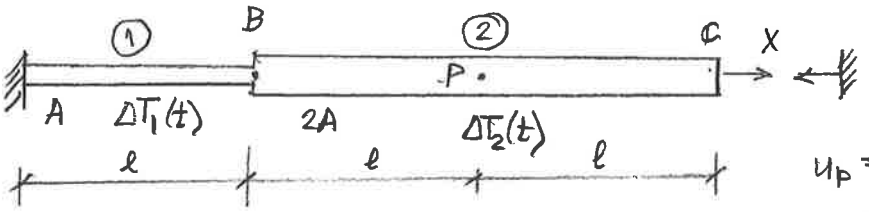
EIF



$u_P = \Delta\ell_1 + \frac{\Delta\ell_2}{2}$

$= \alpha\ell(\Delta T_1 - \Delta T_2)$

- Equilíbrio: $N_1 = N_2 = X$
- Eqs. constitutivas: $\Delta\ell_1 = \frac{X\ell}{EA} + \alpha\ell\Delta T_1$

$\Delta\ell_2 = \frac{X(2\ell)}{2EA} + \alpha 2\ell\Delta T_2 = \frac{X\ell}{EA} + 2\alpha\ell\Delta T_2$

- Compatibility $\boxed{u_C = 0}$

$u_C = \Delta\ell_1 + \Delta\ell_2 = \frac{2X\ell}{EA} + \alpha\ell(\Delta T_1 + 2\Delta T_2) = 0 \Rightarrow X = -(\Delta T_1 + 2\Delta T_2)\frac{\alpha EA}{2}$

a) $\sigma_P \times t$

$\sigma_P = \frac{N_2}{2A} = \frac{X}{2A} = -(\Delta T_1 + 2\Delta T_2)\frac{\alpha E}{4} = -(\Delta T_1 + 2\Delta T_2)\frac{10^{-5} \times 20\times10^3}{4}$

$= -0{,}05(\Delta T_1 + 2\Delta T_2)$

b) $u_B \times t$

$u_B = \Delta\ell_1 = -(\Delta T_1 + 2\Delta T_2)\frac{\alpha EA}{2EA}\ell + \alpha\ell\Delta T_1 = \alpha\ell\left(\frac{\Delta T_1}{2} - \Delta T_2\right)$

$= 10^{-5} \times 100\left(\frac{\Delta T_1}{2} - \Delta T_2\right)$

$= 0{,}001\left(\frac{\Delta T_1}{2} - \Delta T_2\right)$

$t = 8h$ < $\Delta T_1 = 0$, $\Delta T_2 = 0$ $\quad \sigma_P = 0 \quad u_B = 0$

$t = 9h$ < $\Delta T_1 = 400°C$, $\Delta T_2 = 0$ $\quad \sigma_P = -20\ \frac{kN}{cm^2} \quad u_B = 0{,}2\,cm$

$t = 10h$ < $\Delta T_1 = 800°C$, $\Delta T_2 = 400°C$ $\quad \sigma_P = -80\ \frac{kN}{cm^2} \quad u_B = 0$