# Development of MEMS Course Content Using LabView and Arduino (DUE 1400470)

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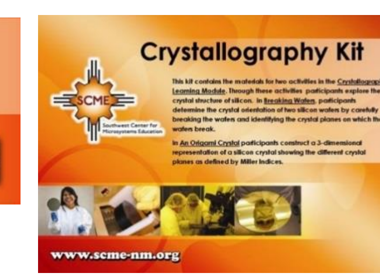
Abstract (simplified) – Describe three new MEMS courses that build on SCME MEMS material using LabView and Arduino. Each of the courses will be taught and developed this summer over a 12 week period. This poster will describe the overall course content, teaching methodology and use of technology to teach MEMS. Three teaching styles will be used: (CA) classical approach (lecture, lab and quizzes) with use of multimedia material, (DB) discovery based with focus on labs and hands-on learning, and (IBL) incremental with blended lecture and discovery based learning. Our goal is to determine whether these courses can be taught online.





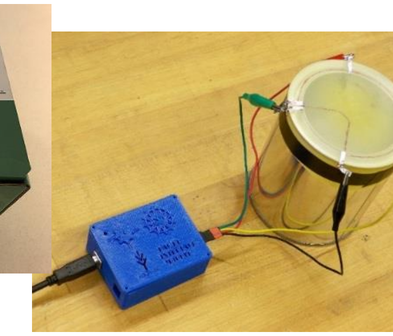

Course Assessment

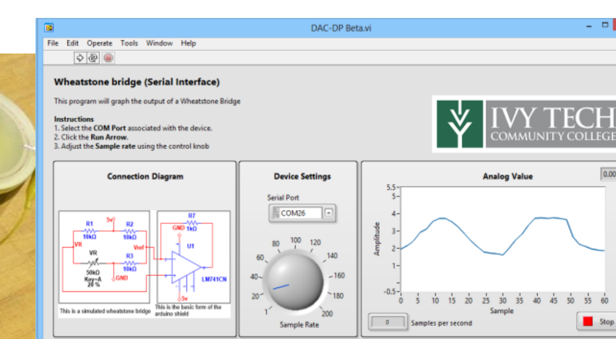
Questions

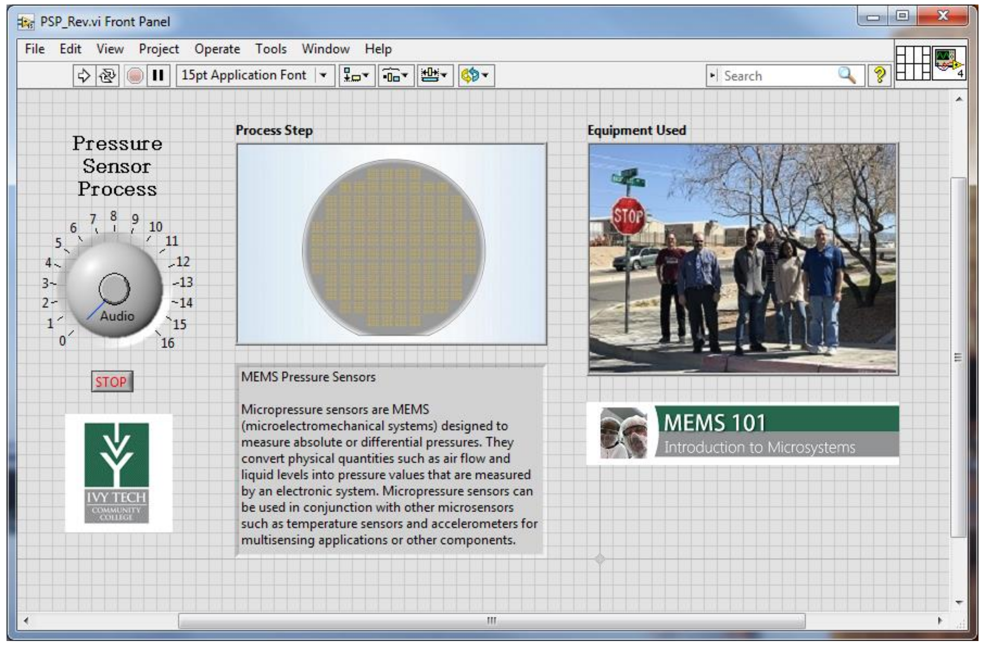
1.) Can this course be taught online?

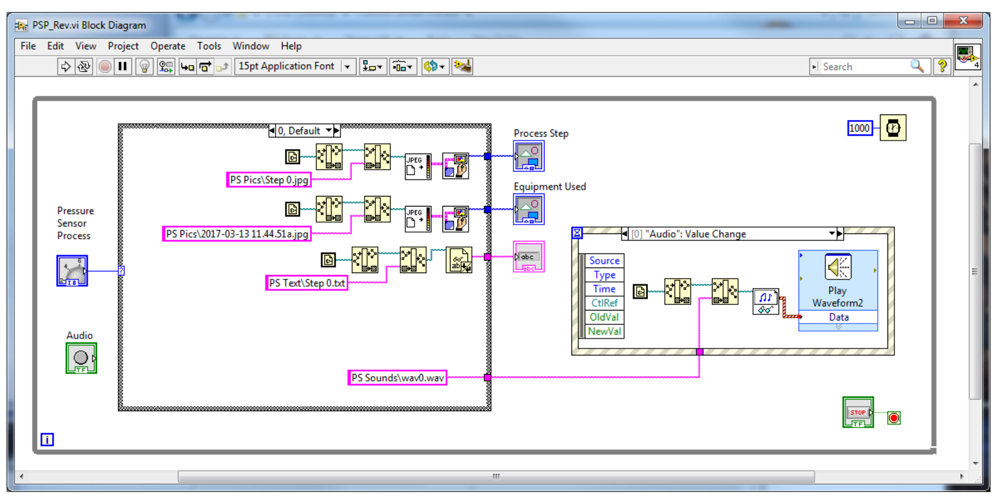
2.) Survey the students regarding each module and course:

- A.) Quality of material?
- B.) What is missing or is too much?
- C.) How about the method of instruction?






**Objective:** Provide introduction to MEMS devices and LabView

**Method of instruction:** (CA) Classical approach: Lectures (YouTube), quizzes and labs

- Provide each student with LabView license
- Labs will be done in classroom
- Embedded all material within Canvas for easy access.

**Approach used for course development:** Capitalize on the use of SCME material and kits

- Introduce LabView using online YouTube Videos
- Used: LabView (students developed simple calculators and worked on a Pressure Sensor Process tutorial aid.
- Use SCME Kits for labs done in-class

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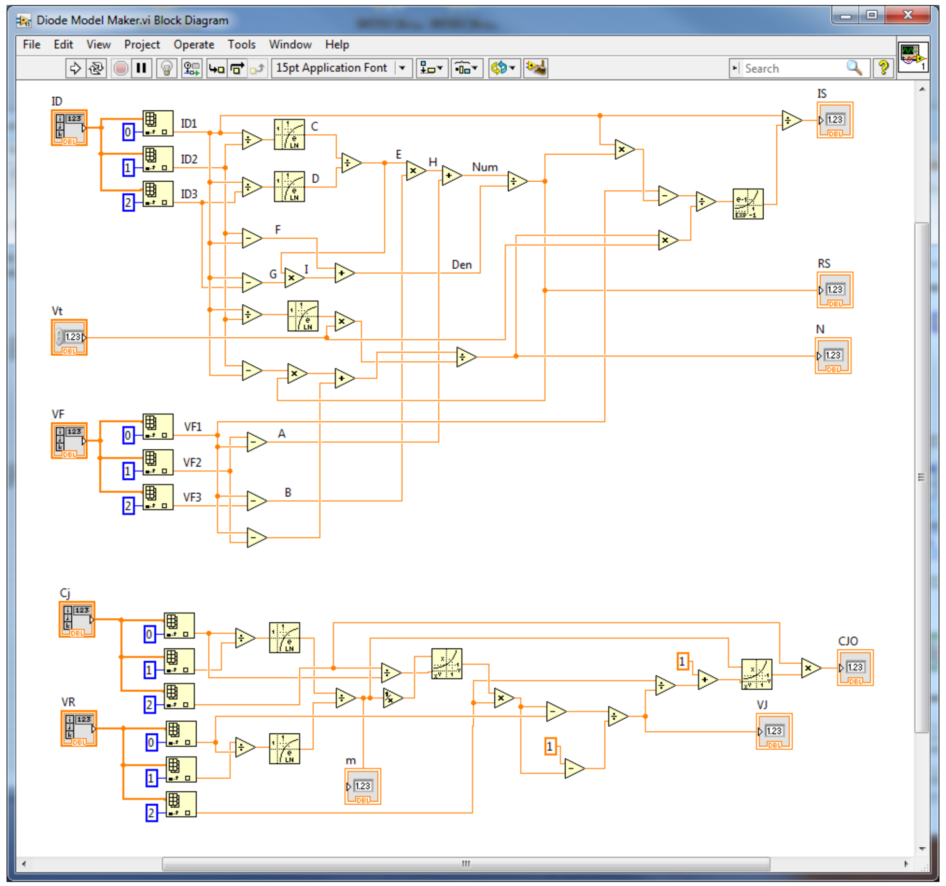
# MEMS 102
## Microsystems Characterization




**MEMS 102 – Microsystems Characterization**

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Diode Models
PSPICE Model Editor



**Objective:** Introduce device modeling of electrical devices that could be used in MEMS design using various software tools such as LabView

**Method of instruction:** (IBL) incremental with blended lecture and discovery based learning

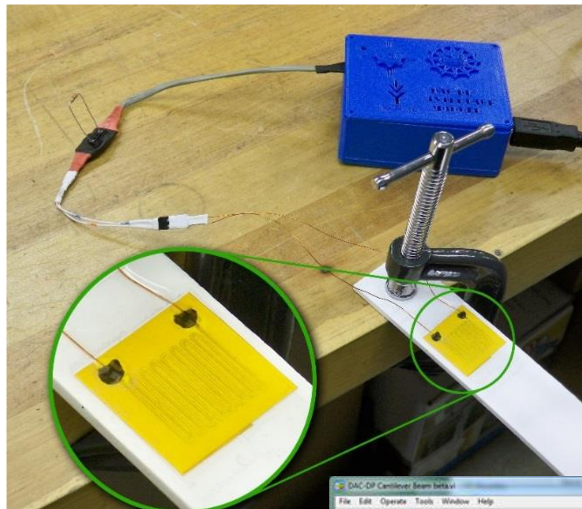
- Provide each student with LabView license
- No “Labs” will be done in classroom since we will be focused on the use of software
- Embedded some material within Canvas for easy access but other will be provided during class.

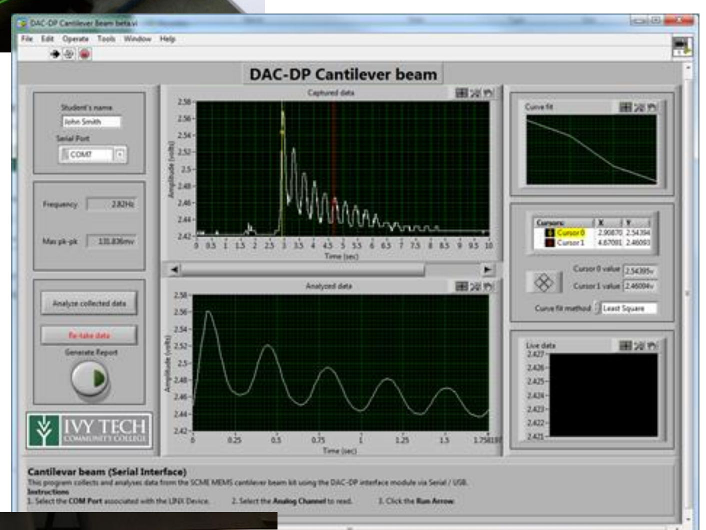
**Approach used for course development:** Use of device modeling material and new lectures, simulations and LabView code to teach concepts.

- LabView used to develop device modeling programs.
- Multisim, PSPICE Model Editor, Excel and Engauge to develop and test device models
- No Labs done but will be done in the future

# MEMS 103

## Microsystems and Electronics







**Objective:** Introduce MEMS Sensors and Transductors and how they can be interfaced to electronics. Arduino UNO will be used to interface to MEMS sensors under the control of student developed LabView code.

**Method of instruction:** (DB) discovery based with focus on labs and hands-on learning

- Provide each student with LabView license and Arduino “kit”
- Labs can be done in both the classroom and at home.
- Embedded some material within Canvas for easy access but other will be provided during class or will be left-up to the student to discover the solution.

**Approach used for course development:** Use LIFA and LINX LabView add-ons with LabView and Arduino UNO with MEMS sensors.

- Software - LabView used to collect and display data from sensors.
- Hardware- Arduino used to interface to the sensors and LabView code
- MEMS - modified SCME kits and off the shelf sensors

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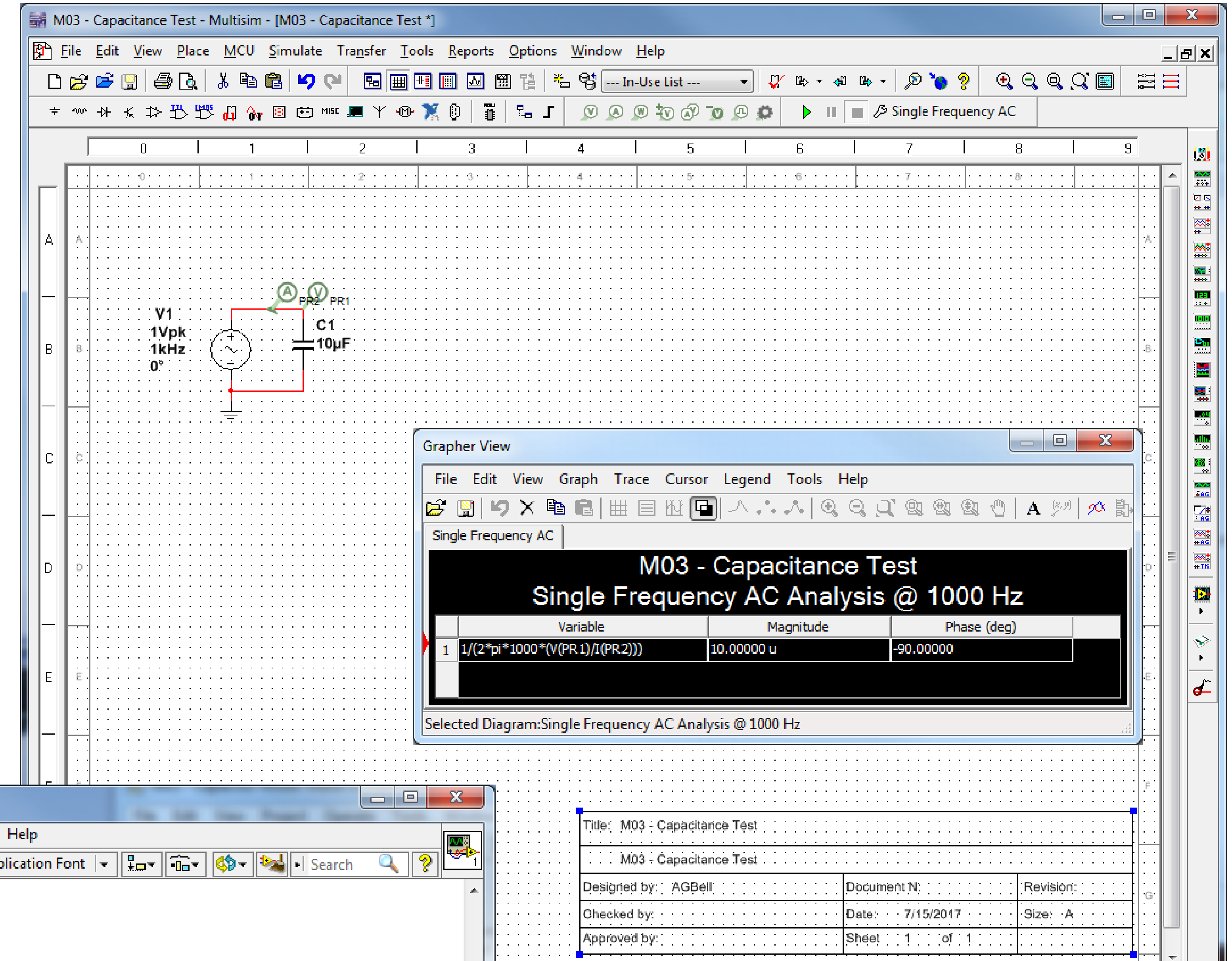
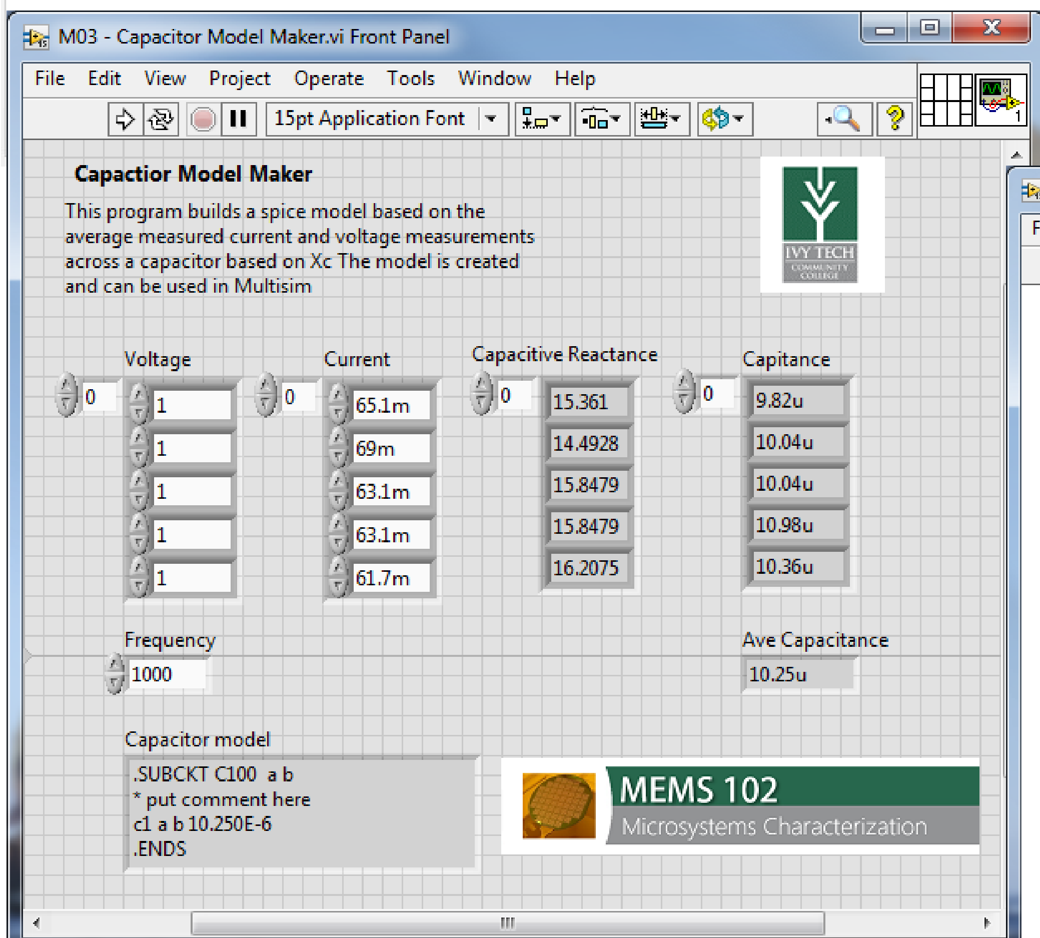
LabVIEW ARDUINO

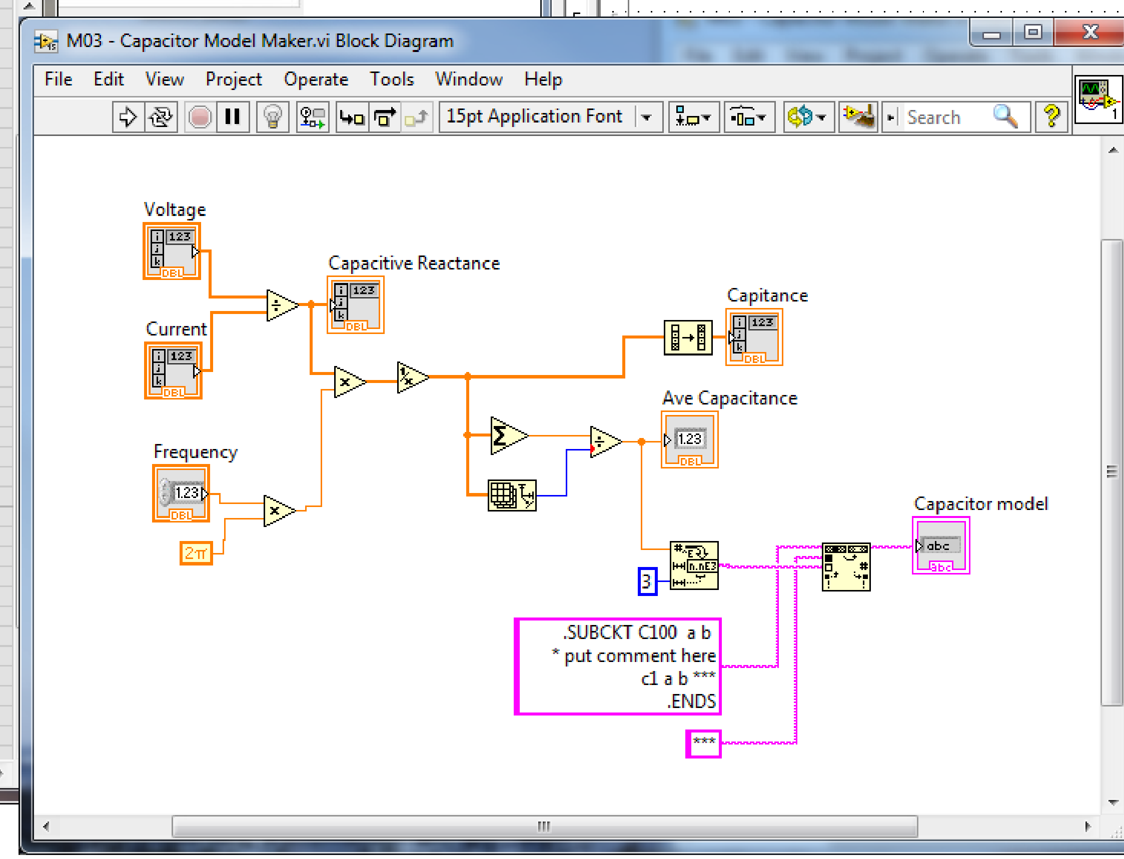
## Capacitor Models – Artifacts needed

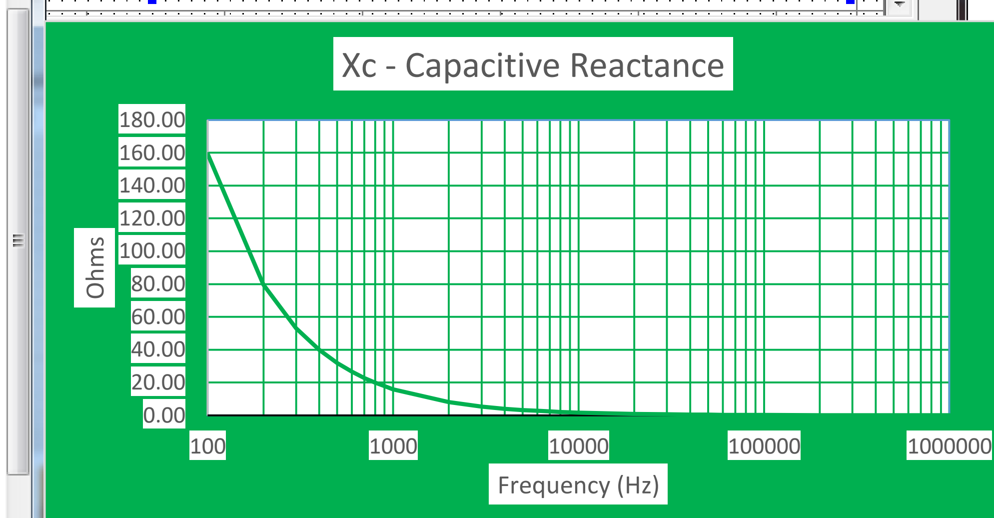
1. M03 – Capacitor Test.ms14 – This simulation calculates the capacitance based on the Xc formula at a fixed frequency using Multsim
2. M03 – Xc spreadsheet.xlsx – This spreadsheet calculates the Xc of a 10uF capacitor from 100Hz to 1MHz
3. M03 – parallel plate capacitor.xlsx – this spreadsheet is used to study how a parallel plate capacitor works.
4. M03 – PPC prog.vi – this LabView program calculates the value of a parallel plate capacitor.
5. M03 – Capacitor Model Maker.vi – using LabView create a .subckt model for a 10uF capacitor that is based on 5 voltage and current readings.

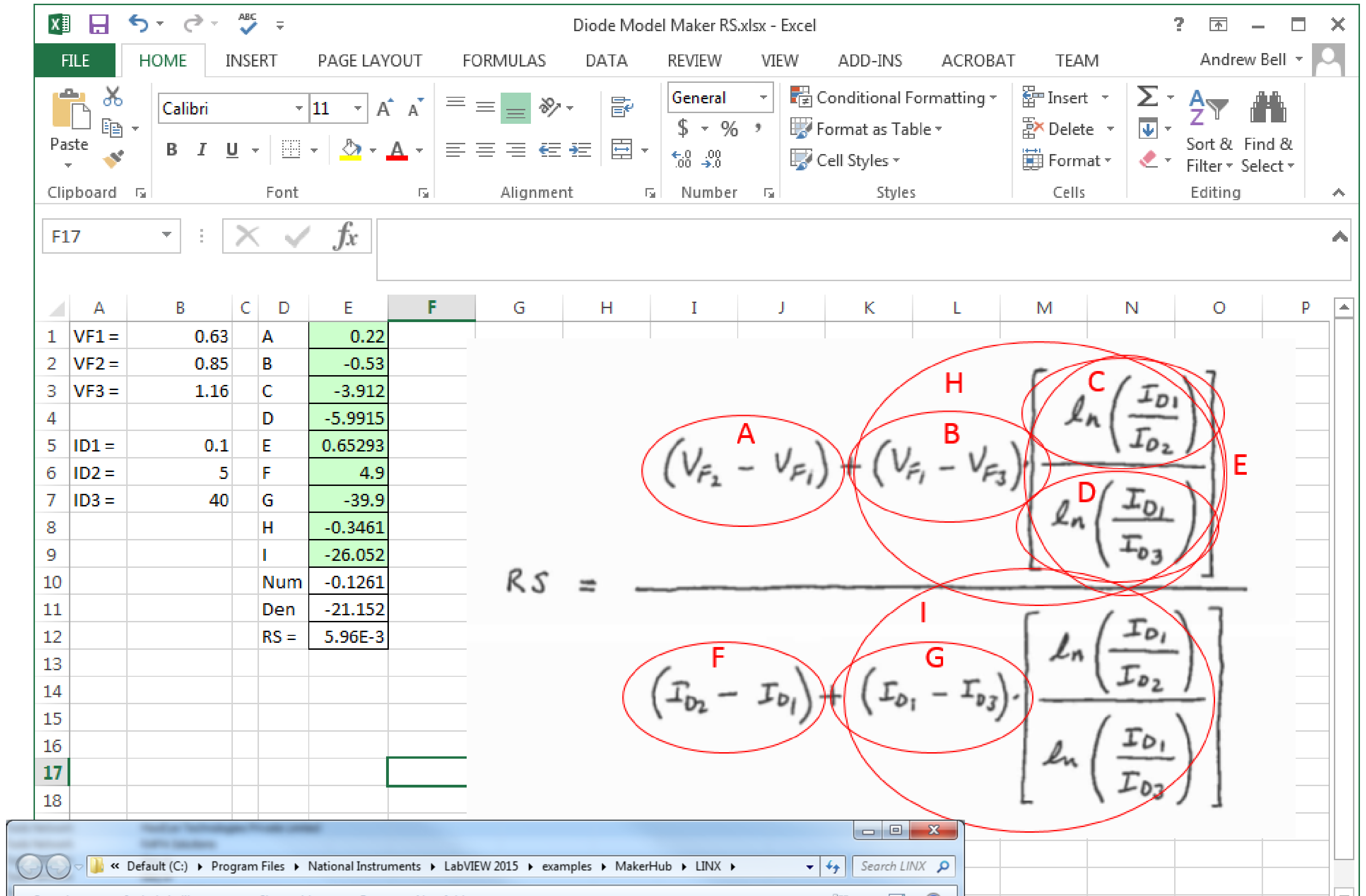


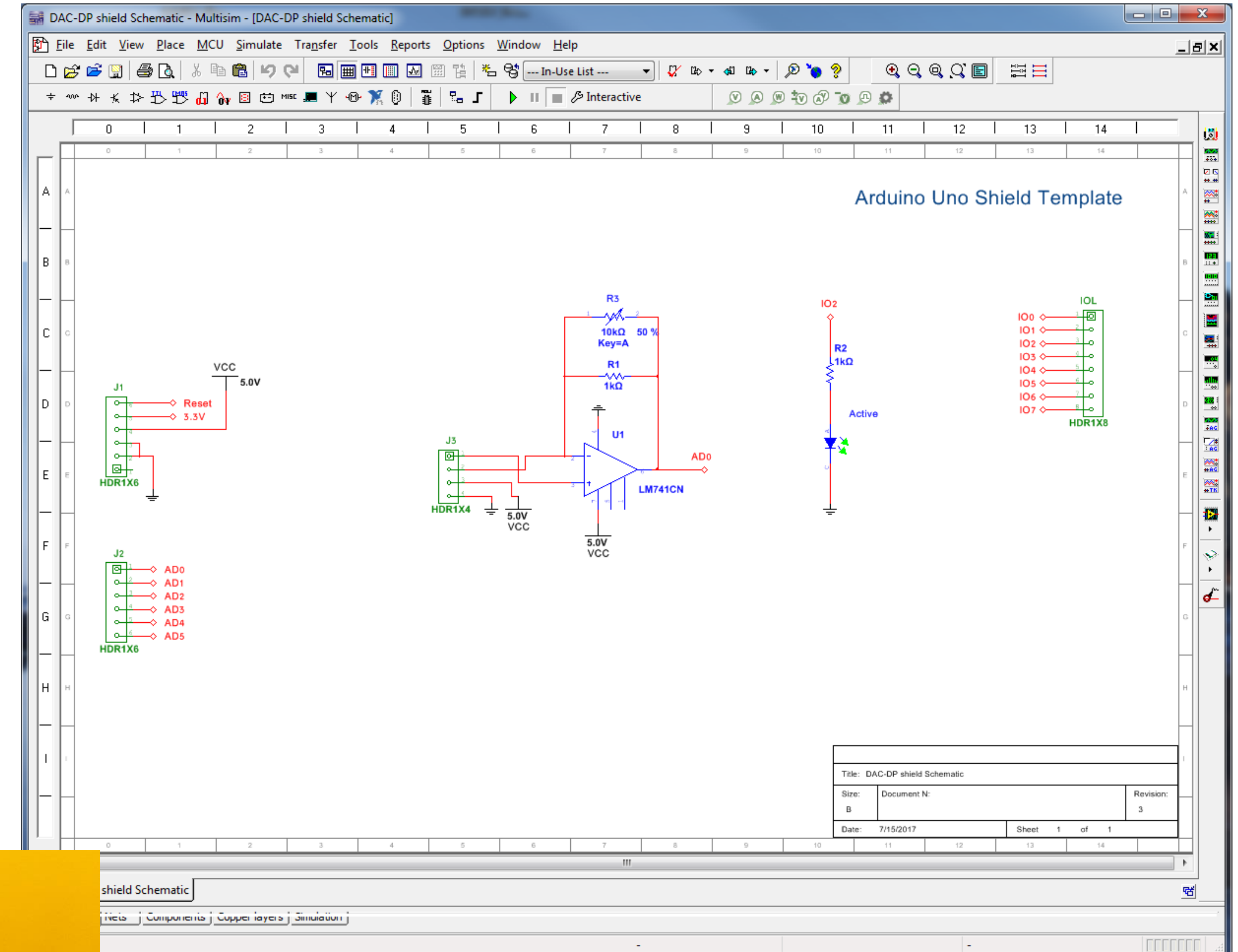


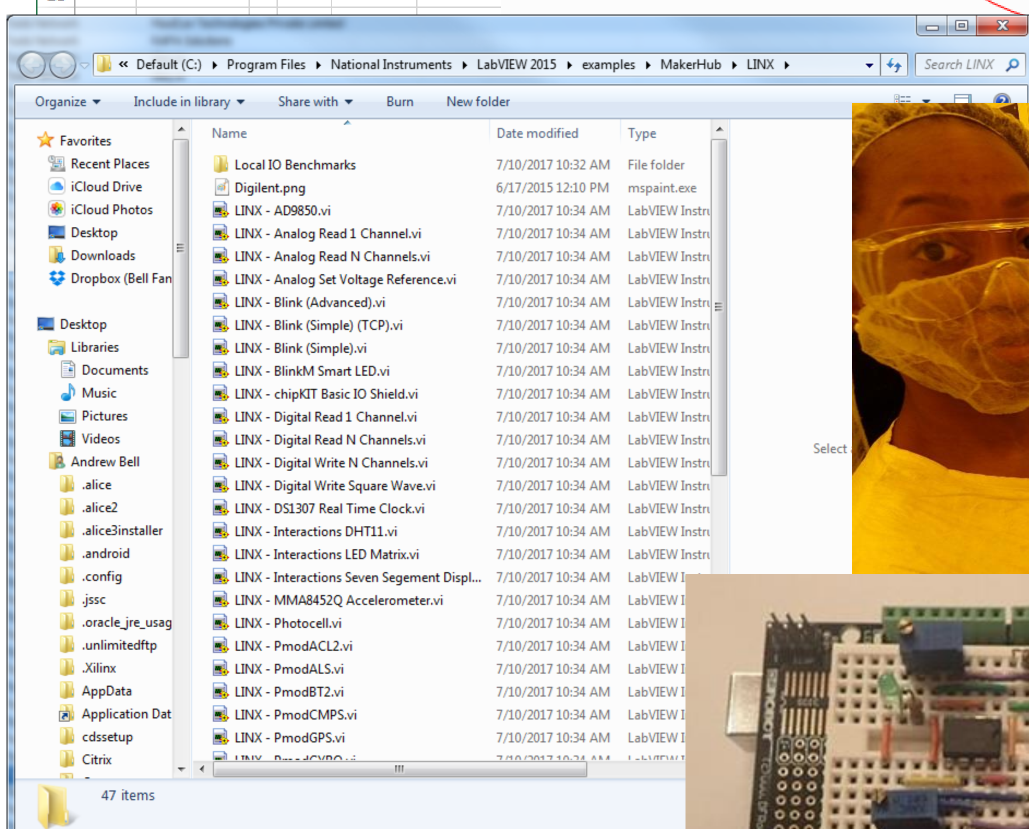



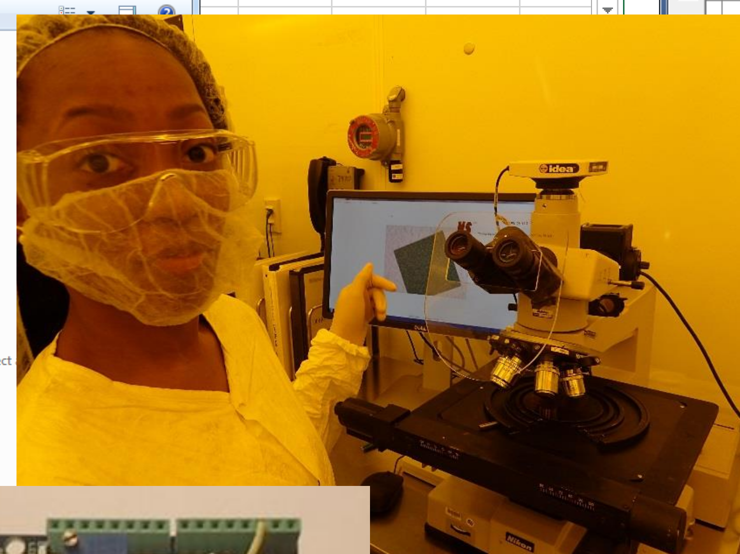



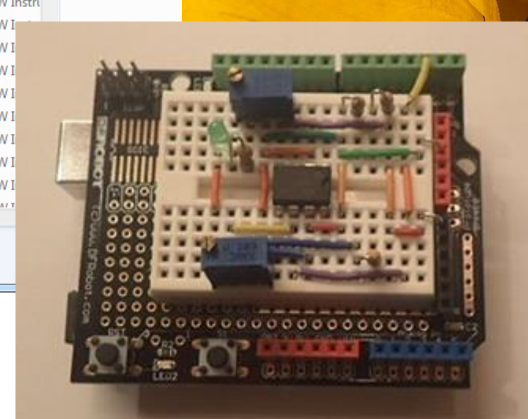









Future plans –

Teach MEMS 101, 102 and 103 online

Develop new MEMS kits

Continue to use SCME material and kits

http://www.scme-nm.org/

http://www.ivytech-mems.org/

http://faculty.ivytech.edu/~abell118/

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