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Stress Formulas

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List of 22 Stress Formulas

Stress

1) Area of Inclined Plane given Stress

Open Calculator

fx $$a_i = \frac{P_t \cdot (\cos(\theta))^2}{\sigma_i}$$

ex $$799.9916\text{mm}^2 = \frac{59611\text{N} \cdot (\cos(35^\circ))^2}{50.0\text{MPa}}$$

2) Beam Shear Stress

Open Calculator

fx $$\zeta_b = \frac{\Sigma S \cdot Ay}{I \cdot t}$$

ex $$27.42857\text{Pa} = \frac{320\text{N} \cdot 4500\text{mm}^3}{3.5\text{kg·m}^2 \cdot 0.015\text{mm}}$$

3) Bending Stress

Open Calculator

fx $$\sigma_b = M_b \cdot \frac{y}{I}$$

ex $$6.5\text{E}\hat{}\text{-5MPa} = 450\text{N*m} \cdot \frac{503\text{mm}}{3.5\text{kg·m}^2}$$

4) Brinell Hardness Number

Open Calculator

$$BHN = \frac{W}{(0.5 \cdot \pi \cdot D) \cdot \left(D - \left(D^2 - d_i^2\right)^{0.5}\right)}$$

$$3208.133 = \frac{3.6N}{(0.5 \cdot \pi \cdot 62mm) \cdot \left(62mm - \left((62mm)^2 - (36mm)^2\right)^{0.5}\right)}$$

5) Bulk Stress

Open Calculator

$$B_{stress} = \frac{N.F}{A_{cs}}$$

$$0.017587MPa = \frac{23.45N}{1333.4mm^2}$$

6) Direct Stress

Open Calculator

$$\sigma = \frac{P_{axial}}{A_{cs}}$$

$$1748.913Pa = \frac{2.332N}{1333.4mm^2}$$

7) Load of Inclined Plane given Stress

Open Calculator

$$P_t = \frac{\sigma_i \cdot A_i}{(\cos(\theta))^2}$$

$$59611.62N = \frac{50.0MPa \cdot 800mm^2}{(\cos(35^\circ))^2}$$

8) Maximum Principal Stress

Open Calculator

$$\sigma_{max} = \frac{\sigma_x + \sigma_y}{2} + \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \zeta_{xy}^2}$$

ex

$$96.05551\text{MPa} = \frac{80\text{MPa} + 40\text{MPa}}{2} + \sqrt{\left(\frac{80\text{MPa} - 40\text{MPa}}{2}\right)^2 + (30\text{MPa})^2}$$

9) Maximum Shearing Stress

Open Calculator

$$\sigma_1 = \frac{1.5 \cdot V}{A_{cs}}$$

ex

$$47247.64\text{Pa} = \frac{1.5 \cdot 42\text{N}}{1333.4\text{mm}^2}$$

10) Minimum Principal Stress

Open Calculator

$$\sigma_{min} = \frac{\sigma_x + \sigma_y}{2} - \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \zeta_{xy}^2}$$

ex

$$23.94449\text{MPa} = \frac{80\text{MPa} + 40\text{MPa}}{2} - \sqrt{\left(\frac{80\text{MPa} - 40\text{MPa}}{2}\right)^2 + (30\text{MPa})^2}$$

11) Shear Stress

Open Calculator

fx $$\tau = \frac{F_t}{A_{cs}}$$

ex $$18.74906\text{Pa} = \frac{0.025\text{N}}{1333.4\text{mm}^2}$$

12) Shear Stress in Double Parallel Fillet Weld

Open Calculator

fx $$\zeta_{fw} = \frac{P_{dp}}{0.707 \cdot L \cdot h_l}$$

ex $$188.1797\text{Pa} = \frac{0.55\text{N}}{0.707 \cdot 195\text{mm} \cdot 21.2\text{mm}}$$

13) Shear Stress of Circular Beam

Open Calculator

fx $$\sigma_1 = \frac{4 \cdot V}{3 \cdot A_{cs}}$$

ex $$41997.9\text{Pa} = \frac{4 \cdot 42\text{N}}{3 \cdot 1333.4\text{mm}^2}$$

14) Shear Stress on Inclined Plane

Open Calculator

fx $$\zeta_i = -P_t \cdot \sin(\theta) \cdot \frac{\cos(\theta)}{A_i}$$

ex $$-35.010011\text{MPa} = -59611\text{N} \cdot \sin(35^\circ) \cdot \frac{\cos(35^\circ)}{800\text{mm}^2}$$

15) Shearing Stress

Open Calculator

$$\tau = \frac{V \cdot Ay}{I \cdot t}$$

$$3.6\text{Pa} = \frac{42\text{N} \cdot 4500\text{mm}^3}{3.5\text{kg·m}^2 \cdot 0.015\text{mm}}$$

16) Stress due to Gradual Loading

Open Calculator

$$\sigma_g = \frac{F}{A_{cs}}$$

$$19401.53\text{Pa} = \frac{25.87\text{N}}{1333.4\text{mm}^2}$$

17) Stress due to Impact Loading

Open Calculator

$$\sigma_l = W_{load} \cdot \frac{1 + \sqrt{1 + \frac{2 \cdot A_{cs} \cdot \sigma_b \cdot h}{W_{load} \cdot L}}}{A_{cs}}$$

$$93544.25\text{Pa} = 53\text{N} \cdot \frac{1 + \sqrt{1 + \frac{2 \cdot 1333.4\text{mm}^2 \cdot 0.00006447\text{MPa} \cdot 50000\text{mm}}{53\text{N} \cdot 195\text{mm}}}}{1333.4\text{mm}^2}$$

18) Stress due to Sudden Loading

Open Calculator

$$\sigma_1 = 2 \cdot \frac{F}{A_{cs}}$$

$$38803.06\text{Pa} = 2 \cdot \frac{25.87\text{N}}{1333.4\text{mm}^2}$$

19) Stress on Inclined Plane

Open Calculator

fx $$\sigma_i = \frac{P_t \cdot (\cos(\theta))^2}{A_i}$$

ex $$49.99948\text{MPa} = \frac{59611\text{N} \cdot (\cos(35^\circ))^2}{800\text{mm}^2}$$

20) Thermal Stress

Open Calculator

fx $$\sigma_T = \alpha \cdot \sigma_b \cdot \Delta T$$

ex $$22.33886\text{Pa} = 0.005 \cdot 0.00006447\text{MPa} \cdot 69.3\text{K}$$

21) Thermal Stress in Tapered Bar

Open Calculator

fx $$\sigma_T = \frac{4 \cdot W_{load} \cdot L}{\pi \cdot D_1 \cdot D_2 \cdot \sigma_b}$$

ex $$23.452\text{Pa} = \frac{4 \cdot 53\text{N} \cdot 195\text{mm}}{\pi \cdot 172.89\text{mm} \cdot 50.34\text{mm} \cdot 0.00006447\text{MPa}}$$

22) Torsional Shear Stress

Open Calculator

fx $$\tau = \frac{\tau \cdot r_{shaft}}{J}$$

ex $$20.51661\text{Pa} = \frac{556\text{N*m} \cdot 2000\text{mm}}{54.2\text{m}^4}$$

Variables Used

- ΔT Change in Temperature *(Kelvin)*
- A_{cs} Cross Sectional Area *(Square Millimeter)*
- a_i Area of Inclined Plane given Stress *(Square Millimeter)*
- A_i Area of Inclined Plane *(Square Millimeter)*
- **Ay** First Moment of Area *(Cubic Millimeter)*
- B_{stress} Bulk Stress *(Megapascal)*
- **BHN** Brinell Hardness Number
- **D** Diameter of Ball Indenter *(Millimeter)*
- D_1 Diameter of Bigger End *(Millimeter)*
- D_2 Diameter of Smaller End *(Millimeter)*
- d_i Diameter of Indentation *(Millimeter)*
- **F** Force *(Newton)*
- F_t Tangential Force *(Newton)*
- **h** Height at which Load Falls *(Millimeter)*
- h_l Leg of Weld *(Millimeter)*
- **I** Moment of Inertia *(Kilogram Square Meter)*
- **J** Polar Moment of Inertia *(Meter^4)*
- **L** Length of Weld *(Millimeter)*
- M_b Bending Moment *(Newton Meter)*
- **N.F** Normal Inward Force *(Newton)*
- P_{axial} Axial Thrust *(Newton)*
- P_{dp} Load on Double Parallel Fillet Weld *(Newton)*
- P_t Tensile Load *(Newton)*
- r_{shaft} Radius of Shaft *(Millimeter)*

- **t** Thickness of Material *(Millimeter)*
- **V** Shearing Force *(Newton)*
- **W** Load *(Newton)*
- W_{load} Weight of Load *(Newton)*
- **y** Distance from Neutral Axis *(Millimeter)*
- ζ_b Beam Shear Stress *(Pascal)*
- ζ_{fw} Shear Stress in Double Parallel Fillet Weld *(Pascal)*
- ζ_i Shear Stress on Inclined Plane *(Megapascal)*
- ζ_{xy} Shear Stress acting in xy Plane *(Megapascal)*
- θ Theta *(Degree)*
- σ Direct Stress *(Pascal)*
- σ_1 Stress on Body *(Pascal)*
- σ_b Bending Stress *(Megapascal)*
- σ_g Stress due to Gradual Loading *(Pascal)*
- σ_i Stress on Inclined Plane *(Megapascal)*
- σ_l Stress due to Loading *(Pascal)*
- σ_{max} Maximum Principal Stress *(Megapascal)*
- σ_{min} Minimum Principal Stress *(Megapascal)*
- σ_T Thermal Stress *(Pascal)*
- σ_x Normal Stress along x Direction *(Megapascal)*
- σ_y Normal Stress along y Direction *(Megapascal)*
- ΣS Total Shear Force *(Newton)*
- τ Torque *(Newton Meter)*
- α Coefficient of Thermal Expansion
- τ Shearing Stress *(Pascal)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **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.
- Function: **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 Millimeter (mm)
  Length Unit Conversion
- Measurement: **Area** in Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Temperature Difference** in Kelvin (K)
  Temperature Difference Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion
- Measurement: **Moment of Inertia** in Kilogram Square Meter (kg·m²)
  Moment of Inertia Unit Conversion
- Measurement: **Moment of Force** in Newton Meter (N*m)
  Moment of Force Unit Conversion

- Measurement: **Second Moment of Area** in Meter⁴ (m⁴)
  Second Moment of Area Unit Conversion
- Measurement: **First Moment of Area** in Cubic Millimeter (mm³)
  First Moment of Area Unit Conversion
- Measurement: **Stress** in Pascal (Pa)
  Stress Unit Conversion

Check other formula lists

- **Strain Formulas**
- **Stress Formulas**
- **Stress and Strain Formulas**

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