EE/CprE/SE 492 GROUP PROGRESS REPORT

Group number: ***sdmay22-39***
Project title: ***Fast, Compact, High Strength Magnetic Pulse Generator***
Client: ***Mani Mina, Wei Shen Theh***
Advisor: ***Robert Bouda***
Team Members: ***Ben Newell, Harith Arsyad, James Camp, Tom Zaborowski, Tyler Bolton, Raheem Alqunais***

- **Project Summary:**

The goal of the project is to design and fabricate a device that is capable of producing magnetic field pulses greater than or equal to 500 gauss with a duration of 100 ns or less, be powered by a source voltage of less than or equal to 15 volts DC, and be less than 3.5” by 2” in physical size. The main application for this type of technology would be for magneto-optic switches. These devices convert optical energy to electrical energy to optical energy once again. This causes a bandwidth bottlecap within optic fiber networks due to the lower communication speed in an electrical connection. By incorporating a fast, high-strength magnetic pulse generator, there is hope to address this bottleneck by placing magneto-optic material between two fiber optic cables and then applying an external magnetic field over said material to modify the phase and/or polarization of the light traveling through the optic cables. With this method, there would not be an optical-electrical conversion, which would increase the bandwidth of optic fiber networks. Given the design requirements and resources from the previous iterations of this project, we plan to create an improved design including a reduced rise time of 10ns, functional programmable control of the magnetic field generation, reduced overall noise, and increased stability. Currently, the team has a monophasic magnetic pulse generator prototype on a perforated board. As of this semester, the team is trying to add an op-amp into the pulse generator/resistor network portion of the circuit. The team is also designing and testing a monophasic and biphasic magnetic pulse generator.

- **Accomplishments**

The team have designed and simulated a biphasic circuit on Multisim. The team has ordered parts for the updated monophasic circuit. There is still some discussion on what resistor values the team wants to use for the biphasic circuit. Components like the current sense resistor, feedback resistor, op-amp, p-channel mosfet, and the diodes were locked in and ready to order. The team already has a few components ordered from last semester. The pending issue is selecting the correct resistors for the op-amp gain section of the circuit. The team found a p-channel GaN FET through Transphorm. It is a new GaN FET that the company is releasing to the market on 2/18/22. The team believes that this p-channel GaN FET could help decrease the rise time of the p-channel half of the biphasic circuit.

- **Pending issues**

The only set of components that were not ordered were the resistors in the op-amp gain section of the circuit. The team have decided to order all the other parts and use the resistors in the provided EE230 kits. The team understands that the power rating for these resistors are not high but in the op-amp gain section of the circuit, the team found that a low amount of current flows through these resistors. Once the team finalizes the resistors in the op-amp gain section of the circuit, resistors with a high power tolerance will be ordered. The team was still not able to implement zero voltage switching into the biphasic circuit. This is a roadblock in achieving a functional biphasic circuit outside of just simulating.

- **Advisor Input/Signature:**

Please select one of the options below and sign.

_____ I am pleased with the progress the team is making.
_____ The teams progress could use some minor improvements which I will discuss with them.
_____ The team's progress has some major concerns that I will discuss directly with Dr. Bigelow
bigelow@iastate.edu , 515-294-4177

Signature: _____