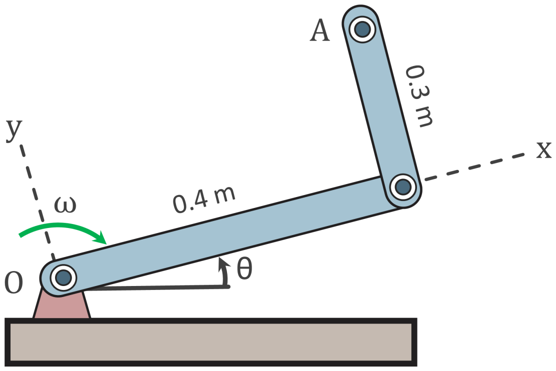
Acceleration at end of Right-Angle Bar



The right-angle bar rotates clockwise with an angular velocity which is decreasing at the rate of 4 rad/s^2. Determine the vector expression for the acceleration of point A when $\omega = 2$ rad/s.

Using known expressions:

$$\boldsymbol{a}_n = \boldsymbol{\omega} \times (\boldsymbol{\omega} \times \boldsymbol{r}) \tag{1}$$

$$\boldsymbol{a}_t = \boldsymbol{\alpha} \times \boldsymbol{r} \tag{2}$$

$$\boldsymbol{a} = \boldsymbol{a}_n + \boldsymbol{a}_t \tag{3}$$

Given:
Distance from O to A: $\boldsymbol{r_{A/O}} = 0.4\boldsymbol{i} + 0.3\boldsymbol{j}$
Angular velocity: $\omega = 2$ rad/s
Angular acceleration: $\alpha = -4$ rad/s^2

Since the angular velocity is clockwise, and in the coordinate system positive is defined as counterclockwise, the angular velocity becomes: $\omega = -2$ rad/s. The angular acceleration is clockwise and decreasing at a rate of 4 rad/s^2, thus this becomes: $\alpha = --4 = 4$ rad/s^2 in the defined coordinate system.
Inserting this in Equation 1 and 2 gives.

$$\boldsymbol{a}_n = \boldsymbol{\omega} \times (\boldsymbol{\omega} \times \boldsymbol{r}) \quad \Rightarrow \quad \boldsymbol{a}_n = \begin{pmatrix} 0 \\ 0 \\ -2 \end{pmatrix} \times \begin{pmatrix} 0 \\ 0 \\ -2 \end{pmatrix} \times \begin{pmatrix} 0.4 \\ 0.3 \\ 0 \end{pmatrix} = \begin{pmatrix} -1.6 \\ -1.2 \\ 0 \end{pmatrix} \text{ m/s}^2 \tag{4}$$

$$\boldsymbol{a}_t = \boldsymbol{\alpha} \times \boldsymbol{r} \quad \Rightarrow \quad \boldsymbol{a}_t = \begin{pmatrix} 0 \\ 0 \\ 4 \end{pmatrix} \times \begin{pmatrix} 0.4 \\ 0.3 \\ 0 \end{pmatrix} = \begin{pmatrix} -1.2 \\ 1.6 \\ 0 \end{pmatrix} \ \mathrm{m/s^2} \tag{5}$$

Combining both gives the final answer for $\boldsymbol{a}$:

$$\boldsymbol{a} = \boldsymbol{a}_n + \boldsymbol{a}_t = \begin{pmatrix} -1.6 \\ -1.2 \\ 0 \end{pmatrix} + \begin{pmatrix} -1.2 \\ 1.6 \\ 0 \end{pmatrix} = \begin{pmatrix} -2.8 \\ 0.4 \\ 0 \end{pmatrix} \ \mathrm{m/s^2} \tag{6}$$