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Analysis of Bar Formulas

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List of 15 Analysis of Bar Formulas

Analysis of Bar

Elongation of Bar due its Own Weight

1) Bar's total elongation if weight given per unit volume of bar

Open Calculator

fx $$\delta L = \frac{w \cdot \left(L_{bar}^2\right)}{2 \cdot E_{bar}}$$

ex $$3E\hat{}\text{-}5mm = \frac{10.0N/m^3 \cdot \left((256.66mm)^2\right)}{2 \cdot 11MPa}$$

2) Elongation of element

Open Calculator

fx $$\Delta L_{Bar} = \frac{w \cdot \left(L_{bar}^2\right)}{2 \cdot E}$$

ex $$0.014321mm = \frac{10.0N/m^3 \cdot \left((256.66mm)^2\right)}{2 \cdot 0.023MPa}$$

3) Length of Bar given Total Elongation of Bar

Open Calculator

fx $$L_{bar} = \frac{\delta L \cdot 2 \cdot E_{bar}}{\rho_A}$$

ex $$256.6667mm = \frac{70.0mm \cdot 2 \cdot 11MPa}{6MPa}$$

4) Length of Bar using Total Elongation and Weight per unit volume of bar

Open Calculator

$$L_{bar} = \sqrt{\frac{\delta L \cdot 2 \cdot E_{bar}}{w}}$$

$$392428.3\text{mm} = \sqrt{\frac{70.0\text{mm} \cdot 2 \cdot 11\text{MPa}}{10.0\text{N/m}^3}}$$

5) Modulus of Elasticity given Total Elongation of Bar

Open Calculator

$$E_{bar} = \frac{\rho_A \cdot L_{bar}}{2 \cdot \delta L}$$

$$10.99971\text{MPa} = \frac{6\text{MPa} \cdot 256.66\text{mm}}{2 \cdot 70.0\text{mm}}$$

6) Strain in Element

Open Calculator

$$\varepsilon = \frac{w \cdot L_{bar}}{E}$$

$$0.000112 = \frac{10.0\text{N/m}^3 \cdot 256.66\text{mm}}{0.023\text{MPa}}$$

7) Stress on element of rod

Open Calculator

$$\sigma = w \cdot L_{bar}$$

$$2.6\text{E}\hat{}\text{-6MPa} = 10.0\text{N/m}^3 \cdot 256.66\text{mm}$$

8) Total elongation of bar

Open Calculator

$$\delta L = \frac{\rho_A \cdot L_{bar}}{2 \cdot E_{bar}}$$

$$69.99818\text{mm} = \frac{6\text{MPa} \cdot 256.66\text{mm}}{2 \cdot 11\text{MPa}}$$

9) Weight of bar for length x

Open Calculator

$$W = w \cdot A \cdot L_{bar}$$

$$0.164262\text{kg} = 10.0\text{N/m}^3 \cdot 64000\text{mm}^2 \cdot 256.66\text{mm}$$

10) Weight of Bar given Total Elongation of Bar

Open Calculator

$$W_{load} = \frac{\delta L \cdot 2 \cdot E_{bar} \cdot A}{L_{bar}}$$

$$384010\text{N} = \frac{70.0\text{mm} \cdot 2 \cdot 11\text{MPa} \cdot 64000\text{mm}^2}{256.66\text{mm}}$$

Strain in Bar

11) Area of lower end of bar

Open Calculator

$$A_2 = \frac{A_1}{e^{w \cdot \frac{L_{bar}}{\sigma}}}$$

$$3000\text{mm}^2 = \frac{3000.642\text{mm}^2}{e^{10.0\text{N/m}^3 \cdot \frac{256.66\text{mm}}{0.012\text{MPa}}}}$$

12) Area of upper end of bar

Open Calculator

fx $$A_1 = A_2 \cdot e^{w \cdot \frac{L_{bar}}{\sigma}}$$

ex $$3000.642\text{mm}^2 = 3000\text{mm}^2 \cdot e^{10.0\text{N/m}^3 \cdot \frac{256.66\text{mm}}{0.012\text{MPa}}}$$

13) Change in length of Tapered Bar

Open Calculator

fx $$\Delta L = \left(F_a \cdot \frac{l}{t \cdot E \cdot \left(L^{Right} - L_{Left} \right)} \right) \cdot \frac{\ln\left(\frac{L^{Right}}{L_{Left}} \right)}{1000000}$$

ex $$0.0084\text{mm} = \left(2500\text{N} \cdot \frac{7800\text{mm}}{1200\text{mm} \cdot 0.023\text{MPa} \cdot (70\text{mm} - 100\text{mm})} \right) \cdot \frac{\ln\left(\frac{70\text{mm}}{100\text{mm}} \right)}{1000000}$$

14) Elongation of bar given applied tensile load, area and length

Open Calculator

fx $$\Delta = P \cdot \frac{L_0}{A_{cs} \cdot E}$$

ex $$339.6739\text{mm} = 10\text{N} \cdot \frac{5000\text{mm}}{6400\text{mm}^2 \cdot 0.023\text{MPa}}$$

15) Longitudinal Strain using Poisson's Ratio

Open Calculator

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

ex $$0.066667 = -\left(\frac{0.02}{-0.3} \right)$$

Variables Used

- Δ Elongation *(Millimeter)*
- **A** Cross Sectional Area of Bar *(Square Millimeter)*
- A_1 Area of Upper End *(Square Millimeter)*
- A_2 Area of The Lower End *(Square Millimeter)*
- A_{cs} Area of Cross-Section *(Square Millimeter)*
- **E** Young's Modulus Bar *(Megapascal)*
- E_{bar} Modulus of Elasticity Of Bar *(Megapascal)*
- F_a Applied Force *(Newton)*
- **l** Length of Tapered Bar *(Millimeter)*
- L_0 Original Length *(Millimeter)*
- L_{bar} Length of Bar *(Millimeter)*
- L_{Left} Length of Tapered Bar on Left *(Millimeter)*
- L^{Right} Length of Tapered Bar on Right *(Millimeter)*
- **P** Axial Force *(Newton)*
- **t** Thickness *(Millimeter)*
- **w** Weight per unit volume *(Newton per Cubic Meter)*
- **W** Weight *(Kilogram)*
- W_{load} Load *(Newton)*
- δL Total Elongation *(Millimeter)*
- ΔL Change in Length of Tapered Bar *(Millimeter)*
- ΔL_{Bar} Increase in Bar Length *(Millimeter)*
- ε Strain
- ε_L Lateral Strain
- ε_{ln} Longitudinal Strain
- ρ_A Weight by Area *(Megapascal)*

- **σ** Stress in Bar *(Megapascal)*
- **ν** Poisson's Ratio

Constants, Functions, Measurements used

- Constant: **e**, 2.71828182845904523536028747135266249
  Napier's constant
- Function: **ln**, ln(Number)
  The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- 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: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Area** in Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Specific Weight** in Newton per Cubic Meter (N/m³)
  Specific Weight Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- Analysis of Bar 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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