PME5231 MEMS Design and Analysis
(Spring 2003)

Course Information

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Lectures: Time Tuesday 2:10pm-4:50pm

Location Room 430, Engineering Building #1, National Tsing Hua University

(Courses will be at National Center for High-Performance Computing on 03/04, 03/11, 03/18, 04/01, 04/29)

Course Web site: http://mx.nthu.edu.tw/~chhsliu/MEMS/PME5231_Liu.html

Course Objectives

The Goal of the course is to provide graduate students with the capability on the design and analysis of Micro-Electro-Mechanical Systems, which use integrated circuit fabrication for their realization. MEMS has applications like mechanical sensors, optical sensors, chemical sensors, projection displays, fiber switches, DNA amplification, medical diagnostics, lab-on-a-chip, microrobots, and many others. The field has become so diverse that it really is not a field anymore. One of the challenges for MEMS is the complexity of MEMS design. Even simple MEMS devices manipulate energy or information in several energy domains. The designer must understand, and find ways to control, complex interactions between these domains. Yet another complicating factor is that parallel processing does not lend itself to step-by-step optimization of a design. We can not whittle away a device till it fits. All of these lead the analysis to another challenge in MEMS developments. This course will focus on the design and analysis of MEMS and train students to get familiar with commercial MEMS software.

General Info

- **Textbook:**
  - Senturia, “Microsystem Design,” Kluwer, 2001
  - My class notes.
  - **Recommended References:**

    Gregory Kovacs, "Micromachined Transducers Sourcebook," McGraw-Hill, 1998
    MEMS Design class notes from Professor Olav Solgaard, Stanford University, 2002
- **Prerequisites:**
  - **Well, none.**
- **Grading:**
  - **Problem Sets (no late submission) and Midterm Presentations: 60%**
  - **Projects and Oral Presentations : 40%**

Course Topics (Tentative)

Topics	Readings	Hours
Introduction to MEMS design, Micromaching fundamentals and State-of-the-art MEMS proceses	Chapter 1- to 4	4
MEMS modeling, Lumped elements, Electrostatic actuation	Chapter 5 and 6	2
CAD for MEMS Design and Analysis		3
LEDIT Layout /MEMCAD/MUMPS		12
Dynamics, Linear and Non-linear systems	Chapter 7	3
Stress and strain, Mechanical structures	Chapter 8 and 9.1-9.5	
Residual stress and stress gradients, Energy methods and Estimating resonance frequencies	Chapter 9.6-9.8, 10	
MEMS Structures	Chapter 11, 12, 13, 15, 16	
Energy methods	Chapter 17, 18	
Microfluidics, Electrostatic projection displays, MEMS fiber switches	Chapter 19, 20	

Last updated: Feb. 11, 2003 by Cheng-Hsien Liu