

Important Fracture Mechanics Formulas PDF



Formulas Examples with Units

List of 10 Important Fracture Mechanics Formulas

1) Fracture toughness given stress intensity factor Formula

Formula

$$K_I = Y \cdot K_0$$

Example with Units

$$5.3395 \text{ MPa}\cdot\sqrt{\text{m}} = 1.1 \cdot 4.854065 \text{ MPa}\cdot\sqrt{\text{m}}$$

Evaluate Formula

2) Fracture toughness given tensile stress at edge of crack Formula

Formula

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

Example with Units

$$5.3395 \text{ MPa}\cdot\sqrt{\text{m}} = 1.1 \cdot \left(50 \text{ N/mm}^2 \cdot \left(\sqrt{3.1416 \cdot 3 \text{ mm}} \right) \right)$$

Evaluate Formula

3) Half crack length given fracture toughness Formula

Formula

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

Example with Units

$$3.1831 \text{ mm} = \frac{\left(\frac{5.50 \text{ MPa}\cdot\sqrt{\text{m}}}{1.1 \cdot 50 \text{ N/mm}^2} \right)^2}{3.1416}$$

Evaluate Formula

4) Half crack length given stress intensity factor Formula

Formula

$$a = \frac{\left(\frac{K_0}{\sigma} \right)^2}{\pi}$$

Example with Units

$$3 \text{ mm} = \frac{\left(\frac{4.854065 \text{ MPa}\cdot\sqrt{\text{m}}}{50 \text{ N/mm}^2} \right)^2}{3.1416}$$

Evaluate Formula

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

Formula

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

Example with Units

$$51.5032 \text{ N/mm}^2 = \frac{\frac{5.50 \text{ MPa}\cdot\sqrt{\text{m}}}{1.1}}{\sqrt{3.1416 \cdot 3 \text{ mm}}}$$

Evaluate Formula



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

Formula

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

Example with Units

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

Evaluate Formula 

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

Formula

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

Example with Units

$$50 \text{ N/mm}^2 = \frac{4.854065 \text{ MPa} \cdot \sqrt{\text{m}}}{\sqrt{3.1416 \cdot 3 \text{ mm}}}$$

Evaluate Formula 

8) Stress Intensity factor for cracked plate Formula

Formula

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

Example with Units

$$4.8541 \text{ MPa} \cdot \sqrt{\text{m}} = 50 \text{ N/mm}^2 \cdot \left(\sqrt{3.1416 \cdot 3 \text{ mm}} \right)$$

Evaluate Formula 

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

Formula

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

Example with Units

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

Evaluate Formula 

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

Formula

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

Example with Units

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





Evaluate Formula 



Variables used in list of Fracture Mechanics Formulas above

- **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 in list of Fracture Mechanics Formulas above


- **constant(s):** pi, 3.14159265358979323846264338327950288
Archimedes' constant
- **Functions:** 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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