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E344 Assignment 4

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Report submitted in partial fulfilment of the requirements of the module Design (E) 344 for the degree Baccalaureus in Engineering in the Department of Electrical and Electronic Engineering at Stellenbosch University.

2 September 2021

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Nomenclature

Variables and Abbreviations

$Op - Amp$	Operational Amplifier.
R_s	Sense Resistor.
TSC	Thyristor-Switched Capacitor Op-Amp.
Ω	Ohms.
mA	Milli Amperé.

Chapter 1

Low-side load control

1.1. Literature

Briefly summarise all the information you have gathered that was necessary to design the load control, with reference to the expected load current. This section is aimed at someone at your level of knowledge (the median E&E third year student).

1.2. Design

Put in calculations, assumptions, analysis, choices.

1.3. Results

Here you include your simulation results and your measured results.

Chapter 2

Bidirectional current sensing

2.1. Literature

The TSC sensor will be carried out as a present sensing circuit. The voltage will be taken over the R_s resistor which has a very exact and low resistance, and a given output voltage will be put together so that it will show the quantity of the current flowing through the resistor, as well as the load. The output voltage received will be used as the input indicator to the Arduino Beetle. If you want to carry out a firm reference voltage, you will have to use a voltage follower. By completing these things, we can know and balance the amount of current moving to the load as well as to and from the battery and origin.

2.2. Design

For the input current range: We know that an input current can vary from a 150-mA discharging current to a 400-mA charging current. It is important to choose a reference voltage so that the output voltage will be able to cover the full range of input currents. Resulting shunt voltage range: my shunt resistance possesses a value of 1Ω. This indicates that, taken from Ohm's law, the voltage span over the shunt resistor will be between 150 and 400 µV consisting of opposing polarities. Output voltage swing: This is restricted to the reference voltage as well as the profit of the current amplifier. The output voltage swing of the output voltage is equivalent to 12.5-mV according to the following formula: $V_o = I_i \times R_s \times Gain + V_(ref)$ Offset refers to the reference that will act as the counterbalance voltage from the ground that will allow sensing of the current in both directions. The difference in voltage over R_s will then be amplified to determine the current flow through the resistor. Noise suppression will only be successful when we use a passive filtering device called a capacitor and we will use this to filter out undesirable high frequencies. A sufficient capacitor will be chosen so that the circuit does not take too long to respond.

2.3. Results

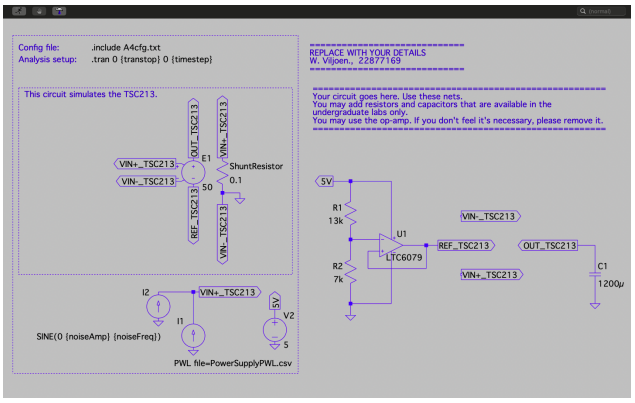

Figure 2.1: My circuit.

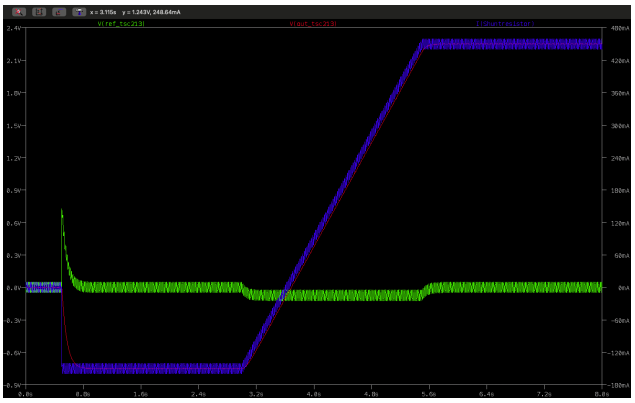

Figure 2.2: My results.

Bibliography

Appendix A

GitHub Activity Heatmap