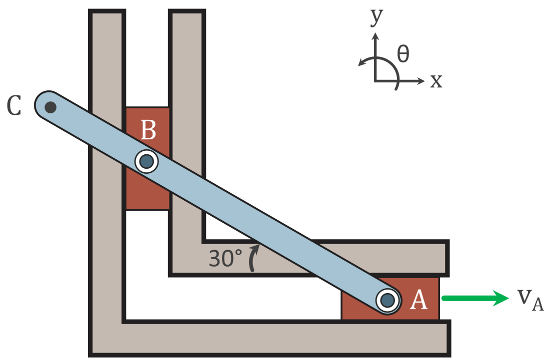
Linked Bodies



The angular velocity is 8 rad/s**. Determine the velocity of block** B **in the path (the y-component). With** $L_{AC} = 1$ m **and** $L_{AB} = 0.75$ m**.**

Using known expressions:

$$\boldsymbol{v_{B/A}} = \boldsymbol{v_A} + \boldsymbol{\omega} \times \boldsymbol{r_{B/A}} \tag{1}$$

Given:
Distance between A and C: $L_{AC} = 1$ m
Distance between A and B: $L_{AB} = 0.75$ m
Angle of the blue bar: $\theta = 30°$
Velocity of C: $v_C = 3$ m/s
Angular velocity: $\omega = 8$ rad/s

Furthermore, point B can only move up and down, thus is has only a velocity term in the y-direction. Point A can only move left and right, thus it has only a velocity term in the x-direction. Inserting this in Equation 1 gives.

$$\boldsymbol{v_{B/A}} = \boldsymbol{v_A} + \boldsymbol{\omega} \times \boldsymbol{r_{B/A}} \quad \Rightarrow \quad \begin{pmatrix} 0 \\ v_B \\ 0 \end{pmatrix} = \begin{pmatrix} v_A \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \\ \omega \end{pmatrix} \times \begin{pmatrix} -\cos 30 \\ \sin 30 \\ 0 \end{pmatrix} L_{AB} \tag{2}$$

$$\begin{pmatrix} 0 \\ v_B \\ 0 \end{pmatrix} = \begin{pmatrix} v_A \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} -\sin 30 \\ -\cos 30 \\ 0 \end{pmatrix} L_{AB} \cdot \omega$$

From this follows that:

$$v_B = -\cos 30 \cdot L_{AB} \cdot \omega \quad \Rightarrow \quad v_B = -\frac{1}{2}\sqrt{3} \cdot \frac{3}{4} \cdot 8 = -3\sqrt{3} \text{ m/s} \tag{3}$$