

GEOMETRIA DELLE AREE

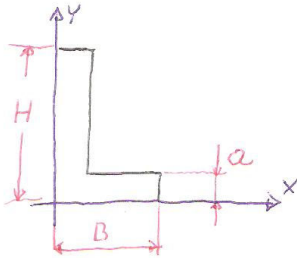
(17)

PROFILO: 30x50x5 UNI 5784-66

$B = 30 \text{ [mm]}$

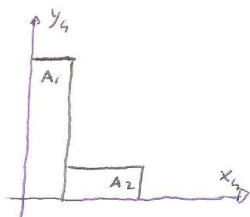
$H = 50 \text{ [mm]}$

$a = 5 \text{ [mm]}$



VALORI ESATTI

AREA cm ²	I _{xx} [cm ⁴]	I _{yy} [cm ⁴]	W _x [cm ³]	W _y [cm ³]	Z _x [cm]	Z _y [cm]
3.78	9.41	2.54	2.88	1.12	1.58	0.820



	AREA	X _G	Y _G
A ₁	250	2.5	25
A ₂	125	17.5	2.5

$X_{G2} = \frac{5+30}{2} = 17.5$

AREA A₁ = B₁ · H₁ = 5 × 50 = 250 [mm²]

AREA A₂ = B₂ · H₂ = 25 × 5 = 125 [mm²]

$X_G = \frac{A_1 X_{G1} + A_2 X_{G2}}{A_1 + A_2} = \frac{250 \times 2.5 + 125 \times 17.5}{375} = 7.5$

$Y_G = \frac{A_1 Y_{G1} + A_2 Y_{G2}}{A_1 + A_2} = \frac{250 \times 25 + 125 \times 2.5}{375} = 17.5$

AREA A₁: $I_{xxL1} = \frac{B_1 H_1^3}{12} = \frac{5 \times 50^3}{12} = 520.83 \text{ [mm}^4\text{]}$ $\Delta X_1 = X_G - X_{G1} = 7.5 - 2.5 = 5$

$I_{yyL1} = \frac{H_1 B_1^3}{12} = \frac{50 \times 5^3}{12} = 520.83 \text{ [mm}^4\text{]}$ $\Delta Y_1 = Y_G - Y_{G1} = 17.5 - 25 = -7.5$

AREA A₂: $I_{xxL2} = \frac{B_2 H_2^3}{12} = \frac{25 \times 5^3}{12} = 260.417 \text{ [mm}^4\text{]}$ $\Delta X_2 = X_G - X_{G2} = 7.5 - 17.5 = -10.0$

$I_{yyL2} = \frac{H_2 B_2^3}{12} = \frac{5 \times 25^3}{12} = 6510.417 \text{ [mm}^4\text{]}$ $\Delta Y_2 = Y_G - Y_{G2} = 17.5 - 2.5 = 15$

$I_{xxG} = I_{xxL1} + A_1 (\Delta Y_1)^2 + I_{xxL2} + A_2 (\Delta X_2)^2 = 520.83 + 250 \times (-7.5)^2 + 260.4 + 125 (15)^2 = 94531$

$I_{yyG} = I_{yyL1} + A_1 (\Delta X_1)^2 + I_{yyL2} + A_2 (\Delta Y_2)^2 = 520.8 + 250 \cdot (5)^2 + 6510 + 125 \cdot (-10)^2 = 25781$

$I_{xyG} = A_1 \cdot \Delta X_1 \Delta Y_1 + A_2 \Delta X_2 \Delta Y_2 = 250 \times 5 \cdot (-7.5) + 125 \times (-10) (15) = -28125$

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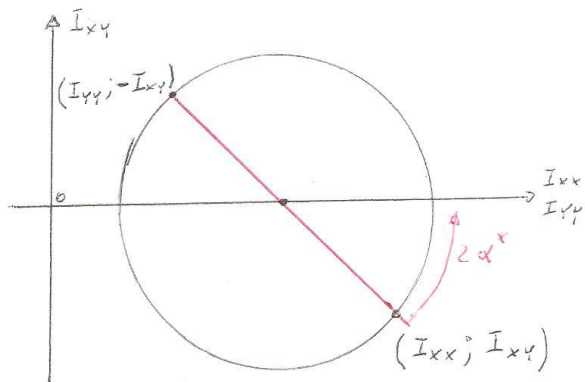
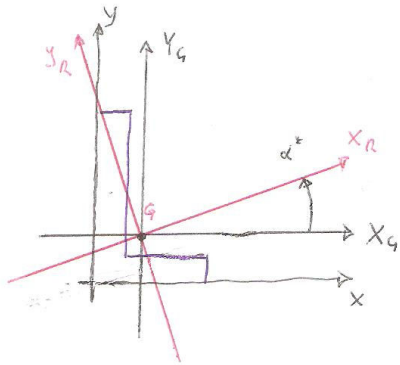
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$$I_{xxG} = 94531 \text{ [mm}^4] \cong 9.45 \text{ [cm}^4]$$

$$I_{yyG} = 25781 \text{ [mm}^4] \cong 2.58 \text{ [cm}^4]$$

$$I_{xyG} = -28125 \text{ [mm}^4] \cong -2.81 \text{ [cm}^4]$$

$$\alpha^* = \frac{1}{2} \arctg\left(\frac{2I_{xyG}}{I_{yyG} - I_{xxG}}\right) = \frac{1}{2} \arctg\left(\frac{-2 \cdot 28125}{25781 - 94531}\right) = 19.6^\circ$$



$$I_{xxR}(\alpha = \alpha^*) = C + R$$

$$I_{yyR}(\alpha = \alpha^*) = C - R$$

$$C = \frac{I_{xxG} + I_{yyG}}{2} = 60156 \text{ [mm}^4]$$

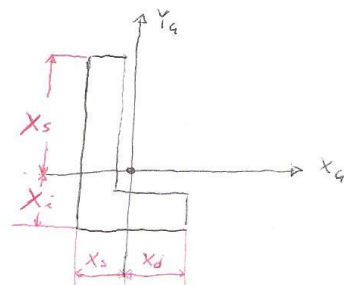
$$R = \frac{1}{2} \sqrt{(I_{xxG} - I_{yyG})^2 + (2I_{xyG})^2} = 44414.6$$

$$I_{xxR} = 60156 + 44414 = 104571$$

$$I_{yyR} = 60156 - 44414 = 15741$$

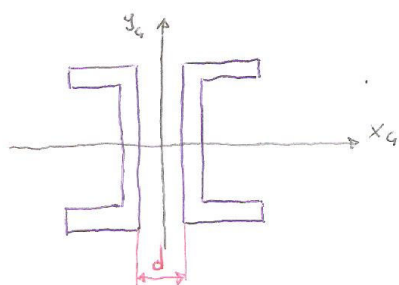
$$r_x = \sqrt{\frac{I_{xxG}}{A}} = \sqrt{\frac{94531}{375}} = 15.88 \text{ [mm]}$$

$$r_y = \sqrt{\frac{I_{yyG}}{A}} = \sqrt{\frac{25781}{375}} = 8.29 \text{ [mm]}$$



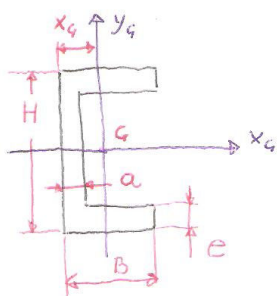
$$W_x = \frac{I_{xxG}}{\text{MAX}(y_i, y_s)} = \frac{94531}{\text{MAX}(17.5; 50 - 17.5)} = 2909 \text{ [mm}^3]; \quad W_y = \frac{I_{yyG}}{\text{MAX}(x_j, x_s)} = \frac{25781}{\text{MAX}(7.5; 22.5)} = 1146 \text{ [mm}^3]$$

2 PROFILATI: UPN - UNI 5680-73



UPN 200

- $H = 200 \text{ [mm]}$
- $B = 75 \text{ [mm]}$
- $a = 8.5 \text{ [mm]}$
- $e = 11.5 \text{ [mm]}$
- $AREA = 32.2 \text{ [cm}^2\text{]}$
- $I_{x \times x_g} = 1911 \text{ [cm}^4\text{]}$
- $I_{y \times y_g} = 148 \text{ [cm}^4\text{]}$
- $W_x = 191 \text{ [cm}^3\text{]}$
- $W_y = 26.9 \text{ [cm}^3\text{]}$



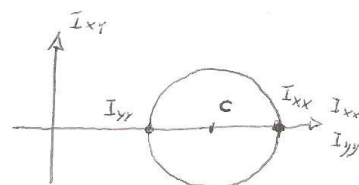
$$W_y = \frac{I_{yy}}{\text{MAX}[x_g; B-x_g]}$$

$$\text{MAX}[x_g; B-x_g] = \frac{I_{yy}}{W_y} = \frac{148}{26.9} = 5.5 \text{ [cm]} = 55 \text{ [mm]}$$

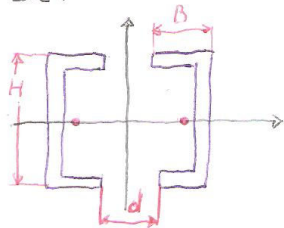
$$\begin{cases} x_g = B - 55 = 75 - 55 = 20 \text{ [mm]} \\ y_g = \frac{H}{2} = 100 \text{ [mm]} \end{cases}$$

SCEGLIAMO: d = 50 [mm]

$$\begin{cases} I_{x \times x_g} (2 \text{ UPN}) = 2 I_{x \times x_g} (1 \text{ UPN}) = 2 \times 1911 = 3822 \text{ [cm}^4\text{]} \\ I_{y \times y_g} (2 \text{ UPN}) = 2 \left[I_{y \times y_g} (1 \text{ UPN}) + A (1 \text{ UPN}) \cdot \Delta x^2 \right] \text{ dove: } \Delta x = \frac{d}{2} + x_g = 45 \\ = 2 \left[148 + 32.2 (4.5)^2 \right] = 1600.1 \text{ [cm}^4\text{]} \\ I_{x \times y_g} = \phi \end{cases}$$



se:



$$I_{x \times x_g} = 3822 \text{ [cm}^4\text{]} \quad ; \quad \Delta x = \frac{d}{2} + B - x_g = 25 + 75 - 20 = 80 \text{ [mm]}$$

$$I_{y \times y_g} = 2 \left[148 + 32.2 (8)^2 \right] = 4417.6 \text{ [cm}^4\text{]}$$

$$\text{se } \Delta x = 7.4 \text{ [cm]} = \frac{d}{2} + 7.5 - 2.0 \rightarrow d = 38 \text{ [mm]}$$

$$\text{ALLORA: } I_{y \times y_g} = I_{x \times x_g} = 3822 \text{ [cm}^4\text{]}$$

