Respostas – Série 1 – Física dos Meios contínuos 2023

Observação: As respostas abaixo são, em geral, parciais e servem apenas de auxílio nos estudos. A resposta completa pode envolver mais discussão dos resultados.

2)

$$a_x = -2V_0^2 \left[(r_L - r_0)/r_0 \right] \Big/ L\left[1 + ((r_L - r_0)/r_0)(x/L) \right]$$

3) a)

$$y = (\tan \omega t)x + C$$

b)

$$(x - C_1)^2 + (y - C_2)^2 = 1$$

c)

$$x^2 + \left(y - \frac{x}{2} \right)^2 = 1$$

4)

$$x = u_0 t + X, \qquad y = \tfrac{1}{2}kt^2 + Y, \qquad z = Z.$$

5) Ver Acheson 1.1

6) a)

$$\zeta_\theta = \frac{\partial u_r}{\partial z} - \frac{\partial u}{\partial r} = 0 - \frac{1}{4\mu}\frac{dP}{dx}2r = -\frac{r}{2\mu}\frac{dP}{dx}$$

b)

$$\varepsilon_{xr} = \frac{1}{2}\left(\frac{\partial u_r}{\partial x} + \frac{\partial u}{\partial r} \right) = \frac{1}{2}\left(0 + \frac{1}{4\mu}\frac{dP}{dx}2r \right) = \frac{r}{4\mu}\frac{dP}{dx}$$

c)

$$\varepsilon_{ij} = \begin{pmatrix} \varepsilon_{rr} & \varepsilon_{rx} \\ \varepsilon_{xr} & \varepsilon_{xx} \end{pmatrix} = \begin{pmatrix} 0 & \dfrac{r}{4\mu}\dfrac{dP}{dx} \\ \dfrac{r}{4\mu}\dfrac{dP}{dx} & 0 \end{pmatrix}$$

7) a) Irrotacional

b)

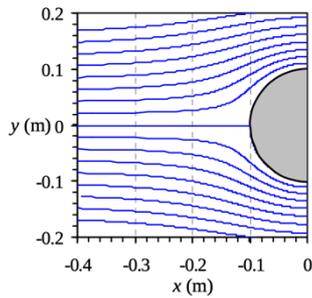$$\boxed{r = a \qquad \theta = -180^\circ} \qquad \boxed{x = -a \qquad y = 0}$$

c)

$$\varepsilon_{\theta\theta} = \frac{1}{r}\left[\frac{\partial u_\theta}{\partial \theta} + u_r \right] = \frac{1}{r}\left[-V\cos\theta\left(1 + \frac{a^2}{r^2} \right) + V\cos\theta\left(1 - \frac{a^2}{r^2} \right) \right] = -2V\cos\theta\,\frac{a^2}{r^3} \qquad \varepsilon_{rr} = \frac{\partial u_r}{\partial r} = 2V\cos\theta\,\frac{a^2}{r^3}$$

d) Incompressível

8) a)

$$r = \frac{\psi \pm \sqrt{\psi^2 + 4a^2 V^2 \sin^2 \theta}}{2V \sin \theta}$$

b)

9) a) Irrotacional

b)
$$x = x_{A'} = \frac{1}{b}\left[\left(U_0 + bx_A\right)e^{bt} - U_0\right]$$

c)
$$\Delta \xi = \left(x_B - x_A\right)\left(e^{bt} - 1\right)$$

d)
$$\varepsilon_{xx} \rightarrow \frac{1}{t}\left(1 + bt - 1\right) = b \qquad\qquad \varepsilon_{xx} = \frac{\partial u}{\partial x} = b$$

e)
$$y = y_{A'} = y_A e^{-bt}$$

10) a)
$$\zeta_z = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} = 0 - \frac{V}{h} = -\frac{V}{h}$$

b)
$$\varepsilon_{xy} = \frac{1}{2}\left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x}\right) = \frac{1}{2}\left(\frac{V}{h} + 0\right) = \frac{V}{2h}$$

c) Não são principais.

12) a)

Upper left corner at t + dt: $\quad\left(x + \left(a + b\left(y + dy\right)\right)dt,\, y + dy\right)$

Upper right corner at t + dt: $\quad\left(x + dx + \left(a + b\left(y + dy\right)\right)dt,\, y + dy\right)$

Lower right corner at t + dt: $\quad\left(x + dx + \left(a + by\right)dt,\, y\right)$

b) exx =0 e eyy=0.

c) Incompressível.

d)
$$\zeta_z = 2\omega_z = 2\left(-\frac{b}{2}\right) = -b$$