Dynamic Fracture Mechanics

Course No ME 722

Instructor Basant Lal Sharma

Department Mechanical Engineering

Units 3-0-0-0

Slot T211, MW 8:00-9:00am & Th 2:00-3:00pm

URL `http://home.iitk.ac.in/~bls/Homepage/ME722_2016.html`

Contents

Overview and history, Discussion on inertial effects. Mathematical preliminaries. Basic linear elastodynamics, Waves in Periodic Structures, Causality Principle. One-dimensional Models. Static Cracks in a Linearly Elastic Body, Stress Intensity Factors and Crack Tip Singularity, Energy Release, General Crack System, Cohesive Zone Model. Elastodynamic solutions for a stationary crack, Scattering of a pulse and a time harmonic waves, Fracture initiation due to dynamic loading. Elastodynamic crack growth, the asymptotic crack tip field, Dynamic energy release rate. One-dimensional Discrete Models, Mode III fracture in square cell elastic lattice. Scattering of lattice waves. Instabilites in dynamic fracture. Modern topics and challenges in dynamic fracture.

Text and References

1. Freund, L. B., 1990. Dynamic Fracture Mechanics. Cambridge University Press (Textbook).
2. Slepyan, L. I., 2002. Models and Phenomena in Fracture Mechanics, Springer.
3. Bui, H. D., 2006. Fracture Mechanics. Inverse Problems and Solutions, Springer.

Grading

- There will be individual in-sem-**project I** (10%), in-sem-**project II** (12%), in-sem-**project III** (12%), and end-sem-**project IV** (16%) requiring a (specified minimum number of pages) writeup (in LaTex, excluding figures to be placed in the end of reports) and 10 minute talk/presentation. This may involve a (detailed) proof (theorem)/derivation/numerical calculations on your project inspired by a paper/book/your curiousity.
- **MidSem** (2 hrs): 20%.
- **EndSem** (3 hrs): 30%.
- Note that all projects will be assigned individually. The topics for projects will be assigned out of a list of several such unless you have your own well posed query (after acceptance/permission of instructor).
- Plagiarized reports/projects or pages filled with arbitrary words lacking any meaning with respect to the topic will fetch zero marks. Rewriting certain paragraph borrowed from a book/paper which enhances the explanation (already given in the borrowed paragraph) or provides new insights into the topic is accepted. It is recommended that an original attempt (i.e. from scratch) should be made in order to explain certain topic.