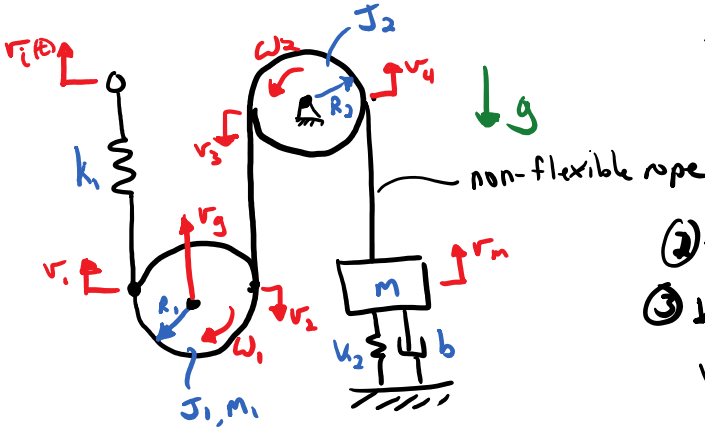
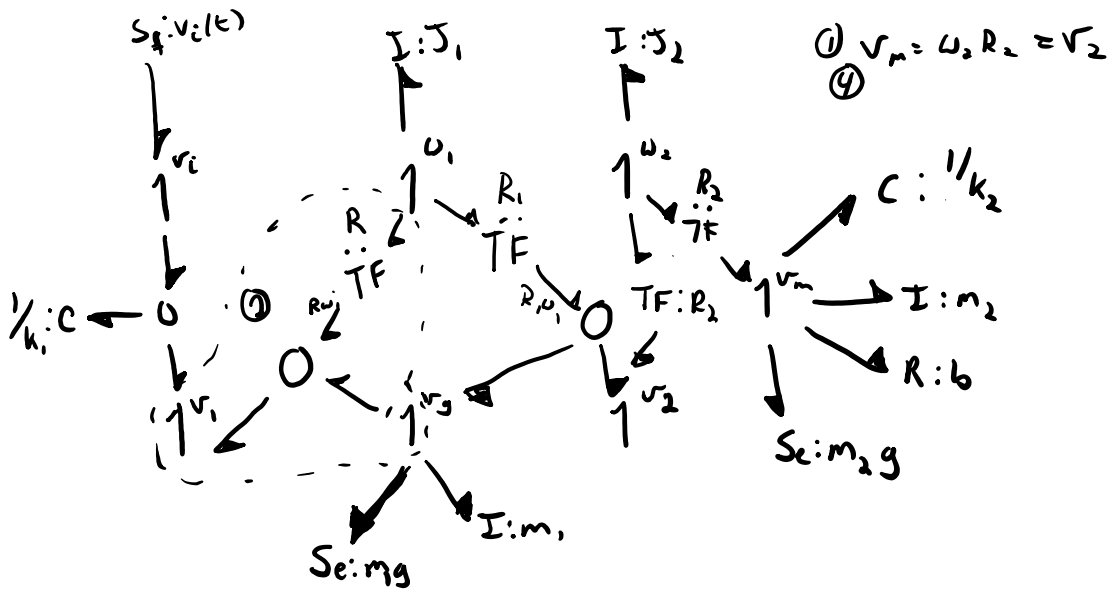


Exercise

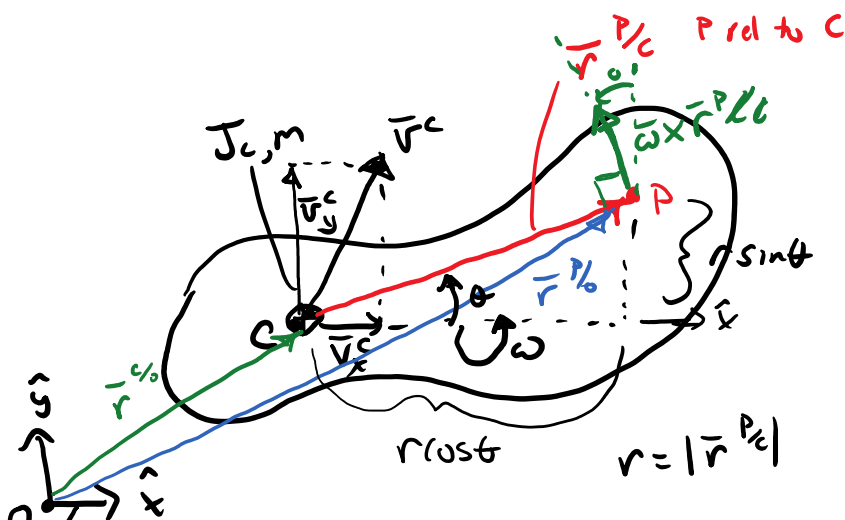
$$\mathbf{r}_p = \mathbf{v}_g + \omega \times \mathbf{r}$$



- ① $v_m = \omega_2 R_2$
- $\omega_2 R_2 = \dot{v}_4 = v_3$
- $v_4 = v_m$
- $v_3 = v_2$
- ② $v_1 = v_g + R_1 \omega_1$
- ③ $v_2 = -v_g + R_1 \omega_1$
- $v_g = R_1 \omega_1 - v_2$
- $v_g - R_1 \omega_1 + v_2 = 0$

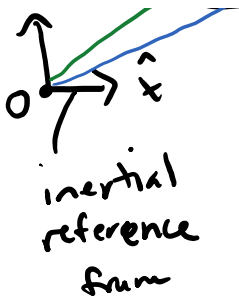


Planar Motion of Rigid Body



3 velocities need to be tracked for each rigid body

- | | | |
|-------|-------|--------|
| I: m | I: m | I: J_C |
| ↑ | ↑ | ↑ |
| ↑ v_x | ↑ v_y | ↑ ω |



$$r \cos \theta \quad r = |\vec{r}^{P/C}| \quad 1^{rx} \quad 1^{ry} \quad 1^{\omega}$$

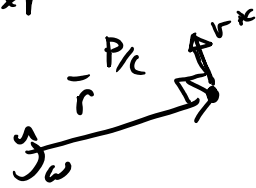
If \vec{v}^C and $\vec{\omega}$ are known then:

$$\vec{v}^P = \vec{v}^C + \vec{\omega} \times \vec{r}^{P/C}$$

holds for any two points fixed on a rigid body

$$\vec{v}^P = \frac{d\vec{r}^{P/O}}{dt} = \frac{d\vec{r}^{C/O}}{dt} + \frac{d\vec{r}^{P/C}}{dt} = \vec{v}^C + \vec{\omega} \times \vec{r}^{P/C}$$

$$\vec{r}^{P/O} = \vec{r}^{C/O} + \vec{r}^{P/C}$$

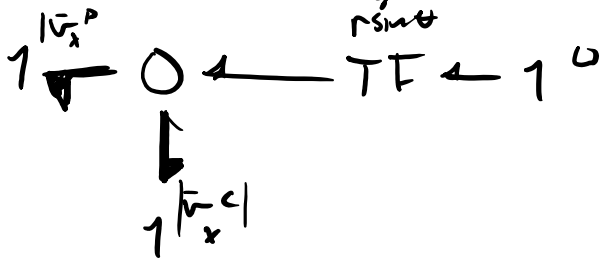
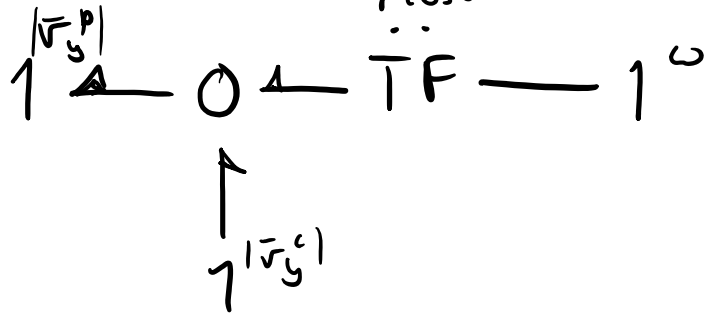


$$\vec{v}_x^P = \vec{v}_x^C - \omega r \sin \theta$$

$$\vec{v}_y^P = \vec{v}_y^C + \omega r \cos \theta$$

$$r = |\vec{r}^{P/C}|$$

θ
modulated transform



If θ is small, e.g. $-30^\circ \leq \theta \leq 30^\circ$

small angle assumptions

$$\sin \theta \approx \theta$$

$$\cos \theta \approx 1$$

$$\vec{v}_x^P \approx \vec{v}_x^C - \omega r \theta$$

$$\vec{v}_y^P = \vec{v}_y^C + \omega r$$

if $|\vec{v}_x^C| \ll \omega r \theta$

then

$$\vec{v}_x^P = \vec{v}_x^C$$

$$\vec{v}_y^P = \vec{v}_y^C + \omega r$$

if $|\bar{v}_x| \ll \omega r$

then

$$\bar{v}_x^p = \bar{v}_x^c$$

$$\bar{v}_y^p = \bar{v}_y^c + \omega r$$

p