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Mohr's Circle of Stresses Formulas

Calculators! Examples! Conversions!

List of 14 Mohr's Circle of Stresses Formulas

Mohr's Circle of Stresses

When a Body is subjected to two Mutual Perpendicular Principal Tensile stresses of Unequal Intensity

1) Maximum Shear Stress

Open Calculator

fx $$\tau_{max} = \frac{\sqrt{(\sigma_x - \sigma_y)^2 + 4 \cdot \tau^2}}{2}$$

ex $$55.26753\text{MPa} = \frac{\sqrt{(95\text{MPa} - 22\text{MPa})^2 + 4 \cdot (41.5\text{MPa})^2}}{2}$$

2) Normal Stress on Oblique Plane with Two Mutually Perpendicular Forces

Open Calculator

fx $$\sigma_\theta = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cdot \cos(2 \cdot \theta_{plane}) + \tau \cdot \sin(2 \cdot \theta_{plane})$$

ex $$112.6901\text{MPa} = \frac{95\text{MPa} + 22\text{MPa}}{2} + \frac{95\text{MPa} - 22\text{MPa}}{2} \cdot \cos(2 \cdot 30^\circ) + 41.5\text{MPa} \cdot \sin(2 \cdot 30^\circ)$$

3) Radius of Mohr's Circle for Two Mutually Perpendicular Stresses of Unequal Intensities

Open Calculator

fx $$R = \frac{\sigma_{major} - \sigma_{minor}}{2}$$

ex $$25.5\text{MPa} = \frac{75\text{MPa} - 24\text{MPa}}{2}$$

4) Tangential Stress on Oblique Plane with Two Mutually Perpendicular Forces

Open Calculator

fx $$\sigma_t = \frac{\sigma_x - \sigma_y}{2} \cdot \sin(2 \cdot \theta_{plane}) - \tau \cdot \cos(2 \cdot \theta_{plane})$$

ex $$10.85993\text{MPa} = \frac{95\text{MPa} - 22\text{MPa}}{2} \cdot \sin(2 \cdot 30^\circ) - 41.5\text{MPa} \cdot \cos(2 \cdot 30^\circ)$$

When a Body is subjected to two Mutual Perpendicular Principal Tensile stresses along with Simple Shear Stress

5) Condition for Maximum Value of Normal Stress

Open Calculator

fx $$\theta_{plane} = \frac{a\tan\left(\frac{2\cdot\tau}{\sigma_x-\sigma_y}\right)}{2}$$

ex $$24.33389° = \frac{a\tan\left(\frac{2\cdot 41.5\text{MPa}}{95\text{MPa}-22\text{MPa}}\right)}{2}$$

6) Condition for Minimum Normal Stress

Open Calculator

fx $$\theta_{plane} = \frac{a\tan\left(\frac{2\cdot\tau}{\sigma_x-\sigma_y}\right)}{2}$$

ex $$24.33389° = \frac{a\tan\left(\frac{2\cdot 41.5\text{MPa}}{95\text{MPa}-22\text{MPa}}\right)}{2}$$

7) Maximum Value of Normal Stress

Open Calculator

fx $$\sigma_{n,max} = \frac{\sigma_x+\sigma_y}{2} + \sqrt{\left(\frac{\sigma_x-\sigma_y}{2}\right)^2 + \tau^2}$$

ex $$113.7675\text{MPa} = \frac{95\text{MPa}+22\text{MPa}}{2} + \sqrt{\left(\frac{95\text{MPa}-22\text{MPa}}{2}\right)^2 + (41.5\text{MPa})^2}$$

8) Maximum Value of Shear Stress

Open Calculator

fx $$\tau_{max} = \sqrt{\left(\frac{\sigma_x-\sigma_y}{2}\right)^2 + \tau^2}$$

ex $$55.26753\text{MPa} = \sqrt{\left(\frac{95\text{MPa}-22\text{MPa}}{2}\right)^2 + (41.5\text{MPa})^2}$$

9) Minimum Value of Normal Stress

Open Calculator

fx $$\sigma_{n,min} = \frac{\sigma_x + \sigma_y}{2} - \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau^2}$$

ex $$3.232469\text{MPa} = \frac{95\text{MPa} + 22\text{MPa}}{2} - \sqrt{\left(\frac{95\text{MPa} - 22\text{MPa}}{2}\right)^2 + (41.5\text{MPa})^2}$$

10) Normal Stress on Oblique Plane with Two Mutually Perpendicular Unequal Stresses

Open Calculator

fx $$\sigma_\theta = \frac{\sigma_{major} + \sigma_{minor}}{2} + \frac{\sigma_{major} - \sigma_{minor}}{2} \cdot \cos(2 \cdot \theta_{plane})$$

ex $$62.25\text{MPa} = \frac{75\text{MPa} + 24\text{MPa}}{2} + \frac{75\text{MPa} - 24\text{MPa}}{2} \cdot \cos(2 \cdot 30^\circ)$$

11) Shear Stress on Oblique Plane given Two Mutually Perpendicular and Unequal Stress

Open Calculator

fx $$\sigma_t = \frac{\sigma_{major} - \sigma_{minor}}{2} \cdot \sin(2 \cdot \theta_{plane})$$

ex $$22.08365\text{MPa} = \frac{75\text{MPa} - 24\text{MPa}}{2} \cdot \sin(2 \cdot 30^\circ)$$

When a Body is subjected to two Mutual Perpendicular Principal Tensile stresses which are Unequal and Unlike

12) Normal Stress on Oblique Plane for Two Perpendicular Unequal and Unlike Stress

Open Calculator

fx $$\sigma_\theta = \frac{\sigma_{major} - \sigma_{minor}}{2} + \frac{\sigma_{major} + \sigma_{minor}}{2} \cdot \cos(2 \cdot \theta_{plane})$$

ex $$50.25\text{MPa} = \frac{75\text{MPa} - 24\text{MPa}}{2} + \frac{75\text{MPa} + 24\text{MPa}}{2} \cdot \cos(2 \cdot 30^\circ)$$

13) Radius of Mohr's Circle for Unequal and Unlike Mutually Perpendicular Stresses

Open Calculator

fx $$R = \frac{\sigma_{major} + \sigma_{minor}}{2}$$

ex $$49.5\text{MPa} = \frac{75\text{MPa} + 24\text{MPa}}{2}$$

14) Shear Stress on Oblique Plane for Two Perpendicular Unequal and Unlike Stress

Open Calculator

fx $$\sigma_t = \frac{\sigma_{major} + \sigma_{minor}}{2} \cdot \sin(2 \cdot \theta_{plane})$$

ex $$42.86826\text{MPa} = \frac{75\text{MPa} + 24\text{MPa}}{2} \cdot \sin(2 \cdot 30^\circ)$$

Variables Used

- **R** Radius of Mohr's circle *(Megapascal)*
- θ_{plane} Plane Angle *(Degree)*
- σ_{major} Major Principal Stress *(Megapascal)*
- σ_{minor} Minor Principal Stress *(Megapascal)*
- $\sigma_{n,max}$ Maximum Normal Stress *(Megapascal)*
- $\sigma_{n,min}$ Minimum Normal Stress *(Megapascal)*
- σ_t Tangential Stress on Oblique Plane *(Megapascal)*
- σ_x Stress Along x Direction *(Megapascal)*
- σ_y Stress Along y Direction *(Megapascal)*
- σ_θ Normal Stress on Oblique Plane *(Megapascal)*
- τ Shear Stress in Mpa *(Megapascal)*
- τ_{max} Maximum Shear Stress *(Megapascal)*

Constants, Functions, Measurements used

- Function: **atan**, atan(Number)
  Inverse trigonometric tangent function
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Function: **sqrt**, sqrt(Number)
  Square root function
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

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