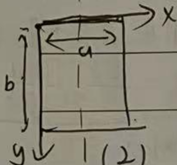
175. 4-5

$J_c = \frac{1}{4}ma^2$, $md^2 = ma^2$ $\therefore$ $J = \cancel{\frac{5}{4}ma^2}\ \frac{5}{4}ma^2$

176. 4-7

(1) $\rho = \frac{m}{ab}$. $J_c = \int \frac{1}{12}a^2 dm$. $dm = \rho \cdot a\,dx$.



$= \int_0^b \frac{1}{12}a^2 \rho a\,dx = \frac{1}{12}ma^2$

$J = J_c + m(\frac{a}{2})^2 = \frac{1}{3}ma^2$

(2) $F = -kSv^2$ $\quad F(x,y) = -k\,x^2\omega^2 d\sigma$

以(0,0)参考, $M = \sum\sqrt{x^2+y^2} \cdot F(x,y) = J\beta = J \cdot \frac{d\omega}{dt}$.

$\Rightarrow -k\omega^2 \iint_D \sqrt{x^2+y^2}\,x^2 d\sigma = J\frac{d\omega}{dt}$ 记 $\iint_D \sqrt{x^2+y^2}\,x^2 d\sigma = D$

$\Rightarrow \frac{kD}{J}t + C = \frac{1}{\omega}$ $t=0$时 $\omega = \omega_0$

$\therefore \frac{1}{\omega} = \frac{1}{\omega_0} + \frac{kD}{J}t$ $\therefore \omega = \frac{\omega_0}{2}$时 $t = \frac{4m}{3ka^2b\omega_0}$.

176. 4-9

(1) $J_c = \frac{1}{12}mL^2$, $J = J_c + m(\frac{L}{4})^2 = \frac{7}{48}mL^2$

(2) $\vec{L}_0 = \vec{L}_{0c} + \vec{L}_i'$, $\vec{L}_i' = 0$

$|\vec{L}_{0c}| = \frac{1}{4}L \times mv = \frac{1}{4}mvL$ $\therefore \vec{L}_0 = \frac{1}{4}mvL \cdot (-\vec{k})$

(3) 撞后系统相对O的角动量没有变化.

$\therefore$ 左边有 $\vec{L} = \sum \frac{dx}{L} \cdot m\omega x = \int_0^{\frac{3L}{4}} \frac{1}{L} m\omega x^2 dx$.

右边有 $\vec{L}' = \int_0^{\frac{L}{4}} \frac{1}{L} m\omega x^2 dx$. $\quad \vec{L} + \vec{L}' = \vec{L}_0$

$\Rightarrow \omega = \frac{12}{7}\frac{v}{L}$

或 $\cancel{\omega = J_0}$ $|\vec{L}| = J_0 \cdot \omega \Rightarrow \omega = \frac{12}{7}\frac{v}{L}$

176. 4-10

(1) $J = J_{盘} + J_{子弹}$, $J_{盘} = \frac{1}{2}MR^2$, $J_{子弹} = mR^2$

$L_0 = m \cdot RV = mVR = (\frac{1}{2}MR^2 + mR^2)\omega_0 \Rightarrow \omega_0 = \cancel{\frac{2mV}{MR+mR}}\ \frac{2mV}{MR+2mR}$

(2) $M = J\beta$. $\cancel{M = \iint f\,dr\,d\theta}$. $\cancel{f = (M+m)g\mu}$

$M = \int_0^R r\,df$, $df = \mu g \frac{M}{\pi R^2} \cdot 2\pi r\,dr$.

$\therefore M = \int_0^R 2r^2 \mu g \frac{M}{R^2} dr = \frac{2}{3}\mu M g R = J \cdot \beta$

$\Rightarrow \beta = \frac{4\mu M g}{3(M+2m)R}$ $\therefore t = \frac{\omega_0}{\beta} = \frac{3mV}{2\mu M g}$

176. 4-11

$J = \frac{1}{2}mR^2 + qtr^2$

$M = \frac{dL}{dt} = \frac{dJ\omega}{dt} = \omega\frac{dJ}{dt} + J\frac{d\omega}{dt} = \omega q r^2 + (\frac{1}{2}mR^2 + qtr^2)\frac{d\omega}{dt}$.

$\Rightarrow$

$\frac{1}{2}mR^2 + qr^2 t = \frac{C}{M - \omega q r^2} \Rightarrow \frac{1}{2}mR^2 + qr^2 t = \frac{\frac{1}{2}mR^2 M}{M - \omega q r^2}$

$t = \frac{m_0}{q}$ 时. $\omega = \frac{2M}{q(R^2+2r^2)}$.

177. 4-14

(1) $J = \frac{1}{2}mR^2$ $L_{B0} = J\omega = \frac{1}{2}mR^2\omega_0$

$mV_A \cdot R + \frac{1}{2}mR^2 \frac{V_A}{R} = \frac{1}{2}mR^2\omega_0 \Rightarrow V_A = \frac{1}{3}R\omega_0$.

(2) $\begin{cases} -F_T + mg\mu = ma \\ F_T R = J\beta \\ \beta \cdot R = a \end{cases} \Rightarrow F = \frac{1}{3}mg\mu$