Lecture_4

Introduction

A **cam** is a specially shaped piece of metal arranged to move a follower in a controls fashion.

A **follower** is a link or linkage train that is

Benefits of Cams

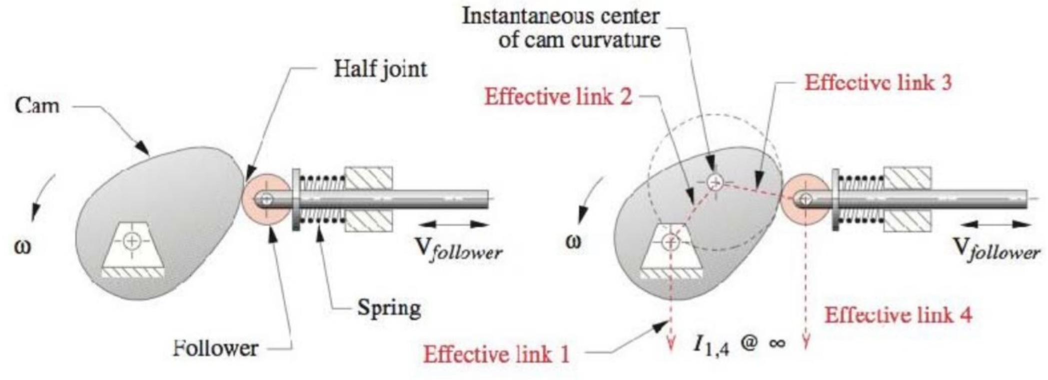
- Function Generation
- A degenerate form of a pure fourbar linkage
- Effective link length

8.1 Cam Terminology

Classifications of Cam-follower Systems

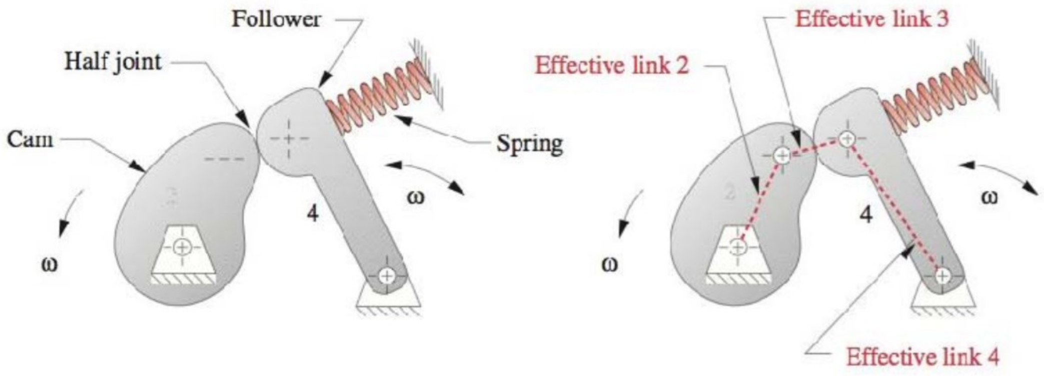
Type of Follower Motion

- translating



(b) A translating cam-follower has an effective fourbar slider-crank equivalent

- rotating



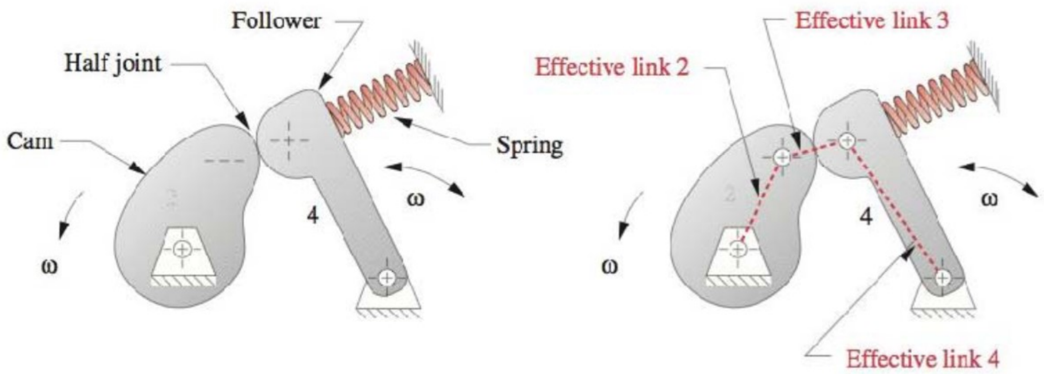
(a) An oscillating cam-follower has an effective pin-jointed fourbar equivalent

Type of Cam

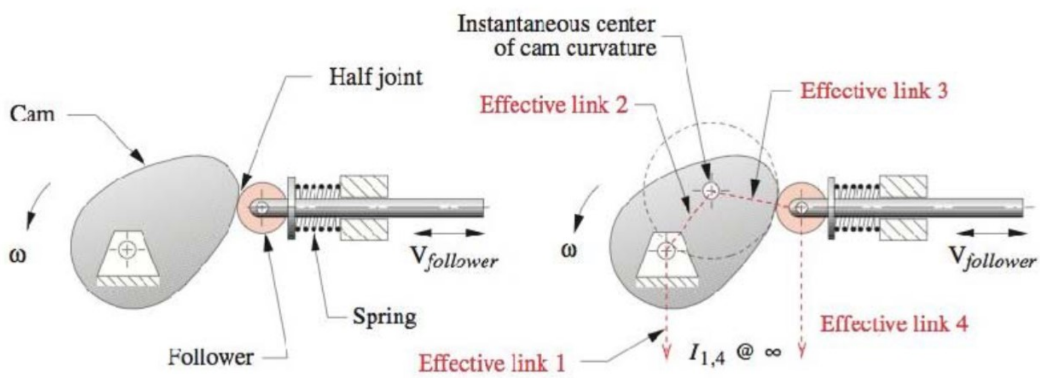
- radical
- cylindrical
- three-dimensional

Type of Joint Closure

- force-closed

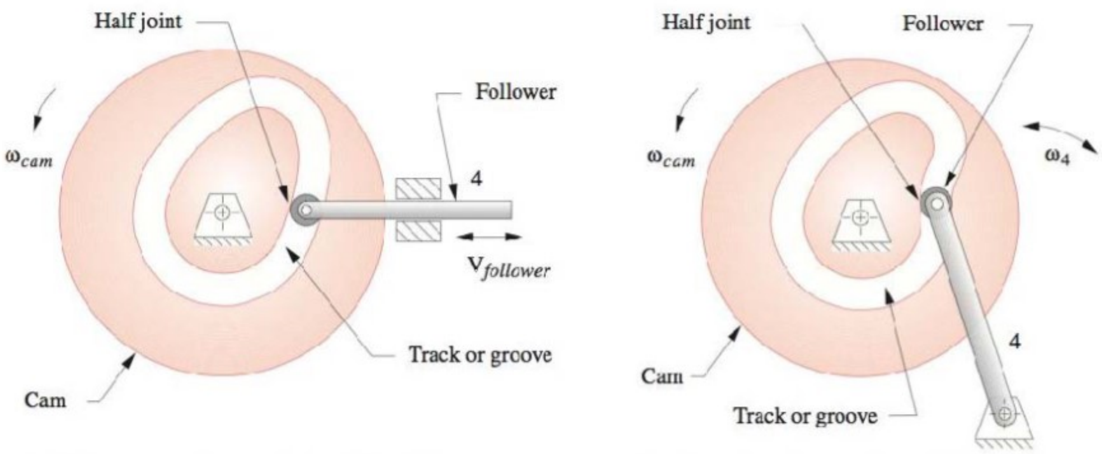


(a) An oscillating cam-follower has an effective pin-jointed fourbar equivalent



(b) A translating cam-follower has an effective fourbar slider-crank equivalent

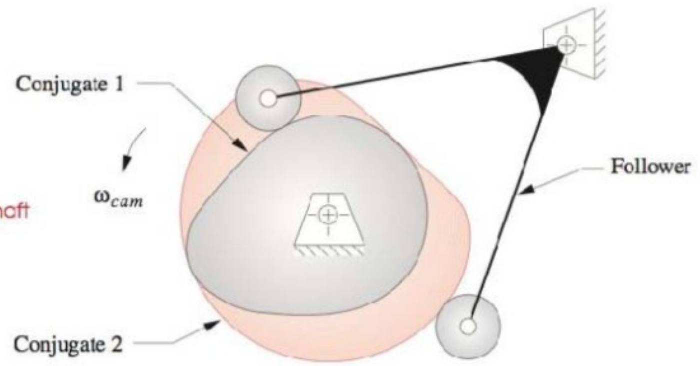
- form closed



(a) Form-closed cam with translating follower

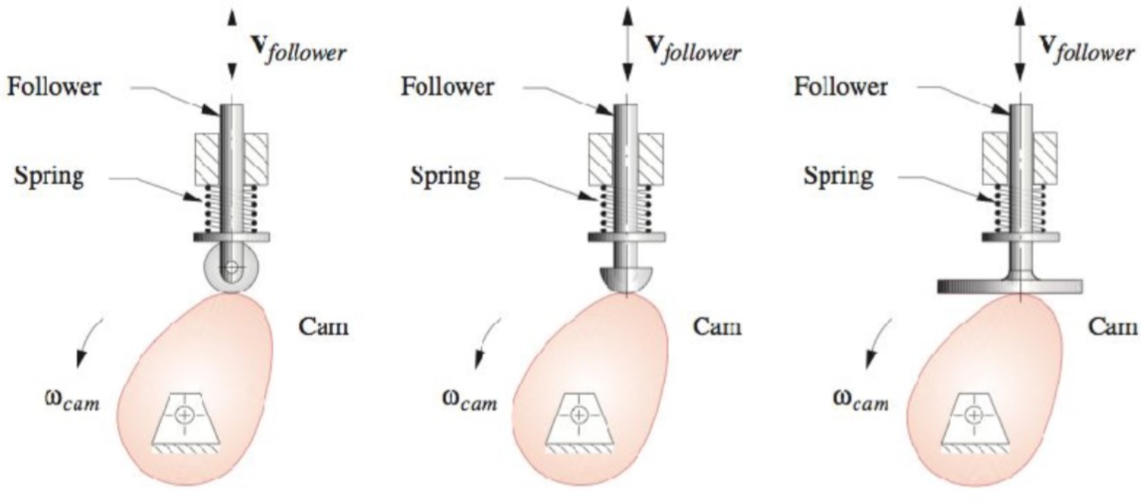
(b) Form-closed cam with oscillating follower

(c) Conjugate cams on common shaft



Type of Follower

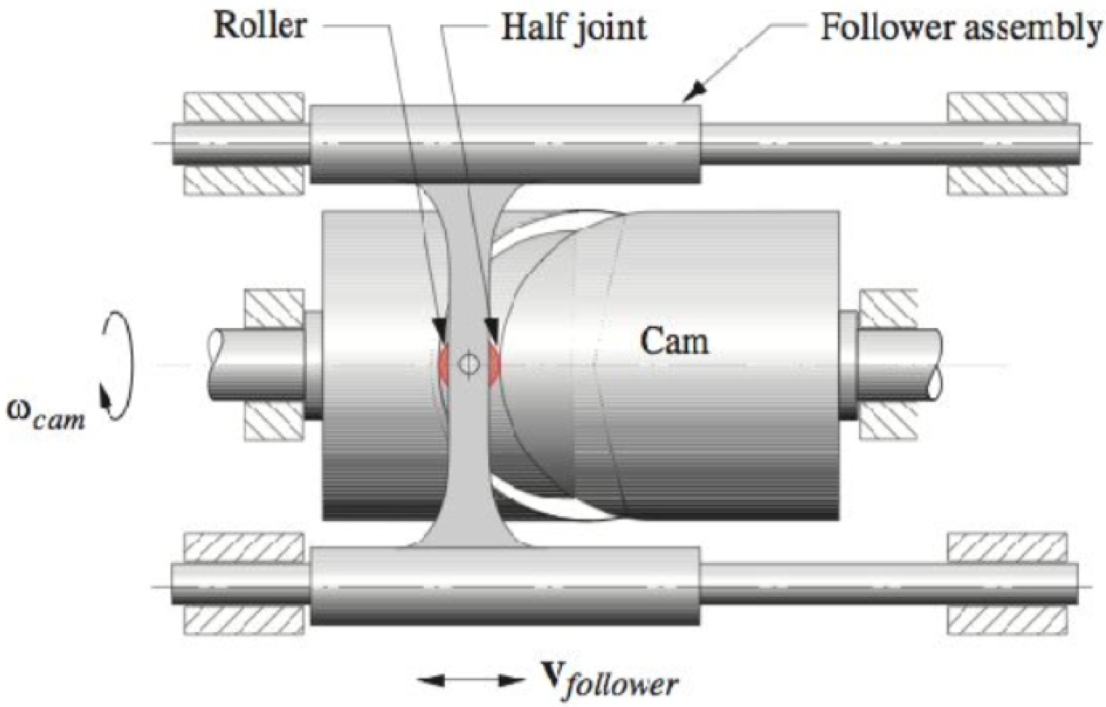
- curved (mushroom)
- flat-faces
- roller



(a) Roller follower (b) Mushroom follower (c) Flat-faced follower

Type of Cam

- radial cam *(the figures above are all radical cams)*
- axial cam



- three-dimensional cam

(c) Three-dimensional cams
Courtesy of The Gillette Co.
Boston, MA

Type of Motion Constraints

- critical extreme position
- critical path motion

Type of Motion Constraints

- rise-fall
- rise-fall-dwell
- rise-dwell-fall-dwell

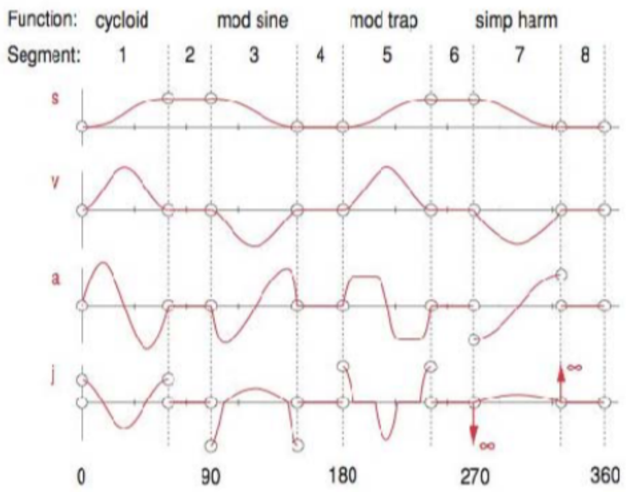
dwell: at zero displacement for 90 degrees (low dwell)

8.2 S V A J Diagrams

$$\theta = \omega t$$

Segment Number	Function Used	Start Angle	End Angle	Delta Angle
1	Cycloid rise	0	60	60
2	Dwell	60	90	30
3	ModSine fall	90	150	60
4	Dwell	150	180	30
5	ModTrap rise	180	240	60
6	Dwell	240	270	30
7	SimpHarm fall	270	330	60
8	Dwell	330	360	30

(a) Cam program specifications



(b) Plots of cam-follower's $s\ v\ a\ j$ diagrams

8.3 Double-Dwell Cam Design Choosing S V A J Functions

The Fundamental Law of Cam Design

Thw cam function must be continuous through the first and second derivatives of displacement across the entire interval

The jerk function must be finite across the entire interval

Simple Harmonic Motion (SHM)

$$s = \frac{h}{2}[1 - \cos{(\pi\frac{\theta}{\beta})}]$$

$$v = \frac{\pi}{\beta}\frac{h}{2}\sin{(\pi\frac{\theta}{\beta})}$$

$$a = \frac{\pi^2}{\beta^2}\frac{h}{2}\cos{(\pi\frac{\theta}{\beta})}$$

$$j = -\frac{\pi^3}{\beta^3}\frac{h}{2}\sin{(\pi\frac{\theta}{\beta})}$$