Title of the work

Subtitle if any

Master of Science Thesis

NAME A
NAME B

Department of Electrical Engineering
Division of Electric Power Engineering
CHALMERS UNIVERSITY OF TECHNOLOGY
Göteborg, Sweden 2023

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Cover:
Text concerning the cover illustration. In this case: Three-phase voltage.

Chalmers Bibliotek, Reproservice
Göteborg, Sweden 2023

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Abstract

- 5-7 lines about what has been done.
- 5-7 lines presenting the most important results. OBS, not general statements that could have been guessed before doing the work, concrete results that have been found in this specific work.
- End with a maximum of 10 keywords that will assist database searchers.

Index Terms: Aa, bbb, and cccc.

Acknowledgements

This work has been carried out at the Department of Electrical Engineering at Chalmers University of Technology. The financial support given by .....

Name of the author
Göteborg, Sweden, 2023

Contents

Chapter 1

Introduction

The introduction is extremely important, and what it does is that it presents the problem area, what has been done before and what you are contributing with.

1.1 Problem background

1.2 Previous work

This section can also be interleaved with the one before.

End these two first paragraphs with ”establishing the niche”, i.e. point what is missing in the scientific literature so far. And then the purpose of your work, i.e. filling this gap, is presented in the next section.

1.3 Purpose

Chapter 2

Collection of known usable theory

General descriptions of previously known knowledge must be kept to a minimum, information not related to the ongoing thesis work is not permitted. Do NOT start to write this 'old theory collection', start instead with later Chapters such as, case descriptions and analysis, and then the general theory that is needed to make your unique chapters (case set-up, analysis etc) clean from 'previously known knowledge', you form into this 'known theory Chapter'. However, to make headings for the 'old theory collection', in order to form the dummy report is not only strongly encouraged, but required.

It must not only be one chapter, it can be divided into several chapters if it is found to be suitable.

Chapter 3

Case set-up

Here you present the case you are working with. It could also include the measurement set-up if you are working with measurements. It must not only be one chapter, it can be divided into several chapters. Usually this (these) chapter(s) are rather straightforward, with not much theory.

This is the part where you start to work, after having though of what the deliveries (results presented in the conclusions) of your work shall be and created the dummy report.

Chapter 4

Analysis Part

This is the part where you start to work, after having though of what the deliveries (results presented in the conclusions) of your work shall be. However, it can also by so that starting with the case set-up is a good choice, to start to write the theory chapter without having stared either the analysis or case set-up chapter is a really bad idea and is not permitted.

Chapter 5

Conclusions

This chapter is in the file Conclusions.tex

5.1 Results from present work

In the initial dummy report, guess some results, this will help you to structure the work and keep the focus on the results

OBS later in the final report, do not write general statements that could have been guessed before doing the work. Concrete results that have been found in this specific work must be presented that could not have been guessed before doing the work.

5.2 Future work

Appendix A

Torbjörn special rules

A.1 Thesis work conduction responsibility

The Master Thesis work is the work of the student. The student takes charge of the work, and the examiner, supervisor or supervisors are coaches. Under no conditions it is acceptable that the thesis worker awaits what the supervisor orders what to do next, absolutely not, the thesis worker takes the full responsibility and drives the work forward continuously. To come with the question a few weeks into the work: What shall I/we do next ? Is utterly unacceptable and totally forbidden.

The thesis worker takes full responsibility of what he/she writes in the report. It is absolutely forbidden to write things the student feels unsure about, this must then be discussed with the supervisor instead. When corrections are given from the examiner/supervisor then it is only allowed to correct according to the suggestion if the student really agree, otherwise circle the comment and discuss with the supervisor/examinor, otherwise the mistakes will appear again and that is just not acceptable. A standard fee for proofreading is 25 USD/ 1000 words, which gives and indication about how energy-consuming proofreading is, just from the grammatical viewpoint. In addition also comments from the Examinor/Supervisor might be wrong, so the students have to be critical all the time. Please write 'mixed text' where text is mixed with equations, tables and figures, to receive full pages with only text, usually brings the reader to not be able to have full attention on what is written.

To answer a question from the supervisor or somebody else why the student has written this or that with "because the supervisor/examiner said so" is accordingly utterly unacceptable. In the same way to answer why something has been done or not been done with "because the supervisor/examiner said (did not say) so" is utterly unacceptable as well.

Very important is to believe in your own ability. Of course it is good to study literature, but there are misleading articles, so try to start from your own viewpoints as quick as possible, and do not start to implement materials from strange articles. A warning sign for the examiner/supervisor is when the students continue to ask for more materials to read, then a problem can be that they have not understood and taken over the project task. If you feel that you are going this path, then stop for a while, and see if you cannot start to implement from your own experiences instead.

Of extreme importance is to work slowly and structured, slips (minor mistakes) can take a huge amount of the available time. Always just make one change at a time, and verify the calculations.

If the thesis worker encounters problems that should be known from the courses the thesis worker has read, it is his/her responsibility to catch up that material, outside regular thesis working hours.

Working time is "free". However, a thesis work in principle never works unless the thesis student work with a regularity, 8-17 on working days. It is quite OK to take some time off and catch up at another time, but this must be notified to the supervisor 2-3 days in advance.

A.2 Thesis work report

A mistake that historically has been made is not to document the results as they are generated. This is of course extremely time-wasting, so please take the time and document, even if it feels boring at the moment to do it.

A couple of weeks after starting the work, the thesis worker provides a dummy report to the supervisor/examiner. It should contain the headings of the different sections and a purpose statement as well as guessed results in the conclusion. It is not permitted to write a list of content, it should instead be inserted by the used writing program from the headings in the dummy report. It is not recommended, but Ok to use Word, while Latex is preferred. A good recommendation is to put approximate working weeks in the headings.

This report is continuously updated and two-three days before meetings, an updated version should be sent to the supervisor. The report shall be clear and structured.

Write the minimum amount of text needed for describing the problem. However, the description should be such that somebody else can take the descriptions and redo the work and obtain the same results. Equations and figures are strongly encouraged, to read a full page with just text, is rather heavy.

General descriptions of previously known knowledge must be kept to a minimum, information not related to the ongoing thesis work is not permitted. Do NOT start to write the 'old theory collection', start instead with the case descriptions and analysis, and then the general theory that is needed to make your unique chapters (case set-up, analysis etc) clean from 'previously known knowledge', you form your 'old theory Chapter'.

A month or two after starting the work, when the first 2-3 pages of text, including some equations and figures, have been produced, please hand it in to the examiner for checking. OBS it is absolutely forbidden, to skip doing that. In this way stylistic and linguistic mistakes can be avoided when writing the full report. If the thesis worker has problem with the grammar, then please make contact with Chalmers learning centre https://writing.chalmers.se/chalmers-writing-centre/ where very useful support has been received during last years. One of the goals of the thesis report is to improve the skills of how to write a report. As mentioned above, to not carefully check linguistic comments from supervisors and examiner and continue to do grammatical errors in writing the bulk of the report, is not acceptable.

Some details before you hand in any material for reading by a supervisor/examiner, please use appropriate paragraph breaks, please check that there is a space after a '.' or a ',' or a '?' etc. Please check that all figures are referred to in the text. (And do not refer to them with 'below/above/etc').Do not use capital letters unless you start a sentence or it is a name or an abbreviation. Remember that there is no 'the' in front of a name, like 'the Matlab', 'the Table 3.3' etc. Variables shall be italic. Table captions are placed above the table and figure captions below a figure. Do not refer to 'the figure/table below/above' always refer to the Figure X or table X. Abbreviations are presented the first time they occur in the text. in addition, it is very useful to have a list of symbols and abbreviations. Please think of numbers of valid digits that you present.

When time traces are presented, make them clear and readable. Matlab default plotting settings are generally not useful, due to their small size. Instead, increase the font size, and add legends, before showing plots. Absolutely do not show time traces from programs with limited plotting visibility, such as P-spice etc. Save them in a file and read them over to Matlab.

Please remember to use proper paragraph starting. Either the paragraph starts with an indent or it is a free line above the starting of a new paragraph.

A.3 Presentation

In order to be allowed to schedule a presentation, a sufficient amount of results must have been presented to the supervisor. The call for the presentations should go out 2 weeks before the presentation. If you are doing your thesis in a company, check what timings they have regarding confidentiality check etc. Plan the presentation carefully, avoid bullet slides and use illustrations, ca 22-23 minutes is a suitable presentation time.

When an OK has been given by the examiner for a presentation, please send an invitation text to the examiner that he can advertise (OOBBSS, do not put it in a word or pdf document, put it in an email, so the examiner just can forward it).

A.4 sending files like registration forms, , report drafts etc, Work cards

It is absolutely forbidden to send a file named WordCard.pdf or similar, your name must be in the file name. Please fill in all the needed information, and in the case that Torbjörn is the examiner, the work card cannot be sent in before every other signature has been obtained, so Torbjörn just can sign everything and finish the work card.

A.5 Progress meetings

It is the responsibility of the thesis worker to propose supervision meetings with the examiner about every 4-8 weeks, where the thesis worker makes a Powerpoint presentation and presents his/her results and problems, so they can be discussed. Two-three days before the meeting the thesis worker sends an updated version of the report. Of course, supervision meetings with the supervisor can take place much more frequently. Also, never hesitate to contact the examiner/supervisor any time if quicker feed-back is needed. In this case, describe the problem very clearly and shortly, preferably in an email.

A.6 Technical problems occurring during the thesis work

26 hours is what the examiner (if there is a supervisor from the school side, his/her time is also included in the 26 hours) are supposed to spend on a thesis work, and this includes, report editing, administrative handling of the project, as well as giving feedback to the student. It is accordingly very important that the work is conducted in a structured way, as described above. When asking for help, the problem must be described in such a way that it is possible for the supervisor to help. To come with a complex simulation file and ask why it does not work, is often an impossible task for the supervisor/examiner. When an unsolvable problem occurs check, unless it is a very simple yes or no question, or just a general knowledge question,

- Has more than 1 step been made since the last working ”solution” ?
- Have all verification methods been tested to find the problem/mistake ?
- Is the problem clearly described for the supervisor ?
- Propose some more ways that could be taken.

A.7 Working in parallel to making the thesis work and Extensions

Working in parallel is in principle not OK. In case any parallel work is being conducted, regardless of how small it is, the examiner/supervisor must be informed. Extensions can in very certain occasions be needed. However, in no way, any longer prolongations cannot be accepted, and shorter ones, can only be granted if really needed for finishing the thesis, absolutely not as subterfuge for any other reason.

A.8 Summary of milestones

- Confirm that no ’job’ is performed in parallel to the thesis work. Alternatively inform about any other jobs to be done in parallel with the thesis
- Hand in dummy report with headings, and guessed conlclusions
- When having meetings - present materials that can be give feedback on
- Hand in 2-3 pages with written text + a couple of equations, where also figures and tables are referred to
- Sufficient results must have been obtained, first then thesis presentation can be discussed

A.9 Some LaTeX hints

A.9.1 Equations

Equations could be inserted as

$$\begin{aligned} U_R &= \hat{U}\cos(\omega t) && \text{(A.1)} \\ U_S &= \hat{U}\cos(\omega t - 120) && \text{(A.2)} \\ U_T &= \hat{U}\cos(\omega t - 240) \end{aligned}$$

where $\hat{U}$ is the peek value of the voltage and $\omega = 2\pi 50$. The $ sign is used to write equations within the text. The & & sign in the eqnarray is used to align the part of the equations between the & signs in the equations, in this case the = sign. The nonumber command is used to not number the equation.

Another way is if the list of equations belongs together and only one equation number is wanted. Then they could be inserted as

$$I_R = \hat{I}\cos(\omega t - \phi) \tag{A.3a}$$

$$I_S = \hat{I}\cos(\omega t - 120 - \phi) \tag{A.3b}$$

$$I_T = \hat{I}\cos(\omega t - 240 - \phi) \tag{A.3c}$$

In this case only one & sign is used for the alignment of the equations.

Some other examples of equations, also see **[?]**

$$\frac{V_{\text{hub}} - V_w}{V_{\text{hub}}} = \frac{\Delta V}{V_{\text{hub}}} = C_2 \ln\left(\frac{t_0}{t}\right) + C_T \tag{A.4}$$

$$\begin{aligned} T &= A(p_3 - p_2) = A\frac{1}{2}\rho V_0^2 \left(1 - (\cos(\gamma) - 2a_{disk})^2 - (\sin(\gamma) - 2a_{disk}\tan(\frac{\chi}{2}))^2\right) = \\ &= A\frac{1}{2}\rho V_0^2 4a_{disk}\left(\cos(\gamma) + \sin(\gamma)\tan(\frac{\chi}{2}) - a_{disk}\sec^2(\frac{\chi}{2})\right) \end{aligned} \tag{A.5}$$

$$\Psi_m(\zeta) = \int_0^{\zeta} \frac{1 - \Phi_m(\zeta)}{\zeta} \mathrm{d}\zeta \tag{A.6}$$

When referring to equations only use parentheses (X.X). In the case that the sentence starts with an equation, then use 'Equation (X.X) shows'. As seen in the equations above, do not use any multiplication signs, such as '$\cdot$' unless absolutely necessary. Do not use multiplication signs in equations, unless absolutely needed (if numerical values are used).

Time varying quantities are written with small letters. When using variable names or other names of components etc, please have the 2nd and other letter in the form of a subscript.

Remember that an equation is a part of the text, so the sentence might continue after the equation has ended. Do NEVER put colons or punctuations before an equation. Do never refer ahead to equations unless really needed.

Remember to have etichs and sustainability integrated into the report.

List of Figures and list of Tables, remove that, nobody reads that.

A.9.2 Figures

OBS! Matlabs default axis labelling is never OK, always resize the text so it becomes visable.

The figures can be inserted in the document as shown here. The figure will most probably not appear were it is inserted, but do not bother about this, if it is enough of text around the figures it will look nice anyway. As is shown in Fig. A.1, use different line styles in the figure if more than one line is plotted, avoid plotting with different colors. Type "help plot" in the Matlab command window to see the different line styles that are available.

To draw other figures Microsoft Visio can be used. To make a eps-figure of the drawn figure, group all things that should be in the figure and copy it and paste it into, for example CorelDRAW and export the figure as eps. In this way the figure can be nicely imported into the thesis. The figure that is inserted into the thesis can be scaled by using for example the command [width=xx cm] or [scale=0.5].

Fig. A.1 Three phase voltages and currents. a) Voltages, R-phase solid, S-phase dashed, T-phase dashed-dotted. b) Currents , R-phase solid, S-phase dashed, T-phase dashed-dotted. c) R-phase voltage and current, black voltage, grey current. d) zoom of the zero crossing of fig c).

Regarding x and y-axis labels it is very good if 10^x can be avoided, use mA,kA, etc instead of Amperes for instance.

Regarding the figure caption, remember that a figure with its caption shall be understandable without reading the text around it. Furthermore the figure shall be presented in the text before it appears and then commented afterwards. The commenting shall be sufficient so that the reader without looking at the figure and caption can understand what it is about.

Finally, figures in a report do not have a title above it, put the information in the figure caption.

A.9.3 Tables and lists

If a numbered list is created as

1. Item 1
2. Item 2

and a bullet list as

- Item 1
- Item 2

A table is inserted as is shown in the Appendix.tex file. In the same way as with the figures the table will most probably not appear where it is inserted in the text. After the begin{tabular} command the columns are specified. The |-sign is used to get a vertical line in the table, c gives center alignment, l gives left alignment and r right alignment. The hline command gives a horizontal line in the table, if this is wanted for all rows then it needs to be in the end of each line.

Table A.1: Test table.

A	1000	50000000
B.bbb	2	6
C	3	$\cos(\varphi)$

A.9.4 References

When putting in cross references in the document the label-command is used. Looking in this file it can be seen how to put the label-command for figures, tables, equations and chapters. Since the master thesis will be large with allot of references it can be good to sort the different references and give them self instructive names. Here f: is added in the beginning of the reference name to inform that the reference is for a figure, t: for tables, e: for equations and c: for chapters or sections. To refer to the label the ref-command is used. Some examples:

In (A.3) the three phase current is defined. In Fig. A.1 d) the zero crossing between the R-phase voltage, (A.1), and current, (A.3a), is shown. The test Table A.1 is shown in Chapter A.9.3.

The $\sim$ is used to keep the number on the same line as the text.

For making references to articles, books, manuals etc a a bib-file is needed. In the file referenser.bib some examples are shown. When you search for information, for example articles, usually the information

Fig. A.2 A picture drawn with Visio.

about articles, books etc can be saved in bibTeX format and thereby be copied directly into the bib-file. When inserting the references in the bib-file, try to give them self instructive names to make it easier. To refer use the cite command and the reference name. For example: The rules for master's thesis work can be found in [**?**]. To get the references into the report, first compile the main document two times then run the BibTex compiler two times to compile the bib-file and finally compile the main document two times again. It is only the references that you actually refer to that will appear in the reference list.

A.10 From Chalmers recommendations regarding Aim and learning objectives, obs check 8 9, they are often missed

The learning objectives for the Masterâs thesis are based on the objectives for the degree of Master of Engineering, Architecture and other Masters of Science programmes contained in the national Qualifications Ordinance and in Chalmers local Qualifications Ordinance (Dnr C2007/723). Specific learning objectives to be achieved in the Masterâs thesis are for the student to be able to:

1. Apply significantly specialised knowledge in the main area/specialisation of the programme in his or her project and relate this to current research and development work in a scientifically correct way,

2. Choose and justify the choice of method in the project, within the main area/specialisation of the programme,

3. Contribute to research and development work, and be able to relate his or her work to the relevant scientific and technical/industrially/architectonic contexts,

4. With a holistic approach, to identify, formulate and deal with complex issues critically, autonomously and creatively,

5. To plan and perform highly qualified tasks using adequate methods within given parameters, and to be capable of critically evaluating this work,

6. Create, analyse and critically evaluate different technical/architectonic solutions,

7. Integrate knowledge critically and systematically,

8. Present clearly and discuss his or her solutions in English, as well as the knowledge and the arguments on which these are based,

9. Identify, within the parameters of the specific project, the questions that need to be answered in order for the relevant societal, ethical and ecological aspects to be taken into consideration, and

10. Take into account and discuss ethical aspects of research and development work, both as regards how the work is to be performed, as well as what is to be investigated/developed.

11. Identify and discuss the need for additional clarification of various aspects of the project prior to decision and implementation, where relevant.