

MECH 450-550, Selected Topics in Mechanical Engineering: Mechanical Testing in Small Scale

- Instructor** : B. Erdem Alaca, ENG 251
ext. 1727, ealaca@ku.edu.tr
- Lecture** : 13:00-14:15 Tu Th, ENG B18
- Office Hrs** : 17:00-18:00 Tu or anytime by appointment
- TA** : Mahmut Biçer, ENG 257, ext: 2633, mbicer13@ku.edu.tr
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Course Description and Objectives:

This elective course is intended to provide an overview of small-scale force measurement techniques and their application to materials characterization. Three topics will be covered:

- 1) Force measurement in mN range: Application to residual stress measurement. Howe *et al.*, "A Micro Strain Gauge with Mechanical Amplifier", *JMEMS* **6**(4):313-320, 1997.
- 2) Force measurement in μ N range: Application to miniaturized tension test. Zhang *et al.*, "A high-sensitivity and quasi-linear capacitive sensor for nanomechanical testing applications", *J. Micromech. Microeng.* **19**:075003, 2009.
- 3) Force measurement in nN range: Application to accelerometers. Allain *et al.*, "Large range mems motion detection using integrated piezo-resistive silicon nanowire", *Proc. MEMS 2012*, 1320-1323, Paris.

Learning outcomes:

At the end of the semester students will gain a solid understanding of basic concepts and challenges associated with force measurement in small scale and its application to materials characterization.

General Rules and Guidelines:

- 1) Attendance is strongly recommended.
- 2) Three projects will be assigned throughout the semester. Each project requires extensive finite element modeling. Demonstrations on COMSOL will be held in class. Students are free to use software of their preference. A project template will be provided along with the first assignment.
- 3) You are welcome to use any available resources to prepare for project submissions, including discussions with other students. However, all work should be an individual effort.

- 4) There will also be a two-week limit on grade discussions (after the item is available for return).
- 5) It is expected that students make a good faith effort on all aspects of the class and come prepared to office hours after spending time on lecture notes and project assignment. Some simple questions can often be answered by e-mail, but others will require you to come to the office.

Course Content:**Force measurement in mN range**

Assignment 1: February 19, 2015
Project 1 due: March 10, 2015 (beginning of class)

Force measurement in μ N range

Assignment 2: March 19, 2015
Project 2 due: April 14, 2015 (beginning of class)

Force measurement in nN range

Assignment 3: April 23, 2015
Project 3 due: May 12, 2015 (by 5PM ENG 257)

Grading:

Project 1	:	30%
Project 2	:	30%
Project 3	:	30%
Attendance	:	10%