Kloomock and Muffley,[2] and Raven.[3] We will follow Kloomock and Muffley's presentation here. Figure 7-8 shows two positions of the follower arm *BC* being rotated around a "stationary" cam in the typical inversion of the motion for analysis purposes. (Typically, the follower arm pivot *B* remains stationary and the cam rotates.) The initial position *BC* becomes $B'C'$ at a later time after the cam has rotated through the angle $\gamma$. Though these positions are shown widely separated for clarity, the analysis considers them to be an infinitesimal angle $d\gamma$ apart.

The pressure angle $\phi$ is defined as the angle between the normal force *N* applied at the cam-roller interface, shown as vector $C'N$, and the direction of the velocity of the roller center, shown as $C'D'$. Neglecting friction and taking moments about the arm pivot $B'$ gives

$$\frac{Nl}{T} = \frac{1}{\cos\phi} \tag{7.6}$$

where $l$ is the length of the arm and $T$ is the applied load torque on the follower arm. The torque ratio $Nl/T$ is similar to the force magnification factor $N/F$ of equation 7.1b for a radial cam with translating roller follower.

From the geometry of Figure 7-8, note that as $d\gamma$ approaches zero, $\gamma'$ approaches $\gamma$, $\delta'$ approaches $\delta$, and $\varepsilon'$ approaches $\varepsilon$. An expression for pressure angle $\phi$ can be written as:

$$\phi = \frac{\pi}{2} - (\varepsilon - \lambda) \tag{7.7a}$$

$$\lambda = \tan^{-1}\frac{1}{R}\frac{dR}{d\gamma} \tag{7.7b}$$

The triangle $OB'C'$ in Figure 7-8a (and shown separately in Figure 7-8b) can be solved for $R$, $\varepsilon$, and $\psi$.

$$R = \sqrt{l^2 + c^2 - 2lc\cos\delta} \tag{7.7c}$$

$$\varepsilon = \sin^{-1}\left(\frac{c}{R}\sin\delta\right) \tag{7.7d}$$

$$\psi = \cos^{-1}\left(\frac{c^2 + R^2 - l^2}{2Rc}\right) \tag{7.7e}$$

Also from Figure 7-8 it can be seen that

$$\gamma = \psi_0 - \psi + \theta \tag{7.7f}$$

Differentiating equation 7.7f with respect to $R$:

$$\frac{d\gamma}{dR} = \frac{d\theta}{dR} - \frac{d\psi}{dR} \tag{7.7g}$$

Differentiating equation 7.7c with respect to $\theta$ and reciprocating: