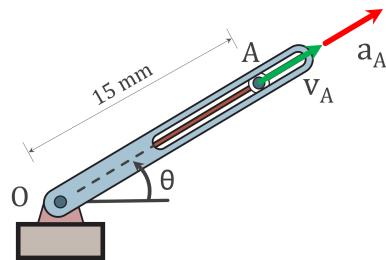


Slider in a Rotating Arm



A slider moves inside a rotating radial slot. This slot is hinged at O. Determine the acceleration mm/s^2 in radial direction at $t = 3$ seconds.

At this time instant the distance between the slider and point O is 15 mm, the sliders velocity is 12 mm/s and its acceleration is 4 mm/s^2 . Furthermore, it is given that $v_\theta = 3.75 \text{ mm/s}$. Round to the nearest integer (no decimals).

Using known expressions:

$$v_\theta = r\dot{\theta} \quad \Rightarrow \quad \dot{\theta} = \frac{v_\theta}{r} \quad (1)$$

$$a_r = \ddot{r} - r\dot{\theta}^2 \quad (2)$$

Given quantities:

Velocity in θ -direction: $v_\theta = 3.75 \text{ mm/s}$

Distance between slider and O: $r = 15 \text{ mm}$

Velocity of the slider: $\dot{r} = 12 \text{ mm/s}$

Acceleration of the slider: $\ddot{r} = 4 \text{ mm/s}^2$

Solution:

Calculating $\dot{\theta}$ using Equation (1) gives:

$$\dot{\theta} = \frac{v_\theta}{r} = \frac{3.75}{15} = 0.25 \text{ rad/s} \quad (3)$$

Now a_r can be calculated as follows:

$$a_r = \ddot{r} - r\dot{\theta}^2 = 4 - 15 \cdot 0.25^2 = 3.0625 \text{ mm/s}^2 \approx 3 \text{ mm/s}^2 \quad (4)$$