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Cam and Follower Formulas

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List of 19 Cam and Follower Formulas

Cam and Follower

Follower Motion

1) Condition for Maximum Acceleration of Follower Exhibiting Cycloidal Motion

Open Calculator

fx $\theta_{rotation} = \frac{\theta_o}{4}$

ex $0.349\text{rad} = \frac{1.396\text{rad}}{4}$

2) Condition for Maximum Velocity of Follower Exhibiting Cycloidal Motion

Open Calculator

fx $\theta_{rotation} = \frac{\theta_o}{2}$

ex $0.698\text{rad} = \frac{1.396\text{rad}}{2}$

3) Displacement of Follower after Time t for Cycloidal Motion

Open Calculator

fx $d_{follower} = S \cdot \left(\frac{\theta_{rotation}}{\theta_o} \cdot \frac{180}{\pi} - \sin\left(\frac{2 \cdot \pi \cdot \theta_{rotation}}{\theta_o} \right) \right)$

ex $266.4789\text{m} = 20\text{m} \cdot \left(\frac{0.349\text{rad}}{1.396\text{rad}} \cdot \frac{180}{\pi} - \sin\left(\frac{2 \cdot \pi \cdot 0.349\text{rad}}{1.396\text{rad}} \right) \right)$

4) Displacement of Follower for Circular Arc Cam, there's Contact on Circular Flank

Open Calculator

fx $d_{follower} = (r_{Base} - r_1) \cdot (1 - \cos(\theta_{turned}))$

ex $266.4045\text{m} = (139.45\text{m} - 3\text{m}) \cdot (1 - \cos(2.8318\text{rad}))$

5) Mean Velocity of Follower during Outstroke at Uniform Acceleration

Open Calculator

fx $V_{mean} = \frac{S}{t_o}$

ex $386.8173\text{m/s} = \frac{20\text{m}}{0.051704\text{s}}$

6) Mean Velocity of Follower during Return Stroke at Uniform Acceleration

Open Calculator

$$V_{mean} = \frac{S}{t_R}$$

$$386.8472\text{m/s} = \frac{20\text{m}}{0.0517\text{s}}$$

7) Peripheral Speed of Projection of Point P' (Projection of Point P on Dia) for SHM of Follower

Open Calculator

$$P_s = \frac{\pi \cdot S \cdot \omega}{2 \cdot \theta_o}$$

$$607.6146\text{m/s} = \frac{\pi \cdot 20\text{m} \cdot 27\text{rad/s}}{2 \cdot 1.396\text{rad}}$$

8) Peripheral Speed of Projection of Point P on Diameter for SHM of Follower

Open Calculator

$$P_s = \frac{\pi \cdot S}{2 \cdot t_o}$$

$$607.6111\text{m/s} = \frac{\pi \cdot 20\text{m}}{2 \cdot 0.051704\text{s}}$$

9) Time Required by Follower for Return Stroke at Uniform Acceleration

Open Calculator

$$t_R = \frac{\theta_R}{\omega}$$

$$0.0517\text{s} = \frac{1.3959\text{rad}}{27\text{rad/s}}$$

10) Time Required for Follower during Outstroke for Uniform Acceleration

Open Calculator

$$t_o = \frac{\theta_o}{\omega}$$

$$0.051704\text{s} = \frac{1.396\text{rad}}{27\text{rad/s}}$$

11) Time Required for Out Stroke of Follower when Follower Moves with SHM

Open Calculator

$$t_o = \frac{\theta_o}{\omega}$$

$$0.051704\text{s} = \frac{1.396\text{rad}}{27\text{rad/s}}$$

12) Velocity of Follower after Time t for Cycloidal Motion

Open Calculator

$$v = \frac{\omega \cdot S}{\theta_o} \cdot \left(1 - \cos\left(\frac{2 \cdot \pi \cdot \theta_{rotation}}{\theta_o}\right)\right)$$

$$386.8195\text{m/s} = \frac{27\text{rad/s} \cdot 20\text{m}}{1.396\text{rad}} \cdot \left(1 - \cos\left(\frac{2 \cdot \pi \cdot 0.349\text{rad}}{1.396\text{rad}}\right)\right)$$

13) Velocity of Follower for Circular Arc Cam if Contact is on Circular Flank

Open Calculator

$$v = \omega \cdot (R - r_1) \cdot \sin(\theta_{turned})$$

$$386.8688\text{m/s} = 27\text{rad/s} \cdot (50\text{m} - 3\text{m}) \cdot \sin(2.8318\text{rad})$$

Tangent Cam

14) Condition for Contact of Roller if Straight Flank Merges into Nose Tangent Cam with Roller Follower

Open Calculator

$$\theta_1 = \alpha - \varphi$$

$$0.785\text{rad} = 1.285\text{rad} - 0.5\text{rad}$$

15) Displacement of Needle for Tangent Cam with Needle-Bearing Follower

Open Calculator

$$d_{needle} = (r_1 + r_{roller}) \cdot \left(\frac{1 - \cos(\theta)}{\cos(\theta)}\right)$$

$$2.404204\text{m} = (3\text{m} + 33.37\text{m}) \cdot \left(\frac{1 - \cos(170\text{rad})}{\cos(170\text{rad})}\right)$$

16) Displacement of Roller of Tangent Cam with Roller Follower, when there's Nose Contact

Open Calculator

$$d_{roller} = L + r - r \cdot \cos(\theta_1) - \sqrt{L^2 - r^2 \cdot (\sin(\theta_1))^2}$$

$$6.191531\text{m} = 33.89\text{m} + 15.192\text{m} - 15.192\text{m} \cdot \cos(0.785\text{rad}) - \sqrt{(33.89\text{m})^2 - (15.192\text{m})^2 \cdot (\sin(0.785\text{rad}))^2}$$

17) Distance between Roller Center and Nose Center of Tangent Cam with Roller Follower

Open Calculator

$$L = r_{roller} + r_{nose}$$

$$33.89\text{m} = 33.37\text{m} + 0.52\text{m}$$

18) Velocity of Follower for Roller Follower Tangent Cam if Contact is with Straight Flanks

Open Calculator

$$v = \omega \cdot (r_1 + r_{roller}) \cdot \frac{\sin(\theta)}{(\cos(\theta))^2}$$

$$386.8983\text{m/s} = 27\text{rad/s} \cdot (3\text{m} + 33.37\text{m}) \cdot \frac{\sin(170\text{rad})}{(\cos(170\text{rad}))^2}$$

19) Velocity of Follower of Roller Follower Tangent Cam for Contact with Nose

Open Calculator

$$v = \omega \cdot r \cdot \left(\sin(\theta_1) + \frac{r \cdot \sin(2 \cdot \theta_1)}{2 \cdot \sqrt{L^2 - r^2 \cdot (\sin(\theta_1))^2}} \right)$$

$$386.8601\text{m/s} = 27\text{rad/s} \cdot 15.192\text{m} \cdot \left(\sin(0.785\text{rad}) + \frac{15.192\text{m} \cdot \sin(2 \cdot 0.785\text{rad})}{2 \cdot \sqrt{(33.89\text{m})^2 - (15.192\text{m})^2 \cdot (\sin(0.785\text{rad}))^2}} \right)$$

Variables Used

- $d_{follower}$ Displacement of Follower *(Meter)*
- d_{needle} Displacement of Needle *(Meter)*
- d_{roller} Displacement of Roller *(Meter)*
- **L** Distance b/w Roller Centre and Nose Centre *(Meter)*
- P_s Peripheral Speed *(Meter per Second)*
- **r** Distance b/w Cam Center and Nose Center *(Meter)*
- **R** Radius of Circular Flank *(Meter)*
- r_1 Radius of the Base Circle *(Meter)*
- r_{Base} Base Radius of Truncated Cone *(Meter)*
- r_{nose} Radius of Nose *(Meter)*
- r_{roller} Radius of Roller *(Meter)*
- **S** Stroke of Follower *(Meter)*
- t_o Time Required for the Outstroke *(Second)*
- t_R Time Required for the Return Stroke *(Second)*
- **v** Velocity *(Meter per Second)*
- V_{mean} Mean Velocity *(Meter per Second)*
- α Angle of Ascent *(Radian)*
- θ Angle Turned by Cam from Beginning of Roller *(Radian)*
- θ_1 Angle Turned by Cam when Roller is at Nose Top *(Radian)*
- θ_o Angular Displacement of Cam during Out Stroke *(Radian)*
- θ_R Angular Displacement of Cam during Return Stroke *(Radian)*
- $\theta_{rotation}$ Angle through Cam Rotates *(Radian)*
- θ_{turned} Angle Turned by Cam *(Radian)*
- φ Angle Turned by the Cam for Contact of Roller *(Radian)*
- ω Angular Velocity of Cam *(Radian per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion
- Measurement: **Angular Velocity** in Radian per Second (rad/s)
  Angular Velocity Unit Conversion

Check other formula lists

- **Acceleration of the Follower Formulas**
- **Cam and Follower Formulas**
- **Maximum Velocity of the Follower Formulas**

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