Cam System Design

Typical Problem

• Design a cam system to:
  1. Open a valve 0.05 inches in 0.0025 seconds
  2. Stay open for 0.0050 seconds
  3. Close in 0.0025 seconds, and
  4. Stay closed for 0.02 seconds.
  5. Repeat continuously.

• Use a roller follower.
• Make accelerations as small as possible.
Classification of Cams

Classification of Followers
Reciprocating vs. Oscillating

Offset vs. Radial Follower
Mechanical Constraint Cam Systems

Designing Cam Systems

1. Create a displacement diagram

2. Select geometric parameter values
Creating Displacement Diagram

- Lift and dwell are usually application-dependent (given by application requirements)
- Therefore mainly need to design transitions:
  - Full-rise
  - Half-rise
  - Full-return
  - Half-return

Designing Transitions

- Select an equation to meet maximum velocity, acceleration and jerk rate requirements:
  - Parabolic motion
  - Simple harmonic motion
  - Cycloidal motion
  - Polynomial
Selecting Geometric Parameters

- Geometric parameter values need to be chosen to avoid problems such as:
  - Interference/undercuts
  - High pressure angles
  - Large enough face on follower

Parameter selection: Roller Follower

- Select values of $R_0$, $e$, etc. to avoid high pressure angles

To obtain pressure angles, draw cam with follower in each position and measure or use nomograph (Fig. 6.28) to find maximum $\phi$ if possible.
Parameter selection: Roller Follower

- Select values of $R_0$, $e$, etc. to avoid undercuts.

- Minimum curvature ($\rho_{\text{min}}$) must be greater than 0.
- To obtain $\rho_{\text{min}}$, draw cam and measure it or use Fig.s 6.30 – 6.34 if possible.

Parameter selection: flat face follower

- Select $R_0$, $e$, etc. to avoid undercutting.
Parameter selection: flat face follower

- Select face size & position so that face stays on cam