

Predmet: Fizika 1

Tip vežbi: Računske vežbe

Predmetni asistent: Violeta Stanković

Termin: Četrnaesti (14.6.2021)

1.

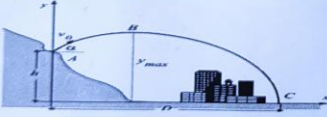
Ispit iz predmeta Fizika 1, Julski rok, 8.7.2016

1) Poznate su jednačine kretanja tačke u Dekartovom pravouglom koordinatnom sistemu: $x=2t$, $y=e^{2t}$, $z=2t$. U trenutku $t=0$, odrediti: (20%)
a) brzinu, b) tangencijalno i normalno ubrzanje c) poluprečnik krivine trajektorije

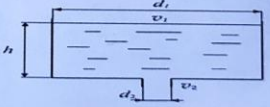
2) Telo, koje se može smatrati materijalnom tačkom, bačeno je kao kosi hitac sa neke visine, pod nekim početnim uglom. Ako je maksimalna visina tela tokom leta $h_{max}=287.5$ m, poluprečnik krivine trajektorije u tački maksimuma trajektorije $R_B=125$ m, poluprečnik krivine trajektorije u tački izbacivanja tela $R_A=1000$ m (njihov odnos $R_B/R_A=\cos^2\alpha$), a početna brzina $v_0=\sqrt{gR_A\cos\alpha}$, naći: (20%)
a) početni elevacioni ugao (α), b) početnu brzinu (v_0) kojom je telo izbačeno, c) visinu (h) sa koje je telo izbačeno
d) domet tela (D) mereno duž horizontale e) vreme leta τ

3) Na dnu cilindrične posude prečnika 0.4 m nalazi se kružni otvor prečnika 0.01 m. Odrediti brzinu opadanja nivoa vode u trenutku kada je visina stuba vode 0.3 m. (30%)

4) U sistemu sa slike tela imaju mase m_0 , m_1 i m_2 . U sistemu ne postoji trenje, a mase kotura i konca (niti) su zanemarljive. Naći ubrzanje tela mase m_1 . (30%)



Slika uz zadatak br. 2



Slika uz zadatak br. 3

2.

Yucnu pok, 8.7.2016

1) $\begin{cases} x = 2t \\ y = e^{2t} \\ z = 2t \end{cases} \Rightarrow \begin{cases} v_x = \dot{x} = 2 \\ v_y = \dot{y} = e^{2t} \cdot 2 \\ v_z = \dot{z} = 2 \end{cases} \left\{ \begin{aligned} |v| &= \sqrt{v_x^2 + v_y^2 + v_z^2} = \\ &= \sqrt{2^2 + (2e^{2t})^2 + 2^2} = \\ &= \sqrt{8 + 4e^{4t}} \end{aligned} \right.$

$t=0$:

$|v(t=0)| = 2\sqrt{3}$ - yuzna opzama

$\begin{cases} a_x = \ddot{x} = 0 \\ a_y = \ddot{y} = 4e^{2t} \\ a_z = \ddot{z} = 0 \end{cases} \left\{ \begin{aligned} t=0: \\ a = 4 \end{aligned} \right.$ - yuzna yopsame

$|a_t| = \frac{dv}{dt} = \frac{1 \cdot 4 \cdot 4e^{4t}}{2\sqrt{8+4e^{4t}}} = \frac{4e^{4t}}{\sqrt{2+e^{4t}}} \quad t=0 \quad \frac{4}{\sqrt{3}} = \frac{4\sqrt{3}}{3}$

$|a_n|_{t=0} = \sqrt{a^2 - a_t^2} = \sqrt{16 - \frac{16 \cdot 3}{9}} = \sqrt{\frac{48-16}{3}} = \frac{\sqrt{32}}{\sqrt{3}} = \frac{4\sqrt{2}}{\sqrt{3}}$

$R_{t=0} = \frac{|v|^2}{|a_n|} = \frac{12}{\frac{4\sqrt{2}}{\sqrt{3}}} = \frac{12\sqrt{3}}{4\sqrt{2}} = 3\sqrt{\frac{3}{2}}$

Konsultacije petkom na mejl violeta.stankovic@ff.bg.ac.rs u terminu od 12h do 14h.

3.

a) $\alpha = \arccos \sqrt[3]{\frac{R_B}{R_A}} = 60^\circ$

d) $V_0 = \sqrt{g R_A \cos \alpha} = 70,71 \text{ m/s}$

$\vec{w} \frac{d^2 \vec{z}}{dt^2} = -\mu \vec{g}$

$\frac{dz}{dt} = -gt + \vec{V}_0 \sin \alpha$

$z(t) = -\frac{gt^2}{2} + V_0 \sin \alpha t + C_2$

$\vec{w} \frac{d^2 \vec{x}}{dt^2} = 0$

$\frac{dx}{dt} = \vec{V}_0 \cos \alpha$

$x(t) = V_0 \cos \alpha t + C_4$

$\left. \frac{dz}{dt} \right|_{t=t'} = 0$

$-\frac{2gt'}{2} + V_0 \sin \alpha = 0$

$-gt' = -V_0 \sin \alpha$

$t' = \frac{V_0 \sin \alpha}{g}$

$z(t') = h_{\max} = -\frac{g}{2} \frac{V_0^2 \sin^2 \alpha}{g^2} + \frac{V_0^2 \sin^2 \alpha}{g} + h$

$h_{\max} = -\frac{V_0^2 \sin^2 \alpha}{2g} + \frac{V_0^2 \sin^2 \alpha}{g} + h$

$h_{\max} = h + \frac{V_0^2 \sin^2 \alpha}{2g}$

c) $h = h_{\max} - \frac{V_0^2 \sin^2 \alpha}{2g} = 100 \text{ m}$

$\textcircled{D} = V_0 \cos \alpha T = 484,80 \text{ m}$

c) $-\frac{gt^2}{2} + V_0 \sin \alpha t + h = 0$

$T_{1/2} = \frac{V_0 \sin \alpha \pm \sqrt{V_0^2 \sin^2 \alpha + 2gh}}{g}$

$T = 13,71 \text{ s}$

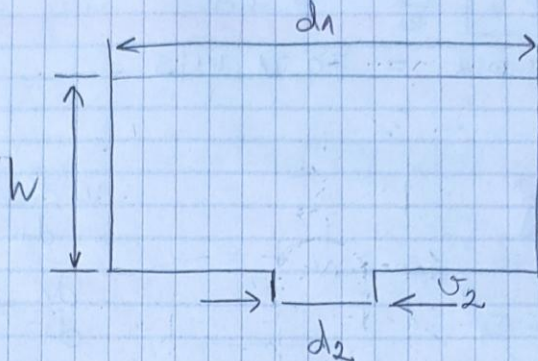
4.

3)

$$d_2 = 0,4 \text{ m}$$

$$d_1 = 0,01 \text{ m}$$

$$h = 0,3 \text{ m}$$

$$v_1 = ?$$


(1) $\rho \frac{v_1^2}{2} + \rho gh = \rho \frac{v_2^2}{2}$

(2) $v_2 S_2 = v_1 S_1 \Rightarrow v_2 = \frac{S_1}{S_2} v_1$

$$\frac{\rho}{2} v_1^2 - \frac{\rho}{2} \left(\frac{S_1}{S_2} \right)^2 v_1^2 = -\rho gh$$

$$\frac{\rho}{2} v_1^2 \left(1 - \left(\frac{S_1}{S_2} \right)^2 \right) = -\rho gh / (-1)$$

$$\rho gh = \frac{\rho}{2} v_1^2 \left(\left(\frac{S_1}{S_2} \right)^2 - 1 \right)$$

$$\frac{2\rho gh}{\rho} = v_1^2 \left(\left(\frac{S_1}{S_2} \right)^2 - 1 \right)$$

$$v_1^2 = \frac{2\rho gh}{\rho \left(\left(\frac{S_1}{S_2} \right)^2 - 1 \right)}$$

$$v_1 = \sqrt{\frac{2gh}{\frac{S_1^2}{S_2^2} - 1}} = \sqrt{\frac{2gh}{\frac{d_1^4}{d_2^4} - 1}} = d_2^2 \sqrt{\frac{2gh}{d_1^4 - d_2^4}} =$$

$$= 1,516 \cdot 10^{-3} \frac{\text{m}}{\text{s}}$$

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$$a'(m_1 + m_2) = m_1 g - T - m_1 a_0 + T - m_2 g + m_2 a_0$$

$$a'(m_1 + m_2) = g(m_1 - m_2) + a_0(m_2 - m_1) =$$

$$= g(m_1 - m_2) - a_0(m_1 - m_2)$$

$$\boxed{a'} = g \frac{(m_1 - m_2)}{m_1 + m_2} - \frac{a_0(m_1 - m_2)}{m_1 + m_2} =$$

$$= \left[g \frac{m_1 - m_2}{m_1 + m_2} - \frac{m_1 - m_2}{m_1 + m_2} \frac{2g}{2 + \frac{m_0}{2} \left(\frac{m_1 + m_2}{m_1 m_2} \right)} \right]$$

$$\boxed{a_1 = g \frac{m_1 - m_2}{m_1 + m_2} - \frac{2g}{2 + \frac{m_0}{2} \left(\frac{m_1 + m_2}{m_1 m_2} \right)} \left[\frac{m_1 - m_2}{m_1 + m_2} - 1 \right]}$$