Important Rayleigh's Method Formulas PDF

Formulas
Examples
with Units

List of 16
Important Rayleigh's Method Formulas

1) Displacement of Body from Mean Position Formula

Evaluate Formula

Formula

$$s_{body} = x \cdot \sin\left(\omega_n \cdot t_{total}\right)$$

Example with Units

$$0.8539\,\text{m} = 1.25\,\text{m} \cdot \sin\left(21\,\text{rad/s} \cdot 80\,\text{s}\right)$$

2) Maximum Displacement from Mean Position given Displacement of Body from Mean Position Formula

Evaluate Formula

Formula

$$x = \frac{s_{body}}{\sin\left(\omega_n \cdot t_{total}\right)}$$

Example with Units

$$1.0979\,\text{m} = \frac{0.75\,\text{m}}{\sin\left(21\,\text{rad/s} \cdot 80\,\text{s}\right)}$$

3) Maximum Displacement from Mean Position given Maximum Kinetic Energy Formula

Evaluate Formula

Formula

$$x = \sqrt{\frac{2 \cdot KE}{W_{load} \cdot \omega_n^2}}$$

Example with Units

$$2.1296\,\text{m} = \sqrt{\frac{2 \cdot 5000\,\text{J}}{5\,\text{kg} \cdot 21\,\text{rad/s}^2}}$$

4) Maximum Displacement from Mean Position given Maximum Potential Energy Formula

Evaluate Formula

Formula

$$x = \sqrt{\frac{2 \cdot PE_{max}}{s_{constrain}}}$$

Example with Units

$$2.4807\,\text{m} = \sqrt{\frac{2 \cdot 40\,\text{J}}{13\,\text{N/m}}}$$

5) Maximum Displacement from Mean Position given Maximum Velocity at Mean Position Formula

Evaluate Formula

Formula

$$x = \frac{V_{max}}{\omega_f}$$

Example with Units

$$1.6667\,\text{m} = \frac{75\,\text{m/s}}{45\,\text{rad/s}}$$

6) Maximum Displacement from Mean Position given Velocity at Mean Position Formula

Evaluate Formula

Formula

$$x = \frac{v}{\omega_f \cdot \cos\left(\omega_f \cdot t_{total}\right)}$$

Example with Units

$$1.3816\,\text{m} = \frac{60\,\text{m/s}}{45\,\text{rad/s} \cdot \cos\left(45\,\text{rad/s} \cdot 80\,\text{s}\right)}$$

7) Maximum Kinetic Energy at Mean Position Formula

Evaluate Formula

Formula

$$KE = \frac{W_{load} \cdot \omega_f^2 \cdot x^2}{2}$$

Example with Units

$$7910.1562\,\text{J} = \frac{5\,\text{kg} \cdot 45\,\text{rad/s}^2 \cdot 1.25\,\text{m}^2}{2}$$

8) Maximum Potential Energy at Mean Position Formula

Evaluate Formula

Formula

$$PE_{max} = \frac{s_{constrain} \cdot x^2}{2}$$

Example with Units

$$10.1562\,\text{J} = \frac{13\,\text{N/m} \cdot 1.25\,\text{m}^2}{2}$$

9) Maximum Velocity at Mean Position by Rayleigh Method Formula

Evaluate Formula

Formula

$$V_{max} = \omega_f \cdot x$$

Example with Units

$$56.25\,\text{m/s} = 45\,\text{rad/s} \cdot 1.25\,\text{m}$$

10) Natural Circular Frequency given Displacement of Body Formula

Evaluate Formula

Formula

$$\omega_n = \frac{asin\left(\frac{s_{body}}{x}\right)}{t_p}$$

Example with Units

$$0.2145\,\text{rad/s} = \frac{asin\left(\frac{0.75\,\text{m}}{1.25\,\text{m}}\right)}{3\,\text{s}}$$

11) Natural Circular Frequency given Maximum Velocity at Mean Position Formula

Evaluate Formula

Formula

$$\omega_n = \frac{V_{max}}{x}$$

Example with Units

$$60\,\text{rad/s} = \frac{75\,\text{m/s}}{1.25\,\text{m}}$$

12) Natural Frequency given Natural Circular Frequency Formula

Evaluate Formula

Formula

$$f_n = \frac{\omega_n}{2 \cdot \pi}$$

Example with Units

$$3.3423\,\text{Hz} = \frac{21\,\text{rad/s}}{2 \cdot 3.1416}$$

13) Potential Energy given Displacement of Body Formula

Evaluate Formula

Formula

$$PE = \frac{s_{constrain} \cdot \left(s_{body}^{2} \right)}{2}$$

Example with Units

$$3.6562\,\text{J} = \frac{13\,\text{N/m} \cdot \left(0.75\,\text{m}^{2} \right)}{2}$$

14) Time Period given Natural Circular Frequency Formula

Evaluate Formula

Formula

$$t_p = \frac{2 \cdot \pi}{\omega_n}$$

Example with Units

$$0.2992\,\text{s} = \frac{2 \cdot 3.1416}{21\,\text{rad/s}}$$

15) Time Period of Free Longitudinal Vibrations Formula

Evaluate Formula

Formula

$$t_p = 2 \cdot \pi \cdot \sqrt{\frac{W}{s_{constrain}}}$$

Example with Units

$$4.9289\,\text{s} = 2 \cdot 3.1416 \cdot \sqrt{\frac{8\,\text{N}}{13\,\text{N/m}}}$$

16) Velocity at Mean Position Formula

Evaluate Formula

Formula

$$v = \left(\omega_f \cdot x \right) \cdot \cos\left(\omega_f \cdot t_{total} \right)$$

Example with Units

$$54.2838\,\text{m/s} = \left(45\,\text{rad/s} \cdot 1.25\,\text{m} \right) \cdot \cos\left(45\,\text{rad/s} \cdot 80\,\text{s} \right)$$

Variables used in list of Rayleigh's Method Formulas above

- f_n Natural Frequency *(Hertz)*
- **KE** Maximum Kinetic Energy *(Joule)*
- **PE** Potential Energy *(Joule)*
- PE_{max} Maximum Potential Energy *(Joule)*
- s_{body} Displacement of Body *(Meter)*
- $s_{constrain}$ Stiffness of Constraint *(Newton per Meter)*
- t_p Time Period *(Second)*
- t_{total} Total Time Taken *(Second)*
- **v** Velocity *(Meter per Second)*
- V_{max} Maximum Velocity *(Meter per Second)*
- **W** Weight of Body in Newtons *(Newton)*
- W_{load} Load *(Kilogram)*
- **x** Maximum Displacement *(Meter)*
- ω_f Cumulative Frequency *(Radian per Second)*
- ω_n Natural Circular Frequency *(Radian per Second)*

Constants, Functions, Measurements used in list of Rayleigh's Method Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **asin**, asin(Number) *The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **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.*
- Functions: **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: **Weight** in Kilogram (kg) *Weight Unit Conversion*
- Measurement: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Energy** in Joule (J) *Energy Unit Conversion*
- Measurement: **Force** in Newton (N) *Force Unit Conversion*
- Measurement: **Frequency** in Hertz (Hz) *Frequency Unit Conversion*
- Measurement: **Surface Tension** in Newton per Meter (N/m) *Surface Tension Unit Conversion*
- Measurement: **Angular Velocity** in Radian per Second (rad/s) *Angular Velocity Unit Conversion*

Download other Important Natural Frequency of Free Longitudinal Vibrations PDFs

- Important Equilibrium Method Formulas
- Important Rayleigh's Method Formulas

Try our Unique Visual Calculators

- Percentage of number
- LCM calculator
- Simple fraction

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

English Spanish French German Russian Italian Portuguese Polish Dutch

9/30/2024 | 1:06:38 PM UTC