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Fracture Mechanics Formulas

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List of 10 Fracture Mechanics Formulas

Fracture Mechanics

1) Fracture toughness given stress intensity factor

Open Calculator

fx $K_I = Y \cdot K_o$

ex $5.339472\text{MPa*sqrt(m)} = 1.1 \cdot 4.854065\text{MPa*sqrt(m)}$

2) Fracture toughness given tensile stress at edge of crack

Open Calculator

fx $K_I = Y \cdot \left(\sigma \cdot \left(\sqrt{\pi \cdot a}\right)\right)$

ex $5.339471\text{MPa*sqrt(m)} = 1.1 \cdot \left(50\text{N/mm}^2 \cdot \left(\sqrt{\pi \cdot 3\text{mm}}\right)\right)$

3) Half crack length given fracture toughness

Open Calculator

fx $a = \dfrac{\left(\dfrac{\frac{K_I}{Y}}{\sigma}\right)^2}{\pi}$

ex $3.183099\text{mm} = \dfrac{\left(\dfrac{\frac{5.50\text{MPa*sqrt(m)}}{1.1}}{50\text{N/mm}^2}\right)^2}{\pi}$

4) Half crack length given stress intensity factor

Open Calculator

fx $$a = \frac{\left(\frac{K_o}{\sigma}\right)^2}{\pi}$$

ex $$3\text{mm} = \frac{\left(\frac{4.854065\text{MPa*sqrt(m)}}{50\text{N/mm}^2}\right)^2}{\pi}$$

5) Nominal tensile stress at edge of crack given fracture toughness

Open Calculator

fx $$\sigma = \frac{\frac{K_I}{Y}}{\sqrt{\pi \cdot a}}$$

ex $$51.50323\text{N/mm}^2 = \frac{\frac{5.50\text{MPa*sqrt(m)}}{1.1}}{\sqrt{\pi \cdot 3\text{mm}}}$$

6) Nominal tensile stress at edge of crack given load, plate thickness and plate width

Open Calculator

fx $$\sigma = \frac{L}{w \cdot t}$$

ex $$50\text{N/mm}^2 = \frac{5250\text{N}}{70\text{mm} \cdot 1.5\text{mm}}$$

7) Nominal tensile stress at edge of crack given stress intensity factor

Open Calculator

fx $$\sigma = \frac{K_o}{\sqrt{\pi \cdot a}}$$

ex $$50\text{N/mm}^2 = \frac{4.854065\text{MPa*sqrt(m)}}{\sqrt{\pi \cdot 3\text{mm}}}$$

8) Stress Intensity factor for cracked plate

Open Calculator

fx $$K_o = \sigma \cdot \left(\sqrt{\pi \cdot a}\right)$$

ex $$4.854065\text{MPa*sqrt(m)} = 50\text{N/mm}^2 \cdot \left(\sqrt{\pi \cdot 3\text{mm}}\right)$$

9) Thickness of plate given nominal tensile stress at edge of crack

Open Calculator

fx $$t = \frac{L}{(\sigma) \cdot (w)}$$

ex $$1.5\text{mm} = \frac{5250\text{N}}{(50\text{N/mm}^2) \cdot (70\text{mm})}$$

10) Width of plate given nominal tensile stress at edge of crack

Open Calculator

fx $$w = \left(\frac{L}{(\sigma) \cdot t}\right)$$

ex $$70\text{mm} = \left(\frac{5250\text{N}}{(50\text{N/mm}^2) \cdot 1.5\text{mm}}\right)$$

Variables Used

- **a** Half Crack Length *(Millimeter)*
- **K_I** Fracture Toughness *(Megapascal sqrt(meter))*
- **K_o** Stress Intensity Factor *(Megapascal sqrt(meter))*
- **L** Load on Cracked Plate *(Newton)*
- **t** Thickness of Cracked Plate *(Millimeter)*
- **w** Width of Plate *(Millimeter)*
- **Y** Dimensionless Parameter in Fracture Toughness
- **σ** Tensile Stress at Crack Edge *(Newton per Square Millimeter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- 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: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Fracture Toughness** in Megapascal sqrt(meter) (MPa*sqrt(m))
  Fracture Toughness Unit Conversion
- Measurement: **Stress** in Newton per Square Millimeter (N/mm²)
  Stress Unit Conversion

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