3.6. Za prikazani štap, pravokutnog poprečnog presjeka stranica 5/8 cm, potrebno je odrediti minimalnu promjenu temperature pri kojoj će doći do izvijanja.

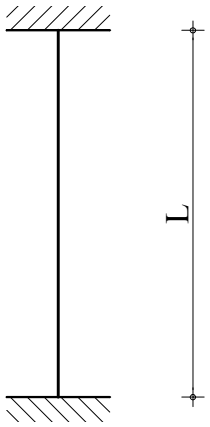
Poznato je:

$$L = 6.0\,\text{m}$$

$$\sigma_P = 21\frac{\text{kN}}{\text{cm}^2}$$

$$E = 2.1\cdot 10^4\,\frac{\text{kN}}{\text{cm}^2}$$

$$\alpha_t = 125\cdot 10^7\ /\ °\text{C}$$



Karakteristike poprečnog presjeka

$$I_{min} = \frac{8\cdot 5^3}{12} = 83.33\,\text{cm}^4$$

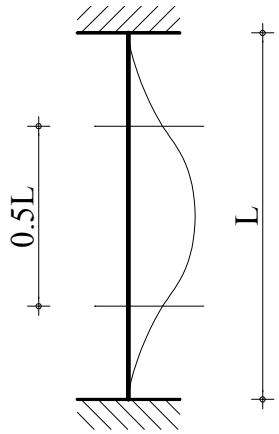
$$A = 40\,\text{cm}^2$$

$$i_{min} = \sqrt{\frac{I_{min}}{A}} = 1.443\,\text{cm}$$

Duljina izvijanja za obostrano upeti štap

$$L_i = 0.5L = 3.0\,\text{m}$$

$$\lambda = \frac{L_i}{i} = 207.85$$



Kontrola izvijanja

$$\lambda_p = \sqrt{\frac{\pi^2 E}{\sigma_p}} = 99.34 < \lambda$$

Kritična sila

$$P_{kr} = \frac{\pi^2 \cdot E \cdot I_{min}}{L_i^{\,2}} = \frac{\pi^2 \cdot 2.1 \cdot 10^4 \frac{kN}{cm^2} \cdot 83.33 cm^4}{(300 cm)^2} = 191.909 kN$$

Potrebna temperatura da bi došlo do izvijanja

$$\Delta L_P = \Delta L_{\Delta t}$$

$$\frac{P_{kr} \cdot L}{E \cdot A} = L \cdot \Delta t \cdot \alpha_t$$

$$\Delta t = \frac{P_{kr}}{E \cdot A \cdot \alpha_t}$$

$$\Delta t = \frac{191.909 kN}{2.1 \cdot 10^4 \frac{kN}{cm^2} \cdot 40 cm^2 \cdot 125 \cdot 10^{-7} / °C} = 18.27 °C$$