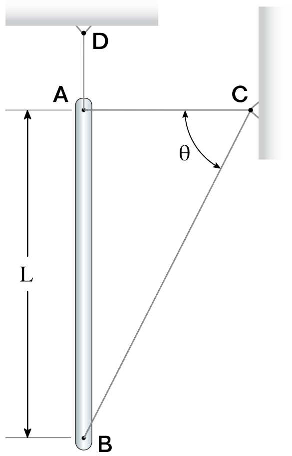
22-R-KM-TW-4



The system is initially at equilibrium when the cord AD is cut. This causes the rod to rotate about the point C with an angular acceleration of $\vec{\alpha} = 2.25\cos(2t)\ \hat{k}$. If the angle $\theta = 60°$ and the length of the rod $L = 4$ m, find the velocity of point A after 0.5 s

Solution:

$$\text{let } A = 2.25,\ \ f = \frac{1}{\pi}$$

$$\vec{\alpha} = A\cos(2\pi f t)\hat{k}$$

$$\vec{\omega} = \int A\cos(2\pi f t)dt\hat{k} = \frac{A}{2\pi f}\sin(2\pi f t) + \omega_0\ \hat{k}$$

$$\omega_0 = 0 \Rightarrow \vec{\omega} = \frac{A}{2\pi f}\sin(2\pi f t)\hat{k}$$

$$\vec{\omega}(0.5) = 0.947\ [\text{rad/s}]$$

$$\vec{\theta} = \int \frac{A}{2\pi f}\sin(2\pi f t)dt\hat{k} = -\frac{A}{4\pi^2 f^2}\cos(2\pi f t) + \theta_0\ \hat{k}$$

$$|\Delta\theta| = fracA4\pi^2 f^2\cos(2\pi f t) = 0.304\ [\text{rad}]$$

$$\tan\theta = \frac{L}{r_{CA}} \Rightarrow r_{AC} = \frac{L}{\tan\theta}$$

$$\vec{r}_{AC} = -r_{CA}\langle\cos(\Delta\theta), \sin(\Delta\theta)\rangle = \langle -2.20, -0.691\rangle$$

$$\vec{v}_A = \vec{\omega}\times\vec{r}_{CA} = \langle -\omega r_{CA_y}, \omega r_{CA_x}, 0\rangle$$

$$\vec{v}_A = \langle 0.654, -2.09\rangle\ [\text{m/s}]$$