

ECE 6580 Module Projects

Module Project: #1

For those who choose Option (B), please take pictures and show measurement waveforms in the picture next to the circuit.

Please upload all documentation for this module on iLearn by the due date.

Modules must be completed on time for full credit.

Please feel free to ask me questions if you have any about the project. I am more concerned with how you obtained your answers than what your answers are. Feel free to experiment with components and configurations – exploratory endeavors will give you higher marks!

All Students:

1. Find and review 5 journal or conference publications that use either Wheatstone bridges, PLLs, or Lock-in Amplifiers in their instrumentation. Make a detailed discussion on what each paper proposes and how the circuitry is used (keep these discussions to approximately 5 pages using single column, single spacing, and 12pt font. Please label any figures similar to the style I have in the modules.

Choose and complete either Option A or Option B (do not do both).

2. Option (A):

- a. Simulate the circuit in Fig. 5 (the N-channel based VOC) – include the varicaps in the simulation and plot the waveforms across Q1 and Q2 to ground, and across the inductor. Attach a load resistor to the “output” as shown in Fig. 5 and plot the power output vs load resistance for a 30V Vcc. How does this profile change with frequency?
- b. Next, mathematically derive the circuit operation and show the equations for output current across an optimum load resistance (i.e. the load resistance that gave the best power output in (a)).
- c. Discuss/suggest ways to improve the circuit in 1-2 pages.

2. Option (B):

- a. Construct an AC wheatstone bridge that uses an inductor as an eddy current transducer (you will need to fabricate the inductor). However, instead of using a tunable inductor to balance the bridge, utilize a variable resistor (potentiostat) as the balancing element. The goal will be to detect a non-ferrous metal target as it approaches the inductor.
- b. Measure the amplitude and phase angle change (if any) at the wheatstone bridge’s output and compare it to the Vin waveform as a piece of non-ferrous metal moves towards the transducing coil. What happens?
- c. Discuss what you observe by plotting the data (I will grade you on how understandable your graph is) and calculate the minimum S/N (this minimum will be found at the max distance the non-ferrous object can be detected).