Victor Paganotto RA:206586 EM423B 2sem2020 Lista 9

2) $EA\dfrac{d^2u(x)}{dx^2} = -p(x)$ ; $p(x) = F_B\langle x - 2L/5\rangle^{-1}$

$u(0) = 0 \quad u(L) = 0$

$EA\dfrac{d^2u(x)}{dx^2} = -F_B\langle x - 2L/5\rangle^{-1}$

$EA\dfrac{du(x)}{dx} = -F_B\langle x - 2L/5\rangle^{0} + C_1$

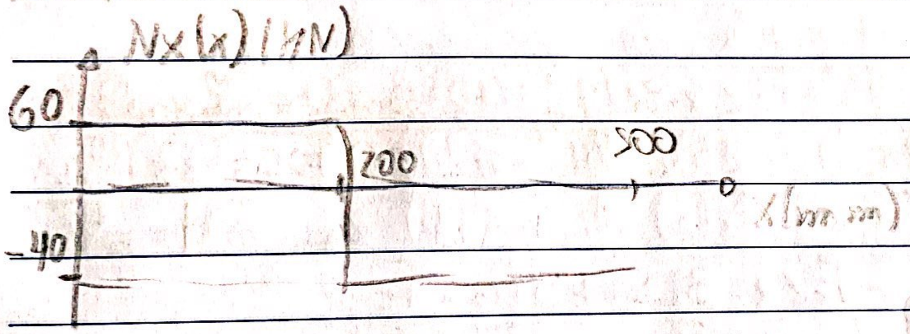
$EA\,u(x) = -F_B\langle x - 2L/5\rangle^{1} + C_1x + C_2$

$u(0)=0 \Rightarrow C_2 = 0$

$u(L)=0 \Rightarrow C_1 = 3F_B/5 = 60\,kN$

$N_x(x) = -F_B\langle x - 2L/5\rangle^{0} + 3F_B/5 = -100\langle x - 200\rangle^{0} + 60$

$EA\,u(x) = -F_B\langle x - 2L/5\rangle^{1} + 3F_Bx/5 = -100\langle x - 2L/5\rangle^{1} + 60x$




Max tensão $\Rightarrow 16\,N/mm^2$

$\sigma_{xx} = \dfrac{N_x(x)_{max}}{A} \Rightarrow A = \dfrac{60\,10^3}{16} = 3{,}75\,10^3\,mm^2$

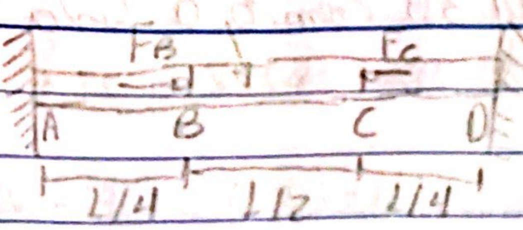
$EA\,u(x) = -100\langle x - 200\rangle^{1} + 60x \Rightarrow u(x) = -\dfrac{100}{EA}\langle x - 200\rangle^{1} + \dfrac{60}{EA}x$

$u(2L/5) = u(200) = -\dfrac{100\langle 0\rangle^{1}}{210 \cdot 3{,}75 \cdot 10^3} + \dfrac{60 \cdot 200}{210 \cdot 3{,}75 \cdot 10^3} = 0{,}015 = u_B$

$K_{xB} = \dfrac{100 \cdot 10^3}{0{,}015} = \boxed{6{,}67 \cdot 10^6\,N/mm}$

EA cte

3)




$F_B = 15kN$ $\quad F_C = 30kN$

$L = 1000mm$ $\quad E = 50GPa$

$A = 2500mm^2$

$$EA\frac{d^2u(x)}{dx^2} = -p(x) \qquad u(x=0)=0$$
$$u(x=L)=0$$

$$p(x) = F_B\langle x - L/4\rangle^{-1} - F_C\langle x - 3L/4\rangle^{-1}$$

$$EA\frac{d^2u(x)}{dx^2} = F_B\langle x-\frac{L}{4}\rangle^{-1} - F_C\langle x - \frac{3L}{4}\rangle^{-1} \Rightarrow EA\frac{du(x)}{dx} = -F_B\langle x-\frac{L}{4}\rangle^0 + F_C\langle x-\frac{3L}{4}\rangle^0 + C_1$$

$$\Rightarrow EAu(x) = -F_B\langle x-\frac{L}{4}\rangle^1 + F_C\langle x - \frac{3L}{4}\rangle^1 + C_1x + C_2$$

$$EAu(x=0) = -F_B\langle x - L/4\rangle^1 + F_C\langle x - 3L/4\rangle^1 + C_1 0 + C_2 = 0 \Rightarrow C_2 = 0$$
$$EAu(x=L) = -F_B\langle L - L/4\rangle^1 + F_C\langle L - 3L/4\rangle^1 + C_1L = 0 \Rightarrow C_1 = \frac{F_B 3}{4} - \frac{F_C}{4}$$

$$N_x(x) = -F_B\langle x - \frac{L}{4}\rangle^0 + F_C\langle x - \frac{3L}{4}\rangle^0 + \frac{3F_B}{4} - \frac{F_C}{4}$$

$$EAu(x) = -F_B\langle x - \frac{L}{4}\rangle^1 + F_C\langle x - \frac{3L}{4}\rangle^1 + \frac{3F_B}{4} - \frac{F_C}{4}$$

O valor da tensão normal máxima ocorre em $x=L$ e seu valor é 0. $N_x(L) = 0$.

O valor do deslocamento axial máximo ocorre em $x=L$ e seu valor é 0.