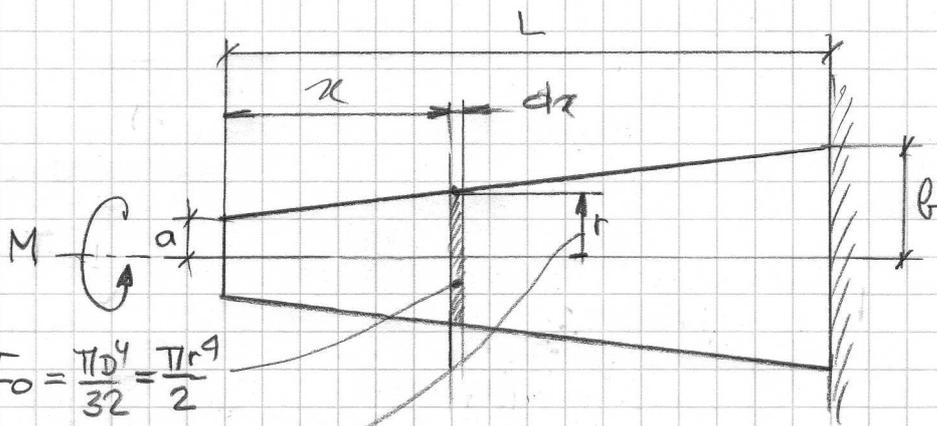


TORSION ARBRE CONIQUE



$$I_0 = \frac{\pi D^4}{32} = \frac{\pi r^4}{2}$$

$$r = a + \frac{(b-a)x}{L}$$

$$I_0 = \frac{\pi}{2} \left(a + \frac{(b-a)x}{L} \right)^4$$

$$d\theta = \frac{M}{G I_0} dx$$

$$d\theta = \frac{M}{G \cdot \frac{\pi}{2} \left(a + \frac{(b-a)x}{L} \right)^4} \cdot dx$$

$$\theta = \frac{2M}{G \cdot \pi} \int_0^L \frac{1}{\left(a + \frac{(b-a)x}{L} \right)^4} dx$$

forme $\int x^m \cdot X^n dx \rightarrow \frac{1}{A^{(m+1)}} \int (X-b)^m \cdot X^n dX$

avec $X = Ax + B$

$m=0 \quad n=-4 \quad A = \frac{(b-a)}{L} \quad B=a$

$$\theta = \frac{2M}{G \cdot \pi} \cdot \frac{L}{(b-a)} \cdot \int \left(a + \frac{(b-a)x}{L} \right)^{-4} dx$$

$$\theta = \frac{2ML}{G \cdot \pi (b-a)} \cdot \left[-\frac{1}{3} \cdot \left(a + \frac{(b-a)x}{L} \right)^{-3} \right]_0^L = \frac{2ML}{3G\pi(b-a)} \left(\frac{1}{\left(a + \frac{(b-a)L}{L} \right)^3} - \frac{1}{(a+0)^3} \right)$$

$$\theta = \frac{2ML}{3G\pi(b-a)} \left(\frac{1}{a^3} - \frac{1}{b^3} \right)$$

! et si a tend vers b ?