Important Design of Flywheel Formulas PDF

Formulas
Examples
with Units

List of 21
Important Design of Flywheel Formulas

1) Coefficient of Fluctuation of Flywheel Energy given Maximum Fluctuation of Flywheel Energy Formula

Evaluate Formula

Formula

$$C_e = \frac{U_0}{W}$$

Example with Units

$$1.93 = \frac{791.3\,\text{J}}{410\,\text{J}}$$

2) Coefficient of Fluctuation of Flywheel Speed given Mean Speed Formula

Evaluate Formula

Formula

$$C_s = \frac{n_{max} - n_{min}}{\omega}$$

Example with Units

$$0.2 = \frac{314.6\,\text{rev/min} - 257.4\,\text{rev/min}}{286\,\text{rev/min}}$$

3) Coefficient of Fluctuation of Flywheel Speed given Min and Max Speed Formula

Evaluate Formula

Formula

$$C_s = 2 \cdot \frac{n_{max} - n_{min}}{n_{max} + n_{min}}$$

Example with Units

$$0.2 = 2 \cdot \frac{314.6\,\text{rev/min} - 257.4\,\text{rev/min}}{314.6\,\text{rev/min} + 257.4\,\text{rev/min}}$$

4) Coefficient of Steadiness of Flywheel given Mean Speed Formula

Evaluate Formula

Formula

$$m = \frac{\omega}{n_{max} - n_{min}}$$

Example with Units

$$5 = \frac{286\,\text{rev/min}}{314.6\,\text{rev/min} - 257.4\,\text{rev/min}}$$

5) Energy Output from Flywheel Formula

Evaluate Formula

Formula

$$U_o = I \cdot \omega^2 \cdot C_s$$

Example with Units

$$779.2631\,\text{J} = 4343750\,\text{kg*mm}^2 \cdot 286\,\text{rev/min}^2 \cdot 0.2$$

6) Mass Density of Flywheel Disk Formula

Evaluate Formula

Formula

$$\rho = \frac{2 \cdot I}{\pi \cdot t \cdot R^4}$$

Example with Units

$$7800.0009\,\text{kg/m}^3 = \frac{2 \cdot 4343750\,\text{kg*mm}^2}{3.1416 \cdot 25.02499\,\text{mm} \cdot 345\,\text{mm}^4}$$

7) Maximum Fluctuation of Flywheel Energy given Coefficient of Fluctuation of Enaergy Formula

Evaluate Formula

Formula

$$U_0 = C_e \cdot W$$

Example with Units

$$791.3\,\text{J} = 1.93 \cdot 410\,\text{J}$$

8) Maximum Radial or Tensile Stress in Flywheel Formula

Evaluate Formula

Formula

$$\sigma_{t,max} = \rho \cdot {V_p}^2 \cdot \left(\frac{3+u}{8}\right)$$

Example with Units

$$0.3447\,\text{N/mm}^2 = 7800\,\text{kg/m}^3 \cdot {10.35\,\text{m/s}}^2 \cdot \left(\frac{3+0.3}{8}\right)$$

9) Mean Angular Velocity of Flywheel Formula

Evaluate Formula

Formula

$$\omega = \frac{n_{max} + n_{min}}{2}$$

Example with Units

$$286\,\text{rev/min} = \frac{314.6\,\text{rev/min} + 257.4\,\text{rev/min}}{2}$$

10) Mean Torque of Flywheel for Four Stroke Engine Formula

Evaluate Formula

Formula

$$T_{m\,FS} = \frac{W}{4 \cdot \pi}$$

Example with Units

$$32626.7633\,\text{N*mm} = \frac{410\,\text{J}}{4 \cdot 3.1416}$$

11) Mean Torque of Flywheel for Two Stroke Engine Formula

Evaluate Formula

Formula

$$T_{m\,TS} = \frac{W}{2 \cdot \pi}$$

Example with Units

$$65253.5267\,\text{N*mm} = \frac{410\,\text{J}}{2 \cdot 3.1416}$$

12) Moment of Inertia of Flywheel Formula

Evaluate Formula

Formula

$$I = \frac{T_1 - T_2}{\alpha}$$

Example with Units

$$4.3E{+}6\,\text{kg*mm}^2 = \frac{20850\,\text{N*mm} - 13900\,\text{N*mm}}{1.6\,\text{rad/s}^2}$$

13) Moment of Inertia of Flywheel Disk Formula

Evaluate Formula

Formula

$$I = \frac{\pi}{2} \cdot \rho \cdot {R}^4 \cdot t$$

Example with Units

$$4.3E{+}6\,\text{kg*mm}^2 = \frac{3.1416}{2} \cdot 7800\,\text{kg/m}^3 \cdot {345\,\text{mm}}^4 \cdot 25.02499\,\text{mm}$$

14) Outer Radius of Flywheel Disk Formula

Evaluate Formula

Formula

$$R = \left(\frac{2 \cdot I}{\pi \cdot t \cdot \rho}\right)^{\frac{1}{4}}$$

Example with Units

$$345\,\text{mm} = \left(\frac{2 \cdot 4343750\,\text{kg*mm}^2}{3.1416 \cdot 25.02499\,\text{mm} \cdot 7800\,\text{kg/m}^3}\right)^{\frac{1}{4}}$$

15) Radial Stress in Rotating Flywheel at given Radius Formula

Evaluate Formula

Formula

$$\sigma_r = \rho \cdot V_p^2 \cdot \left(\frac{3+u}{8}\right) \cdot \left(1 - \left(\frac{r}{R}\right)^2\right)$$

Example with Units

$$0.2288\,\text{N/mm}^2 = 7800\,\text{kg/m}^3 \cdot 10.35\,\text{m/s}^2 \cdot \left(\frac{3+0.3}{8}\right) \cdot \left(1 - \left(\frac{200\,\text{mm}}{345\,\text{mm}}\right)^2\right)$$

16) Tangential Stress in Rotating Flywheel at given Radius Formula

Evaluate Formula

Formula

$$\sigma_t = \rho \cdot V_p^2 \cdot \frac{u+3}{8} \cdot \left(1 - \left(\frac{3 \cdot u + 1}{u+3}\right) \cdot \left(\frac{r}{R}\right)^2\right)$$

Example with Units

$$0.278\,\text{N/mm}^2 = 7800\,\text{kg/m}^3 \cdot 10.35\,\text{m/s}^2 \cdot \frac{0.3+3}{8} \cdot \left(1 - \left(\frac{3 \cdot 0.3 + 1}{0.3+3}\right) \cdot \left(\frac{200\,\text{mm}}{345\,\text{mm}}\right)^2\right)$$

17) Tensile Stress in Spokes of Rimmed Flywheel Formula

Evaluate Formula

Formula

$$\sigma t_s = \frac{P}{b_{rim} \cdot t_r} + \frac{6 \cdot M}{b_{rim} \cdot t_r^2}$$

Example with Units

$$25\,\text{N/mm}^2 = \frac{1500\,\text{N}}{15\,\text{mm} \cdot 16\,\text{mm}} + \frac{6 \cdot 12000\,\text{N*mm}}{15\,\text{mm} \cdot 16\,\text{mm}^2}$$

18) Thickness of Flywheel Disk Formula

Evaluate Formula

Formula

$$t = \frac{2 \cdot I}{\pi \cdot \rho \cdot R^4}$$

Example with Units

$$25.025\,\text{mm} = \frac{2 \cdot 4343750\,\text{kg*mm}^2}{3.1416 \cdot 7800\,\text{kg/m}^3 \cdot 345\,\text{mm}^4}$$

19) Work Done per Cycle for Engine connected to Flywheel Formula

Evaluate Formula

Formula

$$W = \frac{U_0}{C_e}$$

Example with Units

$$410\,\text{J} = \frac{791.3\,\text{J}}{1.93}$$

20) Work Done per Cycle for Four Stroke Engine connected to Flywheel Formula

Evaluate Formula

Formula

$$W = 4 \cdot \pi \cdot T_{m\,FS}$$

Example with Units

$$410\,\text{J} = 4 \cdot 3.1416 \cdot 32626.76\,\text{N*mm}$$

21) Work Done per Cycle for Two Stroke Engine connected to Flywheel Formula

Evaluate Formula

Formula

$$W = 2 \cdot \pi \cdot T_{m\,TS}$$

Example with Units

$$410\,\text{J} = 2 \cdot 3.1416 \cdot 65253.53\,\text{N*mm}$$

Variables used in list of Design of Flywheel Formulas above

- b_{rim} Width of Rim of Flywheel *(Millimeter)*
- C_e Coefficient of Fluctuation of Flywheel Energy
- C_s Coefficient of Fluctuation of Flywheel Speed
- **I** Moment of Inertia of Flywheel *(Kilogram Square Millimeter)*
- **m** Coefficient of Steadiness for Flywheel
- **M** Bending Moment in Flywheel Spokes *(Newton Millimeter)*
- n_{max} Maximum Angular Speed of Flywheel *(Revolution per Minute)*
- n_{min} Minimum Angular Speed of Flywheel *(Revolution per Minute)*
- **P** Tensile Force in Flywheel Rim *(Newton)*
- **r** Distance from Flywheel Centre *(Millimeter)*
- **R** Outer Radius of Flywheel *(Millimeter)*
- **t** Thickness of Flywheel *(Millimeter)*
- T_1 Driving Input Torque of Flywheel *(Newton Millimeter)*
- T_2 Load Output Torque of Flywheel *(Newton Millimeter)*
- $T_{m\ FS}$ Mean Torque of Flywheel for Four Stroke Engine *(Newton Millimeter)*
- $T_{m\ TS}$ Mean Torque of Flywheel for Two Stroke Engine *(Newton Millimeter)*
- t_r Thickness of Rim of Flywheel *(Millimeter)*
- **u** Poisson Ratio for Flywheel
- U_0 Maximum Fluctuation of Energy for Flywheel *(Joule)*
- U_o Energy Output From Flywheel *(Joule)*
- V_p Peripheral Speed of Flywheel *(Meter per Second)*
- **W** Work Done per Cycle for Engine *(Joule)*
- **α** Angular Acceleration of Flywheel *(Radian per Square Second)*
- **ρ** Mass Density of Flywheel *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used in list of Design of Flywheel Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Measurement: **Length** in Millimeter (mm)
  Length 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: **Angular Velocity** in Revolution per Minute (rev/min)
  Angular Velocity Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion
- Measurement: **Torque** in Newton Millimeter (N*mm)
  Torque Unit Conversion
- Measurement: **Moment of Inertia** in Kilogram Square Millimeter (kg*mm²)
  Moment of Inertia Unit Conversion
- Measurement: **Moment of Force** in Newton Millimeter (N*mm)
  Moment of Force Unit Conversion
- Measurement: **Angular Acceleration** in Radian per Square Second (rad/s²)
  Angular Acceleration Unit Conversion
- Measurement: **Stress** in Newton per Square Millimeter (N/mm²)
  Stress Unit Conversion

- σ_r Radial Stress in Flywheel *(Newton per Square Millimeter)*
- σ_t Tangential Stress in Flywheel *(Newton per Square Millimeter)*
- $\sigma_{t,max}$ Maximum Radial Tensile Stress in Flywheel *(Newton per Square Millimeter)*
- σt_s Tensile Stress in Spokes of Flywheel *(Newton per Square Millimeter)*
- ω Mean Angular Speed of Flywheel *(Revolution per Minute)*

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