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E344 Assignment 1

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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.

August 16, 2021

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3. Ek verstaan ook dat direkte vertalings plagiaat is.
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   I declare that the work contained in this assignment, except where otherwise stated, is my original work and that I have not previously (in its entirety or in part) submitted it for grading in this module/assignment or another module/assignment.

23142251 Studentenommer / *Student number*	 Handtekening / *Signature*
T. Islam Voorletters en van / *Initials and surname*	August 16, 2021 Datum / *Date*

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Nomenclature

Update this list to make it applicable to your project.

Variables and functions

$p(x)$	Probability density function with respect to variable x.
$P(A)$	Probability of event A occurring.
ε	The Bayes error.
ε_u	The Bhattacharyya bound.
B	The Bhattacharyya distance.
s	An HMM state. A subscript is used to refer to a particular state, e.g. s_i refers to the i^{th} state of an HMM.
$\mathbf{S}$	A set of HMM states.
$\mathbf{F}$	A set of frames.
$\mathbf{o}_f$	Observation (feature) vector associated with frame f.
$\gamma_s(\mathbf{o}_f)$	A posteriori probability of the observation vector $\mathbf{o}_f$ being generated by HMM state s.
μ	Statistical mean vector.
Σ	Statistical covariance matrix.
$L(\mathbf{S})$	Log likelihood of the set of HMM states $\mathbf{S}$ generating the training set observation vectors assigned to the states in that set.
$\mathcal{N}(\mathbf{x}\|\mu, \Sigma)$	Multivariate Gaussian PDF with mean μ and covariance matrix Σ.
a_{ij}	The probability of a transition from HMM state s_i to state s_j.
N	Total number of frames or number of tokens, depending on the context.
D	Number of deletion errors.
I	Number of insertion errors.
S	Number of substitution errors.

Acronyms and abbreviations

Update this list to make it applicable to your project.

AE	Afrikaans English
AID	accent identification
ASR	automatic speech recognition
AST	African Speech Technology
CE	Cape Flats English
DCD	dialect-context-dependent
DNN	deep neural network
G2P	grapheme-to-phoneme
GMM	Gaussian mixture model
HMM	hidden Markov model
HTK	Hidden Markov Model Toolkit
IE	Indian South African English
IPA	International Phonetic Alphabet
LM	language model
LMS	language model scaling factor
MFCC	Mel-frequency cepstral coefficient
MLLR	maximum likelihood linear regression
OOV	out-of-vocabulary
PD	pronunciation dictionary
PDF	probability density function
SAE	South African English
SAMPA	Speech Assessment Methods Phonetic Alphabet

Chapter 1

Solar photovoltaic cells and solar modules

PV Module A PV cell is an electronic device consists of semiconductor pn junction that converts the energy of photons directly into electricity by the process of photovoltaic effect. Either n type or p type doping allows excess of electrons or holes which is energized by the energy given off by a photons and since a potential difference is created between n and p region, connecting a load between n and p region will result in the flow of electrons, hence DC current. Two types of PV cells is generally used, monocrystalline and polycrystalline PV module. Polycrystalline PV cells are more efficient, sitting at the efficiency rating of approximately 15-22 percent in average. PV cells operate with open circuit voltage where no current is allowed to pass and the potential difference across the cells is at maximum and is due to the amount of forward bias on the solar cell due to the bias of the solar cell junction with the light-generated current. PV cells also operates with short circuit current where the voltage across the solar cell is zero and current is at maximum due to the generation and collection of light-generated carriers. An single photovoltaic solar cell can produce an open circuit voltage of about 0.5 to 0.6 volts at 25oC (typically around 0.58V) no matter how large they are. IV curve of solar cells suggests that under a specific temperature and irradiance the short circuit current (ISC) is at its peak when the voltage is 0 until it approaches the open circuit voltage where the curve goes down exponentially to 0 current and maximum voltage (VOC). The maximum power point of a PV module is the point on a IV curve graph where the solar cells generate the most amount of power which is the product of current and voltage. The open circuit voltage cand open circuit current of PV module SLP005-12 are 21.6V and 0.34 A respectively. It appears to have 72 cells. PV manufacturers rate the power output of their PV modules at standard test conditions (STC), which are a radiation of 1 kW/m2, a cell temperature of 25°C, and no wind. However, the temperature condition is not reflected in typical operating conditions because full-sun cell temperatures tend to be much higher than 25°C.

Table 1.1: Example of a simple table.

	V_{OC} [V]	I_{CC} [A]	V_{pmax} [V]
Measured dark 0.04	0	1.0	
Measured upside-down 14.6	0.85	1.0	
Measured oblique 19.8	0.0186	1.0	
Measured facing 18.95	0.119	1.0	

Chapter 2

Lead acid batteries

Lead Acid Battery Lead acid battery is a type of rechargeable battery. The voltage rating of my battery is at 6V. There are 3 cells in a unit and the nominal voltage per unit is 6V and nominal voltage per cell is 2V. The advertise capacity of the battery is 4.0Ah. The expected capacity of the battery is 7.2 MW. The open circuit voltage of my battery is measured to be 6.43V. Resistance is defined by the opposition to the flow of current and therefore, internal resistance of a battery is the opposition to the flow of current within the battery.

Chapter 3

High-side switching circuit

3.1. Intro

Introduce the reader to **what you want to present** in this chapter (i.e. what are you trying to achieve by initiating this communication?). Try to put yourself in the readers' shoes - what would you ~~like~~ need to see to be convinced that the author (1) knew what they were doing and understood what they had to do (2) properly designed for the requirements, (3) simulation-tested their design, and (4) correctly and critically assessed the outcome.

Include any references to literature you feel is needed. In this section, you put a very short summary of infrormation you gatherered from literature (papers, web sites, datasheets) that you used to do the design. Be sure to cite the references, which you can add in the `References.bib` file.

3.2. Design

In this section, you need to capture your design, which should include the following:

- Design rationale, i.e. what your thinking was behind the design.
- References to literature/sources as appropriate [1], but preferably in the intro above.
- You can assume the reader is in their third year of their E&E engineering degree, and that they will not need detailed explanations of trivial information (e.g. what a resistor is, or what Ohm's law is).
- Design calculations, for example to determine resistor values and capacitor values, or to check for allowed voltage and current ranges and levels. These calculations should also give expected outputs, which hopefully matches the simulated values.
- Analysis of given or expected input conditions.
- Expected values and ranges based on your design.
- Explain your choice of supply by referring to the advantages and disadvantages of each.

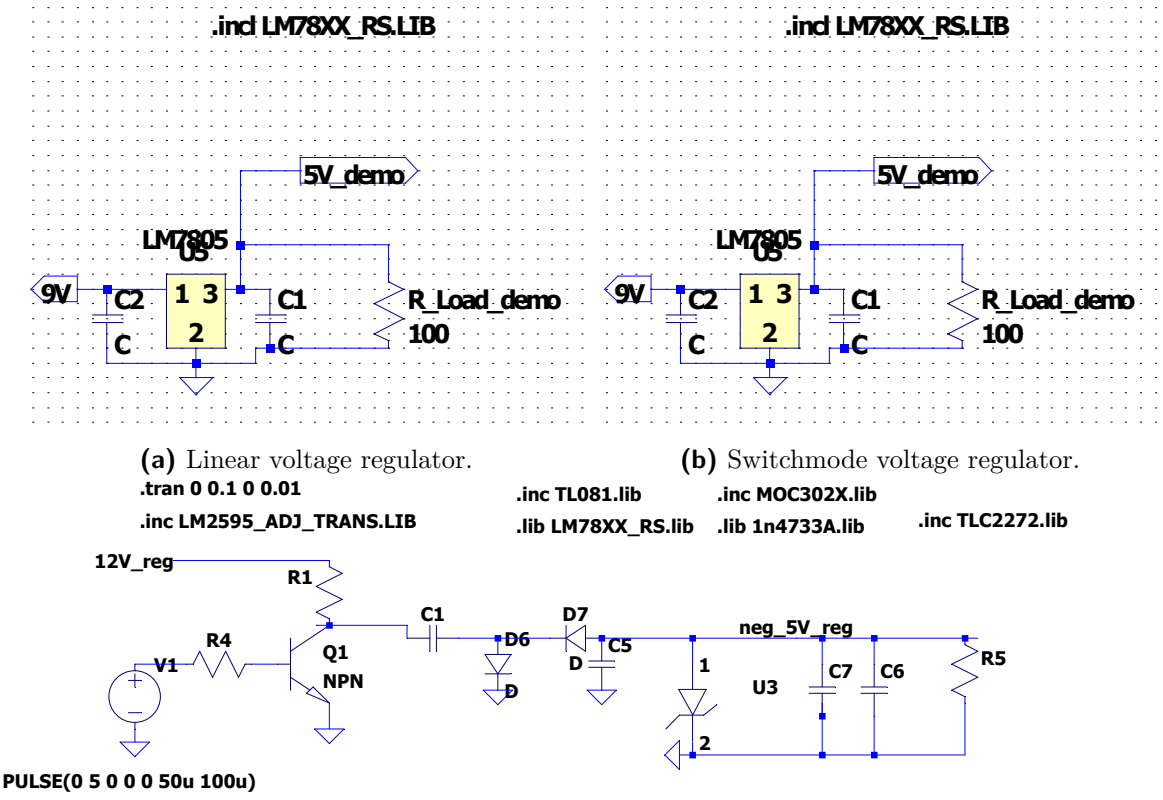
- Circuit diagram like the one in Figure 3.1. I used “print to PDF” from LTSpice, but feel free to use a cropped screengrab if you are PDF-challenged and do not have a PDF printer (there are some free PDF creators online). Also have a look at the demo video on SUNLearn.

For your benefit, here is how to write values with units: 150 mΩ or 199 myUnits, and this is how we write ranges: 2 to 5 kV.

Here is an inline equation $\frac{55}{45+3}$. Here is a numbered equation in Eq. 3.1.

$$a = \frac{55}{45+3}. \tag{3.1}$$

.



(a) Linear voltage regulator.

(b) Switchmode voltage regulator.

(c) Chargepump voltage regulator.

Figure 3.1: Circuit diagrams of the two voltage regulators, and another irrelevant one

.

3.3. Results

In this section, you want to demonstrate, by means of referring to simulation results, using the designed circuit, how your circuit behaves as you designed it in Section 3.2. Present and report on your simulated results in Figure 3.2. Be absolutely sure that the text and information in your report are readable.

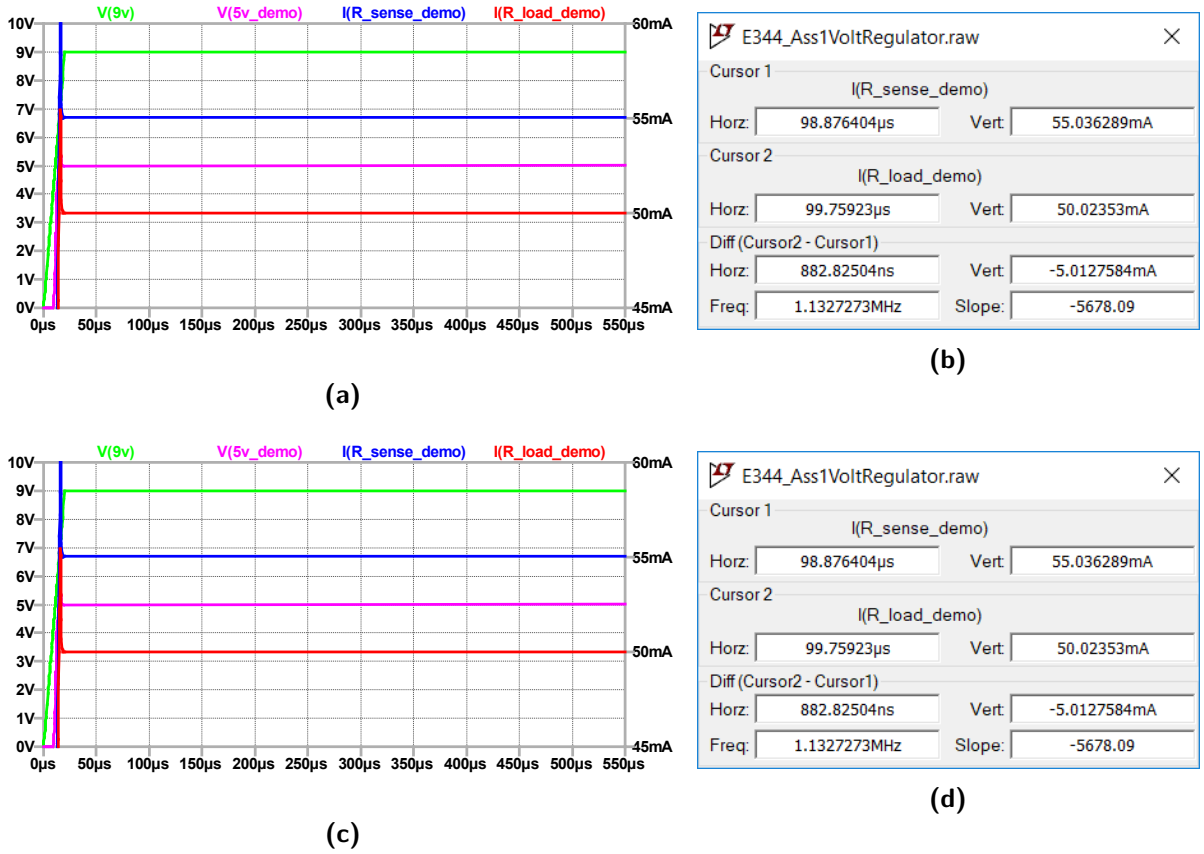


Figure 3.2: Voltage regulation, comparing the linear and switchmode regulators... (a) Blah blah. (b) Blah blah. (c) Blah blah. (d) Blah blah. As far as possible, please put input(s) and output(s) on the same plot rather than on separate plots. Based on the datasheet of XXXX in [1].

Table 3.1: Example of a simple table.

	2017	2018	Δ_{Abs}	Δ_{DiD}
A	9,868	10,399	+5	-11
B	10,191	10,590	+4	-12

Table 3.2: Example of another table.

Schools	Total energy used		Change	
	2017 [kWh]	2018 [kWh]	Δ_{Abs} [%]	Δ_{DiD} [%]
A	9,868	10,399	+5	-11
B	10,191	10,590	+4	-12

You can use screengrabs or photos of the oscilloscope, or download the CSVs and plot them as PDFs using Matlab, Excel or similar. You can also use tables, example of which are presented in Tables 3.1 and 3.2.

3.4. Summary

State whether your design performs as expected and what the limitations or things to keep in mind are.

Bibliography

[1] BBC, "How to make opamps amp op," 2018. [Online]. Available: www.electronics-tutorials.ws

Appendix A

Social contract

Download copy from SUNLearn, sign and include here (replace this one).

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E-design 344 Social Contract

2021

The purpose of this document is to establish commitment between the student and the organisers of E344. Beyond the commitment made here, it is not binding.

In the months preceeding the term, the lecturer (Thinus Booysen) and the Teaching Assistant (Kurt Coetzer) spent countless hours to prepare for E344 to ensure that you get your money's worth and that you are enabled to learn from the module and demonstrate and be assessed on your skills. We commit to prepare the assignments, to set the tests and assessments fairly, to be reasonably available, and to provide feedback and support as best and fast we can. We will work hard to give you the best opportunity to learn from and pass analogue electronic design E344.

I, ... have registered for E344 of my own volition with the intention to learn of and be assessed on the principals of analogue electronic design. Despite the potential publication online of supplementary videos on specific topics, I acknowledge that I am expected to attend the scheduled lectures to make the most of these appointments and learning opportunities. Moreover, I realise I am expected to spend the additional requisite number of hours on E344 as specified in the yearbook.

I acknowledge that E344 is an important part of my journey to becoming a professional engineer, and that my conduct should be reflective thereof. This includes doing and submitting my own work, working hard, starting on time, and assimilating as much information as possible. It also includes showing respect towards the University's equipment, staff, and their time.

Prof. MJ Booysen

Student number: .....

Signature: .....

Signature: .....

Date: 29 July 2021

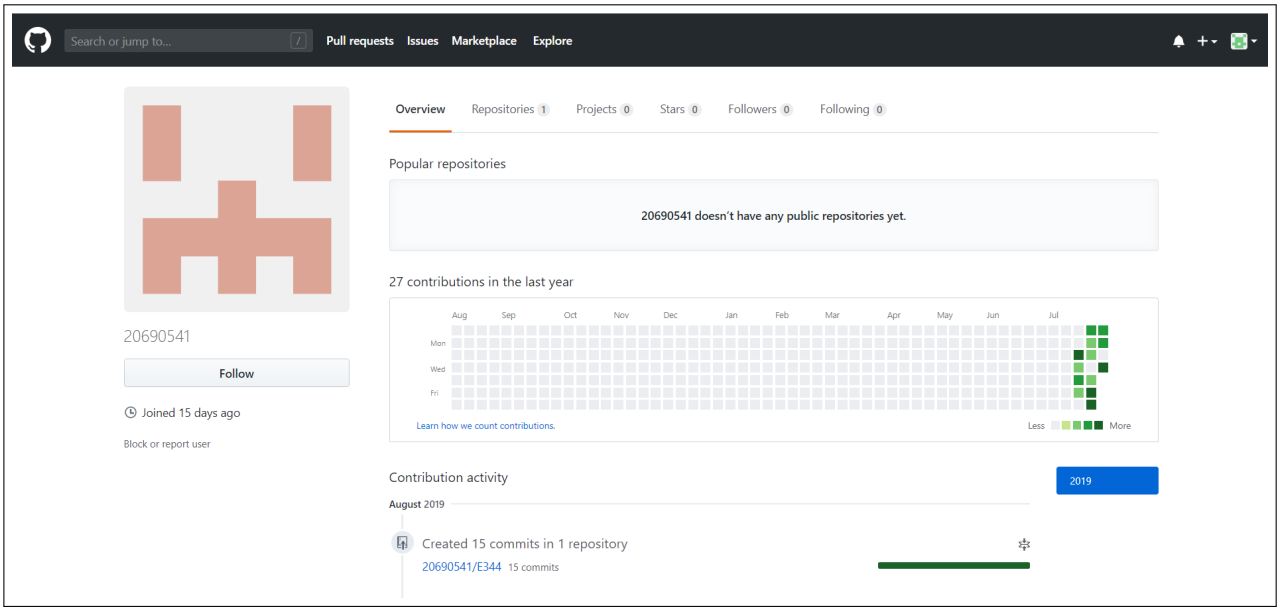
Date: .....

1

Appendix B

GitHub Activity Heatmap

Take a screenshot of your github version control activity heatmap and insert here.



Appendix C

Stuff you want to include

remove this!!

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