# Cam Follower Motion: Simple Harmonic Rise

Peak velocity and acceleration of a cam follower with simple harmonic motion over a rise, from the lift, cam angle of the rise and cam speed.

**Method:** Simple harmonic follower motion y = (h/2)(1 − cos(πθ/β)) (textbook theory of machines)

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Lift (rise) | 25.000 | mm |
| Cam angle for the rise | 120.00 | ° |
| Cam speed | 300.00 | rpm |
| Mass of the follower train (for the force) | 1.5000 | kg |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Peak velocity π h ω/(2β) | 0.58905 | m/s |
| Peak acceleration π² h ω²/(2β²) | 27.758 | m/s² |
| Inertia force m a_max | 0.041637 | kN |
| Time for the rise | 0.066667 | s |

**Notes for this case**

• Acceleration in m/s². Simple harmonic motion jumps in acceleration at the ends of the rise; cycloidal profiles avoid that at high speed.

## Formula and method

$$y = \frac{h}{2}\left(1 - \cos\frac{\pi\theta}{\beta}\right), \quad v_{max} = \frac{\pi h\omega}{2\beta}, \quad a_{max} = \frac{\pi^2 h\omega^2}{2\beta^2}$$

### Variables

| | | |
|---|---|---|
| $h$ | Lift (rise) | m |
| $\beta$ | Cam angle for the rise | rad |
| $N$ | Cam speed | 1/s |
| $m$ | Mass of the follower train (for the force) | kg |
| $v_{max}$ | Peak velocity π h ω/(2β) | m/s |
| $a_{max}$ | Peak acceleration π² h ω²/(2β²), in m/s² | m/s² |
| $F$ | Inertia force m a_max | N |
| $t$ | Time for the rise | s |

### Method and standards

Derivatives of the SHM profile.

### Assumptions and limits

- Rigid follower train.
- F is the inertia force alone; the return spring must also carry its preload and any external load on the follower.
- The peak acceleration is always in m/s², whatever the unit system.

### References

• Simple harmonic follower motion y = (h/2)(1 − cos(πθ/β)) (textbook theory of machines)

## Report details

| | |
|---|---|
| Report reference | FCC-NDVR-X1Q6 (the same inputs always give the same reference) |
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| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/mechanical/machine-design/cam-follower-shm

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.