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Relationship between Stress and Strain Formulas

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List of 19 Relationship between Stress and Strain Formulas

Relationship between Stress and Strain

1) Factor of Safety

Open Calculator

fx $$\mathrm{F.O.S} = \frac{\mathrm{U}}{\mathrm{P}}$$

ex $$4.083333 = \frac{49\mathrm{MPa}}{12\mathrm{MPa}}$$

2) Margin of Safety

Open Calculator

fx $$\mathrm{M.O.S.} = \mathrm{F.O.S} - 1$$

ex $$3 = 4 - 1$$

3) Modulus of Elasticity given Compressive Stress

Open Calculator

fx $$\mathrm{E} = \left(\frac{\sigma_c}{\varepsilon_{\mathrm{compressive}}}\right)$$

ex $$64\mathrm{MPa} = \left(\frac{6.4\mathrm{MPa}}{0.1}\right)$$

4) Modulus of Elasticity given Normal Stress

Open Calculator

fx $$E = \frac{\sigma_n}{\varepsilon_{component}}$$

ex $$96MPa = \frac{48MPa}{0.5}$$

5) Modulus of Elasticity given Tensile Stress

Open Calculator

fx $$E = \left(\frac{\sigma_t}{\varepsilon_{tensile}}\right)$$

ex $$5.65MPa = \left(\frac{3.39MPa}{0.6}\right)$$

6) Modulus of Rigidity given Shear Stress

Open Calculator

fx $$G = \left(\frac{\tau}{\eta}\right)$$

ex $$2.857143MPa = \left(\frac{5MPa}{1.75}\right)$$

Strain

7) Compressive Strain given Compressive Stress

Open Calculator

fx $$\varepsilon_{compressive} = \left(\frac{\sigma_c}{E}\right)$$

ex $$0.8 = \left(\frac{6.4MPa}{8MPa}\right)$$

8) Lateral Strain given Decrease in Breadth

Open Calculator

fx $$\varepsilon_d = \frac{\Delta b}{b}$$

ex $$0.23 = \frac{46mm}{200mm}$$

9) Lateral Strain given Decrease in Depth

Open Calculator

fx $$\varepsilon_d = \frac{\Delta d}{d}$$

ex $$0.43 = \frac{43mm}{100mm}$$

10) Lateral Strain using Poisson's Ratio

Open Calculator

fx $$\varepsilon_d = -\left(\nu \cdot \varepsilon_{longitudinal}\right)$$

ex $$-0.06 = -(0.3 \cdot 0.2)$$

11) Longitudinal Strain

Open Calculator

fx $$\varepsilon_{\text{longitudinal}} = \frac{\Delta L}{l_0}$$

ex $$0.22 = \frac{1100\text{mm}}{5000\text{mm}}$$

12) Shear Strain if Modulus of Rigidity and Shear Stress

Open Calculator

fx $$\eta = \frac{\tau}{G}$$

ex $$0.138889 = \frac{5\text{MPa}}{36\text{MPa}}$$

13) Tensile Strain given Modulus of Elasticity

Open Calculator

fx $$\varepsilon_{\text{tensile}} = \left(\frac{\sigma_t}{E}\right)$$

ex $$0.42375 = \left(\frac{3.39\text{MPa}}{8\text{MPa}}\right)$$

Stress

14) Compressive Stress given Compressive Strain

Open Calculator

fx $$\sigma_c = \left(E \cdot \varepsilon_{\text{compressive}}\right)$$

ex $$0.8\text{MPa} = (8\text{MPa} \cdot 0.1)$$

15) Normal Stress given Modulus of Elasticity

Open Calculator

fx $\sigma_n = \varepsilon_{component} \cdot E$

ex $4\text{MPa} = 0.5 \cdot 8\text{MPa}$

16) Permissible Stress using Factor of Safety

Open Calculator

fx $P = \frac{U}{F.O.S}$

ex $12.25\text{MPa} = \frac{49\text{MPa}}{4}$

17) Shear Stress given Shear Strain

Open Calculator

fx $\tau = (G \cdot \eta)$

ex $63\text{MPa} = (36\text{MPa} \cdot 1.75)$

18) Tensile Stress given Modulus of Elasticity

Open Calculator

fx $\sigma_t = (E \cdot \varepsilon_{tensile})$

ex $4.8\text{MPa} = (8\text{MPa} \cdot 0.6)$

19) Ultimate Stress using Factor of Safety

Open Calculator

fx $U = F.O.S \cdot P$

ex $48\text{MPa} = 4 \cdot 12\text{MPa}$

Variables Used

- **b** Breadth of Component *(Millimeter)*
- **d** Depth of Component *(Millimeter)*
- **E** Modulus of Elasticity *(Megapascal)*
- **F.O.S** Factor of Safety
- **G** Modulus of Rigidity *(Megapascal)*
- l_0 Initial Length *(Millimeter)*
- **M.O.S.** Margin of Safety
- **P** Permissible Stress *(Megapascal)*
- **U** Ultimate Stress *(Megapascal)*
- **Δb** Decrease in Breadth *(Millimeter)*
- **Δd** Decrease in Depth *(Millimeter)*
- **ΔL** Change in Length of Component *(Millimeter)*
- $\varepsilon_{component}$ Strain in Component
- $\varepsilon_{compressive}$ Compressive Strain
- ε_{d} Lateral Strain
- $\varepsilon_{longitudinal}$ Longitudinal Strain
- $\varepsilon_{longitudinal}$ Longitudinal Strain
- $\varepsilon_{tensile}$ Tensile Strain
- σ_c Compressive Stress *(Megapascal)*
- σ_n Normal Stress *(Megapascal)*
- σ_t Tensile Stress *(Megapascal)*
- ν Poisson's Ratio

- η Shear Strain
- τ Shear Stress *(Megapascal)*

Constants, Functions, Measurements used

- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure 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**
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