



PGF 5005 - Mecânica Clássica

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Respostas - Segunda Lista de Exercícios

1.

(b)

$$\theta_1(t) = \alpha_1 + (1 - 2\beta_1 - 3\beta_2)t,$$

$$I_1(t) = \beta_1$$

$$, \theta_2(t) = \alpha_2 + (1 - 3\beta_1 + 2\beta_2)t,$$

$$I_2(t) = \beta_2.$$

2.

(a)

$$I_1 = F_1 - \frac{\alpha m F_1 F_2}{m\omega_1 - n\omega_2} \cos(m\phi_1 - n\phi_2) + \mathcal{O}(\alpha^2),$$

$$\theta_1 = \phi_1 + \frac{\alpha F_2}{m\omega_1 - n\omega_2} \sin(m\phi_1 - n\phi_2) + \mathcal{O}(\alpha^2),$$

$$I_2 = F_2 + \frac{\alpha n F_1 F_2}{m\omega_1 - n\omega_2} \cos(m\phi_1 - n\phi_2) + \mathcal{O}(\alpha^2),$$

$$\theta_2 = \phi_2 + \frac{\alpha F_1}{m\omega_1 - n\omega_2} \sin(m\phi_1 - n\phi_2) + \mathcal{O}(\alpha^2).$$

(b)

$$h_0(F_1, F_2) = F_1 + F_2 - F_1^2 + F_2^2 - 3F_1F_2$$

(d)

$$\nu_1 = 1 - 2F_1 - 3F_2, \quad \nu_2 = 1 + 2F_2 - 3F_1$$

(e) Correção:

$$\bar{\omega}_i = \frac{1}{\tau} \int_0^\tau \frac{\partial H}{\partial I_i} dt$$

$$\bar{\omega}_1 = \omega_1, \bar{\omega}_2 = \omega_2.$$

(f)

$$F_1(t) = F_1(t=0), \quad \phi_1(t) = \phi_1(0) + \nu_1 t,$$

$$F_2(t) = F_2(t=0), \quad \phi_2(t) = \phi_2(0) + \nu_2 t.$$

(g)

$$I_1 = F_1(0) + \frac{\alpha m F_1(0) F_2(0)}{m\omega_1 - n\omega_2} \cos[\phi_0 - (n\nu_2 - m\nu_1)],$$

$$\theta_1 = \phi_1(0) + \frac{\alpha F_2(0)}{m\omega_1 - n\omega_2} \sin[\phi_0 - (n\nu_2 - m\nu_1)],$$

$$I_2 = F_2(0) - \frac{\alpha n F_1(0) F_2(0)}{m\omega_1 - n\omega_2} \cos[\phi_0 - (n\nu_2 - m\nu_1)],$$

$$\theta_2 = \phi_2(0) + \frac{\alpha F_1(0)}{m\omega_1 - n\omega_2} \sin[\phi_0 - (n\nu_2 - m\nu_1)].$$

$$\phi_0 = m\phi_1(0) - n\phi_2(0)$$

4.

(a) $\omega = I$

(c) $I = 1/2$

(d) $\Delta_a = 2\sqrt{a}$

(e) $\Delta_b = 2\sqrt{b}$

(g) $4\sqrt{a} + 4\sqrt{b} \gtrsim 1$

5.

(a) $J(t) = \beta$, $\phi(t) = \alpha + \frac{3\beta^2}{8}t$

(b) $\omega_0 = \frac{3\beta^2}{8}$.

(c) $\beta_r \approx 2$.

6.

(d) $I = \pm \sqrt{\frac{2\epsilon\beta_r}{3}(1 - \cos\theta)}$

(e) $\delta = \sqrt{\frac{\epsilon\beta_r}{3}}$

7.

(a)

$$\theta = 2\phi - 3t, \quad J = 2I.$$

(b)

$$I(t) = \frac{\beta}{2}, \quad \theta(t) = 2\alpha + 3\left(\frac{\beta^2}{4} - 1\right)t$$

(c)

$$\nu = \frac{3\beta^2}{4} - 3.$$

(d)

$$J = I_0 - \frac{4\epsilon I_0^2 \cos(\theta_0 + 3(I_0^2 - 1)t)}{3I_0^2 - 3},$$

$$I_0 = J^{(0)} = \beta.$$

(e) $I^* = 1$.

(f) $\beta \neq 1$.

8.

(c) 3 graus de liberdade.

(d) p_y e p_z são constantes do movimento enquanto H não é constante do movimento.

10.

(a) 2 graus de liberdade.
