

Engineering Fracture Mechanics

Assignment # 1

Overview of fracture mechanics

1. List the spectacular failures that triggered the birth of fracture mechanics. Mention the key lessons one can learn from each of these failures.
2. What are the classifications of the different modes of loading at the crack-tip. Substantiate your answer with at least two examples in each case.
3. State the mode of loading at the crack-tip for the configurations shown in Fig.1.

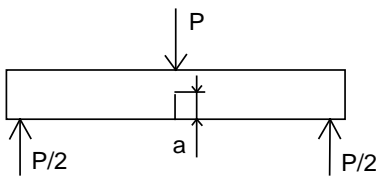
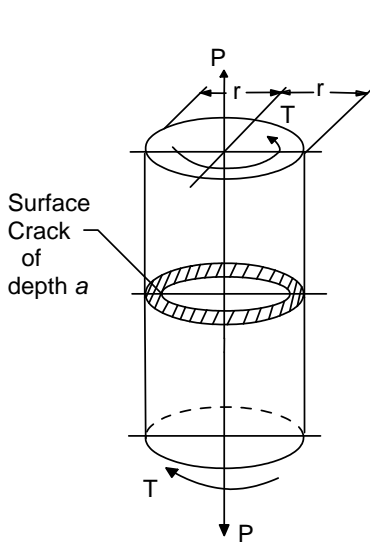
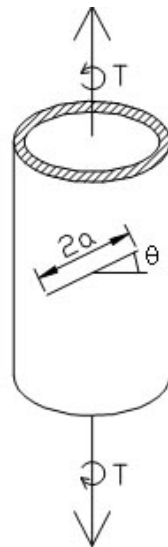


Figure 1
(a) Beam under three point bending

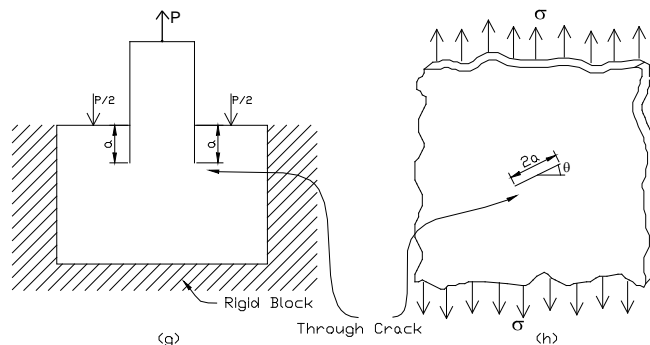


(b) Solid circular shaft in combined torsion and axial load.



Thin tube under torsion. Has a through the thickness crack.

(c) $\theta = 0^\circ$; (d) $\theta = 45^\circ$; (e) $\theta = 60^\circ$;
(f) $\theta = 90^\circ$;



(g)

Through Crack

(h)

4. Take a strip of paper of 100 mm wide and 260 mm long. At 65 mm from one end, cut a centre crack of length $2a = 35$ mm. At 65 mm from the other end cut two edge cracks of $a = 15$ mm each. Predict where the strip will fail in tension. Roll the ends around two round pencils and pull the strip to failure to verify your prediction. Repeat the experiment by changing only the length of the double edge crack to 16 mm and 17 mm.
 5. What are the mechanisms of crack growth?
 6. What is Stress Corrosion Cracking (SCC)? Discuss the various mechanisms of SCC.
 7. What are the mechanisms of fracture? Explain them with neat sketches.
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