

Unit 8 - Week 6

Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

Static Failure Theories (Coulomb-Mohr and Modified Coulomb-Mohr)

Static Failure Theories (Notches and Stress Concentration)

Introduction to Fracture Mechanics, Griffith's Analysis of a Cracked Body

Fracture Mechanics (Energy Release Rate)

Fracture Mechanics (Crack Resistance, Stress Intensity Factor, Fracture Toughness)

Quiz : Assignment 6

Week 6 Feedback Form : Basics of Materials Engineering

Week 6 lecture material

Assignment-6 solutions

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

Video Download

Live Session

Text Transcripts

Assignment 6

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

Due on 2020-10-28, 23:59 IST.

1) The stepped shaft shown in the inset of Figure 1 is subjected to a torque T of magnitude 100 Nm. Assume $r = 6$ mm, $d = 30$ mm, and $D = 60$ mm. The maximum stress developed (rounded off to one decimal place) is _____ MPa.

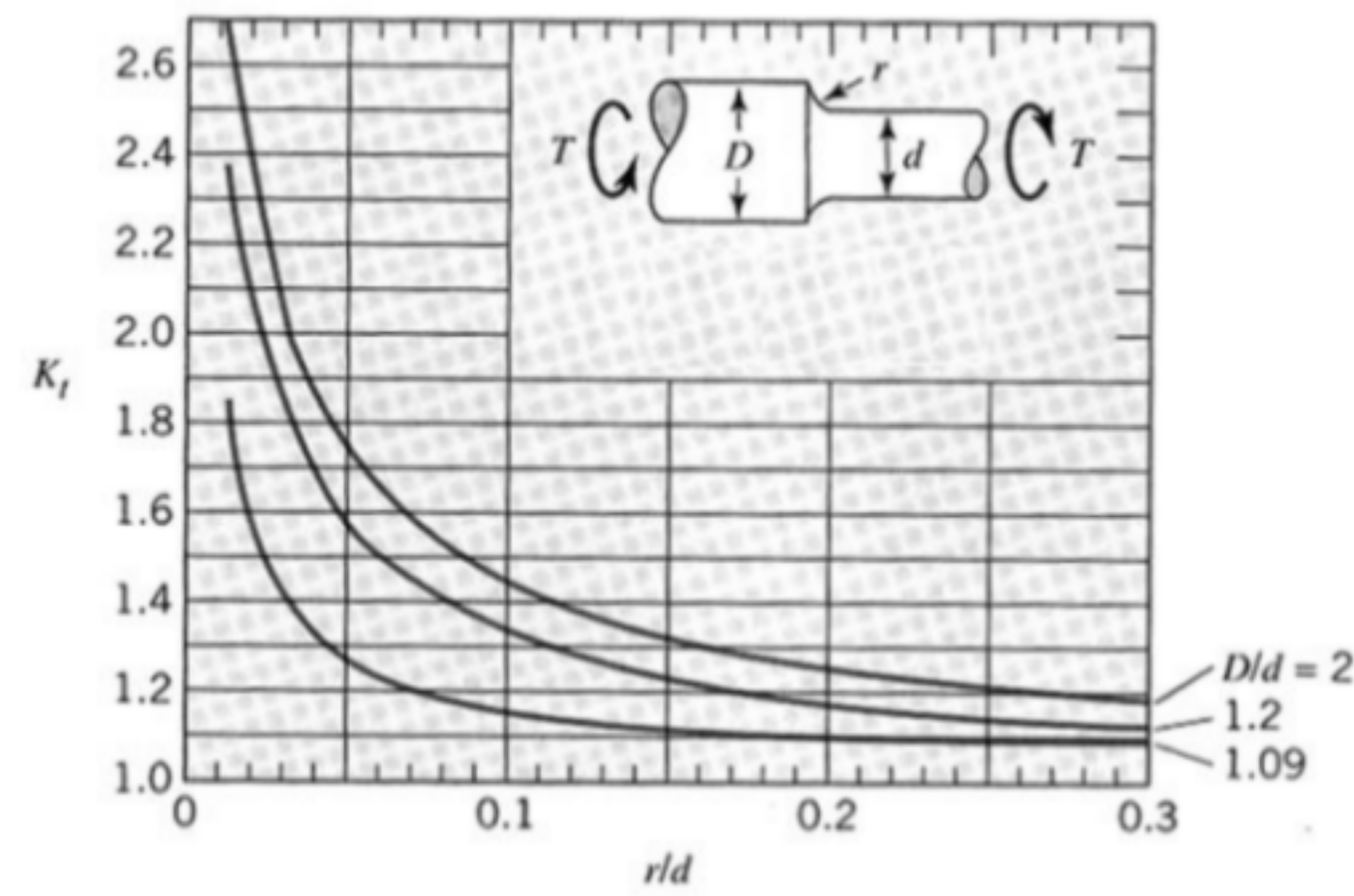


Figure 1: Variation of theoretical stress concentration factor with r/d for a stepped shaft subjected to torsion.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 22.6,24.5

2 points

2) Suppose that a wing component on an aircraft is fabricated from an aluminum alloy that has a plane strain fracture toughness $26 \text{ MPa}\sqrt{\text{m}}$. It has been determined that fracture results at a stress of 112 MPa when the maximum internal crack length is 8.6 mm. For this same component and alloy, the stress level at which fracture occurs for a critical internal crack length of 6.0 mm (rounded off to nearest integer) is _____ MPa.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 133,135

3 points

3) For an uneven material experiencing plane stress loading, the maximum normal stress theory provides a reasonably accurate prediction for failure of brittle materials when both the principal stresses have the same sign. **1 point**

- True
 False

No, the answer is incorrect.
Score: 0

Accepted Answers:
True

4) A rod with circular cross-section is subjected to pure torsion about its longitudinal axis until failure. The rod failed at the center along the length and the failure surface is at an angle of $\approx 45^\circ$ to the axis. Identify the most appropriate statement(s). **2 points**

- The rod is made of a ductile material
 The rod is made of a brittle material
 Failure is limited by the normal strength of the material.
 Failure is limited by the shear strength of the material.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The rod is made of a brittle material
Failure is limited by the normal strength of the material.

5) In Figure 2, the rod length $l = 160$ mm and the arm length $a = 200$ mm. The outside diameter of the rod $d = 40$ mm. A static load $F = 4.5$ kN is applied as shown. Assume that the ultimate strength in tension, $S_{ut} = 360$ MPa and the ultimate strength in compression, $S_{uc} = 1.13$ GPa. The factor of safety for the bracketed rod based on the modified-Mohr theory (rounded off to two decimal places) is _____

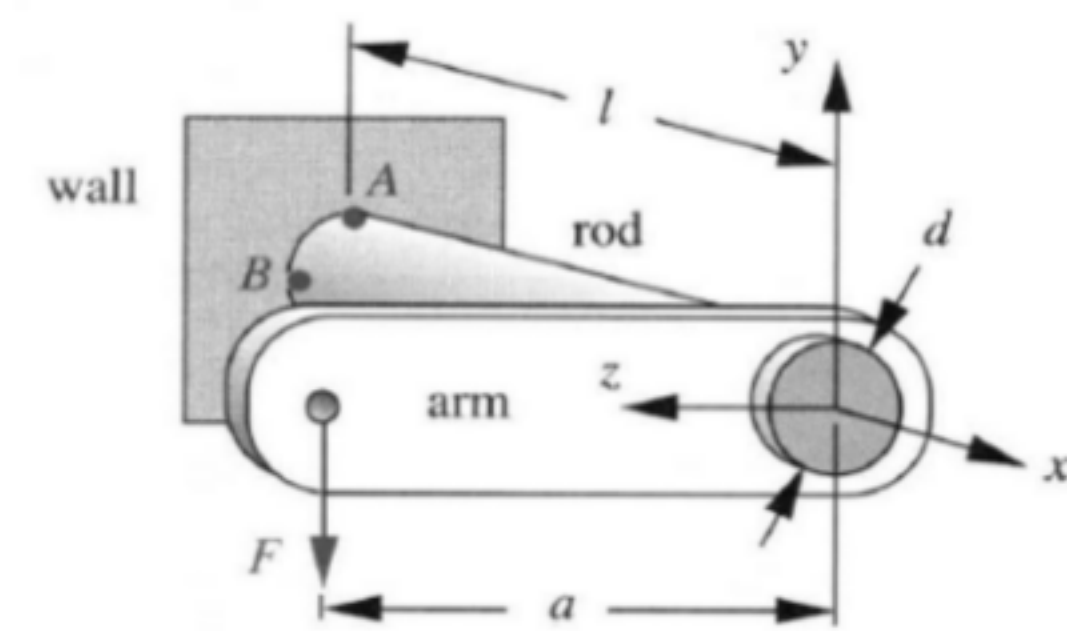


Figure 2:

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 2.36,2.44

5 points

6) An ASTM cast iron has minimum ultimate strengths of 207 MPa in tension and 690 MPa in compression. For the state of stress $\sigma_x = -82$ MPa, $\tau_{xy} = 55$ MPa, the factor of safety using the modified-Mohr theory (rounded off to two decimal places) is _____

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 3.94,3.99

2 points