Simple Harmonic Motion

$$s = \frac{h}{2}\left(1 - \cos\left(\frac{pq}{b}\right)\right)$$ displacement

$$v = \frac{h}{2}\frac{pw}{b}\sin\left(\frac{pq}{b}\right)$$ velocity

$$a = \frac{h}{2}\frac{p^2w^2}{b^2}\cos\left(\frac{pq}{b}\right)$$ acceleration

$$j = -\frac{h}{2}\frac{p^3w^3}{b^3}\sin\left(\frac{pq}{b}\right)$$ jerk

Cycloidal Motion

$$s = h\frac{q}{b} - \frac{h}{2p}\sin\left(2p\frac{q}{b}\right)$$ displacement

$$V = h\frac{w}{b}\left(1 - \cos\left(2p\frac{q}{b}\right)\right)$$ velocity

$$a = h\frac{2pw^2}{b^2}\sin\left(2p\frac{q}{b}\right)$$ acceleration

$$j = h\frac{4p^2w^3}{b^3}\cos\left(2p\frac{q}{b}\right)$$ jerk

Noise, speed, permissible vibration, cam life---parameters that influence the choice of motion curves

What happens in the simple harmonic motion curve, if the rise and fall periods are something other than 180°? (Dwells are included)

What happens in the cylcloidal motion curve, if the rise and fall periods are something other than 180° or if dwells are included?

For high speed applications, which motion curve would you use?

Which kind of motion curve will give you the highest accelerations?

Which kind of motion curve will give you the lowest accelerations?

In Class Assignment

A follower is to move outward 50 mm with simple harmonic motion during 180° of cam rotation, is to dwell for the next 60°, and is to return with simple harmonic motion during the last 120° of cam rotation. Produce displacement, velocity, acceleration and jerk curves for this schedule.

For each stage of the schedule, provide:

h

b

q_o

q_f

write equations for displacement, velocity, acceleration and jerk for each stage of the schedule.

Reproduce this schedule using cycloidal motion curves and compare your observations.