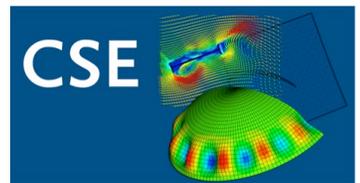


Guideline

**for the compilation of a thesis for the
Master's Programme in Computational Sciences in Engineering (CSE)
at TU Braunschweig
Version 07 | 21 Sep 2020**

This guideline is provided for information only and should be used to attain a general understanding of the requirements of a master's thesis at the CSE master's programme. This guideline is neither legally binding nor exhaustive. It may be used as a starting point and aid to orientation. It is imperative that the points listed in this guideline are to be verified by the supervisor/first examiner at the respective institute. This guideline gives an overview of points which should be discussed with the supervisor/first examiner.

Note regarding other scientific works: Most parts regarding the overall structure, layout and the chapter on further remarks can be applied in general to writing scientifically, such as a student project.



General statement on mentoring and personal responsibility

Composing a master's thesis is an ongoing process. Make sure that you make use of mentoring. It is imperative that you consult your supervisor/first examiner frequently throughout the process of writing your master's thesis. Communication is key. You can contact your supervisor via e-mail and provide short extracts from your ongoing work. This allows your first examiner enough time to consider how you can be guided and assisted while composing your thesis. Make sure that you document the communication with your supervisor in written form (minutes). Refrain from submitting a completed thesis without having consulted your supervisor/first examiner before.

Personal responsibility is key. Make a sound judgement when you choose the topic of your thesis and your supervisor/first examiner: your choices may have far-reaching consequences for your professional future. In case you feel unsure, consult either CSE-staff and/or your colleagues.

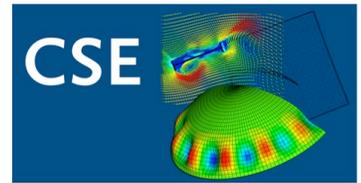
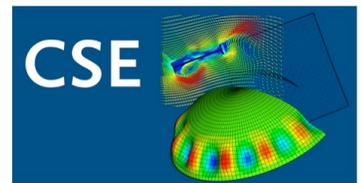


Table of Contents

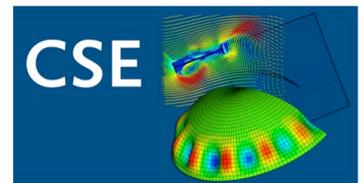
I. Overall Structure.....	4
II. Layout.....	8
III. Submission.....	12
IV. Further remarks and requirements.....	14
V. Examples	18



I. Overall Structure

The thesis could be structured as follows (to be discussed with supervisor/first examiner):

Cover sheet.....	5
Task Sheet	5
Written declaration of truthfulness	5
Overview/Abstract	5
Table of contents.....	5
Denotations/List of symbols and acronyms	5
Introduction.....	5
Main body.....	5
Summary and outlook.....	7
List of references.....	7
List of figures and list of tables	7
Appendix	7



Cover sheet

The thesis has to be prefixed by a cover sheet corresponding to the guidelines of the specific institute.

Task Sheet

The task sheet has to be included in all copies. The original is to be included in the first examiner's copy.

Written declaration of truthfulness

All copies have to include a written declaration of truthfulness. The original is to be included in the first examiner's copy. All have to be signed (no copies of signatures).

Overview/Abstract

The overview contains short details about the goals, applied methods, and results. It briefly summarizes the content of the thesis and is the prefix of the thesis (1-page maximum).

Table of contents

It contains all chapter titles and subtitles with their corresponding page numbers and should be clearly structured (e. g. indentation of subheadings). The titles of the individual chapters and subtitles should be indexed with decimal numbering.

Denotations/List of symbols and acronyms

All symbols used are to be listed, given their meaning. Avoid ambiguity. If standard expressions exist, they should be applied. All physical quantities should be listed including their units. First, the Latin symbols are listed in alphabetical order each with capital letters preceding non-capital. Then, the Greek symbols are to be listed in the same order. At the end, frequently used indices are to be given in numerical and alphabetical order, respectively.

Introduction

The subject and the current problem are briefly introduced and the assignment is presented in the author's own words.

Existing literature with similar methods/problems should be cited and shortly explained and their differences and relevance to the thesis discussed. At the end of the introduction, the structure of the thesis should be sketched.

Main body

The necessary methods/actions to solve the assigned tasks are to be described in detail here. Depending on the assignment the basic principles and methods to solving a

problem are to be explained, testing facilities are to be described, analysed results are to be shown, design drawings to be made and so forth.

The main body is structured into meaningful chapters, sections, and subsections, as shown in the following example:

- 4. Basic principles
 - 4.1 Basic principles of FEM
 - 4.1.1 Elements with linear shape-functions
 - 4.1.2 Elements with quadratic shape-functions
 - ...
 - 5. Development of assigned tasks
 - 5.1 Programming of the algorithm
 - 5.1.1 Generation of the input files
 - 5.1.2 Automatic iteration
 - 5.2 Development of the element stiffness matrix
 - ...
 - 6. Results
 - 6.1 Results of the linear analysis
 - 6.2 Results of the nonlinear analysis
 - ...

A deeper sub-division into further sub-subchapters is usually not advisable. The chapters should roughly have the same length.

Theoretic derivations should be conclusive. Check that symbols are not ambiguous, and derivations are gradually building up and contain no jumps. General theoretic derivations are placed at the beginning of the main part. Results of these equations are to be placed in the results chapter.

Results obtained within the scope of the thesis are to be discussed in detail. If applicable, occurring divergences between theory and measurements are to be interpreted. A focus is to be put on the physical interpretation of mathematical, experimental and numerical results, respectively.

Computer codes are to be documented in depth with respect to the input and output files. Subroutines are at least to be described with respect to their purpose and in- and output parameters. A structure chart showing the logic program sequence is recommended. The program documentation can be either placed in the main part or in the appendix if being too extensive. The source code of developed computer programs is to be attached to a data medium to all copies.

Summary and outlook

In the summary (at least 1.5 pages \approx 1000 words) the main results are high-lighted/listed so that it can be understood without knowledge of the preceding treatise. A short outlook can address new issues which arose while solving the assigned problems.

List of references

In the list of references, all sources (books, papers, journals, internet) are listed which were used and – in accordance with the text – sequentially or alphabetically numbered. Please verify with your supervisor/first examiner if internet sources are allowed. It is also possible to list the references in alphabetical order. Every reference in the list of references must appear in the main part and vice versa. Further information on formatting is given in the next chapter and can be seen in the attached samples. The list of references must contain the following details:

- For essays from journals: Name of the author/-s, title of the essay, name of the journal, volume, year of publication, edition, first and last page of the essay.
- For Books: Name of the author/-s, title of the book, volume, edition, registered office of the publishing house, publishing house and year of publication.
- For internet pages: Title of the page, URL as well date and time of access.

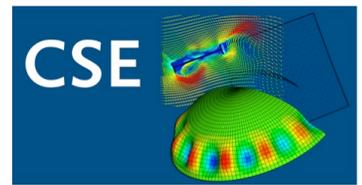
List of figures and list of tables

It is advisable to list figures and/or tables mentioned in the text and the appendices. This provides a clearer structure of the thesis. A list of figures and/or list of tables can be inserted before or after the table of contents or at the beginning of the appendix. Such a list has to contain the sequential number, the title and the page of the figure/table.

Appendix

The appendix may contain further tables, figures or results which are too extensive to be inserted into the main text. A subdivision into chapters may be reasonable. To what extent additional documents (computer programs and codes, prints of results, design drawings, test records,...) are also part of the thesis and, thus, must be documented, is to be clarified with the supervisor/first examiner.

Comment: Make sure you discuss the structure of your thesis with your supervisor/first examiner.



II. Layout

Page layout	9
Font and font size	9
Reproducibility	9
Page numbering	9
Equations	9
Figures, tables, and captions.....	10
Engineering drawings	10
Referencing and quotations from literature.....	10
Footnotes	11
Binding	11

Page layout

The thesis has to be written with a word processing program. Many examiners prefer Latex. Discuss which processing programme should be used with your supervisor/first examiner.

The margin on the inner side is 30 mm and on the outer side, it is 20 mm to be able to book bind the thesis. For information on top margin and bottom margin contact your supervisor/first examiner (or CSE staff).

Font and font size

A clearly structured font is to be used, e. g. „Times New Roman“ or „Arial“. The font size should be between 10pt and 12pt. The line spacing is to be chosen correspondingly. For the above-mentioned fonts single-spaced with a font size of 10pt appears to be narrow while 12pt and one and a half line spacing is rather spacious. In the past, 11pt or 12pt single-spaced has been well-proven and is also basis for this text.

Reproducibility

The thesis is to be printed one-sided and needs to be suitable for copying. This means the predominant colour is black. If any other colours are used - e. g. in drawings or graphs - adequate contrasts are to be ensured (which is not the case for standard colours of excel graphs).

Page numbering

All pages have to be numbered.

Equations

Equations are to be separated from the continuous text to increase readability. Important equations are to be numbered referring to the main chapters. The numbering is to be given in parentheses on the right margin, e. g. for a chapter 4:

“... abiding HOOKE’s law (4.13) yields...”

This allows to refer to this equation later in the thesis:

“Following Eq. (4.13) the stress can be computed...”

It is also possible to integrate less important equations or equations that will not be referred to in the text:

“... abiding HOOKE’s law yields...”

Figures, tables, and captions

Figures (pictures, photos, drafts, graphs) and tables may be placed within the text or in the appendix. Within the text figures and tables should not exceed the length of one page, to ensure readability. There are to be numbered corresponding to the appearance in the text, e. g. Fig. 6-7 or Table 5.1. All figures must be used in the text with a reference and must be explained in detail.

The caption of the figures and tables must not be longer than two lines. Figure captions are to be placed below the figure, table caption is to be placed above the table.

Axes of graphs and tables must be labelled with the correct values, dimensions, and units. MKS (meter, kilogram, seconds) units are to be used. The title must explain the figure or table in such a manner that it may be understood without the text, even if more than one line is required. When using figures or tables from a reference the source has to be detailed. Make sure that you use the same resolution of digital images throughout your thesis.

Engineering drawings

Engineering drawings must be reproducible and existing standards are to be followed (e.g. folding, dimensioning, description fields ...). The size may be reduced to DIN A4 for inclusion in the appendix if the real size is stated and if the original drawing is attached to the work in a common, digital file format. Make sure that you use the same resolution of digital images throughout your thesis.

Referencing and quotations from literature

Referencing is the scientific writing practice of making sure that every time you quote from a book or an article or any piece of work from another author, you accurately inform your reader/examiner of your source. This helps to avoid plagiarism, shows your reader/examiner the extent of the existing research supporting your thesis, and allows your reader/examiner to consult the listed sources themselves.

If parts of a text, derivations, figures, tables or the like are quoted in the text, it has to be marked within the text corresponding to the list of references. The labelling and the style of referencing are possible in different ways. Make sure that you clarify with your supervisor/first examiner which quotation style you should choose. For the sake of consistency, once you have decided on one specific quotation style, you have to use it throughout your thesis.

Number in brackets: ... see [19] ... (with preceding reference)

Number in slashes: ... see /13/ ...

Author's name and year of publishing: in HASHIN, 1974 there is ...

or derivation of author's name and year/number: ... /Has79/ ... or ... [Has3] ...

For explicit quotations, the quoted text has to be marked with quotation marks („ ”). All

alterations (additions, highlights or omissions) are to be indicated with brackets, e. g.:

“Hoffmann [4] explains on p. 173: „In general, those strain gauges are to be used which are self-compensating for the heat extension coefficient, α , of the corresponding material. If the self-compensation of the strain gauge is not sufficient due to the [...] explained reasons or if no fitting [...] strain gauge is at hand, one has to use the possibilities for compensation of Wheatston’s bridge connection [highlighting not in the original reference].“

Comment: For quotations from literature please also see the example list of references on page 21 of this guideline.

Footnotes

Footnotes are a way of placing references at the bottom of each page. A small number - usually formatted in ^{superscript} - follows the quote you use and refers to the identical number at the bottom of the page with the citation for that reference. Most word processing programmes contain a function that enables you to insert the numbers automatically. A footnote should contain the relevant referencing information: name of the author, title, name of the publisher, place of publication, date, page number.

Bronstein, I., N.; Semendjajew, K., A.; Musiol, G.; Mühlig, H.: „Taschenbuch der Mathematik“; 2. Auflage; Verlag Harri Deutsch, Thun, Frankfurt am Main, 1995, p. 36.

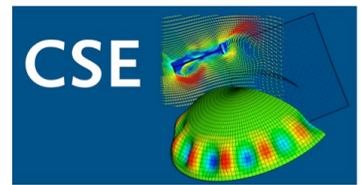
You may abbreviate subsequent footnotes if you make further references to the same text later on in your thesis: name of the author, title (short version), page number, e. g.:

Bronstein; Semendjajew; Musiol; Mühlig: Taschenbuch der Mathematik, p. 89.

Comment: Consistency is key. The most important thing is to make sure that whatever stylistic decisions you make about your references or footnotes, they have to remain completely consistent throughout your thesis.

Binding

All copies may be bound professionally. This may be done with a thermo glue binding or a spiral binding. Make sure you contact your supervisor or the library of the institute for further information. Also, CSE staff will be able to give you advice based on experience.



III. Submission

Number of copies	13
Thesis number.....	13
CD-Rom of the work.....	13
Final presentation.....	13
Books, keys and computer handover	13

Number of copies

The examiners each receive one bound copy of the thesis: one with the original assignment of task (first examiner) and one with a copy (second examiner). The CSE office also receives one copy on CD/DVD. The corresponding written declarations of truthfulness are to be included. Make sure that the copies that you deliver are neat and without stains.

Thesis number

Each thesis may be given an internal number together with label tags. The binding and application of the label tags have to be clarified with the institute.

Note: CSE does not give out thesis numbers. You have to check with your first examiner if one is required from his/her institute.

CD-Rom of the work

For each copy of the thesis, a data medium (CD, DVD, memory stick or memory card) may be attached to include programs, drawings, etc. Additionally, a CD or DVD of the work is to be submitted which contains the previously stated as well as the total thesis (text with figures and tables and the like) as copies. The thesis file format is not only to be given as Word- (.doc) or Latex-format (.tex) but also as Acrobat's portable document file (.pdf) or as Postscript-file (.ps).

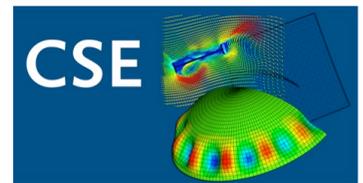
The institute's staff may support file conversion and burning of the CD/DVD. For the CD-case, inlets may be provided by the institute which are to be cut and enclosed. The use of a jewel-case is preferred.

Final presentation

After the submission of the thesis and before the grade announcement, the work has to be presented in a short final presentation (10% of the overall thesis grade). The presentation of about 20-30 minutes length (depending on the first examiner) shall be focused on the results.

Books, keys and computer handover

Before grading, any books, keys and the like are to be returned to the supervising employee and the computer account with a password is to be handed over.



IV. Further remarks and requirements

Registration and submission of master's thesis	15
Duration	15
Presentation of the work	15
Literature	15
General requirements for scientific theses	15
Grading	16
Spelling and grammar	16
Extent of the thesis	16
Avoiding plagiarism, self-plagiarism, and questionable writing practices.....	17

Registration and submission of master's thesis

Please check the current process with the CSE office. Registration and submission of the master's thesis are processed by the CSE office. The original assignment is kept by the student for the duration of the thesis. It has to be included in the copy for the first examiner, a copy has to be included in the second examiner's copy and the copy for the CSE office (CD). The student has to inform the supervisor/first examiner about the registration and submission date appointed by the CSE-office immediately. By the appointed submission date at the latest, the original copies(2 bound, 1 CD) of the master's thesis have to be presented to the CSE office.

Duration

The Examination Regulations for the degree course in Computational Sciences in Engineering (CSE) at TU Braunschweig leading to a Master of Science degree entered into force on 1 October 2019.

“(3) The Master's thesis carries 30 credits and has to be completed within six months. In their Master's thesis, students shall treat a topic within their chosen specialism that is noticeably different from the subject of the specialisation project in terms of method and content.”

Presentation of the work

10% of the overall grade is a presentation of the work.

Literature

The assignment of tasks should contain at least three references which are meant to be an initial start. It is expected that further literature is collected and evaluated autonomously (library of the TU Braunschweig, the centre of mechanics, other institutes, the DLR, TIB Hannover, interlibrary loan, etc.).

General requirements for scientific theses

The general purpose of a scientific thesis is for a student to prove his or her ability to independently (under supervision) present a science-based approach to the assigned task within a given period of time on the basis of the skills and expertise acquired within the CSE Master's Programme.

This implies

- a clear understanding of the assignment,
- the successful search and critical use of literature and other relevant sources,
- the ability to describe systems and to define problems,
- to be able to distinguish between relevant and less relevant aspects,

- to be able to document this critical distinction within the scope of the text that is dedicated to those aspects,
- the courage to leave out irrelevant aspects and to focus on the relevant aspects which are to be presented in a coherent and well readable writing style.

Furthermore, the choice of approach and the developed results have to be presented in a structured and comprehensible way and have to be documented. By means of designing the thesis, the student gets the opportunity to:

- show to what extent he or she is capable to work scientifically and independently
- present one's findings in a comprehensive and comprehensible way and
- conform to formatting requirements and layout rules.

Grading

The grading of the thesis is based on the following criteria:

- Contents of the thesis (introduction, theoretical background, approach, results, discussion)
- Clear understanding of the assignment
- Search and use of literature and other relevant sources
- Logical structure of the thesis
- Scientifically, functional, and well-founded choice of approach
- Correct use of technical terms
- Clear presentation of one's own findings and results
- Outward appearance of the thesis
- Proceeding (own ideas, autonomy, methodology)
- Timing/scheduling
- Spelling and grammar

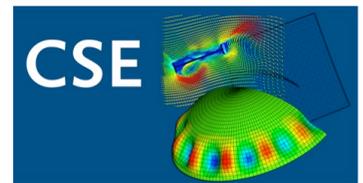
Comment: Check with your thesis supervisor/first examiner at which date the grade is expected to be finalized.

Spelling and grammar

Check your thesis for grammar, spelling, and punctuation mistakes. Most word processing programmes contain a spell checker that identifies possible misspellings. Proofread your thesis before submitting it. Too many grammar, spelling, and punctuation mistakes are considered to be a sign of bad time management, laziness, and flippancy. This may lead to a downgrading of your thesis.

Extent of the thesis

Experience shows that a total extent of the thesis without appendix shall not exceed 100 pages. A scientific work is supposed to be short and concise. One has to think of the reader when considering which information is required. Which details are crucial to



explain and understand correlations are, thus, part of the thesis. Commonly used and easily understandable terms, as well as technical terms, are to be used. Referring to literature containing basic principles might be preferred, depending on the institute. If you need further information on the extent of your thesis contact your supervisor/examiner.

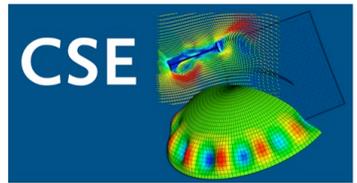
Avoiding plagiarism, self-plagiarism, and questionable writing practices

Your thesis might be checked for plagiarism. As the author of your thesis, you always have to acknowledge the contributions of others and the source of his/her ideas.

For further information on how to avoid plagiarism consult:

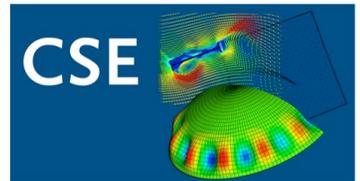
Roig, M. Avoiding plagiarism, self-plagiarism, and other questionable writing practices: A guide to ethical writing. St Johns University. 03/12/2009.

<http://ori.hhs.gov/education/products/plagiarism/>.



V. Examples

Cover sheet (example)	19
Written declaration (example).....	20
Quotations from literature - Examples for list of references.....	21
Project schedule.....	23



Cover sheet (example)

**Optimizing water boiling via numerical and experimental
methods**

Master Thesis

by

John Doe

Matriculation number: 2375231

Supervised by

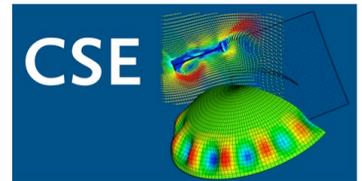
Prof. Dr.-Ing. habil. Jane Thesis

Prof. Dr.-Ing. habil. Joe Plumber

January 2010



Institute for Special Coffee Treatment
Technical University Braunschweig
Braunschweig, Germany



Written declaration (example)

Declaration

I hereby confirm that the present master thesis was composed by myself and that the work contained herein is my own. I also confirm that I only used the specified resources. All formulations and concepts taken verbatim or in substance from printed or unprinted material or from the Internet have been cited according to the rules of good scientific practice and indicated by footnotes or other exact references to the original source.

The present thesis has not been submitted to another university for the award of an academic degree in this form. This thesis has been submitted in printed and electronic form. I hereby confirm that the content of the digital version is the same as in the printed version.

I understand that the provision of incorrect information may have legal consequences.

(Signature)

(Place, Date)

Quotations from literature - Examples for list of references

[1] Bronstein, I., N.; Semendjajew, K., A.; Musiol, G.; Mühlig, H.: „Taschenbuch der Mathematik“; 2. Auflage; Verlag Harri Deutsch, Thun, Frankfurt am Main, 1995.

(Example for a book)

[2] Hashin, Z.: „Analysis of Properties of Fiber Composites With Anisotropic Constituents“; Journal of Applied Mechanics, Vol. 46, 9/1979, S. 543-550.

(Example for journal)

[3] Continuous Fiber;

http://www.hexcelfibers.com/Markets/Products/Continuous/_Productlist.htm;

April 2003, accessed 1 November 2016.

(Example for an internet source)

/1/ Hashin, Z.: „Theory of Fiber Reinforced Materials“; NASA Contractor Report, NASA CR-1974, März 1972.

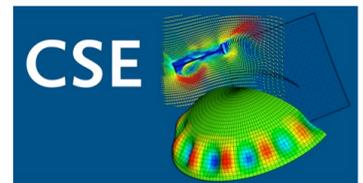
/2/ Kickert, R.; Kossira, H.: „Umdruck zur Vorlesung Leichtbau V - Faserverbundwerkstoffe“; IFL, TU Braunschweig, Sommersemester 1997.

/3/ VDI-Richtlinie 2014: „Entwicklung von Bauteilen aus Faser-Kunststoff-Verbund“; Blatt 1 bis 3, Verein Deutscher Ingenieure, Düsseldorf, 1989/1997.

CHAWLA, 1998, „Composite Materials“; 2. Auflage; Springer Verlag, New York, 1998.

HASHIN, 1983, „Analysis of Composite Materials“; Journal of Applied Mechanics, Vol. 50, S. 481-505.

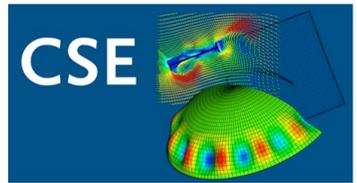
N.N., 1971 DIN 53454: „Prüfung von Kunststoffen – Druckversuch“; Deutsches Institut für Normung e. V.; Beuth Verlag Berlin 1971.



/Kos96/ Kossira, H.: „Grundlagen des Leichtbaus - Einführung in die Theorie dünnwandiger stabförmiger Tragwerke“; 1. Auflage; Springer Verlag Berlin Heidelberg New York, 1996.

/Mic92/ Michler, G. H.: „Kunststoff-Mikromechanik – Morphologie, Deformation- und Bruchmechanik“; 1. Auflage; Carl Hanser Verlag München Wien, 1992.

/N.N.95/ N. N.: „Dubbel – Taschenbuch für den Maschinenbau; 18. Auflage; Springer Verlag Berlin Heidelberg New York, 1995.

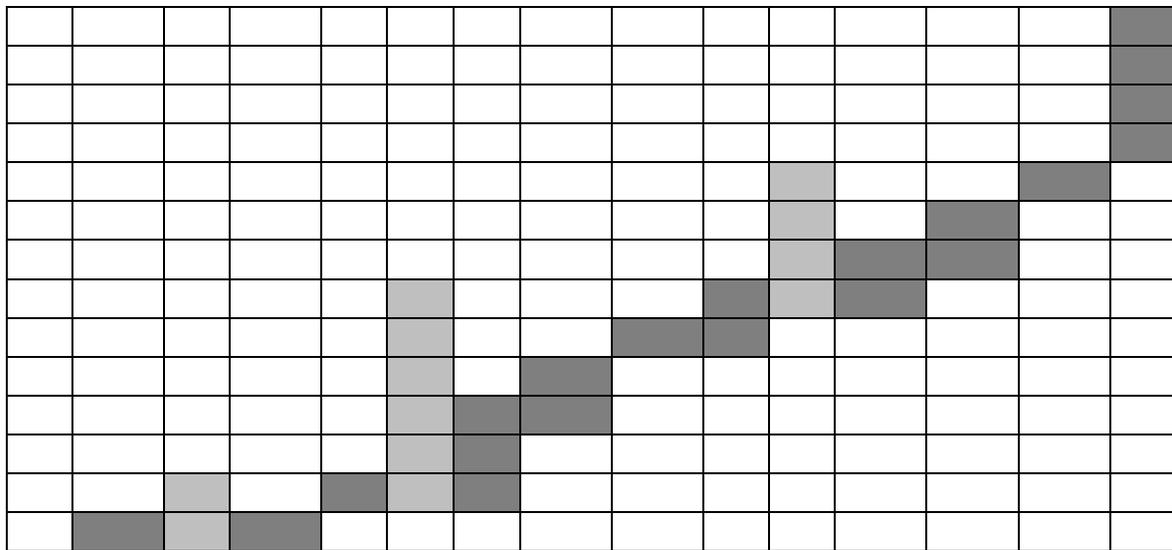


Project schedule

Name: Joe the Plumber

Title of the thesis: Optimizing water boiling via numerical and experimental methods

Duration of the thesis: from May 3 – Nov 2, 2017 – (6 months)



Nr.	Duration	Task
1	0,5	Conduct literature searches on EZ models of multiaxial clutches
2		Familiarisation in ...
2.1	0,5	.. the use of MSC Patran and the programming of PCL
2.2	0,5	.. the FE program ABAQUS
3		Programming of the unit cell model in PCL
3.1	2,0	Creation of the parameterized geometry
3.2	1,5	Setting of the constraints and the material model
3.3	0,5	Output of the model and changes for the ABAQUS calculation
3.4	1,0	Creation of routines for the analysis in Patran
4		Calculations using the model
4.1	1,0	Review of the modelling, the implemented constraints, and the convergence
4.2	1,5	Variation of the geometry and examination of the impact on the stiffness
4.3	1,0	Variation of the material parameters for the adjustment for the stiffness to trial results
5	3,5	Writing of the final report