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Vibration Isolation and Transmissibility Formulas

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List of 18 Vibration Isolation and Transmissibility Formulas

Vibration Isolation and Transmissibility

1) Angular Velocity of Vibration using Force Transmitted

Open Calculator

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

ex $$0.200022\text{rad/s} = \frac{\sqrt{\left(\frac{48021.6\text{N}}{0.8\text{m}}\right)^2 - (60000\text{N/m})^2}}{9000\text{Ns/m}}$$

2) Applied Force given Transmissibility Ratio

Open Calculator

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

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

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

Open Calculator

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

ex $$2501.125\text{N} = \frac{0.8\text{m} \cdot \sqrt{(60000\text{N/m})^2 + (9000\text{Ns/m} \cdot 0.2\text{rad/s})^2}}{19.2}$$

4) Damping Coefficient using Force Transmitted

Open Calculator

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

ex $$9001.012\text{Ns/m} = \frac{\sqrt{\left(\frac{48021.6\text{N}}{0.8\text{m}}\right)^2 - (60000\text{N/m})^2}}{0.2\text{rad/s}}$$

5) Force Transmitted

Open Calculator

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

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

6) Magnification Factor given Transmissibility Ratio

Open Calculator

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

$$19.19137 = \frac{19.2 \cdot 60000\text{N/m}}{\sqrt{(60000\text{N/m})^2 + (9000\text{Ns/m} \cdot 0.2\text{rad/s})^2}}$$

7) Magnification Factor given Transmissibility Ratio given Natural Circular Frequency

Open Calculator

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

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

8) Maximum Displacement of Vibration given Transmissibility Ratio

Open Calculator

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

$$0.79964\text{m} = \frac{19.2 \cdot 2500\text{N}}{\sqrt{(60000\text{N/m})^2 + (9000\text{Ns/m} \cdot 0.2\text{rad/s})^2}}$$

9) Maximum Displacement of Vibration using Force Transmitted

Open Calculator

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

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

10) Natural Circular Frequency given Transmissibility Ratio

Open Calculator

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

ex $$0.194987\text{rad/s} = \frac{0.2\text{rad/s}}{\sqrt{1 + \frac{1}{19.2}}}$$

11) Stiffness of Spring using Force Transmitted

Open Calculator

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

ex $$60000.01\text{N/m} = \sqrt{\left(\frac{48021.6\text{N}}{0.8\text{m}}\right)^2 - (9000\text{Ns/m} \cdot 0.2\text{rad/s})^2}$$

12) Transmissibility Ratio

Open Calculator

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

$$19.20864 = \frac{0.8\text{m} \cdot \sqrt{(60000\text{N/m})^2 + (9000\text{Ns/m} \cdot 0.2\text{rad/s})^2}}{2500\text{N}}$$

13) Transmissibility Ratio given Force Transmitted

Open Calculator

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

$$19.20864 = \frac{48021.6\text{N}}{2500\text{N}}$$

14) Transmissibility Ratio given Magnification Factor

Open Calculator

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

$$19.19863 = \frac{19.19 \cdot \sqrt{(60000\text{N/m})^2 + (9000\text{Ns/m} \cdot 0.2\text{rad/s})^2}}{60000\text{N/m}}$$

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

Open Calculator

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

ex $$0.09842 = \frac{\sqrt{1+\left(\frac{2\cdot 9000\text{Ns/m}\cdot 0.2\text{rad/s}}{\left(1800\text{Ns/m}\cdot 0.194\text{rad/s}\right)^2}\right)}}{\sqrt{\left(\frac{2\cdot 9000\text{Ns/m}\cdot 0.2\text{rad/s}}{1800\text{Ns/m}\cdot 0.194\text{rad/s}}\right)^2+\left(1-\left(\frac{0.2\text{rad/s}}{0.194\text{rad/s}}\right)^2\right)^2}}$$

16) Transmissibility Ratio given Natural Circular Frequency and Magnification Factor

Open Calculator

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

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

17) Transmissibility Ratio if there is No Damping

Open Calculator

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

ex $$15.92047 = \frac{1}{\left(\frac{0.2\text{rad/s}}{0.194\text{rad/s}}\right)^2 - 1}$$

18) Transmitted Force given Transmissibility Ratio

Open Calculator

fx $$F_T = \varepsilon \cdot F_a$$

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

Variables Used

- **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

- Function: **sqrt**, sqrt(Number)
  Square root function
- 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

Check other formula lists

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

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