

Unit 13 - Week 11

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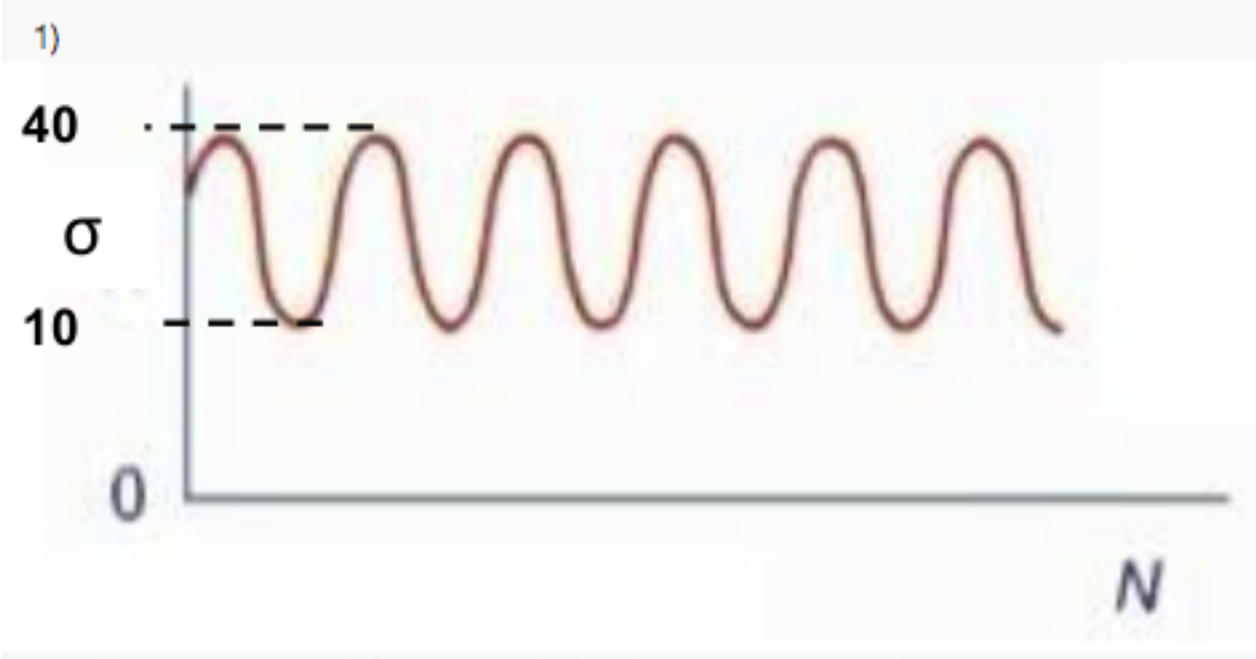
Assignment 11

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2019-10-16, 23:59 IST.

Instructions for answering numerical questions

- In all numerical type questions, you are expected to round off the answers to two decimal places accuracy unless otherwise specified. Examples: 1. Ans: 9.825, you report as 9.83
2. Ans: 9.8, you report as 9.80
3. Ans: 9, you report as 9.00
- This style of reporting is essential for computer based automated correction of your answers.
- The answers for various quantities asked are to be reported in the following units unless otherwise specified, Stress- MPa, Stress Intensity Factor- MPa/m, Strain energy- Nmm, Energy release rate- J/m², deflection – mm



The stress ratio R for the cyclic loading shown above is

- 2.5
- 4
- 0.25
- None of these

No, the answer is incorrect.

Score: 0

Accepted Answers: 0.25

1 point

- Which of the following statements are true regarding nonlinear elastic material behaviour and Elasto-plastic material behaviour

- A) In nonlinear elastic materials the loading and unloading paths are different
- B) In nonlinear elastic materials the loading and unloading paths remains same
- C) In Elasto-plastic materials the loading and unloading paths are different
- D) In Elasto-plastic materials the loading and unloading paths remains same
- E) For one strain value there will be two stress values for nonlinear elastic materials
- F) For Elasto-plastic materials one has to keep track of the loading history

- A, D, E, F
- B, C, E
- A, D, E
- B, C, F

No, the answer is incorrect.

Score: 0

Accepted Answers: B, C, F

1 point

- Provided no unloading is permitted

- Linear elastic fracture mechanics can be extended to nonlinear fracture mechanics
- Linear elastic fracture mechanics can be extended to Elasto-plastic fracture mechanics
- Non-linear elastic fracture mechanics can be extended to Elasto-plastic fracture mechanics
- No such extensions are possible

No, the answer is incorrect.

Score: 0

Accepted Answers: Non-linear elastic fracture mechanics can be extended to Elasto-plastic fracture mechanics

1 point

- Which of the statements are true regarding J integral

- A) The crack faces around which the contour for evaluation of J integral is drawn can either be loaded or unloaded
- B) J integral is path independent
- C) For the evaluation of J Integral the contour that starts from one crack face must end at that crack face itself
- D) It is given by the expression

$$\int_{\Gamma} \left(W dy - \frac{\sigma}{T_i} \frac{\partial u}{\partial x} ds \right)$$

where W is the strain energy per unit volume and $\frac{\sigma}{T_i}$

- A, B, D
- B, C, D
- A, B
- B, D

No, the answer is incorrect.

Score: 0

Accepted Answers: B, D

1 point

- Which of the following statements are true

- A. Striations are macroscopically visible
- B. Striations are visible only at high magnification
- C. There can be thousands of striations between each pair of beach marks
- D. The rate of crack growth can be determined by knowing the distance between striations

- A, B and C
- B, C and D
- A, B and D
- A, B, C and D

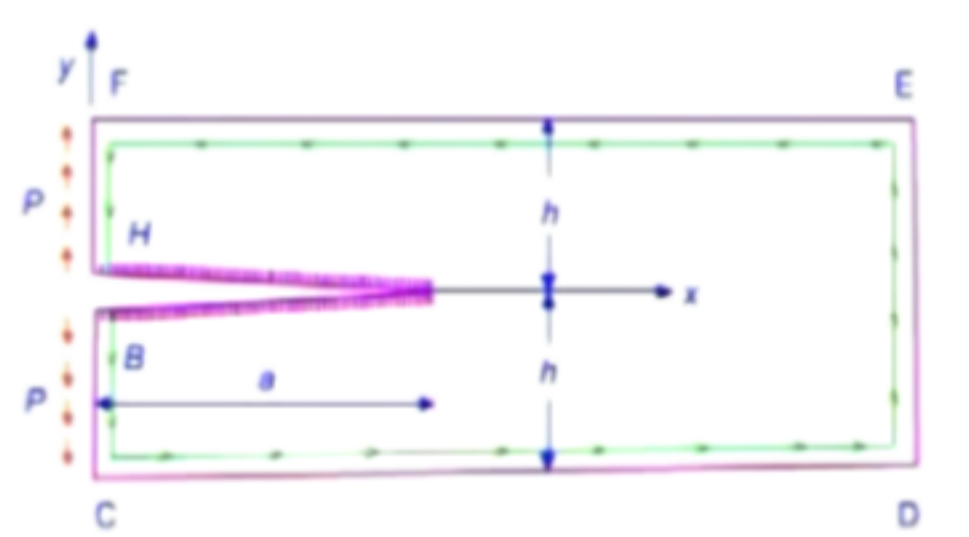
No, the answer is incorrect.

Score: 0

Accepted Answers: B, C and D

1 point

- For the double cantilever specimen having young modulus 72 GPa shown in the figure below, if end load $P = 20N$, height $h = 25mm$, thickness $B = 10mm$, crack length $a = 18mm$, the value of J integral evaluated along the path $B - C - D - E - F - H$ is given by $____ \times 10^{-2} N/mm$



No, the answer is incorrect.

Score: 0

Accepted Answers: (Type: Range) 1.20,1.50

2 points

- In the fatigue crack growth with stress ratio $R = 0$, which of the following statements are true regarding plasticity induced crack closure

- A) In a growing fatigue crack a plastic wake is developed ahead of the crack tip
- B) Crack closure is due to the presence of residual tensile strain in the plastic wake
- C) When the load is reduced, due to permanent elongation of the crack lips, they close before the load is zero

- A, B
- B, C
- A, C
- A, B, C

No, the answer is incorrect.

Score: 0

Accepted Answers: A, C

0 points

- The fracture toughness of an aluminium alloy with a crack of length 8 mm was found to be $45 MPa\sqrt{m}$. It is subjected to fatigue cycle with $\sigma_{min} = 3 MPa$ and $\sigma_{max} = 60 MPa$. What is the critical crack length (in mm). Take $K = 1.12\sigma\sqrt{\pi a}$

No, the answer is incorrect.

Score: 0

Accepted Answers: (Type: Range) 135.00,147.00

2 points

- Electron micrograph fractography at a magnification of 2500x, taken at 7.5mm from the crack's origin show regular striations. There are 26 striations per 25mm in the fractograph. What is the actual striation spacing?

- $2 \times 10^{-4} mm$
- $4 \times 10^{-4} mm$
- 0.4mm
- $20 \times 10^{-3} mm$

No, the answer is incorrect.

Score: 0

Accepted Answers: $4 \times 10^{-4} mm$

2 points

- Which of the following statement are true regarding crack initiation?

- A) Crack initiation is significantly influenced by the radius of curvature of the defect
- B) For blunt crack tips, initiation life is low
- C) The value of $\frac{\Delta K_I}{\sqrt{\rho}}$, where ρ is the radius of curvature of the defect reaches a threshold only beyond 10^6 load cycles.
- D) The threshold value reached by $\frac{\Delta K_I}{\sqrt{\rho}}$ acts as a material constant

- A, B, C, D
- A, B, C
- A, C, D
- B, D

No, the answer is incorrect.

Score: 0

Accepted Answers: A, C, D

2 points

After four years of service life, a wide panel of aluminium alloy was found to contain a 5mm long centre crack oriented normal to the applied stress. The panel was designed to withstand one start-up/ shutdown cycle per day for 20 years (assume 300 operating days in a year), the cyclic range being 0 to 75MPa. If the fracture toughness of the alloy is $45 MPa(m)^{1/2}$ and the cyclic growth rate of the crack is represented by the equation $\frac{da}{dN} = C(\Delta K)^m = 4 \times 10^{-9}(\Delta K)^3$, where a is in meters and ΔK in $MPa(m)^{1/2}$

- What is the critical crack length (in mm)?

No, the answer is incorrect.

Score: 0

Accepted Answers: (Type: Range) 110.0,120.0

1 point

- Calculate how many more cycles of loading can the panel endure before failing (rounded off to the nearest integer)?

No, the answer is incorrect.

Score: 0

Accepted Answers: (Type: Range) 3600,3650

2 points

- Will the panel meet its design life?

- Yes
- No

No, the answer is incorrect.

Score: 0

Accepted Answers: No

2 points