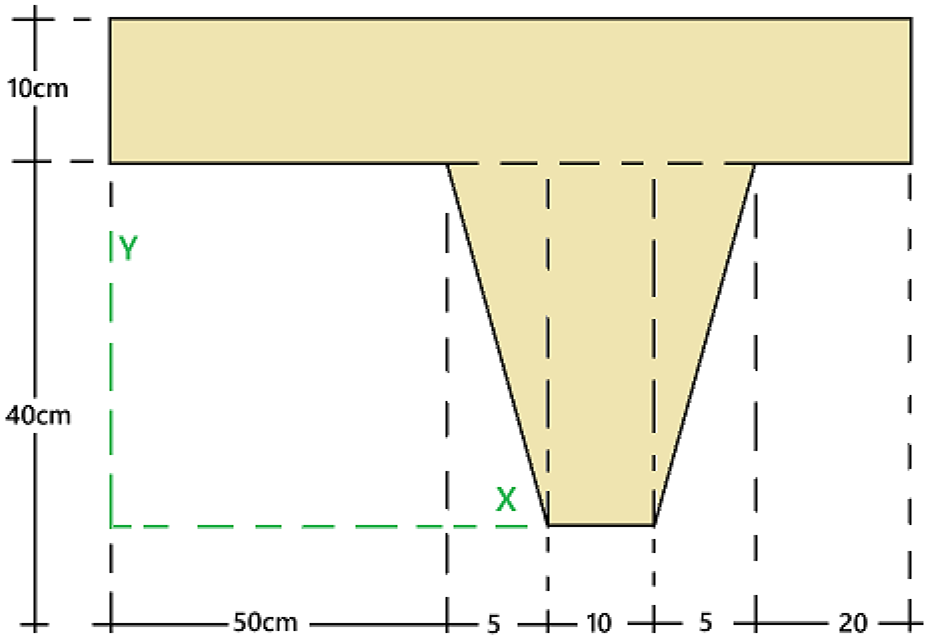
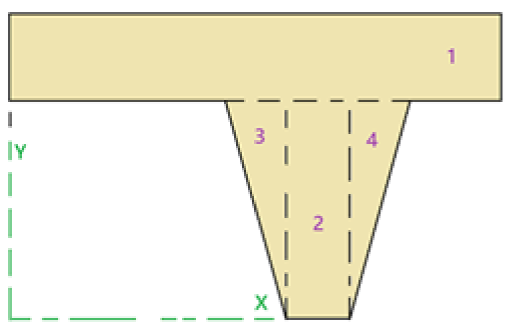
Encontrar las inercias centroidales máximas y mínimas por rotación:



#1: [CaseMode := Sensitive, InputMode := Word]

División por subáreas de formas geométricas conocidas:



Áreas individuales y total:

#2: $\left[A1 := (50 + 5 + 10 + 5 + 20)\cdot 10,\ A2 := 10\cdot 40,\ A3 := \dfrac{5\cdot 40}{2},\ A4 := A3,\ A := A1 + A2 + A3 + A4\right]$

#3: [A1 := 900, A2 := 400, A3 := 100, A4 := 100, A := 1500]

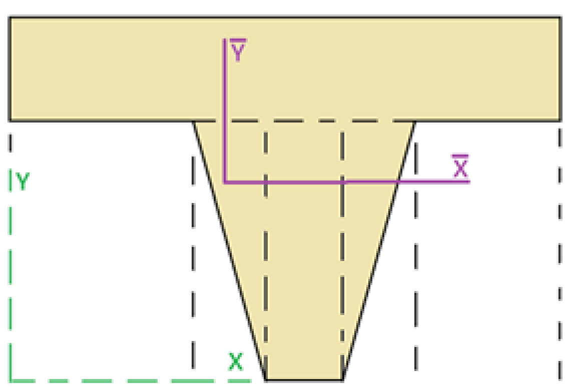
Centroides individuales respecto a los ejes X e Y:

#4:
$$\begin{bmatrix} Xcg1 := \dfrac{50 + 5 + 10 + 5 + 20}{2} & Ycg1 := 40 + \dfrac{10}{2} \\ Xcg2 := 50 + 5 + \dfrac{10}{2} & Ycg2 := \dfrac{40}{2} \\ Xcg3 := 50 + \dfrac{2}{3}\cdot 5 & Ycg3 := \dfrac{2}{3}\cdot 40 \\ Xcg4 := 50 + 5 + 10 + \dfrac{1}{3}\cdot 5 & Ycg4 := Ycg3 \end{bmatrix}$$

#5:
$$\begin{bmatrix} Xcg1 := 45 & Ycg1 := 45 \\ Xcg2 := 60 & Ycg2 := 20 \\ Xcg3 := \dfrac{160}{3} & Ycg3 := \dfrac{80}{3} \\ Xcg4 := \dfrac{200}{3} & Ycg4 := \dfrac{80}{3} \end{bmatrix}$$

#6:
$$\begin{bmatrix} Xcg1 := 45 & Ycg1 := 45 \\ Xcg2 := 60 & Ycg2 := 20 \\ Xcg3 := 53.33333333 & Ycg3 := 26.66666666 \\ Xcg4 := 66.66666666 & Ycg4 := 26.66666666 \end{bmatrix}$$

Centroide de la figura completa:



#7:
$$\left[Xcg := \frac{A1\cdot Xcg1 + A2\cdot Xcg2 + A3\cdot Xcg3 + A4\cdot Xcg4}{A}, \; Ycg := \right.$$

$$\left.\frac{A1\cdot Ycg1 + A2\cdot Ycg2 + A3\cdot Ycg3 + A4\cdot Ycg4}{A}\right]$$

#8: $$\left[Xcg := 51,\ Ycg := \frac{323}{9}\right]$$

#9: $$[Xcg := 51,\ Ycg := 35.88888888]$$

Inercias centroidales individuales:

#10: $$\begin{bmatrix} Ixc1 := \dfrac{(50 + 5 + 10 + 5 + 20)\cdot 10^3}{12} & Iyc1 := \dfrac{(50 + 5 + 10 + 5 + 20)^3\cdot 10}{12} & Ixyc1 := 0 \\ Ixc2 := \dfrac{10\cdot 40^3}{12} & Iyc2 := \dfrac{10^3\cdot 40}{12} & Ixyc2 := 0 \\ Ixc3 := \dfrac{5\cdot 40^3}{36} & Iyc3 := \dfrac{5^3\cdot 40}{36} & Ixyc3 := -\dfrac{5^2\cdot 40^2}{72} \\ Ixc4 := Ixc3 & Iyc4 := Iyc3 & Ixyc4 := \dfrac{5^2\cdot 40^2}{72} \end{bmatrix}$$

#11:

$$\left[\begin{array}{ccc} Ixc1 := 7500 & Iyc1 := 607500 & Ixyc1 := 0 \\ Ixc2 := \dfrac{160000}{3} & Iyc2 := \dfrac{10000}{3} & Ixyc2 := 0 \\ Ixc3 := \dfrac{80000}{9} & Iyc3 := \dfrac{1250}{9} & Ixyc3 := -\dfrac{5000}{9} \\ Ixc4 := \dfrac{80000}{9} & Iyc4 := \dfrac{1250}{9} & Ixyc4 := \dfrac{5000}{9} \end{array}\right]$$

#12:

$$\left[\begin{array}{ccc} Ixc1 := 7500 & Iyc1 := 6.075\cdot10^{5} & Ixyc1 := 0 \\ Ixc2 := 5.333333333\cdot10^{4} & Iyc2 := 3333.333333 & Ixyc2 := 0 \\ Ixc3 := 8888.888888 & Iyc3 := 138.8888888 & Ixyc3 := -555.5555555 \\ Ixc4 := 8888.888888 & Iyc4 := 138.8888888 & Ixyc4 := 555.5555555 \end{array}\right]$$

Inercias respecto a los ejes X e Y individuales:

#13:

$$\left[\begin{array}{ccc} Ix1 := Ixc1 + A1\cdot Ycg1^{2} & Iy1 := Iyc1 + A1\cdot Xcg1^{2} & Ixy1 := Ixyc1 + A1\cdot Xcg1\cdot Ycg1 \\ Ix2 := Ixc2 + A2\cdot Ycg2^{2} & Iy2 := Iyc2 + A2\cdot Xcg2^{2} & Ixy2 := Ixyc2 + A2\cdot Xcg2\cdot Ycg2 \\ Ix3 := Ixc3 + A3\cdot Ycg3^{2} & Iy3 := Iyc3 + A3\cdot Xcg3^{2} & Ixy3 := Ixyc3 + A3\cdot Xcg3\cdot Ycg3 \\ Ix4 := Ixc4 + A4\cdot Ycg4^{2} & Iy4 := Iyc4 + A4\cdot Xcg4^{2} & Ixy4 := Ixyc4 + A4\cdot Xcg4\cdot Ycg4 \end{array}\right]$$

#14:
$$\left[\begin{array}{ccc} Ix1 := 1830000 & Iy1 := 2430000 & Ixy1 := 1822500 \\ Ix2 := \dfrac{640000}{3} & Iy2 := \dfrac{4330000}{3} & Ixy2 := 480000 \\ Ix3 := 80000 & Iy3 := \dfrac{853750}{3} & Ixy3 := \dfrac{425000}{3} \\ Ix4 := 80000 & Iy4 := \dfrac{1333750}{3} & Ixy4 := \dfrac{535000}{3} \end{array}\right]$$

#15:
$$\left[\begin{array}{ccc} Ix1 := 1.83\cdot 10^{6} & Iy1 := 2.43\cdot 10^{6} & Ixy1 := 1.8225\cdot 10^{6} \\ Ix2 := 2.133333333\cdot 10^{5} & Iy2 := 1.443333333\cdot 10^{6} & Ixy2 := 4.8\cdot 10^{5} \\ Ix3 := 8\cdot 10^{4} & Iy3 := 2.845833333\cdot 10^{5} & Ixy3 := 1.416666666\cdot 10^{5} \\ Ix4 := 8\cdot 10^{4} & Iy4 := 4.445833333\cdot 10^{5} & Ixy4 := 1.783333333\cdot 10^{5} \end{array}\right]$$

Inercias de toda la figura respecto a los ejes X e Y:

#16: $[Ix := Ix1 + Ix2 + Ix3 + Ix4,\ Iy := Iy1 + Iy2 + Iy3 + Iy4,\ Ixy := Ixy1 + Ixy2 + Ixy3 + Ixy4]$

#17: $$\left[Ix := \frac{22033333333}{10000},\ Iy := \frac{11506249999}{2500},\ Ixy := \frac{26224999999}{10000}\right]$$

#18: $$\left[Ix := 2.203333333\cdot 10^{6},\ Iy := 4.602499999\cdot 10^{6},\ Ixy := 2.6225\cdot 10^{6}\right]$$

Inercias centroidales de toda la figura:

#19: $\left[Ixc :\!= Ix - A \cdot Ycg^2,\ Iyc :\!= Iy - A \cdot Xcg^2,\ Ixyc :\!= Ixy - A \cdot Xcg \cdot Ycg\right]$

#20: $\left[Ixc :\!= \dfrac{73254999991}{270000},\ Iyc :\!= \dfrac{1752499999}{2500},\ Ixyc :\!= -\dfrac{1230000001}{10000}\right]$

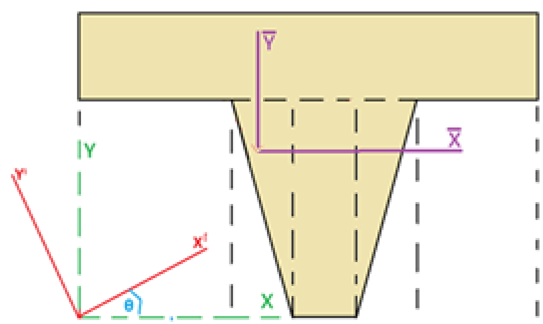
#21: $\left[Ixc :\!= 2.713148147 \cdot 10^5,\ Iyc :\!= 7.009999996 \cdot 10^5,\ Ixyc :\!= -1.230000001 \cdot 10^5\right]$

Ángulo donde se presentan las inercias principales, respecto a los ejes X e Y:

#22: $\theta :\!= \dfrac{1}{2} \cdot \text{ATAN}\left(-\dfrac{2 \cdot Ixy}{Ix - Iy}\right)$

#23: $\theta :\!= 0.5708946404$

Aproximadamente 33°



Inercias centroidales principales X′ e Y′:

#24: $\left[Imax :\!= \dfrac{Ix + Iy}{2} + \sqrt{\left(\left(\dfrac{Ix - Iy}{2}\right)^2 + Ixy^2\right)},\ Imin :\!= \dfrac{Ix + Iy}{2} - \sqrt{\left(\left(\dfrac{Ix - Iy}{2}\right)^2 + Ixy^2\right)}\right]$

#25: $\left[Imax :\!= 6.286752033 \cdot 10^6,\ Imin :\!= 5.190812996 \cdot 10^5\right]$

#26: $\left[Ixp = Ix \cdot \text{COS}(\theta)^2 - 2 \cdot Ixy \cdot \text{COS}(\theta) \cdot \text{SIN}(\theta) + Iy \cdot \text{SIN}(\theta)^2,\ Iyp =\right.$

$$Iy \cdot COS(\theta)^2 + 2 \cdot Ixy \cdot COS(\theta) \cdot SIN(\theta) + Ix \cdot SIN(\theta)^2\Big]$$

#27: $$\left[Ixp = 5.190812996 \cdot 10^5,\ Iyp = 6.286752033 \cdot 10^6\right]$$

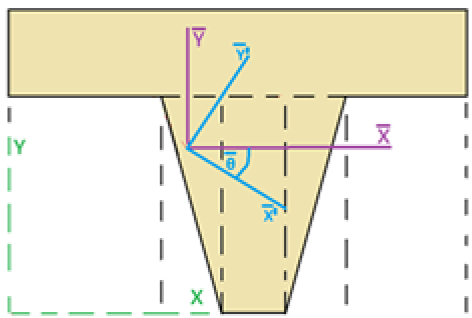
La inercia mayor es alrededor del eje Y′ y la inercia menor alrededor del eje X′, ambos con giro θ de aproximadamente 33°

Ángulo donde se presentan las inercias principales, respecto a los ejes X e Y centroidales:

#28: $$\theta c := \frac{1}{2} \cdot ATAN\left(-\frac{2 \cdot Ixyc}{Ixc - Iyc}\right)$$

#29: $$\theta c := -0.259981302$$

Aproximadamente −15°



#30: $$\left[Imaxcg := \frac{Ixc + Iyc}{2} + \sqrt{\left(\left(\frac{Ixc - Iyc}{2}\right)^2 + Ixyc^2\right)},\ Imincg := \frac{Ixc + Iyc}{2} - \sqrt{\left(\left(\frac{Ixc - Iyc}{2}\right)^2 + Ixyc^2\right)}\right]$$

#31: $$\left[Imaxcg := 7.337181866 \cdot 10^5,\ Imincg := 2.385966276 \cdot 10^5\right]$$

#32: $$\left[Ixcp = Ixc \cdot COS(\theta c)^2 - 2 \cdot Ixyc \cdot COS(\theta c) \cdot SIN(\theta c) + Iyc \cdot SIN(\theta c)^2,\ Iycp = Iyc \cdot COS(\theta c)^2 + 2 \cdot Ixyc \cdot COS(\theta c) \cdot SIN(\theta c) + Ixc \cdot SIN(\theta c)^2\right]$$

#33: $$\left[Ixcp = 2.385966276 \cdot 10^5,\ Iycp = 7.337181866 \cdot 10^5\right]$$

La inercia mayor es alrededor del eje Y′ centroidal y la inercia menor alrededor del eje X′ centroidal, ambos con giro θ de aproximadamente −15°