Dodatna naloga 4

Za nosilec na sliki preverite statično določenost in določite mesto ter velikost maksimalnega notranjega upogibnega momenta.

Podatki:

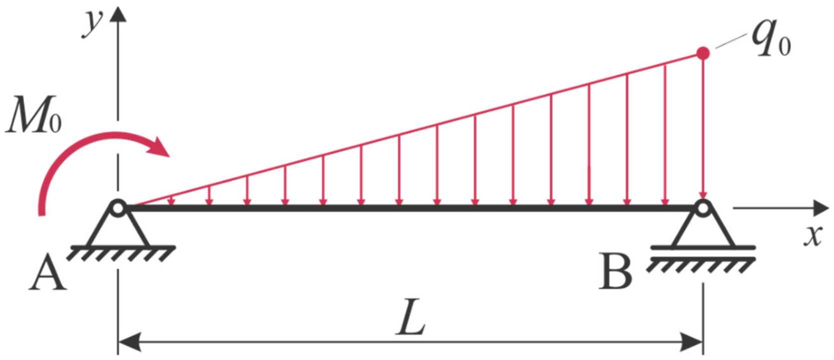
$q_0 = 8\ \mathrm{kN/m}$

$M_0 = 2{,}4\ \mathrm{kNm}$

$L = 1{,}5\ \mathrm{m}$

a) Statična določenost

b) $|M|_{\mathrm{MAX}} = ?\,,\ x_{\mathrm{MAX}} = ?$



a) $2\text{č} + \mathrm{n} = 3\mathrm{p} + 2\mathrm{v}$

$2 \cdot 2 + 3 = 3 \cdot 1 + 2 \cdot 2$

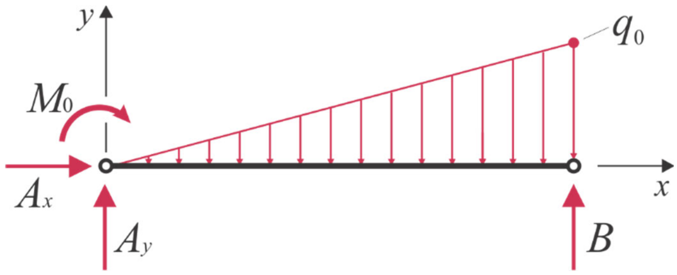
$7 = 7 \rightarrow$ sistem je statično določen

b) Izračunamo reakcijske sile:

$$A_x = 0$$

$$A_y + B - \frac{q_0 L}{2} = 0$$

$$-M_0 + BL - \frac{q_0 L}{2} \cdot \frac{2L}{3} = 0$$



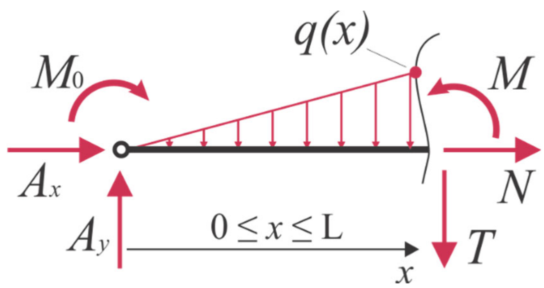
$$A_x = 0; \quad B = \frac{M_0}{L} + \frac{q_0 L}{3} = 5{,}6\ \mathrm{kN}; \quad A_y = -B + \frac{q_0 L}{2} = 0{,}4\ \mathrm{kN}$$

Zapišemo enačbe ravnovesja notranjih in zunanjih sil:

$$N + A_x = 0$$

$$T - A_y + \frac{q(x)x}{2} = 0$$

$$M - M_0 - A_y x + \frac{q(x)x}{2} \cdot \frac{x}{3} = 0 \qquad q(x) = q_0 \frac{x}{L}$$



$$N = -A_x = 0; \quad T = A_y - \frac{q_0 x^2}{2L}; \quad M = M_0 + A_y x - \frac{q_0 x^3}{6L} = 0$$

Poiščemo maksimalno (absolutno) vrednost notranjega upogibnega momenta:

* robovi polja: $M(0) = M_0 = 2{,}4\ \mathrm{kNm}; \quad M(L) = 0\ \mathrm{kNm}$

* stacionarne točke: $\frac{dM(x)}{dx} = 0 \quad \Rightarrow \quad x_e \approx \pm\, 0{,}3873\ \mathrm{m}$

$M(x = +0{,}3873\ \mathrm{m}) = 2{,}5033\ \mathrm{kNm} \quad \Rightarrow \quad |M|_{\mathrm{MAX}} = 2{,}5033\ \mathrm{kNm}, \quad x_{\mathrm{MAX}} = 0{,}3873\ \mathrm{m}$