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Design of Flywheel Formulas

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List of 21 Design of Flywheel Formulas

Design of Flywheel

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

Open Calculator

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

ex $1.926829 = \frac{790\text{J}}{410\text{J}}$

2) Coefficient of Fluctuation of Flywheel Speed given Mean Speed

Open Calculator

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

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

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

Open Calculator

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

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

4) Coefficient of Steadiness of Flywheel given Mean Speed

Open Calculator

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

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

5) Energy Output from Flywheel

Open Calculator

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

ex $782.1783\text{J} = 4.36\text{E6kg*mm}^2 \cdot (286\text{rev/min})^2 \cdot 0.2$

6) Mass Density of Flywheel Disk

Open Calculator

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

ex $7837.007\text{kg/m}^3 = \frac{2 \cdot 4.36\text{E6kg*mm}^2}{\pi \cdot 25\text{mm} \cdot (345\text{mm})^4}$

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

Open Calculator

fx $U_0 = C_e \cdot W$

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

8) Maximum Radial or Tensile Stress in Flywheel

Open Calculator

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

ex $0.344667\text{N/mm}^2 = 7800\text{kg/m}^3 \cdot (10.35\text{m/s})^2 \cdot \left(\frac{3+0.3}{8}\right)$

9) Mean Angular Velocity of Flywheel

Open Calculator

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

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

10) Mean Torque of Flywheel for Four Stroke Engine

Open Calculator

fx $$T_m = \frac{W}{4 \cdot \pi}$$

ex $$32626.76\text{N*mm} = \frac{410\text{J}}{4 \cdot \pi}$$

11) Mean Torque of Flywheel for Two Stroke Engine

Open Calculator

fx $$T_m = \frac{W}{2 \cdot \pi}$$

ex $$65253.53\text{N*mm} = \frac{410\text{J}}{2 \cdot \pi}$$

12) Moment of Inertia of Flywheel

Open Calculator

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

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

13) Moment of Inertia of Flywheel Disk

Open Calculator

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

ex $$4.3\text{E}\hat{}6\text{kg*mm}^2 = \frac{\pi}{2} \cdot 7800\text{kg/m}^3 \cdot (345\text{mm})^4 \cdot 25\text{mm}$$

14) Outer Radius of Flywheel Disk

Open Calculator

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

ex $$345.4085\text{mm} = \left(\frac{2 \cdot 4.36\text{E}6\text{kg*mm}^2}{\pi \cdot 25\text{mm} \cdot 7800\text{kg/m}^3}\right)^{\frac{1}{4}}$$

15) Radial Stress in Rotating Flywheel at given Radius

Open Calculator

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

ex $$0.228837\text{N/mm}^2 = 7800\text{kg/m}^3 \cdot (10.35\text{m/s})^2 \cdot \left(\frac{3+0.3}{8}\right) \cdot \left(1-\left(\frac{200\text{mm}}{345\text{mm}}\right)^2\right)$$

16) Tangential Stress in Rotating Flywheel at given Radius

Open Calculator

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

ex $$0.277977\text{N/mm}^2 = 7800\text{kg/m}^3 \cdot (10.35\text{m/s})^2 \cdot \frac{0.3+3}{8} \cdot \left(1-\left(\frac{3\cdot 0.3+1}{0.3+3}\right) \cdot \left(\frac{200\text{mm}}{345\text{mm}}\right)^2\right)$$

17) Tensile Stress in Spokes of Rimmed Flywheel

Open Calculator

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

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

18) Thickness of Flywheel Disk

Open Calculator

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

ex $$25.11861\text{mm} = \frac{2 \cdot 4.36\text{E6kg*mm}^2}{\pi \cdot 7800\text{kg/m}^3 \cdot (345\text{mm})^4}$$

19) Work Done per Cycle for Engine connected to Flywheel

Open Calculator

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

ex $$409.3264\text{J} = \frac{790\text{J}}{1.93}$$

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

Open Calculator

fx $$W = 4 \cdot \pi \cdot T_m$$

ex $$540.3539\text{J} = 4 \cdot \pi \cdot 43000\text{N*mm}$$

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

Open Calculator

fx $$W = 2 \cdot \pi \cdot T_m$$

ex $$270.177\text{J} = 2 \cdot \pi \cdot 43000\text{N*mm}$$

Variables Used

- 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 Mean Torque for Flywheel *(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)*
- $V_{peripheral}$ 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)*
- 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)*

Constants, Functions, Measurements used

- Constant: **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

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- Design of Chain Drives Formulas
- Design of Cotter Joint Formulas
- Design of Coupling Formulas
- Design of Flywheel Formulas
- Design of Friction Clutches Formulas
- Design of Helical Gears Formulas
- Design of Keys Formulas
- Design of Knuckle Joint Formulas
- Design of Lever Formulas
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