7.8 RADIUS OF CURVATURE—BARREL CAM WITH TRANSLATING ROLLER FOLLOWER

The radius of curvature of a barrel cam with a translating follower is the same as the radius of curvature of the *s* diagram when scaled to the prime cylinder circumference since there is no distortion of that function in the direction of follower motion when "wrapped" around the curved-surface plane of a cylinder. It is found from:

$$\rho = -\frac{\left[1+\left(\dfrac{V}{\omega R_p}\right)^2\right]^{\frac{3}{2}}}{\dfrac{A}{\omega^2 R_p^2}} \tag{7.21}$$

where ω is camshaft angular velocity in rad/sec, *Rp* is the barrel prime cylinder radius in length units, *V* is the follower velocity in length/sec and *A* is the follower acceleration in length/sec^2. On a dwell, and anywhere else the acceleration is zero, equation 7.21 cannot be numerically evaluated, and $\rho = \infty$.

7.9 RADIUS OF CURVATURE—BARREL CAM WITH OSCILLATING ROLLER FOLLOWER

The radius of curvature of a barrel cam with an oscillating follower is affected by the radius and direction of initial motion of the follower arm in addition to the factors in equation 7.21, which is for the translating follower case. (See Figure 7-6 on p. 160).

$$\rho = \frac{\operatorname{sgn}(x_0)\operatorname{sgn}(\omega_{arm})\left\{R_p^2\omega^2 + 2\operatorname{sgn}(\omega_{arm})R_p R_a V\omega\sin[\psi(\theta)] + R_a^2 V^2\right\}^{\frac{3}{2}}}{R_a\left\{-R_p\omega\sin[\psi(\theta)]V^2 + \operatorname{sgn}(\omega_{arm})R_a V^3 + \operatorname{sgn}(\omega_{arm})R_p\omega\cos[\psi(\theta)]A\right\}} \tag{7.22}$$

where ω is camshaft angular velocity in rad/sec, *Rp* is the barrel prime cylinder radius in length units, *Ra* is the follower arm radius in length units, *V* is the follower arm angular velocity in rad/sec, *A* is the follower arm angular acceleration in rad/sec^2 and $\psi(\theta)$ is the angle of the follower arm as defined in equation 7.5c. The *sgn* function defines the arm motion as CCW or CW on the rise. On a dwell, or at any other point where the acceleration and velocity are simultaneously zero, equation 7.22 cannot be numerically evaluated, and $\rho = \infty$. Note that elsewhere the radius of curvature will vary radially as well as circumferentially over the surface of the cam because it is a function of both cam radius and cam angle θ. Equation 7.22 calculates it at radius *Rp*, defined at the radial center of the cam track.

Note that the radius of curvature at the centerline of the roller follower will also vary due to the arc motion of the oscillating arm that moves out of the plane of the axis of the cam during its sweep, effectively changing the cam pitch radius at which the center of the roller contacts the slot. If the arm radius is reasonably long in respect to the lift of the cam and has a small angular excursion, then this error will be small. If not then the nominal pitch cylinder radius needs to be corrected by substituting *Rp*' for *Rp* from equation 7.5e in equation 7.22.

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