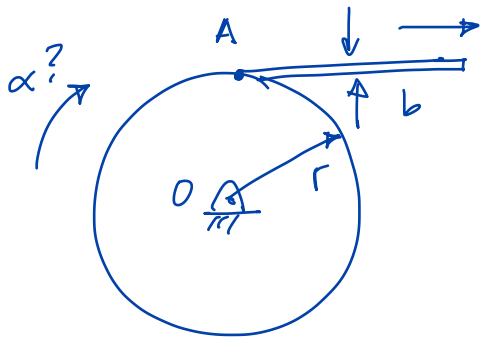
UBC-DYN-18-004



$$\vec{a}_A = \vec{a}_O^{\,0} + \vec{\alpha} \times \vec{r}_{A/O} - \omega^2 \vec{r}_{A/O}$$

$$v = \omega r \qquad \omega = \frac{v}{r}$$

$$\frac{dr}{d\theta} = \frac{b}{2\pi} \qquad \frac{d\theta}{dt} = \omega \qquad \frac{d\omega}{dt} = \alpha$$

$$\frac{dv}{dt} = 0 = \frac{d\omega}{dt} \cdot r + \omega \cdot \frac{dr}{dt} \qquad \omega = \frac{d\theta}{dt}$$

$$0 = \alpha \cdot r + \frac{d\theta}{dt} \cdot \frac{dr}{dt}$$

$$0 = \alpha \cdot r + \frac{d\theta^2}{d^2t} \cdot \frac{dr}{d\theta}$$

$$0 = \alpha \cdot r + \omega^2 \frac{b}{2\pi} \qquad \omega = \frac{v}{r}$$

$$\alpha \cdot r = -\frac{\omega^2 b}{2\pi}$$

$$\alpha = -\frac{\omega^2 b}{2\pi r} = \frac{-v^2}{r^2} \frac{b}{2\pi r}$$

$$= \frac{-v^2}{r^3} \frac{b}{2\pi}$$

$v = 64\ cm/s$

$= 0.64\ m/s$

$b = 0.001\ m$

$r = 1\ m$

$$= -\frac{(0.64)^2}{1m^3} \frac{(0.001)}{2\pi}$$

$$= 6.52 \times 10^{-5}\ rad/s^2$$

(helping student)

$$\omega = \frac{v}{r}$$

$$\frac{d\omega}{dt} = \frac{dv}{dt}\cdot\frac{1}{r} - v\cdot\frac{1}{r^2}\frac{dr}{dt}$$

($\frac{dv}{dt} = 0$)

$$v = \omega r$$

$$\frac{d\omega}{dt} = -\frac{\omega r}{r^2}\frac{dr}{dt}$$

$$= -\frac{\omega}{r}\cdot\frac{dr}{d\theta}\cdot\underbrace{\frac{d\theta}{dt}}_{\omega}$$

$$\frac{d\omega}{dt} = -\frac{\omega^2}{r}\cdot\frac{dr}{d\theta}$$

$$= \frac{-\omega^2}{r}\cdot\frac{b}{2\pi} \qquad \omega^2 = \frac{v^2}{r^2}$$

$$= -\frac{v^2}{r^3}\cdot\frac{b}{2\pi}$$