

EE607: MICROELECTROMECHANICAL SYSTEMS (MEMS)

Technology methods and physical principles of MEMS including survey of current MEMS

- Instructor: Prof. Eun Sok Kim (email: eskim@usc.edu, PHE 612, 740-4697)
- Office Hours: TuTh 1:00-2:00
- Class Time and Place: TuTh 5:00-6:30 in THH 213
- Textbook: Lecture notes.
- References:
 - IEEE/ASME Journal of Microelectromechanical Systems
 - Journal of Micromechanics and Microengineering
 - Sensors and Actuators Journal (Elsevier Sequoia Publishing, Switzerland)
 - Sensors and Materials Journal (Japan)
 - Sensors Magazine
 - International Conference on Solid-State Sensors and Actuators (Transducers Conf.)
 - Solid-State Sensor & Actuator Workshop, Hilton Head Island, SC (Hilton Head Workshop)
 - Micro Electro Mechanical Systems (MEMS) Workshop/Conference.
 - Micromachined Transducers Sourcebook by Gregory Kovacs
 - Fundamentals of Microfabrication by Marc Madou
 - Introduction to Microelectromechanical Systems Engineering by Nadim Maluf.

Course Contents and Grading

- Weeks 1 - 4: Micromachining
 - Bulk and Surface Micromachining, Plasma and Laser Micromachining, LIGA, etc.
- Weeks 5 & 6: Microactuators
- Weeks 7 & 8: Optical and RF MEMS
- Week 9: Material Properties (and Measurement Techniques) of Thin Films
 - Polysilicon, Low-Stress Silicon Nitride, ZnO, PZT, etc.
- Weeks 10 & 11: Microfluidic Systems
 - Microvalves, Micropumps, Flow Sensors
- Weeks 12 & 13: Mechanical Theories and Inertial/Mechanical MEMS
 - Resonance, Solid Mechanics, Beam and Plate Theories
 - Accelerometers, Gyroscopes and Pressure Sensors
- Week 14: Acoustic MEMS
 - Microphones, Ultrasonic Transducers, SAW/BAW Sensors
- Grading: Midterm Exam on Selected Fundamentals: 20%, Term Paper & Oral Presentation: 40%, Final Exam: 40%.

TERM PAPER

- DATES: March 21 (Thurs.): Abstract presentation (2 min.) in class.
 April 18 (Thurs.): Term paper due.
 April 23, 24 and 25 (Tues. thru Thurs.): In-class presentations.
- TERM PAPER FORMAT:
Cover page: Name, title of paper, and half-page of double spaced abstract which highlights the interesting results, significance of the research, novelty of approach, difference from existing theory or data, verification with experiments, applications, numerical examples, etc.
Text: Not more than 6 pages of double-spaced text (with times font of size 12 or other fonts of equivalent size) expanding on the abstract/summary. List the key references.
Figures: Unlimited number of figures with descriptive captions.
Appendices: Any number of pages of appendices may be attached, though not encouraged. Here, you may show long derivations of equations, extensive review of literature, (additional) examples and explanations.
- Two Possibilities:
Category A: Literature Survey or Review Article
Category B: New Proposals or Results

Term Paper Grading

- GRADING: 60% on technical content and 40% on written and oral presentation
- The technical content includes
 - significance of the problem/issue/topic
 - innovation in approach *or* breath & depth of coverage (in case of literature review)
 - usefulness of the results or review
 - correctness of physics, mathematics, technical reasoning, etc.
- The presentation includes
 - clarity of oral presentation including transparency preparation, mechanics.
 - effective classification/formatting and grammatical correctness of writing
 - effectiveness in showing the usefulness, significance, or accuracy of the results/review: effective use of figures, examples, etc.