Important Vibration Isolation and Transmissibility Formulas PDF

Formulas
Examples
with Units

List of 18
Important Vibration Isolation and Transmissibility Formulas

1) Angular Velocity of Vibration using Force Transmitted Formula

Evaluate Formula

Formula

$$\omega = \frac{\sqrt{\left(\frac{F_T}{K}\right)^2 - k^2}}{c}$$

Example with Units

$$0.2\,\text{rad/s} = \frac{\sqrt{\left(\frac{48021.6\,\text{N}}{0.8\,\text{m}}\right)^2 - 60000\,\text{N/m}^2}}{9000\,\text{Ns/m}}$$

2) Applied Force given Transmissibility Ratio Formula

Evaluate Formula

Formula

$$F_a = \frac{F_T}{\varepsilon}$$

Example with Units

$$2501.125\,\text{N} = \frac{48021.6\,\text{N}}{19.2}$$

3) Applied Force given Transmissibility Ratio and Maximum Displacement of Vibration Formula

Evaluate Formula

Formula

$$F_a = \frac{K \cdot \sqrt{k^2 + (c \cdot \omega)^2}}{\varepsilon}$$

Example with Units

$$2501.1247\,\text{N} = \frac{0.8\,\text{m} \cdot \sqrt{60000\,\text{N/m}^2 + (9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s})^2}}{19.2}$$

4) Damping Coefficient using Force Transmitted Formula

Evaluate Formula

Formula

$$c = \frac{\sqrt{\left(\frac{F_T}{K}\right)^2 - k^2}}{\omega}$$

Example with Units

$$9001.0124\,\text{Ns/m} = \frac{\sqrt{\left(\frac{48021.6\,\text{N}}{0.8\,\text{m}}\right)^2 - 60000\,\text{N/m}^2}}{0.2\,\text{rad/s}}$$

5) Force Transmitted Formula

Evaluate Formula

Formula

$$F_T = K \cdot \sqrt{k^2 + (c \cdot \omega)^2}$$

Example with Units

$$48021.5951\,\text{N} = 0.8\,\text{m} \cdot \sqrt{60000\,\text{N/m}^2 + (9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s})^2}$$

6) Magnification Factor given Transmissibility Ratio Formula

Evaluate Formula

Formula

$$D = \frac{\varepsilon \cdot k}{\sqrt{k^2 + (c \cdot \omega)^2}}$$

Example with Units

$$19.1914 = \frac{19.2 \cdot 60000\,\text{N/m}}{\sqrt{60000\,\text{N/m}^2 + (9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s})^2}}$$

7) Magnification Factor given Transmissibility Ratio given Natural Circular Frequency Formula

Evaluate Formula

Formula

$$D = \frac{\varepsilon}{\sqrt{1 + \left(\frac{2 \cdot c \cdot \omega}{c_c \cdot \omega_n}\right)^2}}$$

Example with Units

$$1.8537 = \frac{19.2}{\sqrt{1 + \left(\frac{2 \cdot 9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s}}{1800\,\text{Ns/m} \cdot 0.194\,\text{rad/s}}\right)^2}}$$

8) Maximum Displacement of Vibration given Transmissibility Ratio Formula

Evaluate Formula

Formula

$$K = \frac{\varepsilon \cdot F_a}{\sqrt{k^2 + (c \cdot \omega)^2}}$$

Example with Units

$$0.7996\,\text{m} = \frac{19.2 \cdot 2500\,\text{N}}{\sqrt{60000\,\text{N/m}^2 + (9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s})^2}}$$

9) Maximum Displacement of Vibration using Force Transmitted Formula

Evaluate Formula

Formula

$$K = \frac{F_T}{\sqrt{k^2 + (c \cdot \omega)^2}}$$

Example with Units

$$0.8\,\text{m} = \frac{48021.6\,\text{N}}{\sqrt{60000\,\text{N/m}^2 + (9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s})^2}}$$

10) Natural Circular Frequency given Transmissibility Ratio Formula

Evaluate Formula

Formula

$$\omega_n = \frac{\omega}{\sqrt{1 + \frac{1}{\varepsilon}}}$$

Example with Units

$$0.195\,\text{rad/s} = \frac{0.2\,\text{rad/s}}{\sqrt{1 + \frac{1}{19.2}}}$$

11) Stiffness of Spring using Force Transmitted Formula

Evaluate Formula

Formula

$$k = \sqrt{\left(\frac{F_T}{K}\right)^2 - (c \cdot \omega)^2}$$

Example with Units

$$60000.0061\,\text{N/m} = \sqrt{\left(\frac{48021.6\,\text{N}}{0.8\,\text{m}}\right)^2 - (9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s})^2}$$

12) Transmissibility Ratio Formula

Evaluate Formula

Formula

$$\varepsilon = \frac{K \cdot \sqrt{k^2 + (c \cdot \omega)^2}}{F_a}$$

Example with Units

$$19.2086 = \frac{0.8\,\text{m} \cdot \sqrt{60000\,\text{N/m}^2 + (9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s})^2}}{2500\,\text{N}}$$

13) Transmissibility Ratio given Force Transmitted Formula

Evaluate Formula

Formula

$$\varepsilon = \frac{F_T}{F_a}$$

Example with Units

$$19.2086 = \frac{48021.6\,\text{N}}{2500\,\text{N}}$$

14) Transmissibility Ratio given Magnification Factor Formula

Evaluate Formula

Formula

$$\varepsilon = \frac{D \cdot \sqrt{k^2 + (c \cdot \omega)^2}}{k}$$

Example with Units

$$19.1986 = \frac{19.19 \cdot \sqrt{60000\,\text{N/m}^2 + (9000\,\text{Ns/m} \cdot 0.2\,\text{rad/s})^2}}{60000\,\text{N/m}}$$

15) Transmissibility Ratio given Natural Circular Frequency and Critical Damping Coefficient Formula

Evaluate Formula

Formula

$$\varepsilon = \frac{\sqrt{1+\left(\frac{2\cdot c\cdot \omega}{c_c\cdot \omega_n}\right)^2}}{\sqrt{\left(\frac{2\cdot c\cdot \omega}{c_c\cdot \omega_n}\right)^2+\left(1-\left(\frac{\omega}{\omega_n}\right)^2\right)^2}}$$

Example with Units

$$0.0984 = \frac{\sqrt{1+\left(\frac{2\cdot 9000\,\text{Ns/m}\cdot 0.2\,\text{rad/s}}{1800\,\text{Ns/m}\cdot 0.194\,\text{rad/s}}\right)^2}}{\sqrt{\left(\frac{2\cdot 9000\,\text{Ns/m}\cdot 0.2\,\text{rad/s}}{1800\,\text{Ns/m}\cdot 0.194\,\text{rad/s}}\right)^2+\left(1-\left(\frac{0.2\,\text{rad/s}}{0.194\,\text{rad/s}}\right)^2\right)^2}}$$

16) Transmissibility Ratio given Natural Circular Frequency and Magnification Factor Formula

Evaluate Formula

Formula

$$\varepsilon = D\cdot\sqrt{1+\left(\frac{2\cdot c\cdot \omega}{c_c\cdot \omega_n}\right)^2}$$

Example with Units

$$198.7636 = 19.19\cdot\sqrt{1+\left(\frac{2\cdot 9000\,\text{Ns/m}\cdot 0.2\,\text{rad/s}}{1800\,\text{Ns/m}\cdot 0.194\,\text{rad/s}}\right)^2}$$

17) Transmissibility Ratio if there is No Damping Formula

Evaluate Formula

Formula

$$\varepsilon = \frac{1}{\left(\frac{\omega}{\omega_n}\right)^2-1}$$

Example with Units

$$15.9205 = \frac{1}{\left(\frac{0.2\,\text{rad/s}}{0.194\,\text{rad/s}}\right)^2-1}$$

18) Transmitted Force given Transmissibility Ratio Formula

Evaluate Formula

Formula

$$F_T = \varepsilon\cdot F_a$$

Example with Units

$$48000\,\text{N} = 19.2\cdot 2500\,\text{N}$$

Variables used in list of Vibration Isolation and Transmissibility Formulas above

- **c** Damping Coefficient *(Newton Second per Meter)*
- c_c Critical Damping Coefficient *(Newton Second per Meter)*
- **D** Magnification Factor
- F_a Applied Force *(Newton)*
- F_T Force Transmitted *(Newton)*
- **k** Stiffness of Spring *(Newton per Meter)*
- **K** Maximum Displacement *(Meter)*
- **ε** Transmissibility Ratio
- **ω** Angular Velocity *(Radian per Second)*
- ω_n Natural Circular Frequency *(Radian per Second)*

Constants, Functions, Measurements used in list of Vibration Isolation and Transmissibility Formulas above

- 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: **Force** in Newton (N)
  Force 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
- Measurement: **Damping Coefficient** in Newton Second per Meter (Ns/m)
  Damping Coefficient Unit Conversion

Download other Important Longitudinal and Transverse Vibrations PDFs

- Important Load for Various Types of Beams and Load Conditions Formulas
- Important Critical or Whirling Speed of Shaft Formulas
- Important Effect of Inertia of Constraint in Longitudinal and Transverse Vibrations Formulas
- Important Frequency of Free Damped Vibrations Formulas
- Important Frequency of Under Damped Forced Vibrations Formulas
- Important Natural Frequency of Free Transverse Vibrations Formulas
- Important Natural Frequency of Free Transverse Vibrations Due to Uniformly Distributed Load Acting Over a Simply Supported Shaft Formulas
- Important Natural Frequency of Free Transverse Vibrations of a Shaft Fixed at Both Ends Carrying a Uniformly Distributed Load Formulas
- Important Values of length of beam for the various types of beams and under various load conditions Formulas
- Important Values of static deflection for the various types of beams and under various load conditions Formulas
- Important Vibration Isolation and Transmissibility Formulas

Try our Unique Visual Calculators

- Percentage increase
- HCF calculator
- Mixed 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

7/8/2024 | 7:25:07 AM UTC