Victor Pagandtto RA: 206586 Lista 7 EM423B 2sem2020

1) a) $u = 0{,}001x + 0{,}009y + 0{,}006z$
$v = 0{,}002x + 0{,}007y + 0{,}009z$
$w = 0{,}001x + 0{,}001y - 0{,}008z$

Os estados de deformação podem ser calculados a partir de:

$\varepsilon_{xx} = \frac{du}{dx} = 0{,}001$ $\varepsilon_{yy} = \frac{dv}{dy} = 0{,}007$ $\varepsilon_{zz} = \frac{dw}{dz} = -0{,}008$

E a deformação volumétrica é:

$K = \varepsilon_{xx} + \varepsilon_{yy} + \varepsilon_{zz} = 0{,}001 + 0{,}007 - 0{,}008 = 0$

b) $u = 0{,}001x + 0{,}002y + 0{,}006z$
$v = 0{,}002x + 0{,}003y + 0{,}004z$
$w = 0{,}006x + 0{,}004y - 0{,}004z$

$\varepsilon_{xx} = \frac{du}{dx} = 0{,}001$ $\varepsilon_{yy} = \frac{dv}{dy} = 0{,}003$ $\varepsilon_{zz} = \frac{dw}{dz} = -0{,}04$

$K = \varepsilon_{xx} + \varepsilon_{yy} + \varepsilon_{zz} = 0{,}001 + 0{,}003 - 0.004 = 0$

2) $\vec{u}(\vec{x}) = x\hat{i} + y\hat{j} + z\hat{k}$

$$[\varepsilon] = \begin{bmatrix} \frac{du}{dx} & \frac{1}{2}\left(\frac{du}{dy}+\frac{dv}{dx}\right) & \frac{1}{2}\left(\frac{du}{dz}+\frac{dw}{dx}\right) \\ \frac{1}{2}\left(\frac{du}{dy}+\frac{dv}{dx}\right) & \frac{dv}{dy} & \frac{1}{2}\left(\frac{dv}{dz}+\frac{dw}{dy}\right) \\ \frac{1}{2}\left(\frac{du}{dz}+\frac{dw}{dx}\right) & \frac{1}{2}\left(\frac{dv}{dz}+\frac{dw}{dy}\right) & \frac{dw}{dz} \end{bmatrix}$$

Temos que $\frac{du}{dx} = \frac{du}{dy} = \frac{du}{dz} = 1$ o resto é nulo

$$[\varepsilon] = \begin{bmatrix} 1 & 1/2 & 1/2 \\ 1/2 & 0 & 0 \\ 1/2 & 0 & 0 \end{bmatrix}$$

$\vec{u}(\vec{x}) = (3x^2y+6).10^{-4}\hat{i} + (y^2+6xz).10^{-4}\hat{j} + (6z^2-2xy+10).10^{-4}\hat{k}$

$\varepsilon_{ij} = \frac{1}{2}\left(\frac{du_i}{dx_j} + \frac{du_j}{dx_i}\right) \Rightarrow u_1 = (3x^2y+6)\,10^{-4}$

$u_2 = (y^2+6xz).10^{-4}$

$u_3 = (6z^2+2yz+10)\,10^{-4}$

$$\varepsilon = \varepsilon_{ij} = \begin{bmatrix} 6xy & \frac{3}{2}x^2+3z & 0 \\ \frac{3}{2}x^2+3z & 2y & 3x+z \\ 0 & 3x+z & 12z+2y \end{bmatrix} .10^{-4}$$

3) $L_1 = L_2 = 1m$, $\Delta T_1 = \Delta T_2 = 50°C$

$\alpha_1 = 11 \cdot 10^{-6} °C^{-1}$ $\alpha_2 = 23 \cdot 10^{-6} °C^{-1}$

$\varepsilon_T = \alpha \Delta T$ $\frac{\Delta u}{L} = \frac{Lf - L}{L}$ $Lf = L(1 + \alpha \Delta t)$

Ferro fundido

$Lf_1 = L_1(1 + \alpha_1 \Delta T_1) = 1(1 + 11 \cdot 10^{-6} \cdot 50°) = \boxed{5{,}5 \cdot 10^{-4}\ m}$

$Lf_2 = L_2(1 + \alpha_2 \Delta T_2) = 1(1 + 23 \cdot 10^{-6} \cdot 50°) = \boxed{1{,}15 \cdot 10^{-3}\ m}$

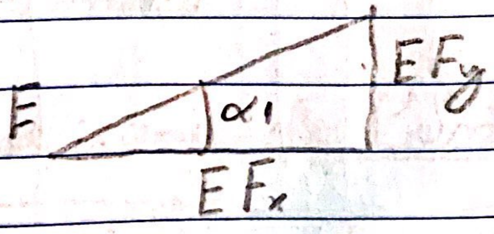
Alumínio

4) $A(0;0) \longrightarrow E(1{,}5;0{,}5)$
$B(1;0) \longrightarrow F(2{,}55;0{,}56)$
$C(1;1) \longrightarrow G(2{,}58;1{,}59)$
$D(0;1) \longrightarrow H(1{,}54;1{,}53)$

Deformações pequenas e somente no plano xy.

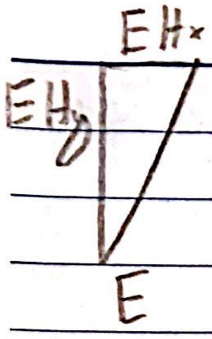
a) $\Delta u = EF_x - AB_x = (2{,}55 - 1{,}5) - (1 - 0) = 0{,}05$
$\Delta x = AB_x = 1$

$\Delta v = EH_y - AD_y = (1{,}53 - 0{,}5) - (1 - 0) = 0{,}03$
$\Delta y = AD_y = 1$



$\tan \alpha_1 = \alpha_1 = \frac{EF_y}{EF_x} = \frac{0{,}06}{1{,}05} = 0{,}057$

$\alpha_1 = 0{,}057$



$$\tan \alpha_2 = \alpha_2 = \frac{EH_x}{EH_y} = \frac{0,04}{1,03} = 0,039$$

$$\alpha_2 = 0,039$$

b) $[\varepsilon] = \begin{bmatrix} \varepsilon_{xx} & \varepsilon_{xy} \\ \varepsilon_{yx} & \varepsilon_{yy} \end{bmatrix}$

$$\varepsilon_{xx} = \frac{\Delta u}{\Delta x} = \frac{0,05}{1} = 0,05$$

$$\varepsilon_{yy} = \frac{\Delta v}{dy} = \frac{0,03}{1} = 0,03$$

$$\varepsilon_{yx} = \varepsilon_{xy} = \frac{1}{2}\gamma_{xy} = \frac{1}{2}(\alpha_1 + \alpha_2) = \frac{1}{2}(0,057 + 0,039)$$

$$\varepsilon_{yx} = \varepsilon_{xy} = 0,048$$

$$\boxed{[\varepsilon] = \begin{bmatrix} 0,05 & 0,048 \\ 0,048 & 0,03 \end{bmatrix}}$$