

07.03.2021
אוני' ת"א
בי"ס להנדסה מכנית

Theory of Fracture **Prof. Dov Sherman**

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Topics:

Basic Science - Energy Balance

Theoretical strength vs. practical strength
Inglis – Stress Concentration (1913)
Griffith's Energy Balance (1920)
Obreimoff's experiment (1930)
Load controlled, displacement controlled problems
Plane stress and planes strain approximation
Energy release rate, Fracture energy

Continuum - Crack-tip Elasticity

Williams' Expansion-stresses at crack tip - Mode I solution
The K-annulus concept
Irwin fracture criterion
Irwin K-G relation

Engineering Fracture Mechanics

Fracture testing- K_{IC}
Fracture resistance
R-curve behavior
 K_I calculations in various specimens
Scales in fracture

Plasticity - Non-Linear Fracture Mechanics (2 meetings)

Rice's J-Integral
Crack tip plasticity
HRR field-hardening effect

New aspects of fracture

The effect of $\Theta = dG_0/da$
 Θ effect on Griffith, Freund Eq. of Motion

Special Topics

Weibull statistics for strength of (brittle) materials
The long strip-like specimen
Eshelby Cut and Paste method
Thin films delamination - Examples
Dynamic fracture mechanics - Introduction

Text Books:

- B. Lawn, "Fracture of brittle solids", second edition, Cambridge Solid State Science Series, Cambridge, 1993.
- D. Broek. "Elementary Engineering Fracture Mechanics", Kluwer Academic Publishers, Fourth revised edition, Netherlands, 1986.
- D. Broek, "The Practical Use of Fracture Mechanics", Kluwer Academic Publishing, Netherlands, 1988.
- M. F. Kanninen, C.H. Popelar, "Advanced Fracture Mechanics", Oxford Engineering Science Series-15, Oxford University press, New-York, 1985.
- L.B. Freund, "Dynamic Fracture Mechanics", Cambridge University press, Cambridge, 1990.

Journals:

- 1) ASTM-STP (American Society for Testing and Materials-Special Technical Publication)
- 2) International Journal of Fracture
- 3) Engineering Fracture Mechanics
- 4) Theoretical And Applied Fracture Mechanics
- 5) PRL, PRB, JAP, JMPS
- 6) More...

Handbooks:

- 1) D.P. Rooke, D.J. Cartwright, *Compendium of Stress Intensity Factors*, Her Majesty's Stationary Office, London, **1976**.
- 2) H. Tada, P. Paris, G. Irwin, *The Stress Analysis of Cracks Handbook*, Del Research Corporation, **1987**.
- 3) Y. Murakami, *Stress Intensity Factors Handbook*, Vol. 1 and 2, Pergamon Press, Oxford, **1987**.

Evaluation:

Homework assignments
Final exam