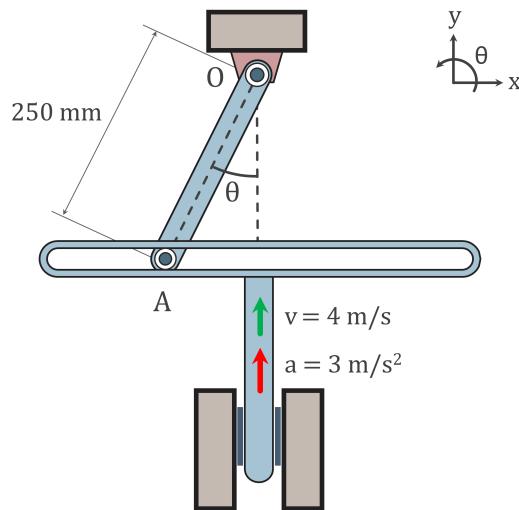


Link Motion



A link rotates clockwise shown in the picture. Give the correct expression for the velocity of the roller inside slotted guide, v_A .

Using known expressions:

$$\mathbf{v}_{A/O} = \boldsymbol{\omega} \times \mathbf{r}_{A/O} \quad (1)$$

Given:

Vertical velocity of the slotted guide: $v = 4 \text{ m/s}$

Distance between O and A: $L_{OA} = 0.25 \text{ m}$

First a kinematic diagram is made in Figure 1 which shows all velocities acting on roller A. From this it can be seen that v_A can be calculated using v and $v_{A/O}$. Using Equation 1 $v_{A/O}$ becomes:

$$\mathbf{v}_{A/O} = \boldsymbol{\omega} \times \mathbf{r}_{A/O} = \begin{pmatrix} 0 \\ 0 \\ -\omega \end{pmatrix} \times \begin{pmatrix} -0.25 \sin \theta \\ -0.25 \cos \theta \\ 0 \end{pmatrix} = \begin{pmatrix} -0.25\omega \cos \theta \\ 0.25\omega \sin \theta \\ 0 \end{pmatrix} \quad (2)$$

Where $\omega = \dot{\theta}$.

From Figure 1 follows:

$$\mathbf{v}_{A/O} = \mathbf{v}_A + \mathbf{v} \Rightarrow \begin{pmatrix} -0.25\omega \cos \theta \\ 0.25\omega \sin \theta \\ 0 \end{pmatrix} = \begin{pmatrix} -v_A \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ v \\ 0 \end{pmatrix} \quad (3)$$

This results in that $v_A = 0.25\omega \cos \theta = 0.25\dot{\theta} \cos \theta$. Since we have drawn v_A in Figure 1 in the negative x-direction. The velocity of the roller in the positive x-direction becomes: $v_A = -0.25 \cdot \dot{\theta} \cdot \cos \theta$.

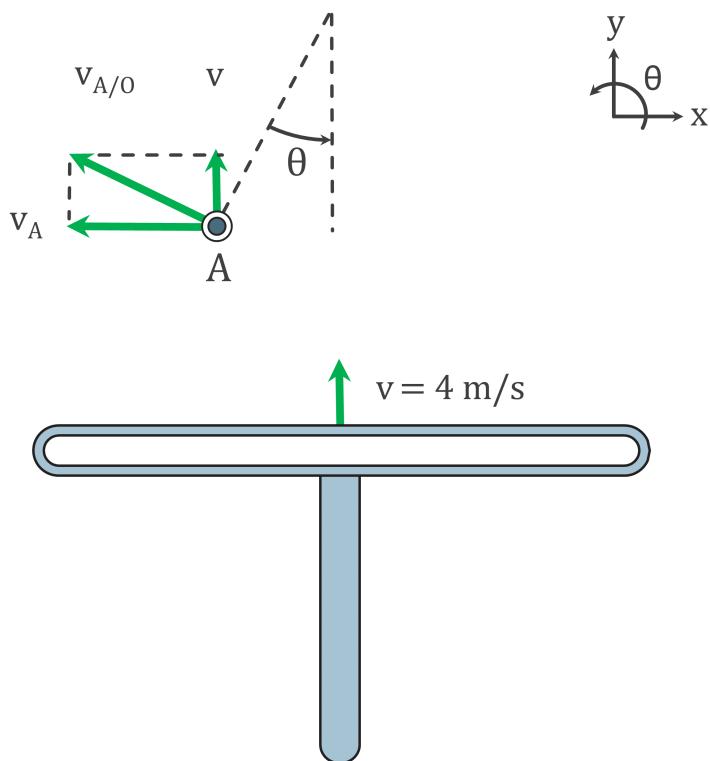


Figure 1: Kinematic diagram of the roller and the slotted guide.