

Problem Set 2 Solutions 11-02-11

1

$$\theta = \pi t / 4$$

$$r = t^2 + 2$$

$$t=1, \theta(1)=\pi/4, r(1)=3$$

$$t=2, \theta(2)=\pi/2, r(2)=6$$

in frame XY

$$\vec{r}(1) = r(1) \begin{bmatrix} \cos \theta(1) \\ \sin \theta(1) \end{bmatrix} = \begin{bmatrix} \frac{3\sqrt{2}}{2} \\ \frac{3\sqrt{2}}{2} \end{bmatrix}$$

$$\vec{r}(2) = r(2) \begin{bmatrix} \cos \theta(2) \\ \sin \theta(2) \end{bmatrix} = \begin{bmatrix} 0 \\ 6 \end{bmatrix}$$

$$\vec{r}(2) - \vec{r}(1) = \begin{bmatrix} -\frac{3\sqrt{2}}{2} \\ 6 - \frac{3\sqrt{2}}{2} \end{bmatrix}$$

in frame $X'Y'$

$$\vec{r}(2) - \vec{r}(1) = \begin{bmatrix} 6 \\ 0 \end{bmatrix} - \begin{bmatrix} 3 \\ 0 \end{bmatrix} = \begin{bmatrix} 3 \\ 0 \end{bmatrix}$$

2

$$|h| = |AB| \sin \theta = |OA| \sin \varphi \rightarrow |AB| \sin \theta = |OA| \sin \varphi \rightarrow |OA| = \frac{|AB| \sin \theta}{\sin \varphi} = 413.488$$

$$|OB| = |AB| \cos(\pi - \theta) + |OA| \cos \varphi = 529.973$$

$$\vec{r}_A = \text{sgn}(\theta - \varphi) |OA| \begin{bmatrix} \cos \varphi \\ \sin \varphi \end{bmatrix} = \begin{bmatrix} -388.552 \\ -141.421 \end{bmatrix}$$

$$\vec{r}_B = \text{sgn}(\theta - \varphi) |OB| \begin{bmatrix} -1 \\ 0 \end{bmatrix} = \begin{bmatrix} -529.973 \\ 0 \end{bmatrix}$$

$$\vec{r}_{A/B} = |AB| \begin{bmatrix} \cos \theta \\ \sin \theta \end{bmatrix} = \begin{bmatrix} 141.421 \\ -141.421 \end{bmatrix}$$

3

$$r_{OA} = s$$

$$r_{OB} = q$$

$$Q = \frac{\pi + \varphi}{\pi - \varphi}$$

$$e = (q + s) \sin \theta = (q - s) \sin(\theta + \varphi)$$

$$\varphi = \arcsin\left(\frac{q+s}{q-s} \sin \theta\right) - \theta$$

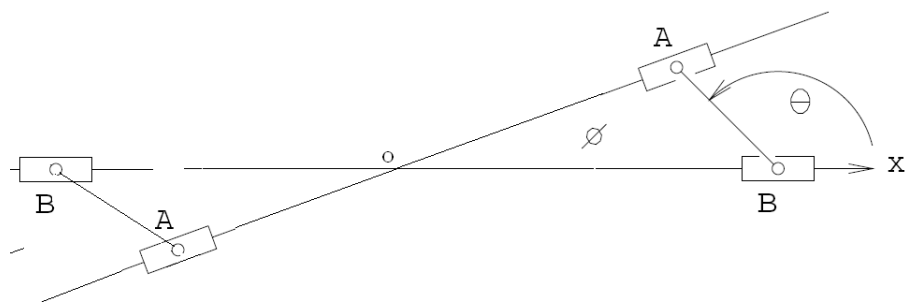


Figure 1: problem 2

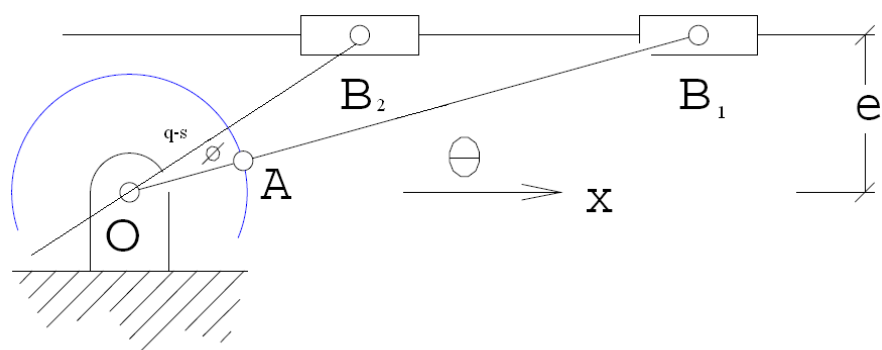


Figure 2: problem 3