

Fast, Compact, High Strength Magnetic Pulse Generator

EE 491 Weekly Report

May 15-30

Week 5 (9/29/14-10/06/14)

Advisors: Mani Mina, John Pritchard, Robert Bouda
Client: High Speed Systems Engineering Lab
Members: Team Leader – Adam Kaas
Team Webmaster – Gregory Fontana, Meiyong Himmtann
Team Communication Leader – Brittany Duffy
Team Key Concept Holder – Megan Sharp, Brandon Dixon
Team Commissioner – Alain Ndoutoume

Weekly Summary

The first version of our project plan was completed this week. Much of our focus was centered on this document and continuation of MOSFET and coil education. As a team, we feel confident our project plan was carried out to the best of our ability. In addition, we created a circuit with a pulsing LED and wrote MATLAB code to easily calculate current and magnetic field for a single short coil and a Helmholtz coil.

Meeting Notes

9/29 Group meeting with core members

Duration: 1 hour **Members Present:** Megan, Brandon, Adam, Brittany, Meiyong, Greg

Purpose and Goals:

Our goals during this meeting were to discuss delegations for project plan and begin to briefly cover topics of example project plan.

Achievements:

During this meeting, all purposes and goals were met. The project plan got us thinking what information we need from our client and resources we will be in need of. Our timeline and schedule was great to look over to give each member a better sense of what needs to be accomplished by when. We also talked about goals for the week.

10/1 Group meeting with core members

Duration: 1 hour **Members Present:** All Members

Purpose and Goals:

Our goal during this meeting was to answer any questions members have about their section of the project plan.

Achievements:

Before this meeting, we each worked on our individual project plan section so that we could show every member a draft of our findings and accomplishments. We quickly and efficiently went through our results using a Google doc. This meeting focused on team assistance for sections allocated to each member. Our goal for our next meeting was to move forward with our project in creating circuits and MATLAB code.

10/3 Group meeting with core members

Duration: 1 hour **Members Present:** All Members

Purpose and Goals:

Our goal during this meeting was to move our education forward in circuit design and MATLAB calculations. Our advisor provided us with more direction, so we accomplished those tasks as quickly and in depth as possible.

Achievements:

To begin our exploration, our team demonstrated setting up a pulse generator to create a continuous pulsed waveform with a pulse width of 1 second, a period of 2 seconds, a high amplitude of 5V, and a

low amplitude of 0V. We set up a MOSFET circuit using an LED with a 330 Ohm resistor as a load. This “acts” similar to what an inductor would as a load. We had VDC set at 5V, and connect the output from the pulsed waveform to the gate pin of the MOSFET. We see the light illuminate for 1 second in 2 second intervals showing a very similar concept of how a magnetic field is generated. Once we get into testing with the coil, there will only be minor changes. The circuit will be replacing the LED with a coil, and the pulse waveform will be much faster. After going over this activity and understand concepts, ideas, theories, etc. the rest is simply optimization.

For testing purposes and calculations, our team has created multiple scripts to aid in our understanding of how our design is intended to run with the specifications we provide as a user. Understanding how to go back and forth from calculating current and magnetic field will help us when we need to optimize the circuit. With the scripts, we will be able to answer concepts such as how increasing the current affects how much magnetic field is generated.

1. MATLAB script that asks the user to input the number of turns, length, radius, *magnetic field (in Gauss)* and then calculates the current required to generate that field **for a single short coil.**
2. MATLAB script that asks the user to input the number of turns, length, radius, *current (in Amps)* and then calculates the magnetic field required generated **for a single short coil.**
3. MATLAB script that asks the user to input the number of turns, radius, *magnetic field (in Gauss)* and then calculates the current required to generate that field **for a Helmholtz coil.**
4. MATLAB script that asks the user to input the number of turns, length, radius, *current (in Amps)* and then calculates the magnetic field required generated **for a Helmholtz coil.**

Pending Issues

N/A

Plans for Next Week

Adam: Work with Brandon leading the schematic and layout efforts. Learn Eagle PCB. Layout circuit provided by John in Eagle PCB.

Greg: Simulate Circuit and work more with eagle and MATLAB. Update website.

Meiyong: Will be out of town at a conference most of the week. During free time I plan to take a look and attempt MATLAB scripts that will calculate current and magnetic fields given certain inputs, similar to what Adam, Brandon and Megan did last week

Brittany: Work on MATLAB scripts that will calculate current and magnetic fields given certain inputs. I will be out of town during Grace Hopper conference most of the week, but in my free time, I plan to completely understand the concepts demonstrated in the blinking LED circuit and how that relates to the magnetic field circuit we will be soon creating.

Megan: Work on coil design and understanding, and create multiple plots with #of turns vs. current. Next week (since I will be at Grace Hopper,) have a meeting with John to discuss what I find. Also, understand the circuit and measurements that Meiyong and others did last week.

Brandon: To further understand Eagle PCB schematic and layout, I will find necessary component libraries, figure out how to add parts from digikey (as we have already done for OrCAD), and recreate the circuit John sent us, both as a schematic and as a PCB layout.

Alain: continue to work on the circuit John sent us and ask him question to understand the circuit and how every part of the circuit are related to each other.

Individual Contributions This Week

Adam: Attended core meeting (1 hr), wrote MATLAB code with Megan & Brandon (.5 hrs), Meeting to discuss project plan (.2 hr), Assisted in finalizing project plan (1 hr), Attempted to build circuit to measure magnetic field of a coil (1 hr)

Greg: Attended core meeting (1 hr), worked with Meiyong and Alain to get a light to blink (.75 hrs)), Laid out simple circuit in eagle(1 hr), my part of project plan (.25 hr). Played with website with Meiyong (.5hr)

Meiyong: Attended core meeting (1hr), Explored website access and got the website up and running (2hrs), played with circuit given by John using different MOSFETs and different values (4hrs)

Brittany: Attended core team meetings throughout the week (3hrs), project plan formatting and looking at other project plans for examples (2hrs), finalizing project plan (3hrs), wrote weekly report (.5 hr)

Megan: Attended core meeting (1hr), Discussed project plan (0.5hrs) Initially worked on MATLAB/commenting/revision per John's suggestion (3.5hrs), Played with website/discussed it with Meiyong (1hr)

Brandon: Attending core meeting (1hr), attempted to recreate the circuit given to us by John (1.5 hr), assisted in MATLAB code (.25 hr), found and read parts of an Eagle PCB design book (1.25 hr), assisted in finishing project plan (.5 hr), researched circuits similar to the one John gave us and current vs. magnetic field equations (1 hr)

Alain: Attended team meeting (1hr), worked on the circuit John sent us in the lab(1hr), worked on the risks and market on the project plan(1hr)

Total Contributions for Project (This Week / Total for Semester)

Adam: 3.7 hrs/ 17.2 hrs

Greg: 3.5 hrs/15.5 hrs

Meiyong: 7 hrs/ 20.5 hrs

Brittany: 8.5 hrs/23.8 hrs

Megan: 6 hrs/ 19.25 hrs

Brandon: 5.5 hrs / 19.75 hrs

Alain: 3hr/16.75hr