

High Current Pulse Generator for the Application of Transcranial Magnetic Stimulation

Clients/ Advisors: Priyam Rastogi, Neelam Gaunkar, Jayaprakash Selvaraj, Dr. Mani Mina

Project Objective: Over the course of 2 semesters, design, fabricate, and test a high-current pulse generation device for use in TMS research.

- Objective of Circuit

- Peak Current of 2 kA +10%

- EMF feedback must be considered

- Peak Current Sustained for 400 μ s

- Rise/fall time of 100 μ s

- Up to 36 Hz pulse frequency (Commercial Benchmark)

- Circuit Input is 120 V wall outlet.

- Range of Load - 5 micro-Henry (min) to Max(Undefined)

- 10 pulses a minute max

- Circuit shall be monophasic;

- If successfully completed then a biphasic version shall be built.

- The device shall output multiple waveforms (Square, Sawtooth, Triangle, Sine)

Team Members:

Brian Kirkpatrick: Head of Circuit Design

Jon Rothfus: Head of Micro-Controllers, Team Communications Leader, Webmaster

Tania Alvarado Carias: Head of Electrical Safety

Abdul Bahashawn: Head of Rectification Circuits

Yan Wang: Head of Component Selection

Curtis Richards: Team Leader

Sub Teams:

Chassis Design: Tania, Curtis, Yan

-Meets Thursdays 3:00-5:00 p.m. Durham

Rectification Circuit: Abdul, Yan, Brian

-Meets Thursdays 3:00-5:00 p.m. Durham

Power Circuit: Tania, Curtis, Abdul

-Meets Thursdays 3:00-5:00 p.m. Durham

Micro Controller: Jon, Brian

-Meets Thursdays 3:00-5:00 p.m. Durham

Weekly Summary:

- Power Circuit: Tania, Curtis and Yan are now testing IGBT. The testing began with the load at the emitter, but the current was limited. The load was then moved to the collector side, but no signal across the load could be seen.
- Chassis Design: n/a (Will finish chassis after circuit is tested and complete.)
- Micro-Controller (M.C.): Performed a number of stress tests for Matlab GUI/Bluetooth communication related to read/write timing and terminator characters. Refactored code for new Bluetooth module. Additional code cleanup/additions.
- Precision Electronics: Brian is working on total PCB board for whole circuit. Abdul is working on sweep simulation of inductor coil.

Accomplishments of the Past Week:

Each member is to write up a reflection on their work throughout the week. The reflections can be found at <https://iastate.app.box.com/folder/46145323949>

Pending Issues:

- I. Due Dates
 - a. Weekly Report to be filled out by Wednesday at midnight
- II. Team Reports
 - a. Update your sub team sections accordingly

New Business:

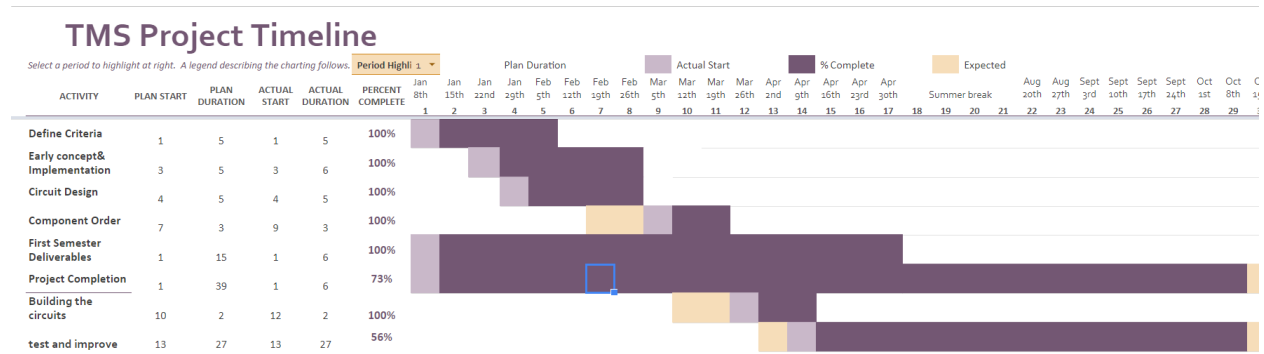
1. Meeting with Neelam and new Grad Students at 4:30 p.m.

Individual Contributions:

Group Member	Accomplishments	Time Worked This Week	Total Time Worked
Abdul	Ran a more simulations on the I?	3	27.5
Yan	Tested the circuit that blew the op-amp and troubleshooting.	4	32.5
Jon	Performed stress tests on Bluetooth module communication with Matlab GUI related to read/write timing and terminator character. Refactored code for new Bluetooth module. Created	5	33

	command protocol for GUI/MC Bluetooth communication. Other code cleanup/additions.		
Brian	Implemented new capacitor monitoring circuit and performed functional testing. Created Eagle file designs and updated part parameters. Ordered additional parts for the PCB from ETG.	5	31
Tania	Continued testing, changing the location of the load and oscilloscope port.	4.5	32.5
Chuck	Tested the circuit with load in designed position at the emitter, then modified design for load at the collector. Troubleshoot current limit we are finding in the load.	5	35

Current Progress:+



Individual tasks to be completed before next meeting:

Everyone:

- Weekly reflection
- Senior Design Report
- Chuck find SPICE file for transistor.
- Abdul simulate circuit sweep for the inductor coil
- Test IGBT
- Electronic Measurements Team
 - Measure inductance of test coil
 - Additional Voltage measurement for Capacitors
 - Build Capacitor Charging Indicator Circuit
- Power Team
 - Begin testing using old pulsar

- Wire in the Relay
- Chassis Team
 - IR Camera
- M.C.
 - Work out the bugs for the new amplifier from the micro-controller to IGBT
 - Add relay into circuit.
 - Investigate built-in IGBT temp sensor and evaluate potential to sense temp with MC
 - Test IGBT Signal Output system
 - Work with Brian on capacitor charge level detection circuit integration with MC

Summary of Weekly Advisor Meeting:

Abdul will now be in charge of the circuit simulation. Chuck and Tania will fix the capacitor charging circuit and then continue the IGBT testing. Jon will use a bluetooth chip to send the signals from our GUI to microcontroller so his computer won't be directly connected to the circuit.