



# **Theories of Failure Formulas**

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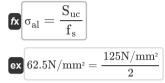
Theories of Failure Formulas...

## List of 20 Theories of Failure Formulas

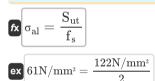
## Theories of Failure 🖉



#### 1) Allowable Stress in Brittle Material under Compressive Loading 🕑



#### 2) Allowable Stress in Brittle Material under Tensile Loading



#### 3) Allowable Stress in Ductile Material under Compressive Loading

$$fx \sigma_{al} = \frac{S_{yc}}{f_s}$$

$$fx = \frac{105N/mm^2}{2}$$

$$fx = \frac{105N/mm^2}{2}$$

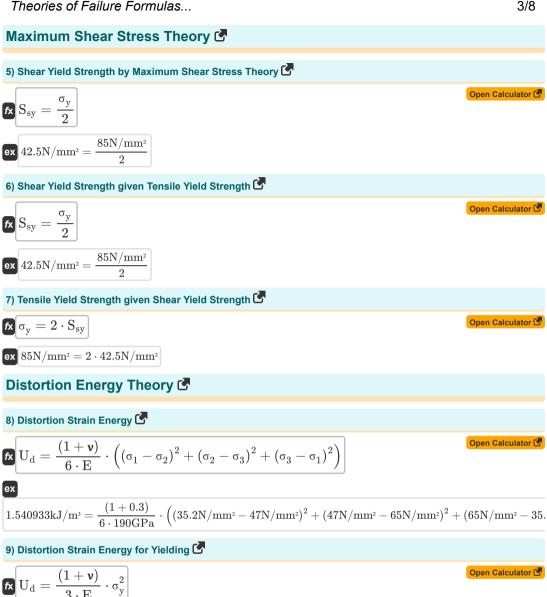
#### 4) Allowable Stress in Ductile Material under Tensile Loading





Open Calculator

Open Calculator



ex 
$$16.47807 \mathrm{kJ/m^3} = rac{(1+0.3)}{3\cdot 190 \mathrm{GPa}} \cdot (85 \mathrm{N/mm^2})^2$$

10) Shear Yield Strength by Maximum Distortion Energy Theorem G

$$m S_{sy}=0.577\cdot \sigma_y$$
 Open Calculator  $m Calculator$ 





## 11) Shear Yield Strength by Maximum Distortion Energy Theory 🖸

$$\begin{bmatrix} \mathbf{S}_{Sy} = 0.577 \cdot \mathbf{q}_y \end{bmatrix}$$
User Latitude To  

$$\begin{bmatrix} \mathbf{M}_{Sy} = 0.577 \cdot \mathbf{q}_y \end{bmatrix}$$
User Latitude To  

$$\begin{bmatrix} 49.045N/mm^2 = 0.577 \cdot 85N/mm^2 \end{bmatrix}$$
12) Strain Energy due to Change in Volume given Principal Stresses  $\begin{bmatrix} \mathbf{M}_{sy} \\ \mathbf{M}_{sy} = \frac{(1-2\cdot v)}{6\cdot E} \cdot (\sigma_1 + \sigma_2 + \sigma_3)^2 \end{bmatrix}$ 
(Seen Calculator II)  

$$\begin{bmatrix} \mathbf{M}_{sy} = \frac{(1-2\cdot v)}{6\cdot E} \cdot (\sigma_1 + \sigma_2 + \sigma_3)^2 \end{bmatrix}$$
(Deen Calculator II)  
13) Strain Energy due to Change in Volume given Volumetric Stress  $\begin{bmatrix} \mathbf{M}_{sy} \\ \mathbf{M}_{sy} = \frac{3}{2} \cdot \sigma_v \cdot \varepsilon_v \end{bmatrix}$ 
(Deen Calculator II)  
14) Strain Energy due to Change in Volume with No Distortion  $\begin{bmatrix} \mathbf{M}_{sy} \\ \mathbf{M}_{sy} = \frac{\sigma_1 + \sigma_2 + \sigma_3}{3} \end{bmatrix}$ 
(Deen Calculator II)  
15) Stress due to Change in Volume with No Distortion  $\begin{bmatrix} \mathbf{M}_{sy} \\ \mathbf{M}_{sy} = \sqrt{\frac{1}{2} \cdot ((\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2)} \end{bmatrix}$ 
(Deen Calculator II)  
16) Tensile Yield Strength by Distortion Energy Theorem  $\begin{bmatrix} \mathbf{M}_{sy} \\ \mathbf{M}_{sy} = \sqrt{\frac{1}{2} \cdot ((\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2)} \end{bmatrix}$ 
(Deen Calculator II)  
15)  
16)  
25.99308N/mm^2 =  $\sqrt{\frac{1}{2} \cdot ((35.2N/mm^2 - 47N/mm^2)^2 + (47N/mm^2 - 65N/mm^2)^2 + (65N/mm^2 - 35.2N/mm^2 - 47N/mm^2)^2 + (65N/mm^2 - 35.2N/mm^2 - 47N/mm^2 - 47N/mm^2)^2 + (65N/mm^2 - 35.2N/mm^2 - 47N/mm^2)^2 + (65N/mm^2 - 35.2N/mm^2 - 47N/mm^2 - 47N/mm^2)^2 + (65N/mm^2 - 35.2N/mm^2 - 47N/mm^2 - 47N/mm^2)^2 + (65N/mm^2 - 35.2N/mm^2 - 47N/mm^2 - 47N/mm^2$ 





Theories of Failure Formulas...

17) Tensile Yield Strength by Distortion Energy Theorem Considering Factor of Safety 🕑

$$\begin{aligned} \sigma_{y} &= f_{s} \cdot \sqrt{\frac{1}{2} \cdot \left( (\sigma_{1} - \sigma_{2})^{2} + (\sigma_{2} - \sigma_{3})^{2} + (\sigma_{3} - \sigma_{1})^{2} \right)} \end{aligned}$$
Correct Calculator (\*)
$$\begin{aligned} \sigma_{y} &= f_{s} \cdot \sqrt{\frac{1}{2} \cdot \left( (35.2N/mm^{2} - 47N/mm^{2})^{2} + (47N/mm^{2} - 65N/mm^{2})^{2} + (65N/mm^{2} - 35.2N) \right)} \end{aligned}$$
(b) The set of t



# Variables Used

- E Young's Modulus of Specimen (Gigapascal)
- **f**<sub>S</sub> Factor of Safety
- S<sub>sv</sub> Shear Yield Strength (Newton per Square Millimeter)
- Suc Ultimate Compressive Stress (Newton per Square Millimeter)
- Sut Ultimate Tensile Strength (Newton per Square Millimeter)
- Svc Compressive Yield Strength (Newton per Square Millimeter)
- Ud Strain Energy for Distortion (Kilojoule per Cubic Meter)
- UTotal Strain Energy (Kilojoule per Cubic Meter)
- U<sub>v</sub> Strain Energy for Volume Change (Kilojoule per Cubic Meter)
- $\boldsymbol{\epsilon}_{v}$  Strain for Volume Change
- σ<sub>1</sub> First Principal Stress (Newton per Square Millimeter)
- σ<sub>2</sub> Second Principal Stress (Newton per Square Millimeter)
- σ<sub>3</sub> Third Principal Stress (Newton per Square Millimeter)
- σ<sub>al</sub> Allowable Stress for Static Load (Newton per Square Millimeter)
- σ<sub>v</sub> Stress for Volume Change (Newton per Square Millimeter)
- σ<sub>v</sub> Tensile Yield Strength (Newton per Square Millimeter)
- v Poisson's Ratio



# **Constants, Functions, Measurements used**

- 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: Pressure in Gigapascal (GPa) Pressure Unit Conversion
- Measurement: Energy Density in Kilojoule per Cubic Meter (kJ/m<sup>3</sup>) Energy Density Unit Conversion
- Measurement: Stress in Newton per Square Millimeter (N/mm<sup>2</sup>) Stress Unit Conversion



## Check other formula lists

- Fracture Mechanics Formulas
- Radius of Fiber and Axis Formulas
- Design of Curved Beams Formulas
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