



Microstructural Elasticity

MATSCEN 7862

Credit Hours:

2.00 - 2.00

Course Levels:

Graduate (5000-8000 level)

Course Components:

Lecture

Course Description:

Elastic interaction between vacancies, dislocations, faults, grain boundaries, interfaces, precipitates, transforming particles, cracks, and indentations controls material properties, primarily mechanical.

Prerequisites and Co-requisites:

Prereq: 6765.

Course Goals / Objectives:

- Develop the capacity to accurately describe material defects in crystallographic terms
 - Develop analytic and computational skills to determine the elastic stress and strain fields for a variety of defects
 - Understand the nature and computation of interaction energies between defects, calculation of energetic forces on defects, and the role of energetic forces on the kinetics of defect motion or evolution
 - Apply course principles to determine the threshold for yield or fracture and the dependence on microstructural defects
 - Apply course principles to an independent student project
 - Use elementary computer codes that implement course concepts
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Course Topics:

- Overview of defects
 - Overview of elasticity and internal and external work
 - Continuum and lattice Green's functions
 - Applications of Green's functions to transforming particles, dislocations, point sources of dilatation.
 - Dislocations and modeling of dislocation mobility and evolution
 - Grain boundaries and modeling of energy and mobility
 - Cracks and conditions for propagation, microstructural toughening, path independent integrals
 - Contact stress fields and wear models
 - Effective elastic properties of aggregates
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Designation:

Elective