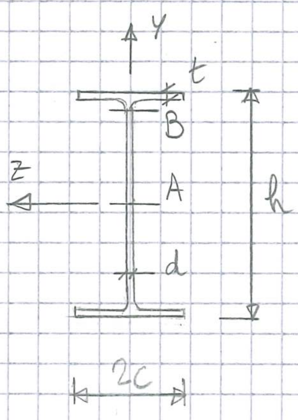
TB_SRM2 Corrections Exercices Chapitre 7

Exercice 1



IPE 300

$h = 300\,mm$

$2c = 150\,mm$

$t = 10{,}7\,mm$

$d = 7{,}1\,mm$

$I_z = 83{,}6.10^6\,mm^4 = I$; $A_W = 2050\,mm^2$.

$S_A = 314\,cm^3 = 314.10^3\,mm^3$

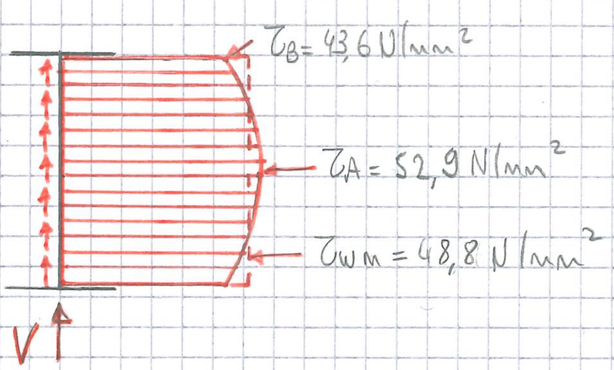
$S_B = 259\,cm^3 = 259.10^3\,mm^3$

a) Distribution exacte

en B : $\tau_B = \dfrac{V.S_B}{I.d} = \dfrac{100.10^3.259.10^3}{83{,}6.10^6.7{,}1} = 43{,}6\ N/mm^2$

en A : $\tau_A = \dfrac{V.S_A}{I.d} = \dfrac{100.10^3.314.10^3}{83{,}6.10^6.7{,}1} = 52{,}9\ N/mm^2$

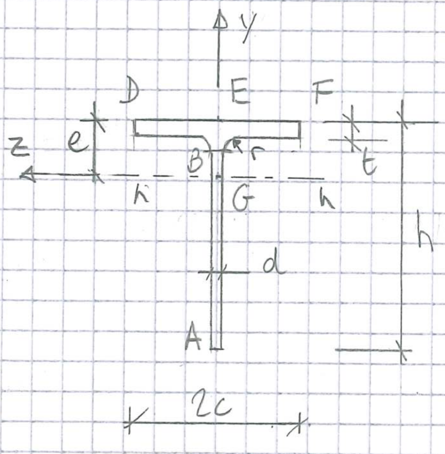
b) Moyenne : $\tau_{Wm} = \dfrac{V}{A_W} = \dfrac{100.10^3}{2050} = 48{,}8\ N/mm^2$.



La parabole (distribution exacte) est assez plate, on peut supposer que les contraintes de cisaillement sont réparties uniformément sur l'âme.

$\dfrac{\tau_{Wm}}{\tau_A} = \dfrac{48{,}8}{52{,}9} = 0{,}92$

Exercice 2



Demi-profilé IPE 600

$h = 600/2 = 300$ mm

$2c = 220$ mm

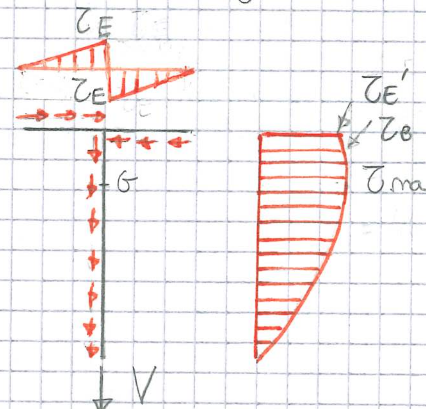
$t = 19$ mm

$d = 12$ mm ; $r = 24$ mm

$e = 75$ mm

$I_{h-h} = 6500.10^4 \text{ mm}^4 = I$

Allure du diagramme des contraintes de cisaillement. $\tau = \dfrac{V.S}{I.t}$



aile: S varie linéairement

âme: S varie paraboliquement

Calcul des contraintes de cisaillement:

- E: $S_E = \dfrac{2c}{2} \cdot t\left(e - \dfrac{t}{2}\right) = \dfrac{220}{2} \cdot 19 \cdot \left(75 - \dfrac{19}{2}\right) = 136{,}9 \cdot 10^3 \text{ mm}^3$

$$\tau_E = \frac{V.S_E}{I.t} = \frac{120.10^3 . 136{,}9.10^3}{6500.10^4 . 19} = 13{,}3 \text{ N/mm}^2 \rightarrow \tau_E' = \frac{2\tau_E . t}{d} = \frac{2.13{,}3.19}{12} = 42{,}1 \text{ N/mm}^2$$

- G: $S_G = (h-e).d.\dfrac{1}{2}(h-e) = \dfrac{1}{2}(300-75)^2.12 = 303{,}8.10^3 \text{ mm}^3$

$$\tau_G = \frac{V.S_G}{I.d} = \frac{120.10^3 . 303{,}8.10^3}{6500.10^4 . 12} = 46{,}7 \text{ N/mm}^2$$

- B: $S_B = 2c.t.\left(e - \dfrac{t}{2}\right) + \left(\dfrac{t}{2} + r\right)d\left(e - \dfrac{3t}{4} - \dfrac{r}{2}\right)$: approximation (arrondis négligés)

$$= 220.19.\left(75 - \frac{19}{2}\right) + \left(\frac{19}{2} + 24\right).12.\left(75 - \frac{3.19}{4} - \frac{24}{2}\right)$$

$$= 293{,}4.10^3 \text{ mm}^3$$

$$\tau_B = \frac{V.S_B}{I.d} = \frac{120.10^3 . 293{,}4.10^3}{6500.10^4 . 12} = 45{,}1 \text{ N/mm}^2$$

ou :

$$S_B = S_G - S_{BG} = S_G - (e-t-r).d.\frac{1}{2}(e-t-r)$$

$$= 303{,}8.10^3 - \frac{1}{2}.(75-19-24)^2.12$$

$$= 297{,}7.10^3 \ mm^3$$

$$\tau_B = \frac{V.S_B}{I.d} = \frac{120.10^3.297{,}7.10^3}{6500.10^4.12} = 45{,}8 \ N/mm^2$$

La différence de ces deux calculs est due au fait de considérer ou pas l'arrondi entre l'âme et la semelle.