

Ex 10-10
p 326

$$\Delta \vec{L}_{\text{tot}} = 0$$

$$\vec{L}_{\text{tot},f} = \vec{L}_{\text{tot},i}$$

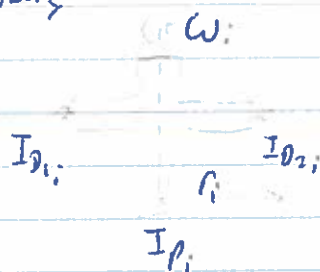
Rotate about fixed axis:

$$L_{\text{tot},f} = L_{\text{tot},i}$$

$$L = I\omega$$

$$I_f \omega_f = I_i \omega_i$$

Initially



Finally



Rot. inaction

Initially: Professor: $I_{p,i} = 3 \text{ kg m}^2$ (constant)
Dumbbells: $I_{D1,i} = I_{D2,i} = m r_i^2$

Finally: Professor: $I_{p,f} = 2.2 \text{ kg m}^2$ (4 arms @ stem)
Dumbbells: $I_{D1,f} = I_{D2,f} = m r_f^2$

$$\therefore I_i = I_{p,i} + I_{D1,i} + I_{D2,i} = I_{p,i} + 2m r_i^2$$

$$I_f = I_{p,f} + I_{D1,f} + I_{D2,f} = I_{p,f} + 2m r_f^2$$

Find ω_f :

$$\omega_f = \omega_i \left(\frac{I_{p,i} + 2m r_i^2}{I_{p,f} + 2m r_f^2} \right)$$

$$T_i = 2s \quad f_i = \frac{1}{T_i} = 0.5 \text{ rev/s} = 0.5 \text{ Hz}$$

$$\text{As } \omega = 2\pi f \text{ (rev/s)}$$

$$f_f = f_i \left(\frac{I_{P_i} + 2mr_i^2}{I_{P_f} + 2mr_f^2} \right)$$

$$f_f = (0.5 \text{ Hz}) \left(\frac{349 \text{ kg}\cdot\text{m}^2 + 2(5.049)(1.0\text{m})^2}{2.249 \text{ kg}\cdot\text{m}^2 + 2(5.049)(0.20\text{m})^2} \right)$$

$$f_f = 2.5 \text{ Hz}$$

$$\omega_f = 2\pi f_f = 2\pi (2.5 \text{ Hz})$$

$$\underline{\omega_f = 5\pi \text{ rad/s} = 15.7 \text{ rad/s}}$$