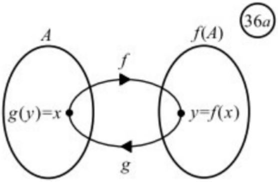
Συναρτήσεις

Αντίστροφη

Κωνσταντίνος. Λόλας

- A_1 γ A_2 δ A_3 γ A_4 β
- Λ Σ Λ Σ Σ

B1 - (i)



B1 - (i)

$$\Sigma\vec{F} = \vec{0} \implies \vec{W} = -\vec{F}_{\varepsilon\lambda}$$
$$W = F_{\varepsilon\lambda} \implies mg = k \cdot \Delta l_0$$
$$\Delta l_0 = \frac{mg}{k} = \mathrm{A}_1 \quad (1)$$

Ασκώντας τη δύναμη $\vec{F}$, η Θ.Ι. της ΑΑΤ συμπίπτει με τη θέση φυσικού μεγέθους του ελατηρίου. Εφόσον ξεκινά από την ηρεμία, η θέση έναρξης αυτής, είναι ακραία. Άρα

$$\mathrm{A}_2 = \Delta l_0 = \frac{mg}{k} \quad (2)$$
$$(1),(2) \implies \mathrm{A}_1 = \mathrm{A}_2$$

B2 - (ii)

Η παροχή από κάθε οπή είναι σταθερή:

$$\Pi = \frac{V}{\Delta t} \implies V = \Pi \cdot \Delta t$$

Όταν είναι ανοιχτή μόνο η οπή (1):

$$V = \Pi_1 \cdot \Delta t = \mathrm{A} v_1 \cdot \Delta t_1 \quad (1)$$

Ταχύτητα εκροής:

$$v_1 = \sqrt{2g\left(H - \frac{5H}{6}\right)} = \sqrt{2g\frac{H}{6}} = \sqrt{g\frac{H}{3}}$$

Όταν είναι ανοιχτές και οι δύο οπές (1), (2):

$$V = V_1 + V_2 = \Pi_1 \cdot \Delta t_2 + \Pi_2 \cdot \Delta t_2 = \mathrm{A} \cdot v_1 \cdot \Delta t_2 + \mathrm{A} \cdot v_2 \cdot \Delta t_2 \quad (2)$$

$$v_1 = \sqrt{g\frac{H}{3}} \qquad v_2 = \sqrt{2g\left(H - \frac{H}{3}\right)} = \sqrt{2g\frac{2H}{3}} = 2\sqrt{g\frac{H}{3}} \Rightarrow v_2 = 2v_1$$

$$\mathrm{A} v_1 \cdot \Delta t_1 = \mathrm{A} \cdot v_1 \cdot \Delta t_2 + \mathrm{A} \cdot v_2 \cdot \Delta t_2 \Rightarrow \Delta t_1 = \Delta t_2 + 2\Delta t_2 = 3\Delta t_2 \Rightarrow \frac{\Delta t_2}{\Delta t_1} = \frac{1}{3}$$

B3 - (iii)

$$K_1 = \frac{P_1^2}{2m_1}$$

$$K_1' = \frac{\left(\frac{P_1}{5}\right)^2}{2m_1} \frac{1}{25} \frac{P_1^2}{2m_1} = \frac{1}{25} K_1$$

$$K_{o\lambda(\pi\rho\iota\nu)} = K_{o\lambda(\mu\varepsilon\tau)} \Rightarrow K_1 = K_1' + K_2' \Rightarrow K_2' = \frac{24}{25} K_1 \Rightarrow \frac{K_2'}{K_1} \cdot 100\% = \frac{\frac{24}{25} K_1}{K_1} \cdot 100\% = 96\%$$

Γ1

$$I = \frac{E}{R_{\mathrm{K\Lambda}} + r} \Rightarrow I = 3A$$

$$\Sigma\vec{F} = \vec{0} \Rightarrow \vec{F}_L = -\vec{W} \Rightarrow F_L = W \Rightarrow$$
$$B \cdot I \cdot l = mg \Rightarrow B = \frac{mg}{I \cdot l} \Rightarrow B = 1T$$

Γ2

Αντίσταση θερμικής συσκευής

$$P_{\Sigma} = \frac{V_{\Sigma}^2}{R_{\Sigma}} \Rightarrow R_{\Sigma} = 6\Omega$$

Στιγμιαίες τιμές

$$\mathrm{E}_{\varepsilon\pi} = B \cdot v \cdot l \quad I_{\varepsilon\pi} = \frac{\mathrm{E}_{\varepsilon\pi}}{R_{o\lambda}} = \frac{B \cdot v \cdot l}{R_{\mathrm{K\Lambda}} + R_{1,\Sigma}} \quad R_{1,\Sigma} = \frac{R_1 \cdot R_{\Sigma}}{R_1 + R_{\Sigma}} = 2\Omega$$

$$F_L = B \cdot I_{\varepsilon\pi} \cdot l = \frac{B^2 v l^2}{R_{\mathrm{K\Lambda}} + R_{1,\Sigma}}$$

Αρχικά $W > F_L$, οπότε:

$$\Sigma\vec{F} = \vec{W} + \vec{F}_L \uparrow\uparrow \vec{W} \text{ δηλαδή } \Sigma\vec{F} \uparrow\uparrow \vec{v}$$

Άρα επιταχυνόμενη κίνηση με στιγμιαία επιτάχυνση μέτρου:

$$\Sigma F = mg - F_L = ma \Rightarrow a = g - \frac{mg - F_L}{m} = g - \frac{B^2 v l^2}{m\left(R_{\mathrm{K\Lambda}} + R_{1,\Sigma}\right)}$$

Καθώς αυξάνει το μέτρο της ταχύτητας v, μειώνεται το μέτρο της επιτάχυνσης. Ο αγωγός αποκτά οριακή ταχύτητα όταν

$$a = 0 \Rightarrow g = \frac{B^2 v_{o\rho} l^2}{m\left(R_{\mathrm{K\Lambda}} + R_{1,\Sigma}\right)} \Rightarrow v_{o\rho} = \frac{mg\left(R_{\mathrm{K\Lambda}} + R_{1,\Sigma}\right)}{B^2 l^2} \Rightarrow v_{o\rho} = 12m/s$$

Γ3

Τη στιγμή όπου $v = \frac{v_{o\rho}}{2} = 6m/s$

$$I' = \frac{Bvl}{R_{o\lambda}} = \frac{Bvl}{R_{\mathrm{K}\Lambda} + R_{1,\Sigma}} = \frac{6}{4} = 1,5A$$

$$\frac{dP}{dt} = \Sigma F = mg - F_L = mg - BIl = 3 - 1,5 = 1,5kg\frac{m}{s^2}$$

Γ4

Όταν $v_{o\rho} = 12m/s \Rightarrow I_{o\rho} = \frac{Bv_{o\rho}l}{R_{\mathrm{K\Lambda}}+R_{1,\Sigma}} = 3A$

$$V_{\mathrm{K\Lambda}} = V_{\pi o\lambda} = I_{o\rho}R_{1,\Sigma} = 3 \cdot 2 = 6V$$

Άρα $V_{\mathrm{MN}} = V_{\mathrm{K\Lambda}} = 6V = V_{\Sigma} \Rightarrow$ κανονική λειτουργία

Δ1

$$\Sigma_{\tau(\Gamma)} = 0 \Rightarrow W\frac{l}{2}\sigma\upsilon\nu\varphi + N_B\frac{l}{2}\sigma\upsilon\nu\varphi = T_1\frac{l}{2}\eta\mu\varphi \Rightarrow$$

$$N_B\sigma\upsilon\nu\varphi = T_1\eta\mu\varphi - W\sigma\upsilon\nu\varphi \Rightarrow$$

$$0,6N_B = 10,5\cdot 0,8 - 10\cdot 0,6 \Rightarrow 0,6N_B = 8,4 - 6 \Rightarrow N_B = 4N$$

Δ2

$$I_{o\lambda} = I_\rho + I_{\sigma\varphi} = \frac{1}{12}M_\rho l^2 + m\left(\frac{l}{2}\right)^2 = \frac{1}{12}\cdot 3\cdot 4 + 1\cdot 1 = 2kg\cdot m^2$$

$$\Sigma_{\tau(\Gamma)} = I_{o\lambda}\alpha_{\gamma\omega\nu} \Rightarrow mg\frac{l}{2}\sigma\upsilon\nu\varphi = I_{o\lambda}\cdot\alpha_{\gamma\omega\nu} \Rightarrow$$

$$10\cdot 0,6 = 2\alpha_{\gamma\omega\nu} \Rightarrow \alpha_{\gamma\omega\nu} = 3rad/s^2$$

$$\frac{dL_\rho}{dt} = I_\rho\cdot\alpha_{\gamma\omega\nu} = 3kg\cdot m^2/s^2$$

Δ3

Γωνιακή ταχύτητα ω ωριακά πριν φτάσει στο οριζόντιο δάπεδο

$$E_{o\lambda(\alpha\rho\chi)} = E_{o\lambda(\tau\varepsilon\lambda)} \Rightarrow$$
$$mgl\eta\mu\varphi + M_\rho g\frac{l}{2}\eta\mu\varphi = 0 + M_\rho g\frac{l}{2}\eta\mu\varphi + \frac{1}{2}I_{o\lambda}\omega^2 \Rightarrow$$
$$10\cdot 2\cdot 0,8 = \frac{1}{2}2\omega^2 \Rightarrow \omega = 4rad/s$$
$$|\vec{L}_{\pi\rho\iota\nu}| = I_{o\lambda}|\vec{\omega}| = 2\cdot 4 = 8kg\cdot m^2/s$$
$$|\vec{L}_{\mu\varepsilon\tau}| = I_{o\lambda}|\vec{\omega}'| = 2\cdot 2 = 4kg\cdot m^2/s$$
$$\Delta\vec{L} = \vec{L}_{\mu\varepsilon\tau} - \vec{L}_{\pi\rho\iota\nu} \Rightarrow \Delta L = 4-(-8) = 12kg\cdot m^2/s$$

Δ4

Κύλιση χωρίς ολίσθηση

$$v_E = 0 \Rightarrow v_{cm} = \omega R \Rightarrow a_{cm} = a_{\gamma\omega\nu}$$

Μεταφορική

$$\Sigma F = F + T_{\sigma\tau} = M_T \cdot a_{cm}$$

Περιστροφική

$$\Sigma_{\tau(\mathrm{O})} = I_{\tau\rho} \cdot a_{\gamma\omega\nu} \Rightarrow F \cdot r - T_{\sigma\tau} R = \frac{1}{2} M_T R^2 \cdot a_{\gamma\omega\nu} \Rightarrow$$

$$F \frac{r}{R} - T_{\sigma\tau} = \frac{1}{2} M_T \cdot a_{cm}$$

$$F \left(1 + \frac{V}{R}\right) = \frac{3}{2} M_T \cdot a_{\gamma\omega\nu} \Rightarrow$$

$$F \left(1 + \frac{3}{4}\right) = \frac{3}{2} M_T \cdot a_{\gamma\omega\nu} \Rightarrow a_{\gamma\omega\nu} = \frac{7F}{6M_T} = 2m/s^2$$

Δ5

$\Delta x_{cm} = \frac{1}{2} a_{cm} t_1^2 = \frac{1}{2} \cdot 2 \cdot 4 = 4m$ Μετατόπιση άκρου νήματος:

$$\Delta x_z = \Delta x_{cm} + r \cdot \Delta\varphi = \Delta x_{cm} + r\frac{\Delta x_{cm}}{R} = \Delta x_{cm}\left(1 + \frac{r}{R}\right) = \frac{7}{4}\Delta x_{cm}$$

$$W_F = F \cdot \Delta x_z \cdot \sigma\upsilon\nu 0^\circ = 12 \cdot 7 = 84J$$