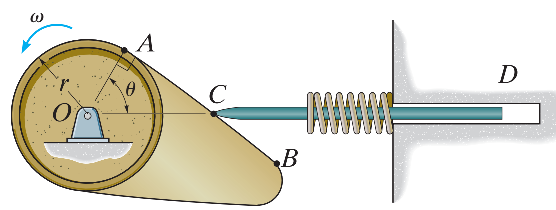
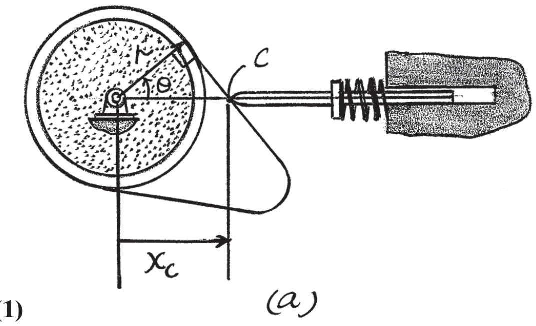
***16–44.**

Determine the velocity and acceleration of the follower rod CD as a function of θ when the contact between the cam and follower is along the straight region AB on the face of the cam. The cam rotates with a constant counterclockwise angular velocity $\boldsymbol{\omega}$.



SOLUTION



Position Coordinate: From the geometry shown in Fig. a,

$$x_C = \frac{r}{\cos\theta} = r\sec\theta$$

Time Derivative: Taking the time derivative,

$$v_{CD} = \dot{x}_C = r\sec\theta\tan\theta\dot{\theta} \qquad \textbf{(1)}$$

Here, $\dot{\theta} = +\omega$ since ω acts in the positive rotational sense of θ. Thus, Eq. (1) gives

$$v_{CD} = r\omega\sec\theta\tan\theta \rightarrow \qquad \textbf{Ans.}$$

The time derivative of Eq. (1) gives

$$a_{CD} = \ddot{x}_C = r\{\sec\theta\tan\theta\ddot{\theta} + \dot{\theta}[\sec\theta(\sec^2\theta\dot{\theta}) + \tan\theta(\sec\theta\tan\theta\dot{\theta})]\}$$

$$a_{CD} = r[\sec\theta\tan\theta\ddot{\theta} + (\sec^3\theta + \sec\theta\tan^2\theta)\dot{\theta}^2]$$

Since $\dot{\theta} = \omega$ is constant, $\ddot{\theta} = \alpha = 0$. Then,

$$a_{CD} = r[\sec\theta\tan\theta(0) + (\sec^3\theta + \sec\theta\tan^2\theta)\omega^2]$$

$$= r\omega^2\left(\sec^3\theta + \sec\theta\tan^2\theta\right) \rightarrow \qquad \textbf{Ans.}$$

Ans:
$v_{CD} = r\omega\sec\theta\tan\theta \rightarrow$
$a_{CD} = r\omega^2\left(\sec^3\theta + \sec\theta\tan^2\theta\right) \rightarrow$