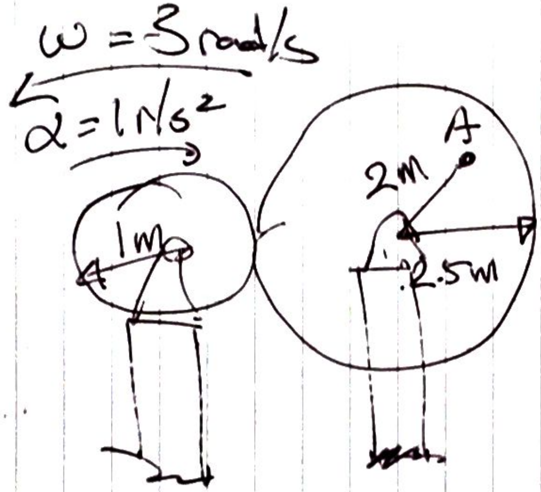
Bruce Emerson   Sample Prob / HW   ENGR 212

Given:



Req'd $\bar{v}_A$ & $\bar{a}_A$

Assump: no slip etc

Strategy match linear velocity & acceleration @ the edge!

Estimate large disc is 2.5× as large $\Rightarrow \omega_L = \frac{\omega_s}{2.5} \cong 1 \frac{rad}{s}$

$\alpha_L = \frac{\alpha_s}{2.5} = .3\ rad/s^2$ V_A is close to edge so I expect it to be approx the same as small edge

$\Rightarrow V_s = r\omega = 3\ m/s \cong V_A$ (tangential)

acceleration will have both a_θ & a_r (or a_n & a_t)

$|a_r| = \frac{V^2}{r} \cong \frac{3^2}{2.5} = 3\ m/s^2$

1 SQUARE =

13

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Soln: call left obj small (s) right object large (L)

$$v_{s_{edge}} = v_{L_{edge}}$$

$$r_s \omega_s = r_L \omega_L$$

$$\omega_L = \frac{r_s}{R_L}\omega_s = \frac{1\,m}{2.5\,m} 3\,rad/s = 1.2\,rad/s$$

$$\boxed{\omega_L = 1.2\,rad/s}$$

$$\bar{v}_{P_A} = +r\omega\hat{e}_\theta = 2m \cdot 1.2\,rad/s\,\hat{e}_\theta$$

$$\boxed{\bar{v}_{P_A} = 2.4\,m/s\,\hat{e}_\theta}$$

$$\alpha_{s_{edge}} = a_{L_{edge}}$$

$$r_s\alpha_s = r_L\alpha_L$$

$$\frac{r_s}{R_L}\alpha_s = \alpha_L = \frac{1\,m}{2.5\,m} 1\,rad/s^2$$

$$\alpha_L = .4\,rad/s^2$$

$$\bar{a}_{P_A} = -r\omega^2\hat{e}_r + r\alpha\hat{e}_\theta$$

$$= -2m(1.2\,rad/s)^2\hat{e}_r + 2m(.4\,rad/s^2)\hat{e}_\theta$$

$$\boxed{\bar{a}_{P_A} = -2.88\,m/s^2\,\hat{e}_r + .8\,\frac{m}{s^2}\hat{e}_\theta}$$

$$|\bar{a}|_{P_A} = \sqrt{2.88^2 + .8^2} = \underline{2.99\,m/s^2}$$

Discussion! Fits nicely w/ estimate! small errors due to round off but feels secure!