

Remarks: See §2.6.5, pages 42 till 44

Answer:

$$\Delta \ell = -3,8 \text{ mm}$$

Explanation:

$$A(x) = \pi \left\{ r_2 - (r_2 - r_1) \frac{x}{\ell} \right\}^2$$

$$\varepsilon(x) = -\frac{F}{EA} = -\frac{F}{E \cdot \pi \left\{ r_2 - (r_2 - r_1) \frac{x}{\ell} \right\}^2}$$

$$\Delta \ell = \int_0^{\ell} \varepsilon dx = -\frac{F}{\pi E} \int \frac{dx}{\left\{ r_2 - (r_2 - r_1) \frac{x}{\ell} \right\}^2} =$$

$$= -\frac{F}{\pi E} \frac{\ell}{r_2 - r_1} \frac{1}{\left\{ r_2 - (r_2 - r_1) \frac{x}{\ell} \right\}} \bigg|_0^{\ell} = -\frac{F \ell}{\pi E \cdot r_1 \cdot r_2} = -3,8 \text{ mm}$$