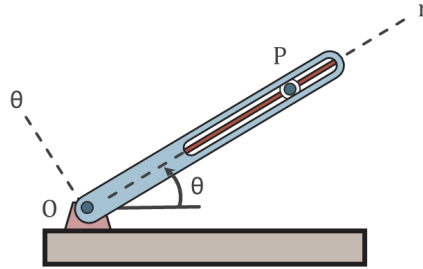


## Sliding Block in a Rotating Slot



The motion of a sliding block P in the rotating radial slot is controlled by a power screw. This slot is hinged at O. For the instant represented,  $\dot{\theta} = 0.1 \text{ rad/s}$ ,  $\ddot{\theta} = -0.04 \text{ rad/s}^2$ ,  $r = 300 \text{ mm}$  and  $\theta = 30^\circ$ . The screw turns at a constant speed giving  $\dot{r} = 40 \text{ mm/s}$ . For this instant, determine the magnitude of the acceleration.

Using known expressions:

$$a_r = \ddot{r} - r\dot{\theta}^2 \quad (1)$$

$$a_\theta = r\ddot{\theta} + 2\dot{r}\dot{\theta} \quad (2)$$

$$a = \sqrt{a_\theta^2 + a_r^2} \quad (3)$$

Given quantities:

Distance between slider and O:  $r = 300 \text{ mm}$

Velocity of the slider:  $\dot{r} = 40 \text{ mm/s}$

Angular velocity of the slot:  $\dot{\theta} = 0.1 \text{ rad/s}$

Angular acceleration of the slot:  $\ddot{\theta} = -0.04 \text{ rad/s}^2$

*Solution:*

Since the speed at which the screw turns is constant,  $\ddot{r} = 0$ .  $a_r$  and  $a_\theta$  are calculated as follows:

$$a_r = \ddot{r} - r\dot{\theta}^2 = 0 - 300 \cdot 0.1^2 = -3 \text{ mm/s}^2 \quad (4)$$

$$a_\theta = r\ddot{\theta} + 2\dot{r}\dot{\theta} = 300 \cdot -0.04 + 2 \cdot 40 \cdot 0.1 = -4 \text{ mm/s}^2 \quad (5)$$

This results in a total acceleration  $a$  of:

$$a = \sqrt{a_\theta^2 + a_r^2} = \sqrt{-4^2 + -3^2} = 5 \text{ mm/s}^2 \quad (6)$$