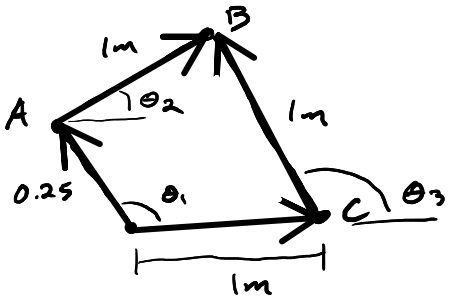


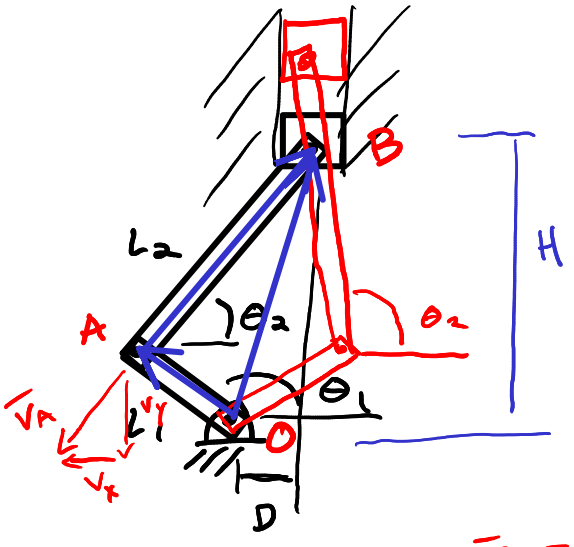

$$\bar{r}_A + \bar{r}_{B/A} = \bar{r}_C + \bar{r}_{B/C}$$

$$x \rightarrow L_1\cos\theta_1 + L_2\cos\theta_2 = L_3\cos\theta_3 + 1$$

$$y \rightarrow L_1\sin\theta_1 + L_2\sin\theta_2 = L_3\sin\theta_3$$

$$V_x \rightarrow L_1\dot{\theta}_1\sin\theta + L_2\dot{\theta}_2\sin\theta_2 = L_3\dot{\theta}_3\sin\theta_3$$

$$V_y \rightarrow L_1\dot{\theta}_1\cos\theta_1 + L_2\dot{\theta}_2\cos\theta_2 = L_3\dot{\theta}_3\cos\theta_3$$




$$|\bar{v}_A| = L_1\dot{\theta}_1$$

$$\bar{r}_A = L_1(\cos\theta_1\,\hat{i} + \sin\theta_1\,\hat{j})$$

$$\bar{v}_A = L_1\dot{\theta}_1(-\sin\theta_1\,\hat{i} + \cos\theta_1\,\hat{j})$$

$$\bar{r}_A = \bar{r}_A(t) = L_1(\cos(\theta_1(t))\,\hat{i} + \sin(\theta_1(t))\,\hat{j})$$

$$\frac{d}{dt}(\bar{r}_A(t)) = \bar{v}_A(t) = \frac{d}{d\theta_1}(\bar{r}_A(t)) \cdot \frac{d\theta_1}{dt}$$

$$\bar{r}_A + \bar{r}_{D/A} = \bar{r}_B$$

$$L_1\cos\theta_1\,\hat{i} + L_1\sin\theta_1\,\hat{j} + L_2\cos\theta_2\,\hat{i} + L_2\sin\theta_2\,\hat{j} = D\,\hat{i} + H\,\hat{j}$$

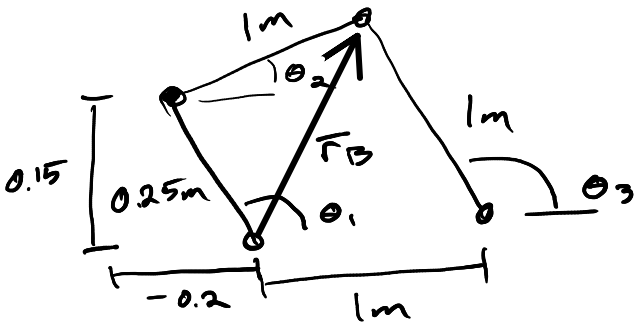
$x \rightarrow L_1\cos\theta_1 + L_2\cos\theta_2 = D \rightarrow$ given $\theta_1 \rightarrow \cos\theta_1 = \frac{D - L_2\cos\theta_2}{L_1}$

$y \rightarrow L_1\sin\theta_1 + L_2\sin\theta_2 = H$

$v_x \rightarrow L_1\dot{\theta}_1\sin\theta_1 + L_2\dot{\theta}_2\sin\theta_2 = 0 \rightarrow \frac{\dot{\theta}_1}{\dot{\theta}_2} = \frac{L_2\sin\theta_2}{L_1\sin\theta_1}$

$v_y \rightarrow L_1\dot{\theta}_1\cos\theta_1 + L_2\dot{\theta}_2\cos\theta_2 = V_B$

## Back to our Program




$\bar{r}_O = \bar{0}$

$\bar{r}_A = -0.2\hat{i} + 0.15\hat{j}$ m

$\bar{r}_B = 0.49\hat{i} + 0.86\hat{j}$ m

$\bar{r}_C = 1\hat{i} + 0\hat{j}$ m

$\dot{\theta}_1 = 10\ rad/s$

$\theta_1 \Rightarrow \cos\theta_1 = \frac{-0.2}{0.25}$ $\sin\theta_1 = \frac{0.15}{0.25}$

$\theta_2 \Rightarrow \cos\theta_2 = \frac{0.49+0.2}{1}$ $\sin\theta_2 = \frac{0.86-0.15}{1}$

$\theta_3 =$ $\cos\theta_3 = \frac{0.49-1m}{1}$ $\sin\theta_2 = \frac{0.86-0}{1}$

$v_x \rightarrow 0.25\cdot 10\left(\frac{0.15}{0.25}\right) + 1\,\dot{\theta}_2\left(\frac{0.86-0.15}{1}\right) = 1\,\dot{\theta}_3\left(\frac{0.86}{1}\right)$

$v_y \rightarrow 0.25\cdot 10\left(\frac{-0.2}{0.25}\right) + 1\,\dot{\theta}_2\left(\frac{0.49+0.2}{1}\right) = 1\,\dot{\theta}_3\left(\frac{0.49-1}{1}\right)$

$$\begin{bmatrix} 10\cdot(0.15) \\ 10\cdot(-0.2) \end{bmatrix} = \begin{bmatrix} (0.86-0.15) & 0.86 \\ -(0.49+0.2) & 0.49-1 \end{bmatrix} \begin{bmatrix} \dot{\theta}_2 \\ \dot{\theta}_3 \end{bmatrix}$$