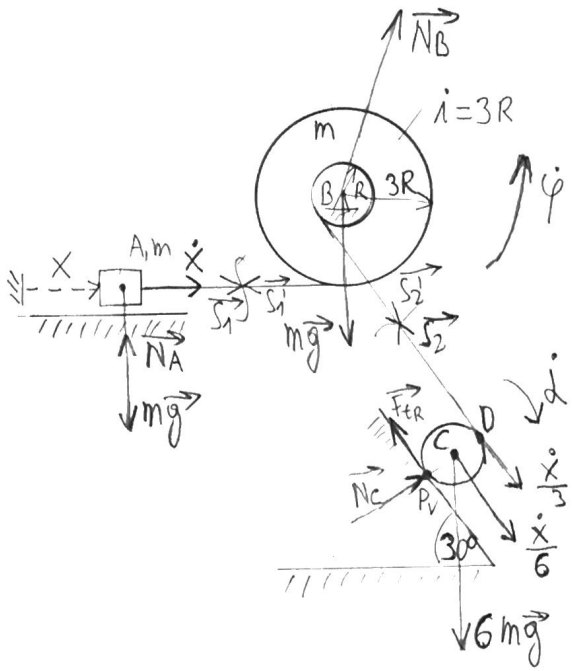
ВЛАДИМИР ИВКОВИЋ 151/18

Вежба 8



$\alpha = 30^\circ$

A: m

B: $m, R, 3R, i = 3R$

C: $R, 6m$

$\ddot{x} = ?$

$\dot{x} = 3R\dot{\varphi}$

$R\dot{\varphi} = \frac{\dot{x}}{3} \Rightarrow \boxed{\dot{\varphi} = \frac{\dot{x}}{3R}}$

$$\vec{v_D} = \vec{v_C} + \vec{v_D^C}$$

$$\Rightarrow \frac{\dot{x}}{3} = \frac{\dot{x}}{6} + R\dot{\alpha} \Rightarrow R\dot{\alpha} = \frac{1}{6}\dot{x} \Rightarrow \boxed{\dot{\alpha} = \frac{\dot{x}}{6R}}$$

ЛАГРАНЖ:

- тело „C" $\Rightarrow$ „равно кретање" $\Rightarrow T(C) = \frac{1}{2} m_C v_C^2 + \frac{1}{2} J_C \cdot \omega_C^2$ ($\omega_C = \dot{\alpha}$)

$$\Rightarrow T(C) = \frac{1}{2} 6m \cdot \left(\frac{\dot{x}}{6}\right)^2 + \frac{1}{2}\left(\frac{1}{2} 6m R^2\right) \cdot \left(\frac{\dot{x}}{6R}\right)^2$$

$$T(C) = \frac{1}{12} m\dot{x}^2 + \frac{1}{24} m\dot{x}^2 = \boxed{\frac{1}{8} m\dot{x}^2}$$

$$T(B) = \frac{1}{2} J_B \cdot \omega_B^2 = \frac{1}{2}(m \cdot gR^2) \cdot \left(\frac{\dot{x}}{3R}\right)^2 = \boxed{\frac{1}{2} m\dot{x}^2}$$

ротација

$$T(A) = \frac{1}{2} m_A \cdot v_A^2 = \boxed{\frac{1}{2} m\dot{x}^2}$$

транслација

$$\Rightarrow \boxed{T = T(A) + T(B) + T(C) = \frac{9}{8} m\dot{x}^2}$$

$$\delta A = 6 mg \cos 60^\circ \cdot \frac{\delta x}{6} = \frac{1}{2} mg \delta x$$

$$\Rightarrow \boxed{Q_x = \frac{1}{2} mg}$$

$$\frac{d}{dt}\frac{\partial T}{\partial \dot{x}} - \frac{\partial T}{\partial x}^{\nearrow 0} = Q_x$$

$$\frac{d}{dt}\left(\frac{9}{4} m \dot{x}\right) = \frac{1}{2} mg$$

$$\frac{9}{2\cancel{4}} m \ddot{x} = \frac{1}{2} mg \Rightarrow \boxed{\ddot{x} = \frac{2}{9} g}$$

Теорема о промени кинетичке енергије:

$\boxed{T = \frac{9}{8} m \dot{x}^2}$ – исто као и код Лагранжеве методе!

$$A = 6 mg \cdot \cos 60^\circ \cdot \frac{x}{6} = \frac{1}{2} mgx$$

$$T = \Sigma A^s \Rightarrow \frac{9}{8} m \dot{x}^2 = \frac{1}{2} mgx \Big/ \frac{d}{dt}$$

$$\frac{9}{4_2} m \dot{x} \ddot{x} = \frac{1}{2} mg \dot{x}$$

$$\Rightarrow \boxed{\ddot{x} = \frac{2}{9} g}$$

ВЕКТОРСКЕ ТЕОРЕМЕ:

тело „A": $\boxed{m \ddot{x} = S_1}$ (1)

тело „B": $(m \cdot 9R^2) \cdot \ddot{\varphi} = S_2 \cdot R - S_1 \cdot 3R$

$$9 m R^2 \cdot \frac{\ddot{x}}{3R} = S_2 \cdot R - S_1 \cdot 3R$$

$$\Rightarrow \boxed{3 m \ddot{x} = S_2 - 3 S_1} \quad (2)$$

↘

тело „C":

$$\cancel{6}m\frac{\ddot{x}}{\cancel{6}} = 6mg\cdot\cos 60° - S_2 - F_{tR}$$

$$\boxed{m\ddot{x} = 3mg - S_2 - F_{tR}} \quad (3)$$

$$\left(\frac{1}{2}6mR^2\right)\cdot\ddot{\alpha} = F_{tR}\cdot R - S_2\cdot R$$

$$3mR^2\cdot\frac{\ddot{x}}{6R} = F_{tR}\cdot R - S_2\cdot R$$

$$\boxed{\frac{1}{2}m\ddot{x} = F_{tR} - S_2} \quad (4)$$

$(3)+(4) \Rightarrow \frac{3}{2}m\ddot{x} = 3mg - 2S_2$

$\Rightarrow 2S_2 = 3mg - \frac{3}{2}m\ddot{x}$

$\Rightarrow S_2 = \frac{3}{2}mg - \frac{3}{4}m\ddot{x}$

$\Rightarrow (2) \Rightarrow 3m\ddot{x} = \frac{3}{2}mg - \frac{3}{4}m\ddot{x} - 3S_1$

$\Rightarrow S_1 = \frac{1}{2}mg - \frac{5}{4}m\ddot{x}$

$\Rightarrow (1) \Rightarrow m\ddot{x} = \frac{1}{2}mg - \frac{5}{4}m\ddot{x}$

$\Rightarrow \frac{9}{4}m\ddot{x} = \frac{1}{2}mg$

$\Rightarrow \boxed{\ddot{x} = \frac{2}{9}g}$

$\Rightarrow \boxed{S_1 = \frac{2}{9}mg}$

$$S_2 = 3m\cdot\frac{2}{9}g + 3\cdot\frac{2}{9}mg = \frac{2}{3}mg + \frac{2}{3}mg$$

$$\boxed{S_2 = \frac{4}{3}mg}$$