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Elastic Constants Formulas

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List of 20 Elastic Constants Formulas

Elastic Constants

Longitudinal and Lateral Strain

1) Lateral Strain using Poisson's Ratio

Open Calculator

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

ex $$-0.0186 = -(0.3 \cdot 0.062)$$

2) Longitudinal Strain using Poisson's Ratio

Open Calculator

fx $$\varepsilon_{longitudinal} = -\left(\frac{\varepsilon_L}{\nu}\right)$$

ex $$0.2 = -\left(\frac{-0.06}{0.3}\right)$$

3) Poisson's Ratio

Open Calculator

fx $$\nu = -\left(\frac{\varepsilon_L}{\varepsilon_{longitudinal}}\right)$$

ex $$0.3 = -\left(\frac{-0.06}{0.2}\right)$$

Volumetric Strain

4) Bulk Modulus given Direct Stress

Open Calculator

fx $$K = \frac{\sigma}{\varepsilon_v}$$

ex $$180000\text{MPa} = \frac{18\text{MPa}}{0.0001}$$

5) Bulk Modulus using Young's Modulus

Open Calculator

fx $$K = \frac{E}{3 \cdot (1 - 2 \cdot \nu)}$$

ex $$16666.67\text{MPa} = \frac{20000\text{MPa}}{3 \cdot (1 - 2 \cdot 0.3)}$$

6) Direct Stress for given Bulk Modulus and Volumetric Strain

Open Calculator

fx $$\sigma = K \cdot \varepsilon_v$$

ex $$1.8\text{MPa} = 18000\text{MPa} \cdot 0.0001$$

7) Lateral Strain given Volumetric and Longitudinal Strain

Open Calculator

fx $$\varepsilon_L = -\frac{\varepsilon_{\text{longitudinal}} - \varepsilon_v}{2}$$

ex $$-0.09995 = -\frac{0.2 - 0.0001}{2}$$

8) Longitudinal Strain given Volumetric and Lateral Strain

Open Calculator

$$\varepsilon_{longitudinal} = \varepsilon_v - (2 \cdot \varepsilon_L)$$

$$0.1201 = 0.0001 - (2 \cdot -0.06)$$

9) Longitudinal Strain given Volumetric Strain and Poisson's Ratio

Open Calculator

$$\varepsilon_{longitudinal} = \frac{\varepsilon_v}{1 - 2 \cdot \nu}$$

$$0.00025 = \frac{0.0001}{1 - 2 \cdot 0.3}$$

10) Poisson's Ratio given Volumetric Strain and Longitudinal Strain

Open Calculator

$$\nu = \frac{1}{2} \cdot \left(1 - \frac{\varepsilon_v}{\varepsilon_{longitudinal}}\right)$$

$$0.49975 = \frac{1}{2} \cdot \left(1 - \frac{0.0001}{0.2}\right)$$

11) Poisson's Ratio using Bulk Modulus and Young's Modulus

Open Calculator

$$\nu = \frac{3 \cdot K - E}{6 \cdot K}$$

$$0.314815 = \frac{3 \cdot 18000\text{MPa} - 20000\text{MPa}}{6 \cdot 18000\text{MPa}}$$

12) Volumetric Strain given Bulk Modulus

Open Calculator

fx $$\varepsilon_v = \frac{\sigma}{K}$$

ex $$0.001 = \frac{18\text{MPa}}{18000\text{MPa}}$$

13) Volumetric Strain given Change in Length

Open Calculator

fx $$\varepsilon_v = \left(\frac{\Delta l}{l}\right) \cdot (1 - 2 \cdot \nu)$$

ex $$0.0004 = \left(\frac{0.0025\text{m}}{2.5\text{m}}\right) \cdot (1 - 2 \cdot 0.3)$$

14) Volumetric Strain given Change in Length, Breadth and Width

Open Calculator

fx $$\varepsilon_v = \frac{\Delta l}{l} + \frac{\Delta b}{b} + \frac{\Delta d}{d}$$

ex $$0.020333 = \frac{0.0025\text{m}}{2.5\text{m}} + \frac{0.014\text{m}}{1.5\text{m}} + \frac{0.012\text{m}}{1.2\text{m}}$$

15) Volumetric Strain given Longitudinal and Lateral Strain

Open Calculator

fx $$\varepsilon_v = \varepsilon_{\text{longitudinal}} + 2 \cdot \varepsilon_L$$

ex $$0.08 = 0.2 + 2 \cdot -0.06$$

16) Volumetric Strain of Cylindrical Rod

Open Calculator

fx $$\varepsilon_v = \varepsilon_{longitudinal} - 2 \cdot (\varepsilon_L)$$

ex $$0.32 = 0.2 - 2 \cdot (-0.06)$$

17) Volumetric Strain of Cylindrical Rod using Poisson's Ratio

Open Calculator

fx $$\varepsilon_v = \varepsilon_{longitudinal} \cdot (1 - 2 \cdot \nu)$$

ex $$0.08 = 0.2 \cdot (1 - 2 \cdot 0.3)$$

18) Volumetric Strain using Young's Modulus and Poisson's Ratio

Open Calculator

fx $$\varepsilon_v = \frac{3 \cdot \sigma_t \cdot (1 - 2 \cdot \nu)}{E}$$

ex $$0.000996 = \frac{3 \cdot 16.6\text{MPa} \cdot (1 - 2 \cdot 0.3)}{20000\text{MPa}}$$

19) Young's Modulus using Bulk Modulus

Open Calculator

fx $$E = 3 \cdot K \cdot (1 - 2 \cdot \nu)$$

ex $$21600\text{MPa} = 3 \cdot 18000\text{MPa} \cdot (1 - 2 \cdot 0.3)$$

20) Young's Modulus using Poisson's Ratio

Open Calculator

fx $$E = \frac{3 \cdot \sigma_t \cdot (1 - 2 \cdot \nu)}{\varepsilon_v}$$

ex $$199200\text{MPa} = \frac{3 \cdot 16.6\text{MPa} \cdot (1 - 2 \cdot 0.3)}{0.0001}$$

Variables Used

- **b** Breadth of Bar *(Meter)*
- **d** Depth of Bar *(Meter)*
- **E** Young's Modulus *(Megapascal)*
- **K** Bulk Modulus *(Megapascal)*
- **l** Length of Section *(Meter)*
- **Δb** Change in Breadth *(Meter)*
- **Δd** Change in Depth *(Meter)*
- **Δl** Change in Length *(Meter)*
- ε_L Lateral Strain
- ε_L Lateral Strain
- $\varepsilon_{longitudinal}$ Longitudinal Strain
- $\varepsilon_{longitudinal}$ Longitudinal Strain
- ε_v Volumetric Strain
- σ Direct Stress *(Megapascal)*
- σ_t Tensile Stress *(Megapascal)*
- ν Poisson's Ratio

Constants, Functions, Measurements used

- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- Mohr's Circle of Stresses Formulas
- Beam Moments Formulas
- Bending Stress Formulas
- Combined Axial and Bending Loads Formulas
- Elastic Constants Formulas
- Elastic Stability of Columns Formulas
- Principal Stress Formulas
- Shear Stress Formulas
- Slope and Deflection Formulas
- Strain Energy Formulas
- Stress and Strain Formulas
- Thermal Stress Formulas
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