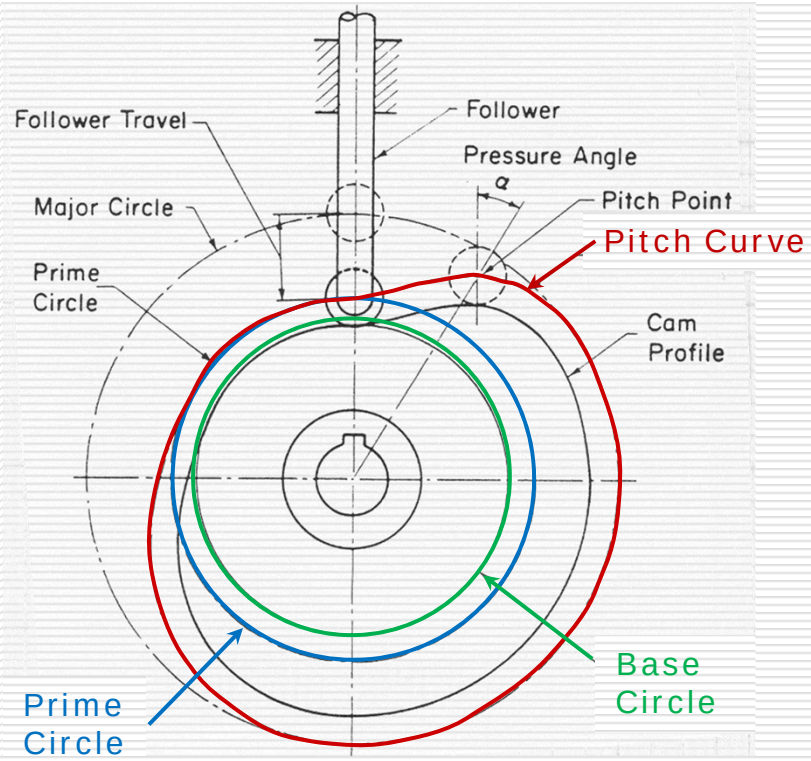
CAMs

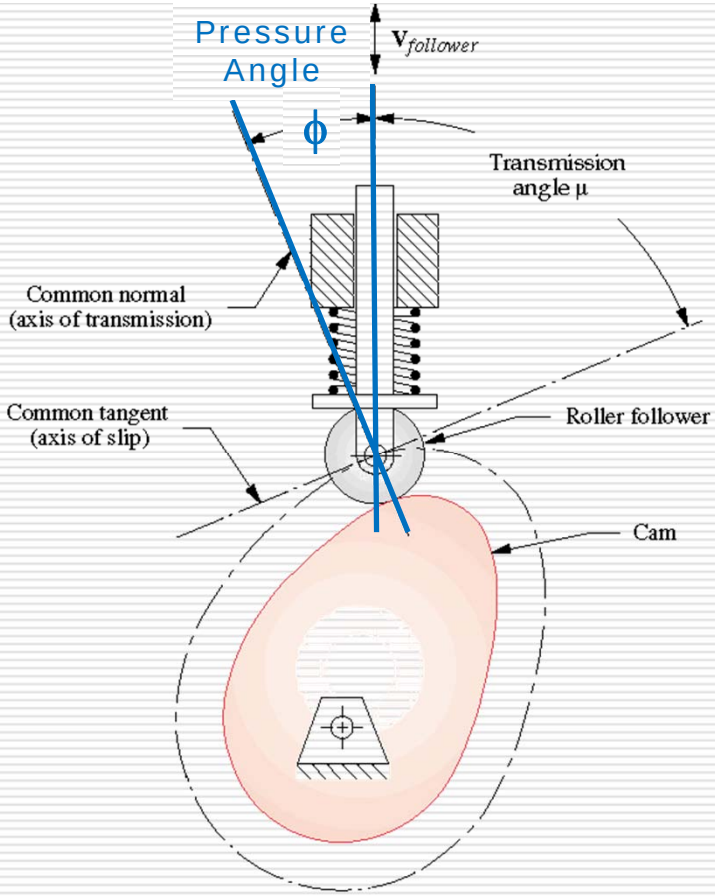
- Roller
- Flat Faced

CAM Sizing Is Based On Radius Of Curvature and Pressure Angle

- Prime Circle
  - ROLLER or RADIUSED Followers
  - Smallest circle which can be drawn tangent to the locus of the centerline of the follower
  - Pitch Curve - locus of the centerline of the follower
  - CAMs with roller followers are defined with respect to the pitch curve
- Base Circle radius
  - FLAT FACED Followers
  - Smallest circle which can be drawn tangent to the physical CAM Surface



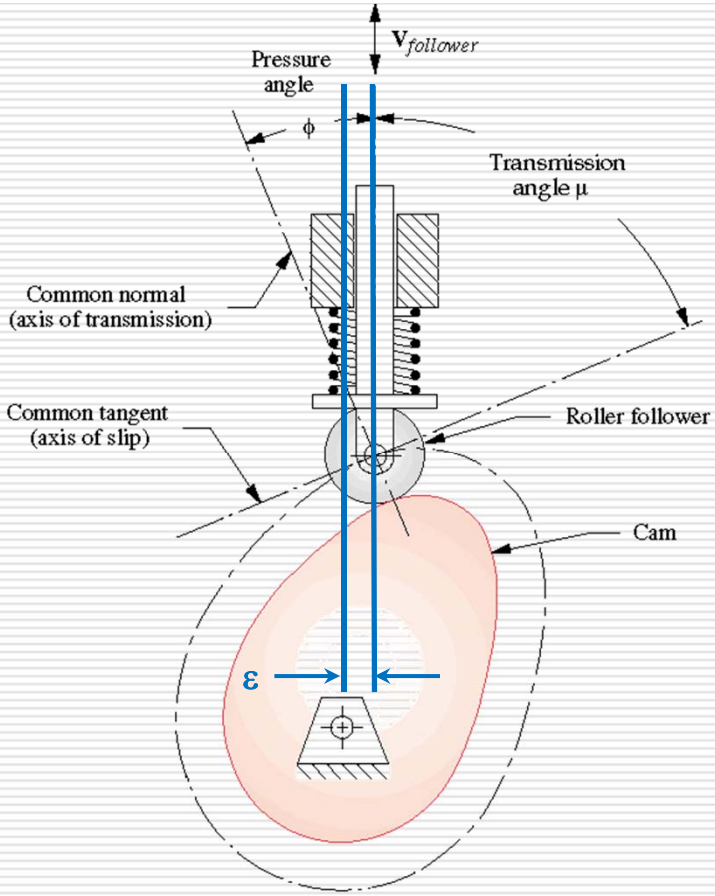
Roller Follower: PRESSURE ANGLE



PRESSURE ANGLE ϕ: Angle between the direction of motion (velocity) of the follower and the direction of the Axis of Transmission (Common Normal)

- Only valid for single DoF systems
- Extremes
  - ϕ=90° no follower motion
  - ϕ=0° all transmission force goes into motion of the follower
- Rule of Thumb
  - Translating Followers 0°≤ ϕ≤ 30°
  - Oscillating Followers 0°≤ ϕ≤ 35°

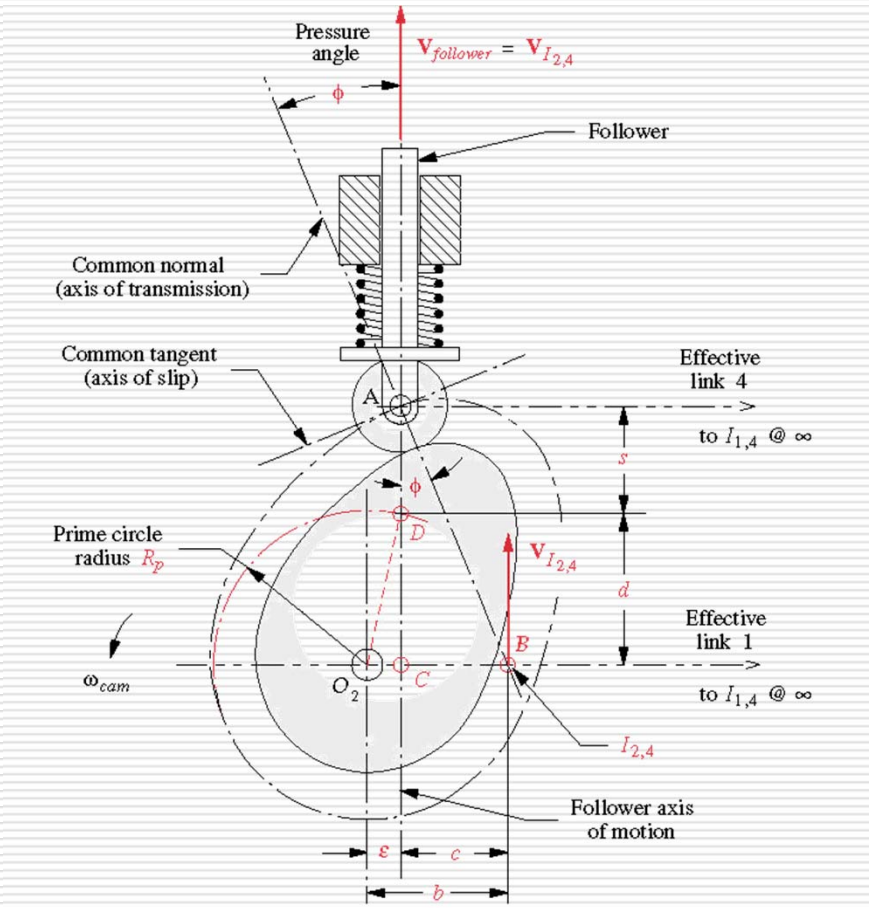
Roller Follower: ECCENTRICITY

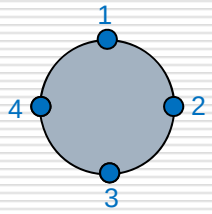


ECCENTRICITY ε: Perpendicular distance between the follower's axis of motion and the center of the CAM

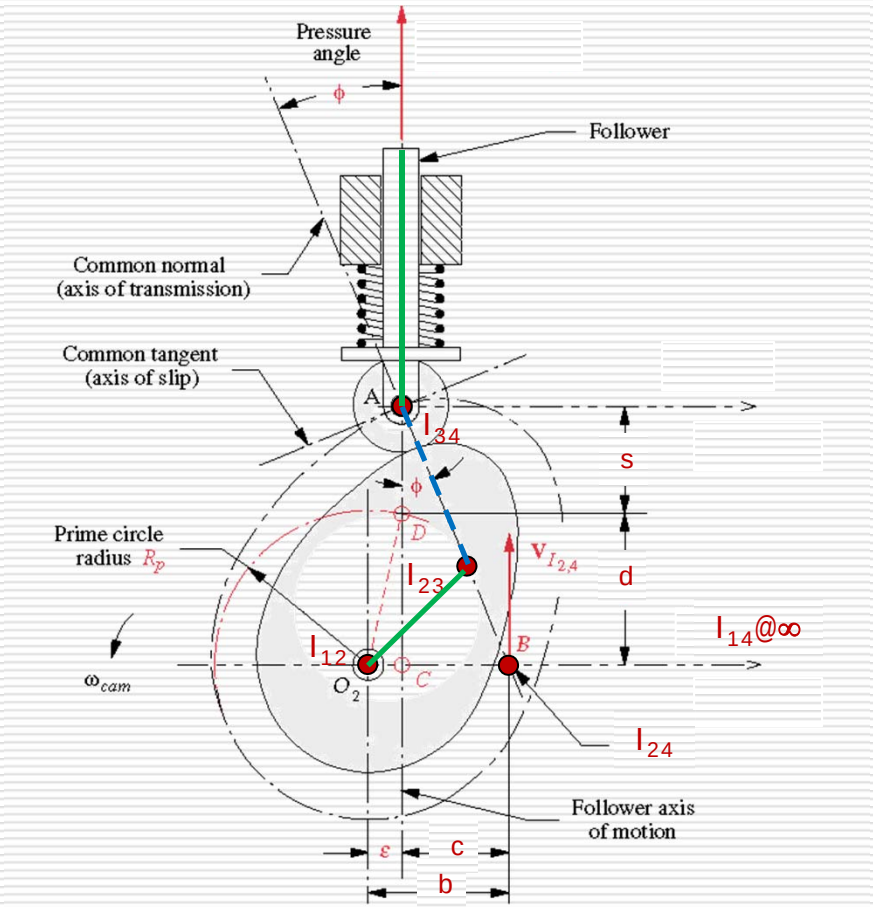
- Aligned Followers, $\varepsilon=0$
- For a positive ω
  - POSITIVE ε, the PRESSURE ANGLE will be decreased on the RISE, but increase on the FALL
  - NEGATIVE ε, the opposite occurs

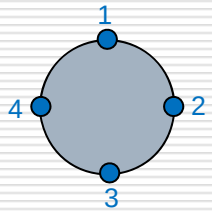
Roller Follower Instant Center

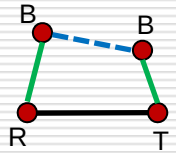




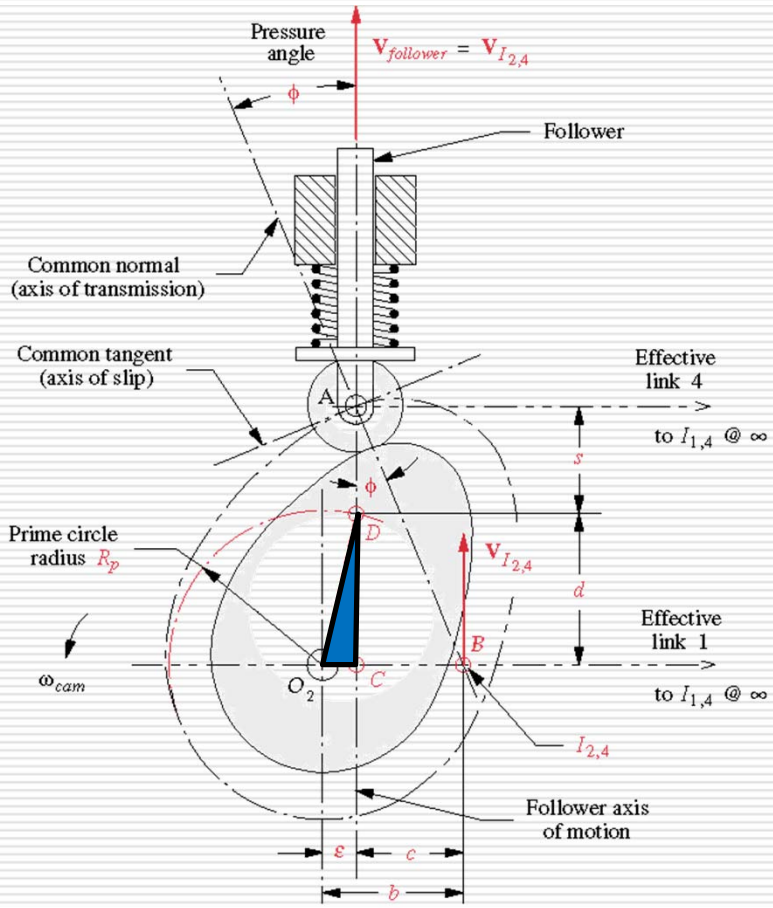
Roller Follower Instant Center Linkage Isomer





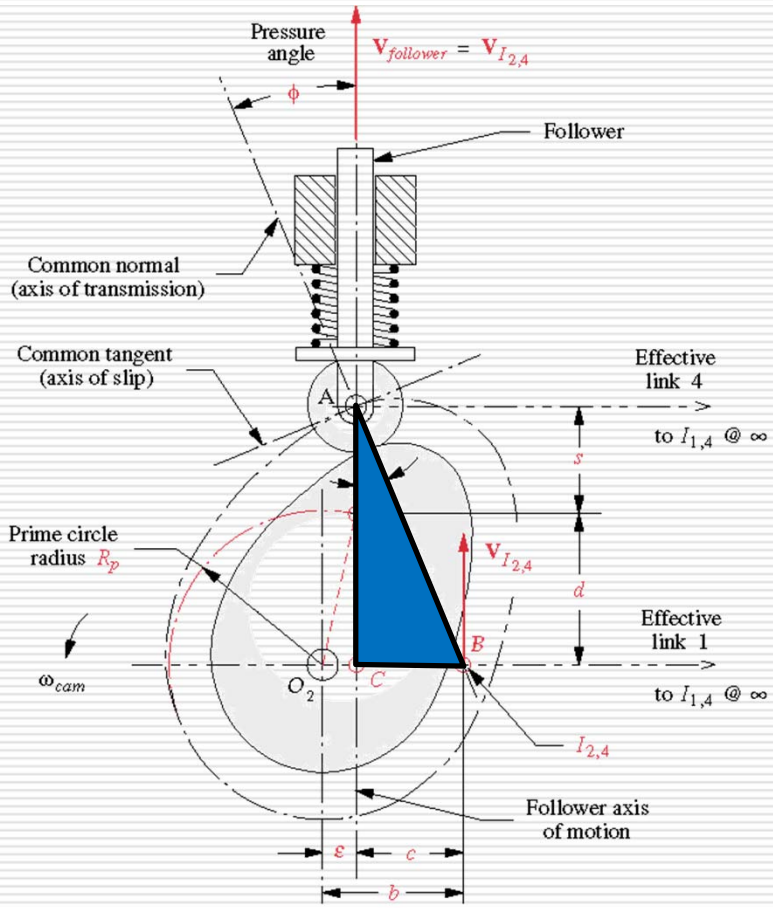


Roller Follower Instant Center Finding d(R_p,ε)



$$d = \sqrt{R_p^2 - \varepsilon^2}$$

Roller Follower Instant Center Determining ϕ



$$\phi = \tan^{-1}\left(\frac{s' - \varepsilon}{s + \sqrt{R_p^2 - \varepsilon^2}}\right)$$

As R_p is increased, ϕ will be reduced

- For a positive ω
  - POSITIVE ε, the PRESSURE ANGLE ϕ will be decreased on the RISE, but increase on the FALL
  - NEGATIVE ε, the opposite occurs

Radius of Curvature Calculation

$$\rho_{pitch} = \frac{\left[\left(R_p + s\right)^2 + s'^2\right]^{3/2}}{\left(R_p + s\right)^2 + 2 \cdot s'^2 - s'' \cdot \left(R_p + s\right)}$$

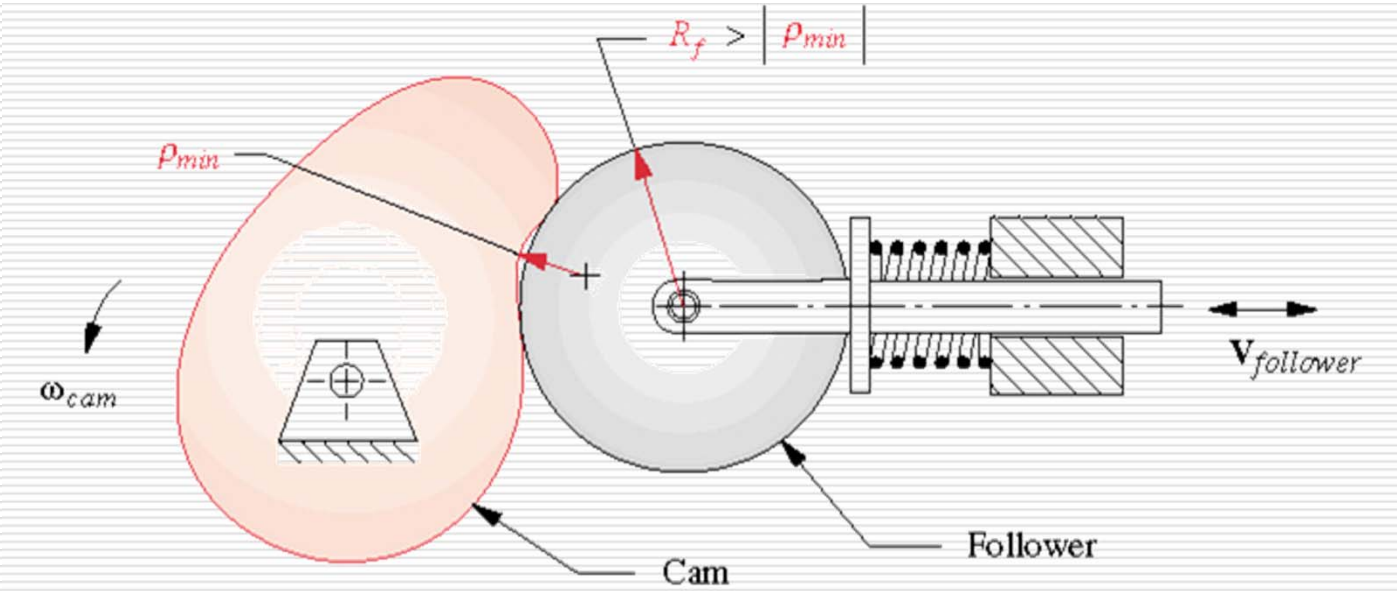
$\equiv$ Radius of Curvature of the Pitch Curve

Rule of Thumb

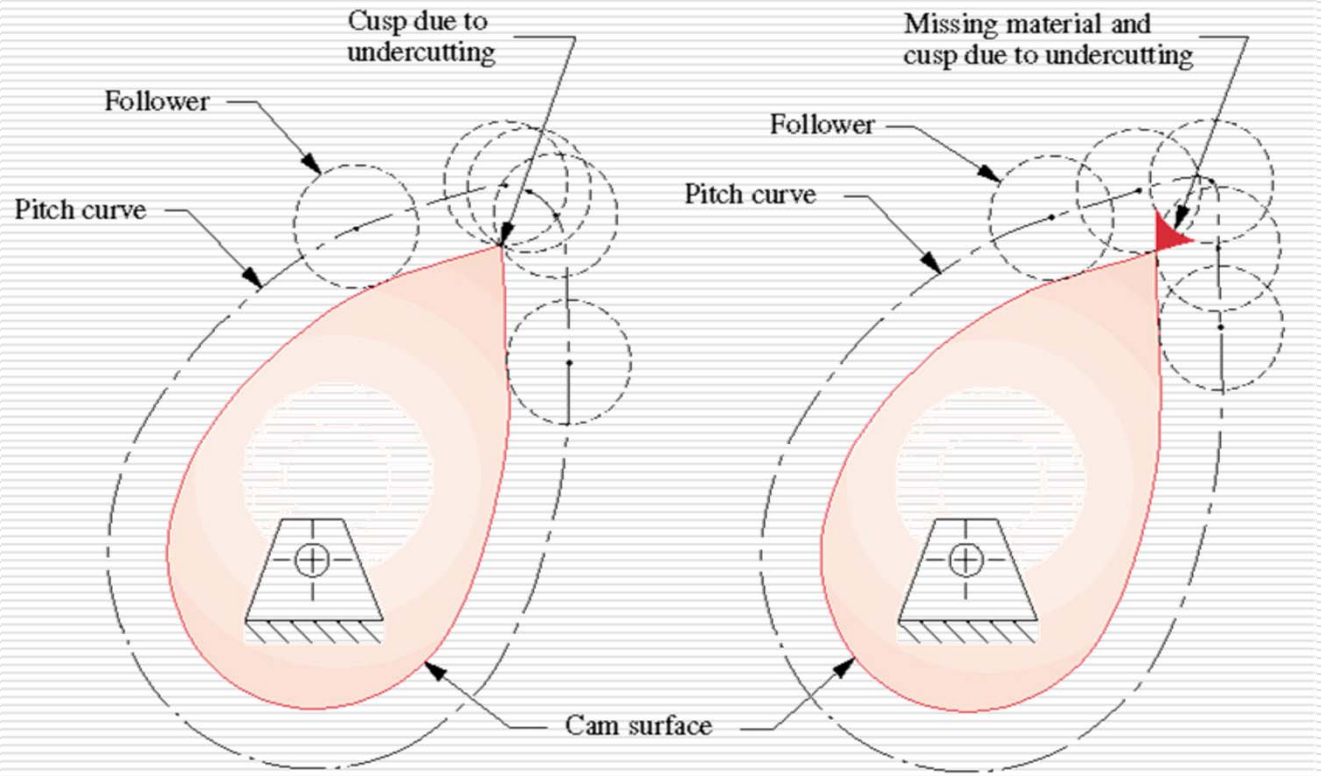
$$\left|\rho_{\min}\right| \gg R_f$$

ρ At Least 2 to 3 Times R_f

Too Large a Follower



Undercutting



(a) Radius of curvature of pitch curve equals the radius of the roller follower

(b) Radius of curvature of pitch curve is less than the radius of the roller follower

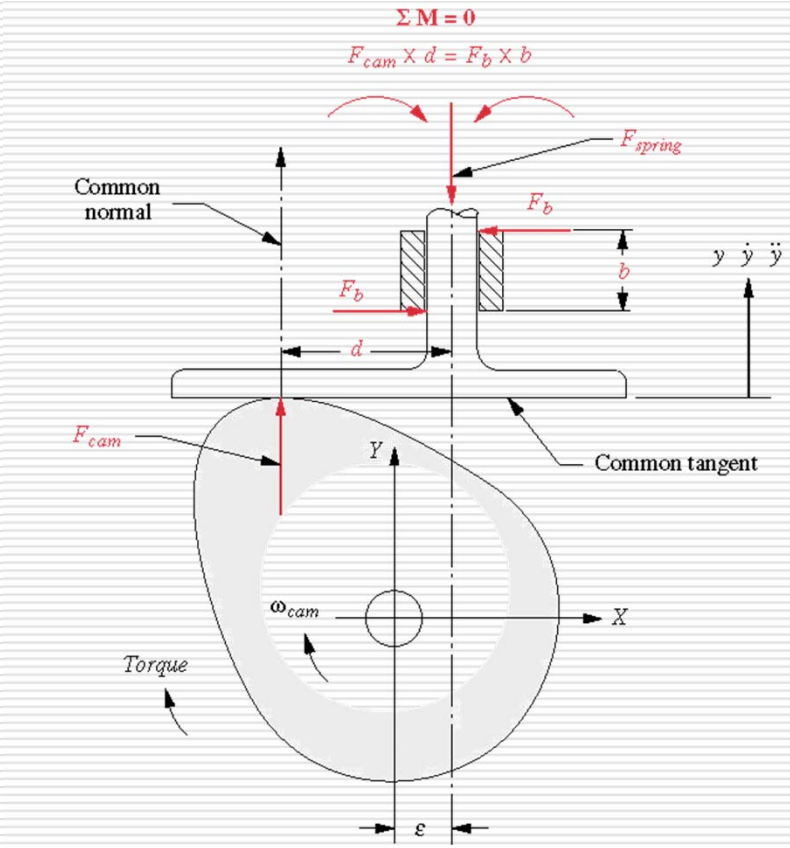
X Y Coordinates

$$x = \cos\lambda \cdot \sqrt{(d+s)^2 + \varepsilon^2}$$

$$y = \sin\lambda \cdot \sqrt{(d+s)^2 + \varepsilon^2}$$

$$\lambda = (2\pi - \theta) - \tan^{-1}\left(\frac{\varepsilon}{d+s}\right)$$

Flat Faced Follower



Determining the Shape of the Cam