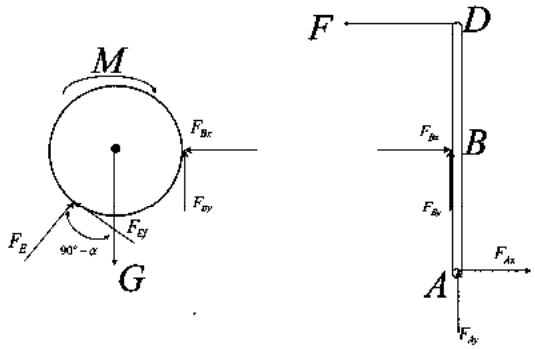
武汉科技大学

2007 年硕士研究生入学考试试题题解

1.解



杆： $\because F\times 2 = F_{Bx}\times 1$

$\therefore F_{Bx} = 2F$

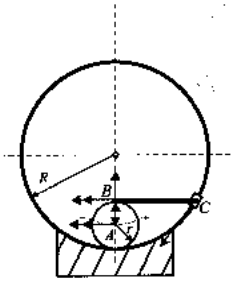
$\therefore F_{By} = f\times F_{Bx} = 0.3\times 2F = 0.6F$

圆柱： $\because M + G\cos\alpha - F_{Bx}r\sin\alpha - F_{By}r(1+\cos\alpha) = 0$

$\therefore M = -G\cos\alpha + F_{Bx}r\sin\alpha + F_{By}r(1+\cos\alpha)0$

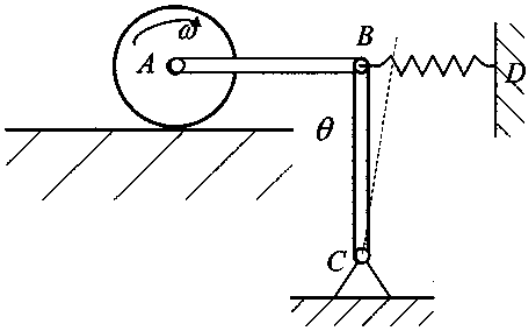
$\therefore M = -\sqrt{2}G/2 + \sqrt{2}Fr\sin\alpha + 0.6Fr(1+\sqrt{2}/2)$

2 解



第二题图

6 解



$$x = l\theta$$

$$T = \frac{1}{2}m\dot{x}^2 + \frac{1}{6}m\dot{x}^2 = \frac{11}{12}m\dot{x}^2$$

$$V = \frac{1}{2}kx^2 + \frac{1}{2}mgl(1-\cos\theta)$$

$$L = T + V = \frac{11}{12}m\dot{x}^2 + \frac{1}{2}kx^2 + \frac{1}{2}mgl(1-\cos\theta)$$

$$\frac{\partial L}{\partial \dot{x}} = \frac{11}{6}m\dot{x}, \frac{\partial L}{\partial x} = kx + \frac{1}{2}mgl\sin\theta$$

$$\therefore \frac{11}{6}m\ddot{x} = kx + \frac{1}{2}mgl\sin\theta \approx (k + \frac{1}{2}mg)x$$

$$x_1=\frac{l}{2};x_2=l$$

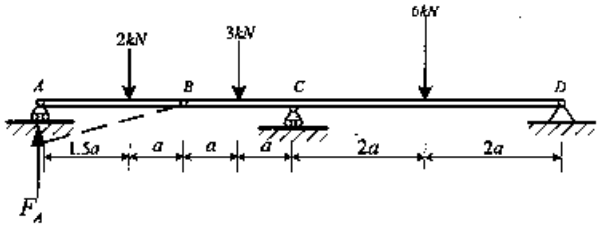
$$x_c=\frac{mx_1+2mx_2}{3m}=\frac{5}{6}l$$

$$a_c=\frac{5}{6}l\alpha=\frac{25}{36}g$$

$$F_{ox}=0$$

$$F_{oy}=3mg+3m\frac{25}{36}g=5.08mg$$

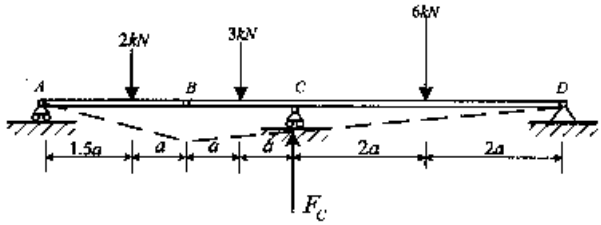
5 解



$$F_A\delta_A=2kN\delta_1$$

$$\frac{\delta_1}{\delta_A}=\frac{2}{5}$$

$$\therefore F_A=0.8kN$$



$$2kN\delta_1+3kN\delta_2+6kN\delta_3-F_C\delta_C=0$$

$$\frac{\delta_1}{\delta_B}=\frac{3}{5},\frac{\delta_2}{\delta_B}=\frac{5}{6},\frac{\delta_3}{\delta_B}=\frac{1}{3},\frac{\delta_C}{\delta_B}=\frac{2}{3}$$

$$\therefore F_C=2kN\frac{\delta_1}{\delta_C}+3kN\frac{\delta_2}{\delta_C}+6kN\frac{\delta_3}{\delta_C}=6.675kN$$

$$v_A = r\omega, J = mr^2,$$

$$x_B = x_A + r\sin\theta, y_B = r\cos\theta,$$

$$T = \frac{1}{2}mv_A^2 + \frac{1}{2}J\omega^2 + \frac{1}{2}mv_B^2 = mr^2\omega^2(2+\cos\theta)$$

$$V = mgr(1-\cos\theta)$$

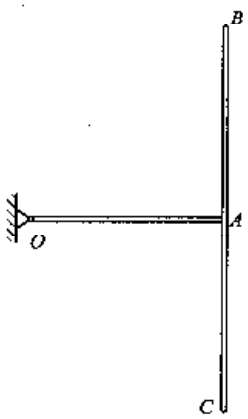
$$\therefore \omega^2(2+\cos\theta) = \frac{g}{r}(1-\cos\theta)$$

$\theta = 90^\circ$ 时 $\omega^2 = \frac{g}{2r}$; $\omega = \sqrt{\frac{g}{2r}}$;

$$2\alpha(2+\cos\theta) - \omega^2\sin\theta = \frac{g}{r}\sin\theta;$$

$\theta = 90^\circ$ 时 $\alpha = \frac{3g}{8r}$;

4 解



$$J\alpha = mg\frac{l}{2} + 2mgl = \frac{5}{2}mgl$$

$$J = J_1 + J_2 = \frac{1}{3}ml^2 + \frac{2}{3}ml^2 + 2ml^2 = 3ml^2$$

$$3ml^2\alpha = \frac{5}{2}mgl$$

$$\alpha = \frac{5}{6}\frac{g}{l}$$

已知： $r=0.6m, R=2.4m,$

$$v_A=\frac{ds}{dt}=0.6e^{t-1}$$

$t=1$ 时 $v_A=0.6e^0=0.6m/s$

$$\omega=\frac{v_A}{r}=1rad/s$$

$$v_B=\omega\times 2r=1.2m/s$$

$$v_B=v_C\cos 60^o$$

$$v_C=2v_B=2.4m/s$$

$$\omega_{BC}=v_B/2r=1rad/s$$

$$a_{An}=v_A^{\ 2}/r=0.6rad/s^2$$

$$a_{At}=\frac{d^2s}{dt^2}=0.6e^{t-1}=0.6m/s^2$$

$$\alpha=a_{At}/r=\frac{d^2s}{dt^2}/r=0.6e^{t-1}=1radm/s^2$$

$$\vec{a}_{Bn}+\vec{a}_{Bt}=\vec{a}_{An}+\vec{a}_{At}+\vec{a}_{BAn}+\vec{a}_{BAt}$$

$$a_{Bn}=a_{An}-a_{BAn}=0.6-1^2\times 0.6=0$$

$$a_{Bt}=a_{At}+a_{BAt}=0.6+1\times 0.6=1.2m/s^2$$

3 解