Syllabus: Micromechanics (CE236 & C214)

(Spring 2005)

Course objectives

Provide and equip graduate students the basic concepts, analytical skills, and the state of the art techniques in micromechanics; Bring them to a level that they can read current literature, and prepare them doing independent research in the area.

Schedule

Week 1: (Jan. 19 – Jan. 21) Introduction; Review of linear elastic theory; Definitions of eigenstrain, eigenstress, inclusion, and inhomogeneities;

Week 2: (Jan. 24 – Jan. 28) Fourier series and Fourier transformation; Radon transform; periodic eigenstrain field; Introduction to Green's function;

Week 3: (Jan. 31 – Feb. 4) 2D, 3D fundamental solutions of elastostatics;

Week 4: (Feb. 7 – Feb. 11) Isotropic inclusion: Eshelby's ellipsoidal solution; Eshelby's tensor and its applications;

Week 5: (Feb. 14 – Feb. 18) Representative volume element (RVE), Homogenization, Averaging methods;

Week 6: (Feb. 21 – Feb. 25) Overall elastic modulus and compliance tensors; Mori-Tanaka theory and self-consistent method;

Week 7: (Feb. 28 – March 4) Applications in Nano-mechanics;

Week 8: (March 7 – March 11) Review of classical variational principles; Hill-Voigt-Reuss variational principles; Voigt bound and Reuss bound;

Week 9: (March 14 – March 18) Comparison variational principles: principles: Convex analysis, Hashin-Shtrikman variational principles; Talbot-Willis variational principles;

Week 10: (March 21 – March 25) Spring break;

Week 11: (March 28 – April 1) Bounds on effective elastic moduli, Walpole-Willis theory; Dislocation theory I: elementary theory

Week 12: (April 4 – April 8) Dislocation theory II: forces on a dislocation,

Week 13: (April 11 – April 15) Dislocation theory III: cohesive dislocation

Weak 14 (April 18 – April 22) Dislocation theory IV: dislocation dynamics

Week 15: (April 25 – April 29) Introduction to nano-mechanics (I)

Week 16: (May 2 – May 9) Introduction to nano-mechanics (II)

Course information

Instructor: Prof. Shaofan Li, li@ce.berkeley.edu,
(510)-642-5362, 783 Davis Hall
Course Website: http://www.ce.berkeley.edu/Course/CE236
MWF 1:00 p.m. – 2:00 pm 5 Evans Hall,
Grading: HW 60 %, Final Examination (Project) 40 %

Text books

1. Shaofan Li [2005], "Lecture Notes on Micro-mechanics and Nano-mechanics"
2. T. Mura [1987], "Micromechanics of Defects in Solids," Kluwer Academic Pub.;
3. S. Nemat-Nasser and M. Hori [1998], "Micromechanics: Overall Properties of Heterogeneous Materials", North-Holland .

Course philosophy

1. Build analytical skills, professional confidence, and intellectual ideology;
2. Engage research;
3. Cultivate creativity;
4. Have a good time and good grade too !