ME340B Elasticity of Microscopic Structures -- Syllabus
Winter quarter, 2004-2005, 3 units, Stanford

Course information
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Classroom: GESB 131 (Green Earth Sciences Building)
Time: MW 1:15-2:30pm
Office hour: (TA) Mon 3-5pm Durand 252, (Instructor) Fri 3-5pm Durand 259
Course website: http://coursework.stanford.edu

Course objective

This course provides analytic tools, notably the Green's function method, to solve elasticity problems (stress, strain, energy) of microscopic structures under deformation. Students shall be able to apply the theory of elasticity to study the interaction of defects in solids, such as inclusions, inhomogeneities, cracks, dislocations and interfaces.

Course outline

1. Stress and strain, equilibrium and compatibility conditions
2. Elastic Green's function of an infinite body
3. Eshelby's transformed inclusion problem
4. Cracks and fracture
5. Dislocations and plasticity
6. Elasticity of interfaces

Grading Policies

The final grade is computed based on homework (30%), midterm exam (30%) and final exam (40%). Homework involves analytic derivations and moderate numerical calculations.

Homeworks are due every Wednesday at 5pm (except the first week or otherwise announced). You are welcome to hand them in before class. To be fair to all students, homeworks that are late by n days will have their grades multiplied by a factor $f(n) = (0.8)^n$. Homework reports are submitted in paper. Students are encouraged to discuss with each other when solving the homework problems, but are required to write up the solution individually.

Reference books

There is not a standard textbook for this course. Lecture notes and reading materials will be distributed in class and available on the coursework.stanford.edu website. Below are some books and notes that overlap with the content of this course.

Toshio Mura, *Micromechanics of Defects in Solids*, 2nd rev. ed., Kluwer Academic Publishers, 1991.

L. D. Landau and E. M. Lifshitz, Theory of Elasticity, 2nd. English ed., Pergamon Press, 1970.

L. B. Freund and S. Suresh, *Thin Film Materials: Stress, Defect Formation and Surface Evolution*, Cambridge University Press, 2003.

Rob Phillips, *Crystals Defects and Microstructures: Modeling Across Scales*, Cambridge University Press, 2001.

J. D. Eshelby, *Elastic Inclusions and Inhomogeneities*, in *Progress in Solid Mechanics*, 2, ed. IN. Sneddon and R. Hill, (North-Holland, Amsterdam, 1961) pp. 89-140.

J. R. Barber, *Elasticity*, 2nd ed., Kluwer Academic Publishers, 2002.

D. M. Barnett, ME340B Lecture Notes, Stanford University, 2003-2004.

W. M. Lai, D. Rubin, E. Krempl, *Introduction to Continuum Mechanics*, 3rd ed., Butterworth-Heinemann 1999.