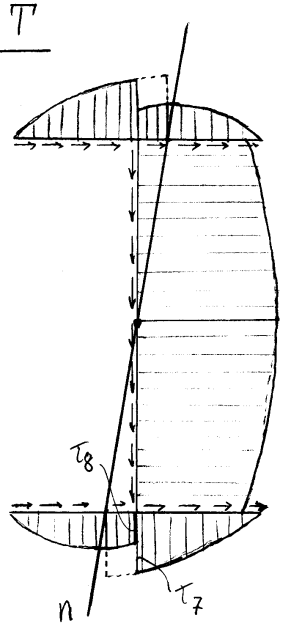
$\rho_y = \sqrt{\frac{J_y}{A}} = 24.40\ mm$

$\alpha_s = -\frac{\pi}{4}$

$\tan\alpha_s \tan\alpha_n = -\frac{J_x}{J_y} \Rightarrow \alpha_s = \tan^{-1}\left(-\frac{J_x}{J_y \tan\alpha_s}\right)$

$\alpha_s = 82.55°$

Taglio T



$$\tau_7 = \tau_4 + \tau_1 = 24.61 \ N/mm^2$$

$$\tau_8 = \tau_4 - \tau_1 = 10.75 \ N/mm^2$$