Micro-606 v.2025

Guidelines for Student Presentations on Sept 18th 2025, AAC 106

Form groups of 2 (or groups of 1).
Sign up by 28.08.2025 at:
https://docs.google.com/spreadsheets/d/1-kOCZkxo7IAtFkz2opnx8TlqypNFegoDnu1JUY529r0/edit?usp=sharing

Your task: *Analyze how scaling laws influence the design, performance, and limitations of one specific MEMS device (e.g., a resonator, accelerometer, micropump, RF switch, micromirror, etc.). Demonstrate an understanding of physical scaling effects, supported by a quantitative analysis, i.e. do some calculations. You may make assumptions if needed, please justify them.*

Time Limit & Format on 18.09.2025

- **Duration**: 16 minute talk + 4 minutes Q&A
- Slides must be clear, uncluttered, and emphasize scaling.

Your tasks:

1. **Select a MEMS Device**

   Choose a *well-defined* MEMS device. Say what model or type. Examples include:

   - Accelerometer
   - RF MEMS switch
   - Micromirror
   - Resonator or filter
   - Microphone
   - Gyroscope
   - Ink-jet print head
   - Etc.

   If unsure, contact H Shea.

2. **Analyze Key Scaling Relationships**

   Explain how miniaturization affects device physics and performance. For example, include metrics such as, depending on device:

   - Force, displacement, and stiffness scaling
   - Thermal time constants

- Electrical and mechanical resonance frequency
- Power consumption and actuation efficiency
- Noise, sensitivity, and signal-to-noise ratio

3. **Include Quantitative Analysis**
    - Show how performance metrics change with linear dimension (L) scaling (e.g., L, L^2, L^{-3}).
    - Use device dimensions and materials for scaling estimates where possible. If not possible, choose reasonable values

4. **Discuss Design Implications**
    - What are the consequences of scaling for manufacturability, sensitivity, robustness, power use, etc.?
    - How does scaling impose limits or offer benefits?