

Advanced Fracture and Structural Mechanics

2 units (selection)

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Target) Because the machine and structure should be safety, it is important to evaluate the stress distribution in front of the defect like crack which is in the component of machine. In Fracture Mechanics, the stress distribution is expressed by stress intensity factor, K . Also, the fracture of component depends on fracture toughness of material. In this lecture, it is explained that for the defect like crack, how the stress intensity factor is expressed. It is then mentioned that how the fracture is toughness evaluated. The students should submit the reports each exercises. Finally, the knowledge of safety design and fracture prevention for machine and structure can be mastered.

Outline) The purpose of fracture mechanics is the evaluation of the strength and fracture of machine and structure and then is the guarantee of safety of machine and structure. We should study the mechanical behavior of crack, the stress distribution in front of crack, the fracture analysis by fracture mechanics and the nonlinear mechanical behavior of elastic-plastic state. It is explained the theory of safety design and prevention of fracture for machine and structure.

Keyword) *fracture, safety design, crack, machine/structure, stress intensity factor*

Relational Lecture) “Solid Mechanics”(0.5),
“Material Engineering”(0.5), “Physical properties of materials”(0.5)

Goal)

1. Concept of Fracture Mechanics
2. Application to fracture analysis of stress intensity factor
3. Concept of Fracture Toughness
4. Concept of J Integral

Schedule)

1. Introduction of linear fracture mechanics
2. Stress intensity factor
3. Fracture toughness and fracture analysis
4. Safety design of machine by fracture mechanics
5. Elastic-plastic deformation in front of crack tip
6. Linear and nonlinear fracture mechanics
7. Midterm examination
8. Concept of J integral

9. Evaluation method of J integral
10. Fracture toughness by J integral
11. Condition of fracture initiation
12. Stable and unstable fracture
13. Application of nonlinear fracture mechanics
14. Fracture analysis by nonlinear fracture mechanics
15. Summary
16. Final examination

Evaluation Criteria) Over 60% of group discussion, reports and examination

Textbook) Prints

Contents) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216811>

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