Engineering Fracture Mechanics

Assignment # 6

Advanced Topics

1.   What is *J*-integral? Prove that it is path independent.

2.   Indicate the path that you would choose for calculating *J* for a double cantilever beam specimen subjected to end loads. Derive the value of J_I using the path you have chosen.

3.   Give a graphical interpretation of *J*-integral.

4.   What is HRR field? Explain it with a suitable sketch.

5.   What is self-similar crack growth? Under what conditions is it possible for a mixed-mode problem?

6.   What are the criteria that allow prediction of crack growth direction?

7.   A cracked body is subjected to a combined Mode-I and Mode-II loading. It fails at a tensile stress of 128.8 MPa and a shear stress of 94.56 MPa. The crack length 2a at the time of failure is 69 mm. Calculate the angle at which the crack will grow initially. Choose an appropriate theory to evaluate the crack-growth angle based on the data supplied and clearly specify the method in your answer. Also calculate K_{Ic}. Take $\beta = 1$ for both Mode-I and Mode-II loading for simplicity.

8.   List the various philosophies of crack arrest. Write a brief note on each of them.

9.   Discuss the autonomic healing concept of a self-healing composite.

10.   What is metal stitching? Mention the steps involved in the process. For what class of problems this technique is useful.

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