$\boxed{6/193}$ $\Delta H = 0;$

Initial: $H_{rods} = 2I\omega = 2(1.5)(0.060)^2 \frac{300 \times 2\pi}{60}$ N·m·s

$H_{base} = mk^2\omega = 4(0.040)^2 \frac{300 \times 2\pi}{60}$ N·m·s

Final: $H_{rods} = 2[\bar{I} + md^2]\omega = 2m\left[\frac{\ell^2}{12} + d^2\right]\frac{2\pi N}{60}$

$= 2(1.5)\left[\frac{0.3^2}{12} + (0.150 + 0.060)^2\right]\frac{2\pi N}{60}$

$= 0.1548\left(\frac{2\pi N}{60}\right)$ N·m·s

$H_{base} = 4(0.040)^2 \frac{2\pi N}{60} = 0.0064\left(\frac{2\pi N}{60}\right)$

Thus $[3(0.06)^2 + 4(0.04)^2]300 = [0.1548 + 0.0064]N$

$0.0172(300) = 0.1612\,N$, $\underline{N = 32.0 \text{ rev/min}}$

6/209 Max. power occurs when dV_g/dt is greatest, which occurs when $\bar{v}_y$ is max. at the start.

$$\bar{v}_y = 1.500\,\omega = 1.500\,\frac{4\pi}{180} = 0.1047 \text{ m/s}$$

$$P = mg\bar{v}_y = 1600(5)\,9.81(0.1047) = 8218 \text{ W}$$

or $\underline{P = 8.22 \text{ kW}}$

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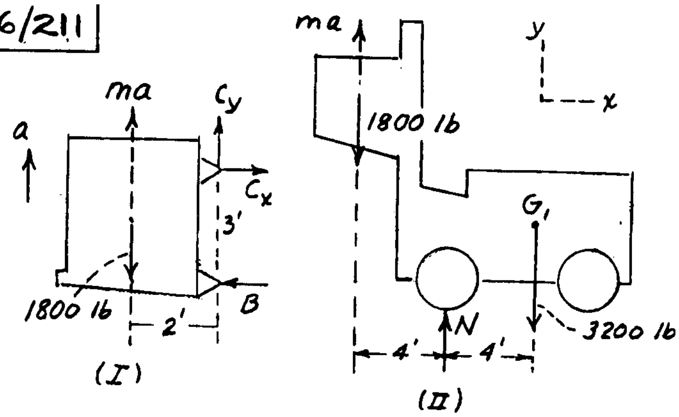
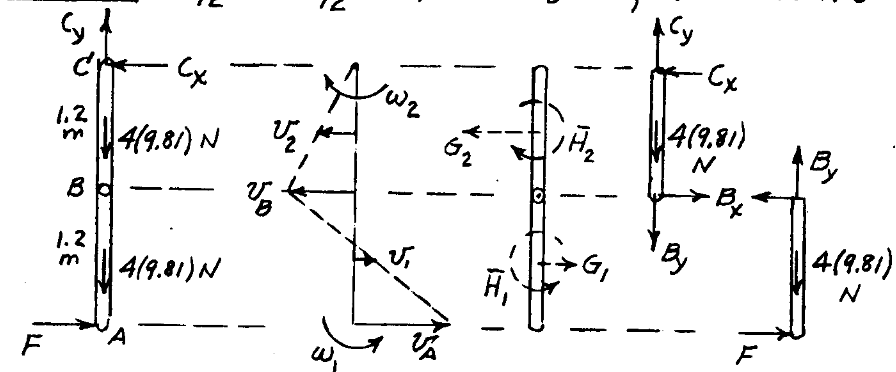


(II) $\Sigma M_N = m\bar{a}d$; $3200(4) - 1800(4) = \frac{1800}{32.2} a(4)$, $a = 25.04$ ft/sec^2

(I) $\Sigma M_C = m\bar{a}d$; $3B - 2(1800) = \frac{1800}{32.2}(25.04)(2)$

$\underline{B = 2130 \text{ lb}}$

▶6/219 $\bar{I} = \frac{1}{12}ml^2 = \frac{1}{12}4(1.2)^2 = 0.48\ \text{kg}\cdot\text{m}^2$; $\int F\,dt = 14\ \text{N}\cdot\text{s}$



$\omega_2 = v_2/0.6$, $\omega_1 = (v_1 + 2v_2)/0.6$, $m = 4$ kg

System: $\int \Sigma M_C\,dt = \Sigma \Delta H_C$; $14(2.4) = 4v_1(1.8) + 0.48\omega_1 - 4v_2(0.6) - 0.48\omega_2$ (a)

AB: $\int \Sigma M_C\,dt = \Delta H_C$; $14(2.4) - \int 1.2B_x\,dt = 4v_1(1.8) + 0.48\omega_1$ (b)

$\int \Sigma F_x\,dt = \Delta G_x$; $14 - \int B_x\,dt = 4v_1$ (c)

(b) & (c) & ω_1 give $2v_1 + v_2 = 10.5$; (a), ω_1, ω_2 give $5v_1 - v_2 = 21$

Combine & get $v_1 = 4.5$ m/s, $v_2 = 1.5$ m/s

& $\underline{\omega_2 = 2.50\ \text{rad/s}}$

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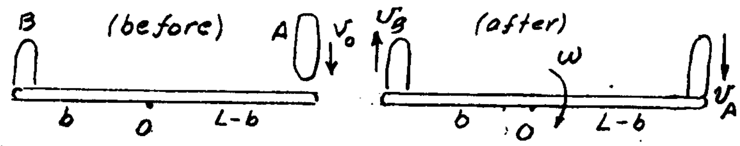

Before: $H_O = m_A v_0 (L-b)$

After: $H_O = m_A v_A (L-b) + m_B v_B b$

$\Delta H_O = 0$ along with $\omega = v_B/b = v_A/(L-b)$ give

$$m_A v_0 (L-b) = m_A \frac{L-b}{b} v_B (L-b) + m_B v_B b$$

$$v_B = v_0 \frac{1}{\frac{L-b}{b} + n\frac{b}{L-b}} \quad \text{where } n = m_B/m_A$$

$$\frac{dv_B}{db} = v_0 \frac{-\left(\frac{L}{b^2} + n\frac{L-b-b(-1)}{(L-b)^2}\right)}{\left(\frac{L-b}{b} + n\frac{b}{L-b}\right)^2} = v_0 \frac{L\left(\frac{1}{b^2} - \frac{n}{(L-b)^2}\right)}{\left(\frac{L-b}{b} + n\frac{b}{L-b}\right)^2} = 0 \text{ for } v_{B_{max}}$$

So $\frac{1}{b^2} = \frac{n}{(L-b)^2}$, $b = \frac{L}{1 \pm \sqrt{n}}$ (+ sign gives positive v_B)

Thus $\underline{b = \frac{L}{1+\sqrt{n}}}$ which gives $v_B = \frac{v_0}{2\sqrt{n}}$

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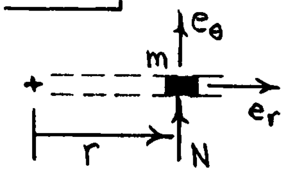

Conservation of angular momentum: $I_o\omega_o = (I_o + mr^2)\omega$

$$\dot\theta = \omega = \frac{I_o\omega_o}{I_o + mr^2}$$

$$\Sigma F_r = ma_r = m(\ddot r - r\dot\theta^2): \quad 0 = m(\ddot r - r\dot\theta^2)$$

$$\ddot r = \dot r\frac{d\dot r}{dr} = r\left(\frac{I_o\omega_o}{I_o + mr^2}\right)^2$$

$$\int_0^{\dot r}\dot r\,d\dot r = I_o^2\omega_o^2\int_0^r\frac{r\,dr}{(I_o + mr^2)^2}$$

Integrating and solving for $\dot r$:

$$\dot r = \left(\frac{I_o\omega_o^2 r^2}{I_o + mr^2}\right)^{1/2} = \underline{\omega_o r\sqrt{\frac{I_o}{I_o + mr^2}}}$$