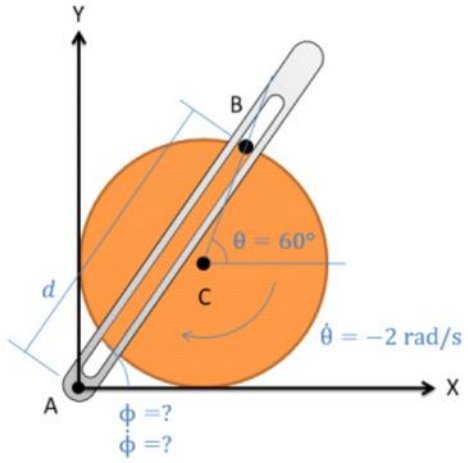
Problem 4

The crank-rocker mechinism as shown below consists of a crank rotating about its fixed center at C at a constant rate of 2 rad/s clockwise and a rocker AB fixed at it's base at A. A pin at point B is fixed to the edge of the crank and can slide along the frictionless slot in AB. In the current state, what is the angular velocity of rocker AB?

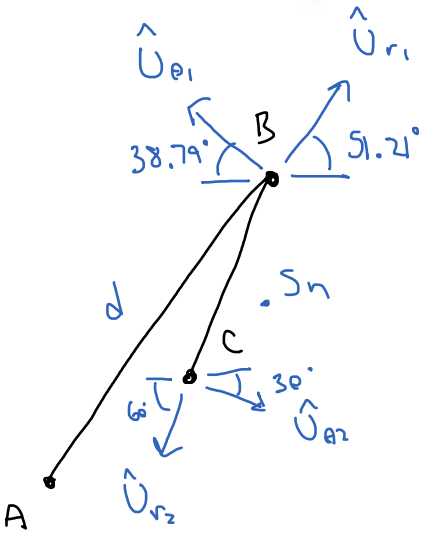


$$x_B = .5 + .5\cos(60) = .75\,m$$

$$y_B = .5 + .5\sin(60) = .933\,m$$

$$d = \sqrt{.75^2 + .933^2} = 1.197\,m$$

$$\phi = \tan^{-1}\left(\frac{.933}{.75}\right) = 51.21^\circ$$



$$\vec{V}_{C/A} = \vec{V}_{B/A} + \vec{V}_{C/B}$$

$$0 = \dot{r}_1 \hat{U}_{r_1} + r_1\dot{\theta}_1 \hat{U}_{\theta_1} + r_2\dot{\theta}_2 \hat{U}_{\theta_2}$$

$$0 = \dot{d}\ \angle 51.21^\circ + (1.197)(\dot{\phi})\ \angle 38.79^\circ + (.5)(-2)\ \angle 30^\circ$$

X

$$0 = \dot{d}\cos(51.21) - 1.197\cos(38.79)\dot{\phi} - 1\cos(30)$$

Y

$$0 = \dot{d}\sin(51.21) + 1.197\sin(38.79)\dot{\phi} + 1\sin(30)$$

$$.625\dot{d} - .933\dot{\phi} = .866$$

$$\dot{d} = 1.49\dot{\phi} + 1.38$$

$$0 = \left(1.44\dot{\phi} + 1.38\right)\sin(51.21) + 1.197\sin(38.79)\dot{\phi} + 1\sin(30)$$

$$0 = 1.161\dot{\phi} + 1.078 + .750\dot{\phi} + .5$$

$$-1.578 = 1.911\dot{\phi}$$

$$\boxed{\dot{\phi} = -.826 \text{ rad/s}^2}$$