Solução - Testinho T4

Dado um campo de pequenos deslocamentos

$$\begin{cases} u = 0{,}001x + 0{,}002y + 0{,}006z \\ v = 0{,}002x + 0{,}003y + 0{,}004z \\ w = 0{,}006x + 0{,}004y - 0{,}004z \end{cases}$$

Determine:

- Matriz de deslocamentos u_{ij}
- Matriz de deformação ε_{ij}
- Matriz de rotação ω_{ij}
- Vetor rotação $\vec{\Omega}$

$$\{\vec{u}\} = \begin{Bmatrix} u \\ v \\ w \end{Bmatrix} = [u_{ij}]\{\vec{x}\}$$

$[u_{ij}]$: Matriz de deslocamentos

$$\{\vec{x}\} = \begin{Bmatrix} x \\ y \\ z \end{Bmatrix}$$

$$[u_{ij}] = \begin{bmatrix} 0{,}001 & 0{,}002 & 0{,}006 \\ 0{,}002 & 0{,}003 & 0{,}004 \\ 0{,}006 & 0{,}004 & -0{,}004 \end{bmatrix}$$

$$[\varepsilon_{ij}] = \begin{bmatrix} \frac{\partial u}{\partial x} & \frac{1}{2}\left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x}\right) & \frac{1}{2}\left(\frac{\partial u}{\partial z} + \frac{\partial w}{\partial x}\right) \\ \frac{1}{2}\left(\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y}\right) & \frac{\partial v}{\partial y} & \frac{1}{2}\left(\frac{\partial v}{\partial z} + \frac{\partial w}{\partial y}\right) \\ \frac{1}{2}\left(\frac{\partial w}{\partial x} + \frac{\partial u}{\partial z}\right) & \frac{1}{2}\left(\frac{\partial w}{\partial y} + \frac{\partial v}{\partial z}\right) & \frac{\partial w}{\partial z} \end{bmatrix}$$

$$[\varepsilon_{ij}] = \begin{bmatrix} 0{,}001 & 0{,}002 & 0{,}006 \\ 0{,}002 & 0{,}003 & 0{,}004 \\ 0{,}006 & 0{,}004 & -0{,}004 \end{bmatrix}$$

$$[\omega_{ij}] = \begin{bmatrix} 0 & \frac{1}{2}\left(\frac{\partial u}{\partial y} - \frac{\partial v}{\partial x}\right) & \frac{1}{2}\left(\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}\right) \\ \frac{1}{2}\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right) & 0 & \frac{1}{2}\left(\frac{\partial v}{\partial z} - \frac{\partial w}{\partial y}\right) \\ \frac{1}{2}\left(\frac{\partial w}{\partial x} - \frac{\partial u}{\partial z}\right) & \frac{1}{2}\left(\frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}\right) & 0 \end{bmatrix}$$

$$[\omega_{ij}] = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$\vec{\Omega} = \frac{1}{2}\left(\vec{\nabla} \times \vec{u}\right) = \begin{Bmatrix} \frac{1}{2}\left(\frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}\right) \\ \frac{1}{2}\left(\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}\right) \\ \frac{1}{2}\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right) \end{Bmatrix}$$

$$\vec{\Omega} = \{0; 0; 0\}$$

OBS: Quando a matriz deslocamento é simétrica, não há rotação.