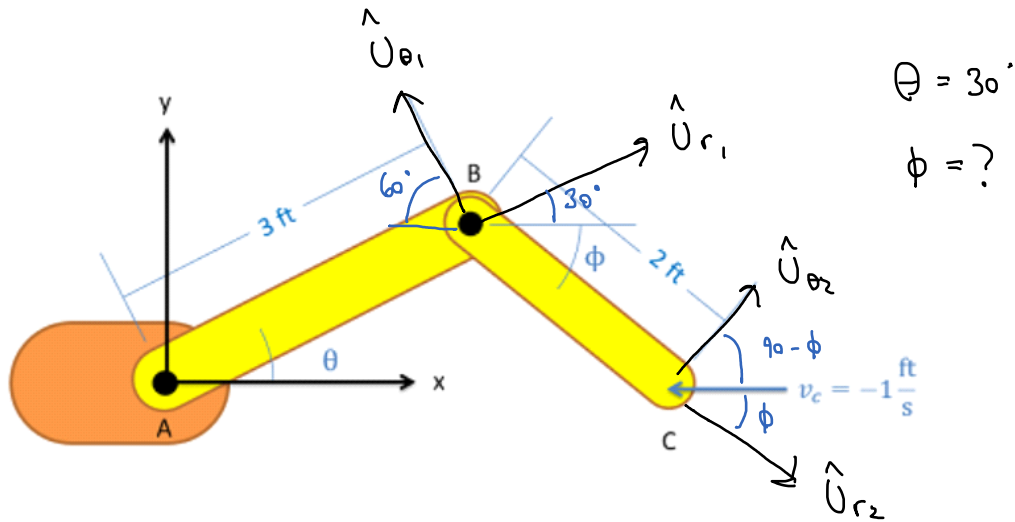


Problem 2

The robotic arm from the previous problem is in the configuration shown below. Assume that θ is currently 30 degrees and that point C currently lies along the x axis. If we want the end effector at C to travel 1 ft/s in the negative x direction, what should the angular velocities be at joints A and B?



$$y_c = 0 = 3 \sin(30) - 2 \sin(\phi)$$

$$\phi = 48.6^\circ$$

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

$$-1 \text{ ft/s } \hat{i} = r_1 \dot{\theta}_1 \hat{u}_{\theta_1} + r_2 \dot{\theta}_2 \hat{u}_{\theta_2}$$

$$-1 \hat{i} = (3) \dot{\theta} \hat{\Delta}_{60^\circ} + (2)(-\dot{\phi}) \hat{\Delta}_{41.4^\circ}$$

$$x \rightarrow -1 = -3 \cos(60) \dot{\theta} - 2 \cos(41.4) \dot{\phi}$$

$$y \rightarrow 0 = 3 \sin(60) \dot{\theta} - 2 \sin(41.4) \dot{\phi}$$

$$X \rightarrow -1 = -3 \cos(60) \dot{\Theta} - 2 \cos(41.4) \dot{\phi}$$

$$Y \rightarrow 0 = 3 \sin(60) \dot{\Theta} - 2 \sin(41.4) \dot{\phi}$$

$$\rightarrow \dot{\Theta} = .509078 \dot{\phi}$$

$$-1 = -3 \cos(60) (.509078 \dot{\phi}) - 2 \cos(41.4) \dot{\phi}$$

$$-1 = -2.26384 \dot{\phi}$$

$$\dot{\phi} = .442 \text{ rad/s} \downarrow$$
$$\dot{\Theta} = .225 \text{ rad/s} \uparrow$$