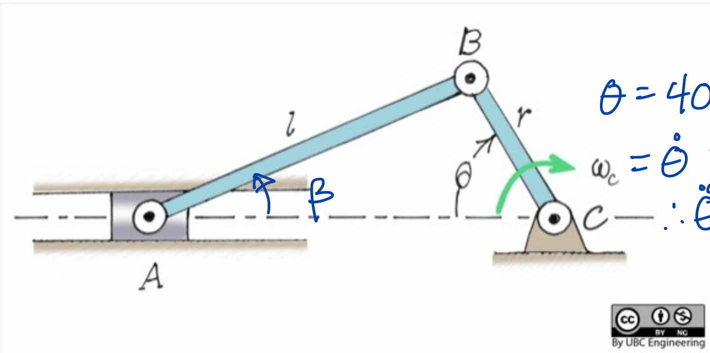
UBC-DYN-18-017



Find
$\omega_{AB} = \dot{\beta}$
$\alpha_{AB} = \ddot{\beta}$

Find the angular velocity and angular acceleration of the AB link in the slider-crank mechanism shown below when $\theta = 40^\circ$. Use the following assumptions:

- ω_C is constant at $1\ rad/sec$
- $r = 1\ m$
- $l = 2\ m$

$\omega_{AB} =$ ____ rad/sec

$\alpha_{AB} =$ ____ rad/sec^2

$$l \sin\beta = r\sin\theta \quad (1) \qquad \Rightarrow \beta = \sin^{-1}\left(\frac{r}{l}\sin\theta\right) = 18.75°$$

rigid bodies

$$\frac{d}{dt}(1): \quad \cancel{\dot{l}}^{\,0}\sin\beta + l\cos\beta\,\dot{\beta} = \cancel{\dot{r}}^{\,0}\sin\theta + r\cos\theta\,\dot{\theta}$$

$$\Rightarrow \quad l\cos\beta\,\dot{\beta} = r\cos\theta\,\dot{\theta} \quad (2)$$

$$\dot{\beta} = \frac{r}{l}\,\frac{\cos\theta}{\cos\beta}\,\dot{\theta} = \frac{1m}{2m}\,\frac{\cos 40}{\cos 18.75}\,(1\,rad/s)$$

$$\boxed{\omega_{AB} = \dot{\beta} = 0.404\ rad/s}$$

rigid body   rigid body   Const. $\dot{\theta}$

$$\frac{d}{dt}(2): \quad \cancel{\dot{l}}^{\,0}\cos\beta\,\dot{\beta} - l\sin\beta\,\dot{\beta}^2 + l\cos\beta\,\ddot{\beta} = \cancel{\dot{r}}^{\,0}\cos\theta\,\dot{\theta} - r\sin\theta\,\dot{\theta}^2 + r\cos\theta\,\cancel{\ddot{\theta}}^{\,0}$$

$$l\cos\beta\,\ddot{\beta} = l\sin\beta\,\dot{\beta}^2 - r\sin\theta\,\dot{\theta}^2$$

$$\ddot{\beta} = \frac{1}{l\cos\beta}\left(l\sin\beta\,\dot{\beta}^2 - r\sin\theta\,\dot{\theta}^2\right)$$

$$\ddot{\beta} = \frac{1}{(2m)\cos 18.75}\left((2m)\sin 18.75(0.404)^2 - (1m)\sin 40(1)^2\right)$$

$$\boxed{\alpha_{AB} = \ddot{\beta} = -0.284 \text{ rad/s}^2}$$