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 set out to make a comprehensive report on the several iterations of the monophasic and biphasic magnetic pulse generator circuit. The team made eleven different tests for the monophasic circuit. The purpose of each test is to see how additional components affect the rise time, the amplitude, and the stability of the waveform flowing through the magnetic coil. Test one is the pulse generator waveforms at certain frequencies. Tests 2-7 build upon the next. Test two starts with a barebones setup in which there is only a MOSFET and the current sense resistor. The next test is adding the magnetic coil. The test after that adds the capacitor bank. After getting the waveforms from the capacitor bank test, filters are added to see how it affects the oscillation in the waveform. The next test was to incorporate zero voltage switching in order to reduce power loss. The last monophasic circuit test was an op-amp test in order to see if the oscillations from the op-amp test can increase the frequency. Based on the tests, the team

ordered three PCB designs to test and eventually pick as the final product. The following are the PCB designs that the team ordered: A monophasic zero volt switching circuit, a monophasic zero volt switching circuit with an op amp in the gate portion of the circuit, and a biphasic zero volt switching circuit.

- **Pending issues**

The team has continued to fail at constructing a coil that fits the parameters we have designed for it. Instead of making the inductance of the coil 11.7 nH, the constructed coils have been measured at 28 nH. The team will continue working on making the coil inductance lower, however, an inductance of 28 nH is still a very low value that will still help the waveform reach a rise time of under 100 ns. The team is also trying to design and make an intertwined coil for the biphasic circuit. Current calculations have the inductance around 100 nH. The team hopes to optimize the coil design. The team is also waiting for the PCBs to arrive. Documentation and a small amount of breadboard testing will be done while the team waits for the PCBs to arrive.

- **Advisor Input: It is very important that you meet regularly with your advisor. Please have your advisor select one of the options below.**

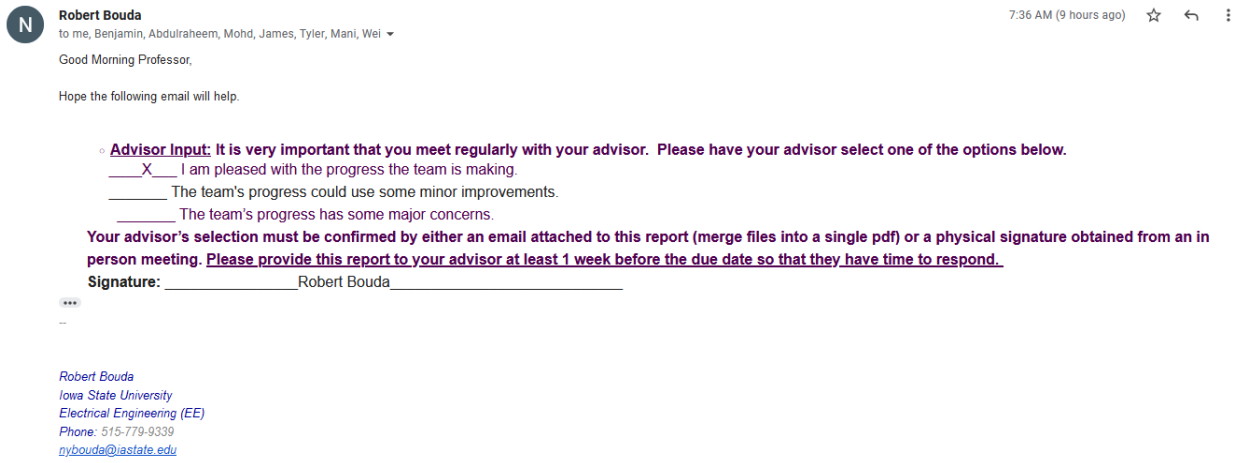
  _____ I am pleased with the progress the team is making.

  ____ The teams progress could use some minor improvements.

  _____ The team's progress has some major concerns.

Your advisor's selection must be confirmed by either an email attached to this report (merge files into a single pdf) or a physical signature obtained from an in person meeting. Please provide this report to your advisor at least 1 week before the due date so that they have time to respond.

Signature: _____



Robert Bouda 7:36 AM (9 hours ago)
to me, Benjamin, Abdulraheem, Mohd, James, Tyler, Mani, Wei

Good Morning Professor,

Hope the following email will help.

- **Advisor Input: It is very important that you meet regularly with your advisor. Please have your advisor select one of the options below.**
  ____X___ I am pleased with the progress the team is making.
  _____ The team's progress could use some minor improvements.
  _____ The team's progress has some major concerns.

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Signature: _____Robert Bouda_____

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