

DFT - IF - UERJ  
Mecânica Geral  
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Lista 1 - Respostas

1. a)

$$x(t) = \frac{F_0}{m(\gamma^2 + \omega^2)} \left[ \frac{(\gamma^2 - \omega^2)}{(\gamma^2 + \omega^2)} (e^{-\gamma t} \cos(\omega t + \theta) - \cos \theta) - \frac{2\gamma\omega}{(\gamma^2 + \omega^2)} (e^{-\gamma t} \sin(\omega t + \theta) - \sin \theta) + t\gamma \cos \theta - t\omega \sin \theta \right];$$

b)

$$v(t \rightarrow \infty) = \frac{F_0}{m(\gamma^2 + \omega^2)} (\gamma \cos \theta - \omega \sin \theta);$$

2. a)

$$v(t) = -\frac{1}{\alpha} \ln \left( \frac{b\alpha t}{m} + e^{-\alpha v_0} \right);$$

b)

$$t(v=0) = \frac{m}{b\alpha} (1 - e^{-\alpha v_0}); \quad x(v=0) = \frac{m}{b\alpha^2} (1 - e^{-\alpha v_0} - \alpha v_0 e^{-\alpha v_0})$$

3.

4. a)

$$F(x) = -mna^2 x^{-2n-1};$$

b)

$$x(t) = ((n+1)at)^{\frac{1}{n+1}}; \quad ; F(t) = -mna^2 ((n+1)at)^{\frac{-(2n+1)}{(n+1)}}$$

5.

$$x = \sqrt{x_0^2 + \frac{kt^2}{mx_0^2}},$$

6. a)

$$x = \frac{c^2}{F} \left( \sqrt{m_0^2 + \frac{F^2 t^2}{c^2}} - m_0 \right); \quad v = \frac{Ft}{\sqrt{m_0^2 + \frac{F^2 t^2}{c^2}}},$$

c)

$$t(v = \frac{c}{2}) = 0.55 \text{ anos}; \quad t(v = 0.99c) = 6.67 \text{ anos},$$

7.

8. d)

$$\tau \approx \frac{2\pi}{\omega_0} \left( 1 + \frac{3}{4} b A^2 \right).$$

e)

$$v_{\text{escape}} = \frac{\omega_0}{2\sqrt{b}}$$

9. 2.74 rad/s

10. a)

$$\begin{aligned} m\omega_0 x = & \left( \frac{3}{2}A + \frac{1}{34}B \right) e^{-\frac{\omega_0}{3}t} \cos\left(\frac{2\sqrt{2}}{3}\omega_0 t\right) \\ & + \left( \frac{3\sqrt{2}}{8}A + \frac{37\sqrt{2}}{136}B \right) e^{-\frac{\omega_0}{3}t} \sin\left(\frac{2\sqrt{2}}{3}\omega_0 t\right) \\ & - \frac{3}{2}A \cos(\omega_0 t) - \frac{1}{34}B \cos(3\omega_0 t) - \frac{2}{17}B \sin(3\omega_0 t), \end{aligned}$$

b)

$$\frac{B}{A} = 3\sqrt{17},$$

11. c)

$$\omega = \sqrt{\omega_0^2 + \gamma^2} \pm \gamma,$$

12.