CAMs

- Polynomial Functions

Polynomial Functions

- Can be tailored to most Design Specifications
- Not limited to single or double-dwell applications
- Constants are determined by boundary conditions

$$s = C_o + C_1 \cdot \left(\frac{\theta}{\beta}\right) + C_2 \cdot \left(\frac{\theta}{\beta}\right)^2 + C_3 \cdot \left(\frac{\theta}{\beta}\right)^3 + \cdots + C_n \cdot \left(\frac{\theta}{\beta}\right)^n$$

3-4-5 Polynomial

$$s = C_o + C_1 \cdot \left(\frac{\theta}{\beta}\right) + C_2 \cdot \left(\frac{\theta}{\beta}\right)^2 + C_3 \cdot \left(\frac{\theta}{\beta}\right)^3 + C_4 \cdot \left(\frac{\theta}{\beta}\right)^4 + C_5 \cdot \left(\frac{\theta}{\beta}\right)^5$$

RISE

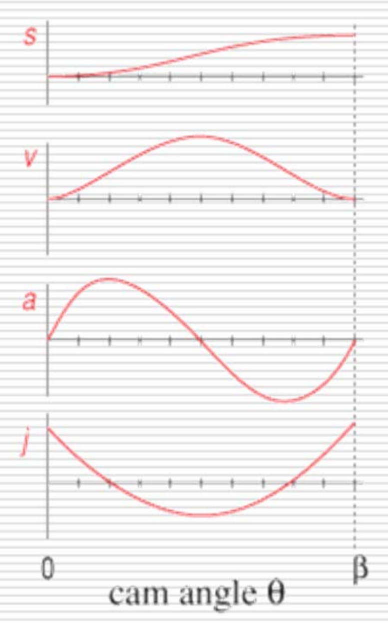
θ=0, s=0, v=0 a=0

$\theta=\beta_1$, s=h, v=0 a=0

FALL

θ=0, s=h, v=0 a=0

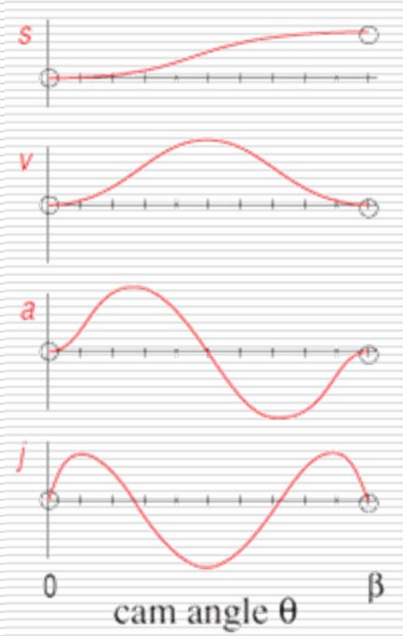
$\theta=\beta_2$, s=0, v=0 a=0



4-5-6-7 Polynomial

$$s = C_o + C_1 \cdot \left(\frac{\theta}{\beta}\right) + C_2 \cdot \left(\frac{\theta}{\beta}\right)^2 + C_3 \cdot \left(\frac{\theta}{\beta}\right)^3 + C_4 \cdot \left(\frac{\theta}{\beta}\right)^4$$

$$+ C_5 \cdot \left(\frac{\theta}{\beta}\right)^5 + C_6 \cdot \left(\frac{\theta}{\beta}\right)^6 + C_7 \cdot \left(\frac{\theta}{\beta}\right)^7$$



Relationship Between Functions of t (time) and θ

$$\theta = \omega \cdot t$$

$s = h \equiv$ Follower Displacement

$$v = \dot{s} = \frac{ds}{dt} = \frac{ds}{d\theta} \cdot \frac{d\theta}{dt} = \frac{ds}{d\theta} \cdot \omega = s' \cdot \omega \quad \Rightarrow s' = \frac{\dot{s}}{\omega}$$

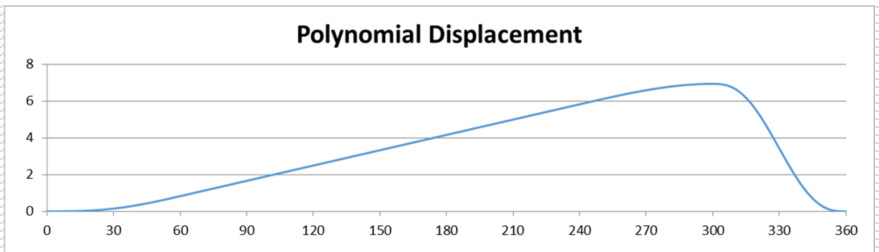
$$a = \ddot{s} = \frac{dv}{dt} = \frac{d\dot{s}}{dt} = \frac{d\left(s' \cdot \omega\right)}{dt} = \frac{ds'}{d\theta} \cdot \frac{d\theta}{dt} \cdot \omega = s'' \cdot \omega^2 \quad \Rightarrow s'' = \frac{\ddot{s}}{\omega^2}$$

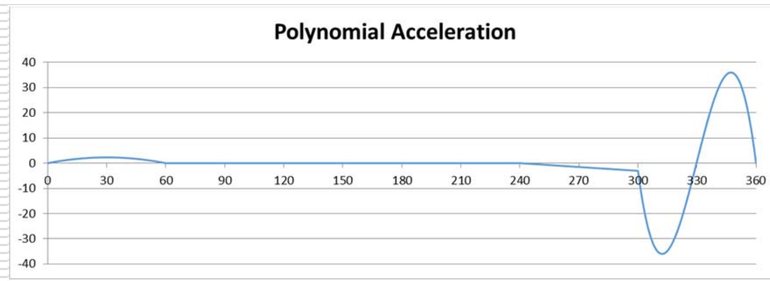
$$j = \dddot{s} = \frac{da}{dt} = \frac{d\ddot{s}}{dt} = \frac{d\left(s'' \cdot \omega^2\right)}{dt} = \frac{ds''}{d\theta} \cdot \frac{d\theta}{dt} \cdot \omega^2 = s'' \cdot \omega^3 \quad \Rightarrow s''' = \frac{\dddot{s}}{\omega^3}$$

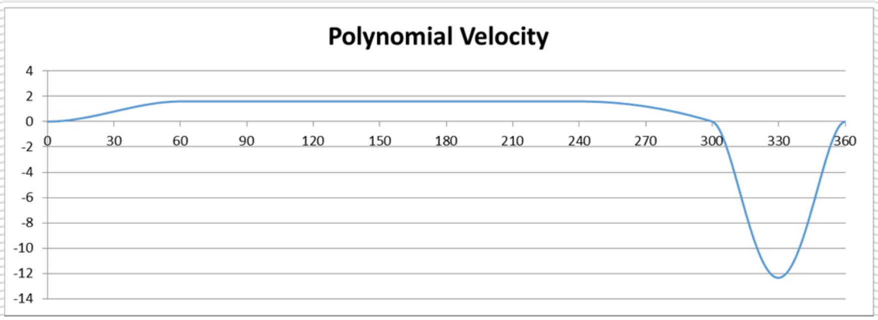
EXAMPLE:
Critical Path Motion

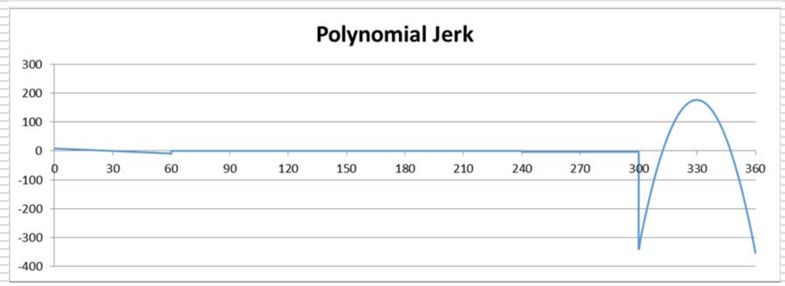
- Accelerate the follower from 0 to 10in/sec
- Maintain a constant velocity of 10in/s for 0.5s
- Decelerate the follower to zero velocity
- Return to the follower start position
- Cycle time exactly 1 second

Solution to Critical Path Motion Problem

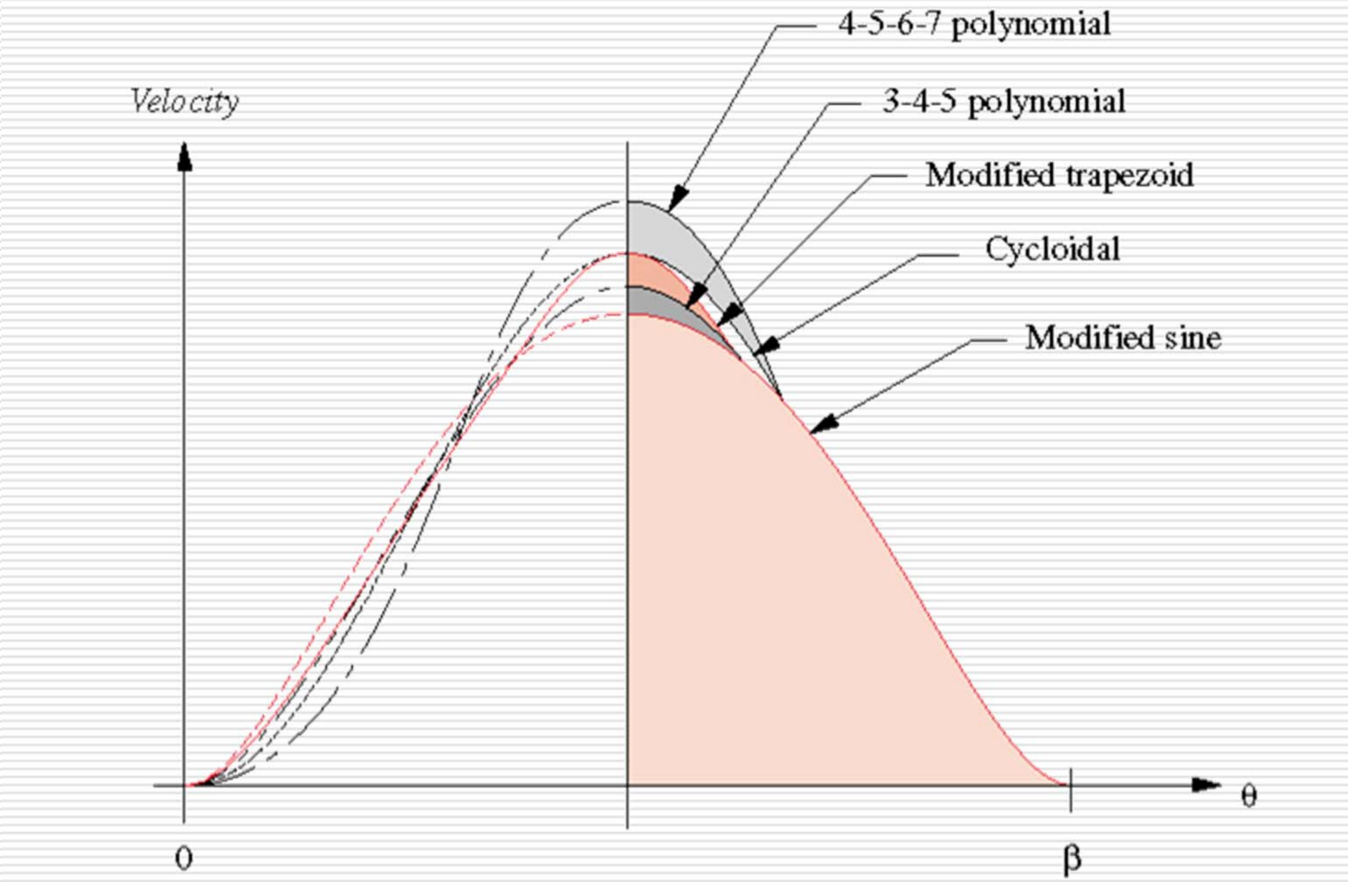




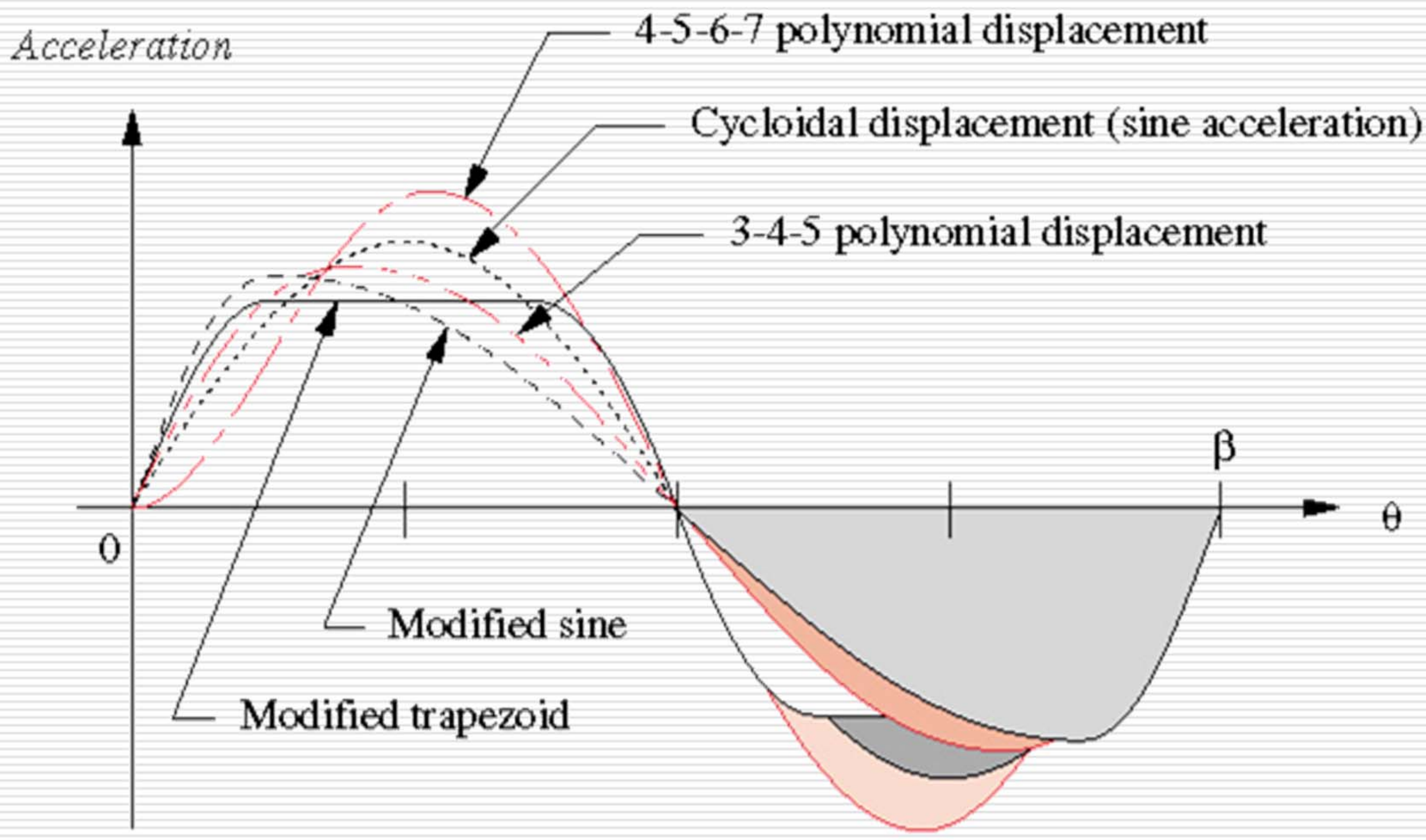




Velocity Comparison



Acceleration Comparison



Jerk Comparison