$$\sigma(\theta) = -\operatorname{sgn}(\omega)\,\phi\left(\theta, R_p\right) - \left[\pi - \psi(\theta)\right]$$
$$= -\operatorname{sgn}(\omega)\,\psi(\theta) - \phi\left(\theta, R_p\right) - \pi \tag{13.21a}$$

The contact points can then be defined in cylindrical coordinates by:

$$\begin{aligned} z_{s_{1,2}}(\theta) &= z(\theta) \pm \operatorname{sgn}(\omega) R_f \cos\left[\sigma(\theta)\right] \\ \delta_{s_{1,2}}(\theta) &= \lambda(\theta) \mp \operatorname{sgn}(\omega) \frac{R_f}{R_p} \sin\left[\sigma(\theta)\right] \end{aligned} \tag{13.21b}$$

where the $sgn(\omega)$ function accounts for cam rotation direction and the sign of the pressure angle accounts for rise or fall. The upper sign on the *sgn* function gives the top surface and the lower sign gives the bottom surface of the track for the case of the arm pivot leading the roller follower as shown in Figure 13.10. The signs are reversed for the case of the arm pivot trailing the roller follower. All angles are in radians.

CAM CUTTER COORDINATES As was pointed out in the discussion of barrel cams with translating followers, cutter compensation should not, in general, be used to cut a barrel cam.* The cutter coordinates will be different for each cylinder radius used in their calculation. However, if the ratio of track depth to prime cylinder radius is small, i.e., a shallow track groove on a large diameter cam, then the change in cam surface or cutter coordinates across the track will be small. Also, if a crowned roller follower, centered at the pitch cylinder radius, is used, then contour errors at other track radii may not significantly affect follower motion. For such circumstances, the following equation will compute the cutter coordinates for an oscillating follower on a barrel cam at any chosen cylinder radius R_p.

$$\begin{aligned} z_{s_{1,2}}(\theta) &= z(\theta) \mp \operatorname{sgn}(\omega)\left(R_f - R_c\right)\cos\left[\sigma(\theta)\right] \\ \delta_{s_{1,2}}(\theta) &= \lambda(\theta) \pm \operatorname{sgn}(\omega) \frac{R_f - R_c}{R_p} \sin\left[\sigma(\theta)\right] \end{aligned} \tag{13.22}$$

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13.4 LINEAR CAMS WITH ROLLER FOLLOWERS

A linear cam is one that either has rectilinear motion with respect to a stationary follower assembly, or one that is stationary with respect to a rectilinearly translating follower assembly that passes over it. In the first case, the cam must be oscillated back and forth past the follower assembly and thus has a time-varying velocity that complicates its dynamic analysis. In the second case, a follower assembly passing over a stationary cam will often have constant velocity in the direction of the cam axis. An example would be a machine in which the workpieces are carried on a constant speed conveyor past one or more stationary cams that impart transverse motion to the assemblies as they pass over the cam(s).

The contour of either type of linear cam can be calculated by the same methods as described in the previous section for barrel cams. The developed barrel cam used for that analysis is in fact a "linear" cam. A true linear cam will of course not have a prime circle

* Program Dynacam does not calculate cutter compensation profiles for barrel cams for this reason.