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Mohr's Circle Formulas

Calculators! Examples! Conversions!

List of 14 Mohr's Circle Formulas

Mohr's Circle

Mohr's Circle when a Body is Subjected to Two Mutual Perpendicular and a Simple Shear Stress

1) 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 $$24.33389^\circ = \frac{a\tan\left(\frac{2\cdot 41.5\text{MPa}}{95\text{MPa}-22\text{MPa}}\right)}{2}$$

2) Condition for Minimum Normal Stress

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

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

3) 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 $$113.7675\text{MPa} = \frac{95\text{MPa}+22\text{MPa}}{2} + \sqrt{\left(\frac{95\text{MPa}-22\text{MPa}}{2}\right)^2 + (41.5\text{MPa})^2}$$

4) Maximum Value of Shear Stress

Open Calculator

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

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

5) 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 $$3.232469\text{MPa} = \frac{95\text{MPa} + 22\text{MPa}}{2} - \sqrt{\left(\frac{95\text{MPa} - 22\text{MPa}}{2}\right)^2 + (41.5\text{MPa})^2}$$

6) 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 $$62.25\text{MPa} = \frac{75\text{MPa} + 24\text{MPa}}{2} + \frac{75\text{MPa} - 24\text{MPa}}{2} \cdot \cos(2 \cdot 30^\circ)$$

7) 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 $$22.08365\text{MPa} = \frac{75\text{MPa} - 24\text{MPa}}{2} \cdot \sin(2 \cdot 30^\circ)$$

Mohr's Circle when a Body is Subjected to Two Mutual Perpendicular Stress which are Unequal and Unlike

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

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

Mohr's Circle when a Body is Subjected to Two Mutual Perpendicular Tensile Stress of Unequal Intensity

11) Maximum Shear Stress

Open Calculator

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

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

12) 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 $$112.6901\text{MPa} = \frac{95\text{MPa} + 22\text{MPa}}{2} + \frac{95\text{MPa} - 22\text{MPa}}{2} \cdot \cos(2 \cdot 30°) + 41.5\text{MPa} \cdot \sin(2 \cdot 30°)$$

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

Open Calculator

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

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

14) 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 $$10.85993\text{MPa} = \frac{95\text{MPa} - 22\text{MPa}}{2} \cdot \sin(2 \cdot 30°) - 41.5\text{MPa} \cdot \cos(2 \cdot 30°)$$

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

- Biaxial Stress Deformation System Formulas
- Direct Strains of Diagonal Formulas
- Elastic Constants Formulas
- Mohr's Circle Formulas
- Principal Stresses and Strains Formulas
- Relationship between Stress and Strain Formulas
- Strain Energy Formulas
- Thermal Stress Formulas
- Types of Stresses Formulas

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