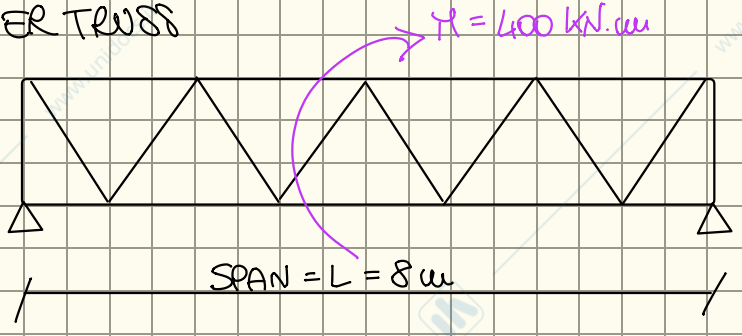
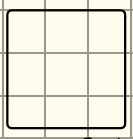
HOMEWORK 1

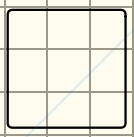
TIMBER TRUSS



SECTION 1: Lower chord



SECTION 2: Upper chord

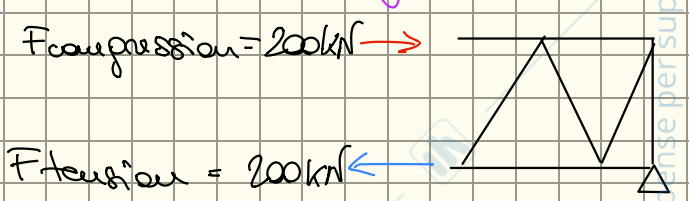


① Initial guessing of h

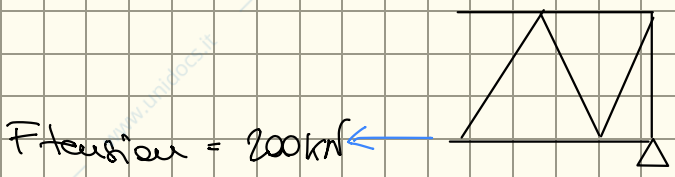
$$h = \frac{L}{4} = \frac{8}{4} \Rightarrow 2\,m$$

② Calculating the load on top chord and bottom chord of truss

$$F = \frac{M}{R} \Rightarrow \frac{400\,kN\,m}{2\,m} = 200\,kN$$



③ Calculating the section that have higher tension strength than the tension of bottom chord



$$N_{t,0,Rd} = f_{t,0,d} A$$

$$200\,kN = 200'000\,N$$

$$200'000\,N = 14,5\,MPa \cdot A \Rightarrow A = \frac{200000\,N}{14,5\,MPa} = 13'793,10\,mm^2$$

$$\sqrt{13793,10\,mm^2} \cong 117,44\,mm$$

④ Calculating the section that have a greater buckling load from the compression face of upper chord

$$P_{cr} = \frac{\pi^2 EI}{(KL)^2}$$

$$E_{timber} = 12'000\,MPa$$

$$k = \frac{1}{5} = 0,2$$

$$L = 8\,m = 8000\,mm$$

$P_{cr} = 200\,kN = 200000\,N$

$$200000N = \frac{3,14^2 \cdot 12000MPa \cdot I}{(0,2 \cdot 8000\,mm)^2}$$

$$I = \frac{200000N \cdot (0,2 \cdot 8000\,mm)^2}{3,14^2 \cdot 12000MPa} = 2704,64\,mm^4$$

$$I = \frac{a^4}{12} \Rightarrow a^4 = I \cdot 12$$

$$a^4 = 2704,64\,mm^4 \cdot 12 = 32455,68\,mm^4$$

$$a = \sqrt[4]{32455,68\,mm^4} \approx 13,4\,mm$$