

### QUIZ 3 - SOLUTION

Problem 2: a) Thermal Expansion: To close the gap

$$\delta_T = \alpha_{al} \cdot \Delta T \cdot L_{Al} + \alpha_{cu} \cdot \Delta T \cdot L_{cu}$$

$$0,3 = 24 \cdot 10^{-6} \cdot (T_2 - 20) \cdot 400 + 17 \cdot 10^{-6} \cdot (T_2 - 20) \cdot 200$$

$$T_2 = 43,07^\circ C$$

b) Compatibility:

$$0,3 = (\delta_T)_{cu} - (\delta_F)_{cu} + (\delta_T)_{Al} - (\delta_F)_{Al}$$

$$0,3 = 17 \cdot 10^{-6} \cdot (160 - 20) \cdot 200 - \frac{F \cdot 200}{\frac{\pi}{4} \cdot (30)^2 \cdot 126000}$$

$$+ 24 \cdot 10^{-6} \cdot (160 - 20) \cdot 400 - \frac{F \cdot 400}{\frac{\pi}{4} \cdot (30)^2 \cdot 70000}$$

$$\bar{F} = 147152,78 \text{ Newton}$$

Average Normal Stress:

$$\sigma_{al} = \sigma_{cu} = \frac{\bar{F}}{A} = \frac{147152,78}{\frac{\pi}{4} \cdot (30)^2} = 208,17 \text{ MPa}$$