

How to write a thesis

Guide for graduates by PhD Eng. Michał Böhm (Opole University of Technology, Faculty of Mechanical Engineering, Department of Mechanics and Machine Design). 2019

At the beginning, I would like to congratulate **You** on reaching this stage of education, I hope that Your cooperation with the supervisor will be fruitful and you will undertake the next stage of education also in our unit. The guide contains basic principles related to the creation of a thesis. These are tips that I created long ago for my graduate students, different supervisors may have an extremely different approach to the subject. Also please read the document with the draft of the thesis provided on the website of the university also in English. Please, read the whole text before any doubts arise as to the content of the work. Regardless of whether it is an bachelor of science engineering or a master's thesis, the rules of creating a thesis will not differ significantly from each other. This document is also a ready pattern for work. Please remember that the titles of the chapters are examples and just like the table of contents, the list of important nomenclature, introduction, literature review, conclusions, literature and summary should be found in every thesis, the nature of each thesis will be forced by individual titles for chapters related strictly to the core of the thesis.

In the first place, it is worth writing a thesis plan, i.e. the names of individual chapters along with their order. This plan will change as the work grows. When writing the plan, remember to keep the proportions:

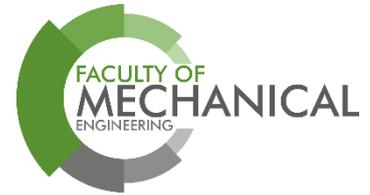
- about 30% of thesis, starting from the introduction to literature review (theoretical part),
- about 60% of the thesis is, for example, a description of the research, a description of the methods used in the research, the way in which the research was carried out, a description of the construction problem, how the solution was solved. (practical part),
- about 10% of the work is a summary, conclusions and insights, literature and summary of the work.
- attachments (if any) - The number of attachments is not limited, we can add up to 100 pages or more of attachments, if necessary. (folding large formats shown on the last page of the document).

Remembering and maintaining these proportions, we should keep the sensible dimensions of the work itself when it comes to the number of pages. We are in engineering studies, so we remember that sentences should be precisely defined, for this purpose we use relatively short sentences. It is connected with the fact that we do not create the so-called waffle. Good and sensible work should be included:

- for engineering thesis from 35 to 50 pages,
- for a master's thesis from 55 to 70 pages.

These are general recommendations, a lot does not mean it is always good and vice versa with excessively short when it runs out far enough. Please do not listen to colleagues or classmates after the humanities, which sometimes create giant theses. Details of the thesis should always be consulted with your supervisor. Please remember that the diploma thesis is your personal creation, which is to confirm acquired competences. Considering this, please do not expect your supervisor to have a significant influence on the shape of the work, more than it is presented in this guide or through your meetings.

When writing a thesis on this given format, please delete the first pages so that the title page is the first without numbering. Please, carefully read the comments and descriptions.



Thesis title

BSc Eng/MSc Eng

Author: .../BSc Eng. Name and Surname

Thesis supervisor: PhD Eng. Name and Surname

Opole, 201...r.

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Important nomenclature

<i>Symbol</i>	<i>Unit</i>	<i>meaning</i>
A	–	coefficient calculated from the Basquin characteristic,
A_σ	–	.....
b	–	.....
c	–	.....
E	MPa	Young Modulus
F	N	Force
f	s ⁻¹	.....
$G_{\sigma T}$	–	.....
G_σ	–	.....
m	–	.....
m_σ	–	.....
σ	MPa	stress
σ_{af}	MPa	.....
ε	–	strain
ε'_f	–	.....
μ	–	.....
α_K	–	.....
$\Gamma(\cdot)$	–	.....
γ	–	.....
t	s	.....
ω	rad ⁻¹	.....
λ	–	.....
Δ	–	.....

Indexes and shortcuts

<i>a</i>	–	amplitude,
GWM	–	power spectral density
<i>m</i>	–	mean value
<i>min</i>	–	.....
<i>max</i>	–	.....
<i>cal</i>	–	.....

1. Introduction

It's good to start each new chapter from the new page. I prefer it to start with the initial, that is, the large letter at the beginning. Sub-sections are written without initials at the beginning. The text should be justified in a font - size 12 preferred Cambria (can be another readable one), drawings and tables should be placed in the middle of the page with a font size 10. Referring to the drawings in the text, we use the abbreviation "Fig."

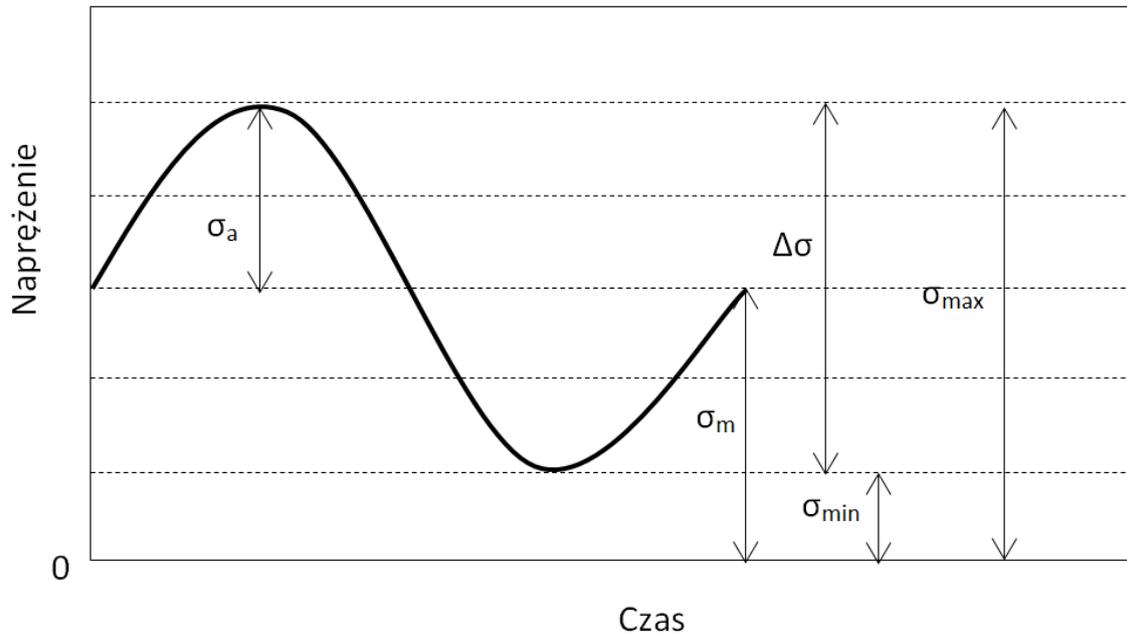


Fig. 1. The values characterizing the course with a constant stress amplitude.

The same principle applies to the tables we use in the text of the abbreviation Tab. Along with the numbering in the style:

In Tab.1 there are basic properties / results etc ...

Table 2. Strength properties of S355JR steel.

R_e [MPa]	R_m [MPa]	A₁₀ [%]	Z [%]	E [GPa]	ν
394	611	20	51	213	0,31

Referring to the attachments in the text, we refer in the form of, for example:

The drawing / diagram is shown in Annex 1.

As for the margins, those placed in this document are sufficient, at the time of printing, we print two unilateral copies and one double-sided for COS student centre with mirror margins. When it comes to patterns, we use Microsoft equation 3.0 or newer version, regardless of which we remember that the pattern was always in the middle, and the numbering in round brackets on the right. So that the numbering and pattern is always in place, I suggest using tabs. Who does not know what tabs are yet can use this link <http://lmgty.com/?q=tabs>

Ultimately, the pattern should have this arrangement

$$\log N_f = A_\sigma - m_\sigma \sigma_a, \quad (1)$$

where: A_σ , m_σ – coefficients of the Wöhler equation, N_f - the number of cycles to destruction, σ_a – stress amplitude.

We remember describing all elements of the equation. If some elements of the equation are repeated in later equations, then we do not repeat them in the description. If we give a description of the equation or refer to it as part of the text, we give the comma after the equation. If we do not give the description of elements after the equation, or it is the end of the thought, then just after the equation we give a full stop. All markings should be presented in the list of important markings immediately after the contents list. Please note that when writing chapters, pre-defined headers are used, this is needed to update the table of contents, which in Word uses just the headers to create page numbering. Also, the lower level of the chapter we use appropriate headings, i.e. Chapter - Header 1, subsection - Header 2, subsection - Heading 3, etc. It makes work easier because we do not have to search for page numbers and we have a table of contents created from the machine.

2. Literature review

In the literature review, we can use Polish as well as foreign literature. It's best to use literature from the last 10 years unless they are so-called classic techniques, they can be older positions. The university pays for access to many magazines, which can be accessed using the university's internal network. We can use for this purpose from the database of the main library or on the pages: [sciencedirect.com](https://www.sciencedirect.com) or link.springer.com, where we use the articles found there in English, but we remember that we must be physically inside the university network !!!! (a computer connected, for example, to eduroam).

Referring to the literature, we enclose the literature in square brackets [1], if we quote more works [2, 8, 9] or if the alphabetical order matches the cited works for a given text fragment, eg numbers 2,3,4,5 we use: [2-5]. The numbering should be consistent with the positions in the literature to be arranged in accordance with the alphabetical order as shown at the end of this document. Quoting sources from the Internet we always give a link and the date and time when the site was visited and something was quoted from it. Quoting norms, we write the whole nomenclature of the norm in literature. When it comes to scans of some drawings, which are hard to reproduce yourself, please approach this with a dose of caution, remembering that whether it is a scan or our reconstruction it is necessary to quote properly. Quoting the work, we write, for example:

- for the work of a single author - as presented by Łagoda [23].
- for the work of two authors - for dependence according to Niesłonego and Böhm [104].
- for a larger number of authors, enter the name of the first author and add the member and others - as presented in the work of Łagoda et al. [89].

Please note that the quote does not mean always work rewriting word for word the text of the publication. To avoid the unpleasant phenomenon of plagiarism, I suggest that you interpret the text read using your own vocabulary as much as possible. There is no sense in citing something that we do not understand and we can not explain using our own language, because it may be unfavorably received by the reviewer of the work. In case of doubts with the interpretation of a text, you can always consult with Your supervisor. It is worth to always write with your own words, and then fine-tune the text after reviewing a longer paragraph.

2.1. Planning work, or what in individual chapters

As previously noted, we are building a work plan. We can plan even without naming individual parts what they should contain. We write the work constantly, we do not wait until we finish creating the engine structure or solve the problem in the subject of the work. Below is a description, or rather expectations for each part of the work, regardless of the size of it.

The introduction should contain the following elements:

- Objective of the work.
- Justification for taking up the topic. Why is it important?
- Who else has significant issues / where can we meet this issue?
- Information for readers. What does the reader expect from work? What are the most important parts / work points? What approach was used to solve the problem?
- Summary - what conclusions can be expected after reading the work? Description of individual chapters with micro information on what is contained in them.

The review / theoretical part should contain the following elements:

- where we can find a given solution,
- explanation of the basic concepts used at work,
- presentation of the theory used in literature,
- presentation of methods used in literature,
- critical works describing the issue,
- analysis of the advantages / disadvantages of the methods used.

The practical part of the thesis depending on the type of thesis:

- information on the materials / signals / data used,
- characteristics of the analyzed construction / method,
- equations used,
- the methodology used to solve the problem,
- methods of measurement, description (types of charts, applied standards or own solution to be presented)
- control systems diagrams,
- the most important structure drawings (larger formats than A4 in the annex),
- characteristics of the program used, with particular reference to the program options or packages used,
- results presented graphically (check if your results can be presented using graphs used in standards or scientific publications),tabela z wynikami liczbowymi,
- summary of all results.

Part with conclusions should contain:

- the most important achievements, presented by short sentences or bulleted items,
- conclusions should not repeat the information previously presented in the results, unless it has to be further analyzed,
- conclusions should not be a summary only with short and concise synthetic descriptions.

This is where the basic recommendations end. Examples of chapter names are given below.

2.2. Mean stress compensation models

2.3. Reducer Construction

2.3.1. Kihl and Sarkani research

2.3.2. Böhm's research

3. The basic theory of fatigue life assessment in frequency domain

3.1. Stationary random processes

3.2. Non-stationary random processes

3.3. Random signals main characteristics

3.3.1. Diagram of an elliptical gear shaft

3.3.2. Probability density

3.3.3. Types of tensometric tests

3.3.4. Dynamic drive simulation methods

3.4. Stress in frequency domain

4. Purpose & scope of the thesis

5. Experimental research

5.1. Description of the test stand

5.2. Materials and samples

5.3. Constant amplitude tests

5.4. Random tests with non-zero mean stress value

6. An algorithm for calculating fatigue life considering the mean stress value

6.1. Registration, generation or calculation $G_{\sigma}(f)$

6.2. Calculation of the static part σ_m

6.3. Calculation of the $K(\sigma_m)$ coefficient

6.4. Calculation of the transformed power spectral density $G_{\sigma T}(f)$ due to mean stress

6.5. Diagram of the control system

6.6. Fatigue life calculation

7. Conclusions and observations

LITERATURE

- [1] Bagci C., Fatigue design of machine elements using Bagci line defining the fatigue failure surface line, *Mechanism and Machine Theory*. 16 (1981) 339.
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Abstract

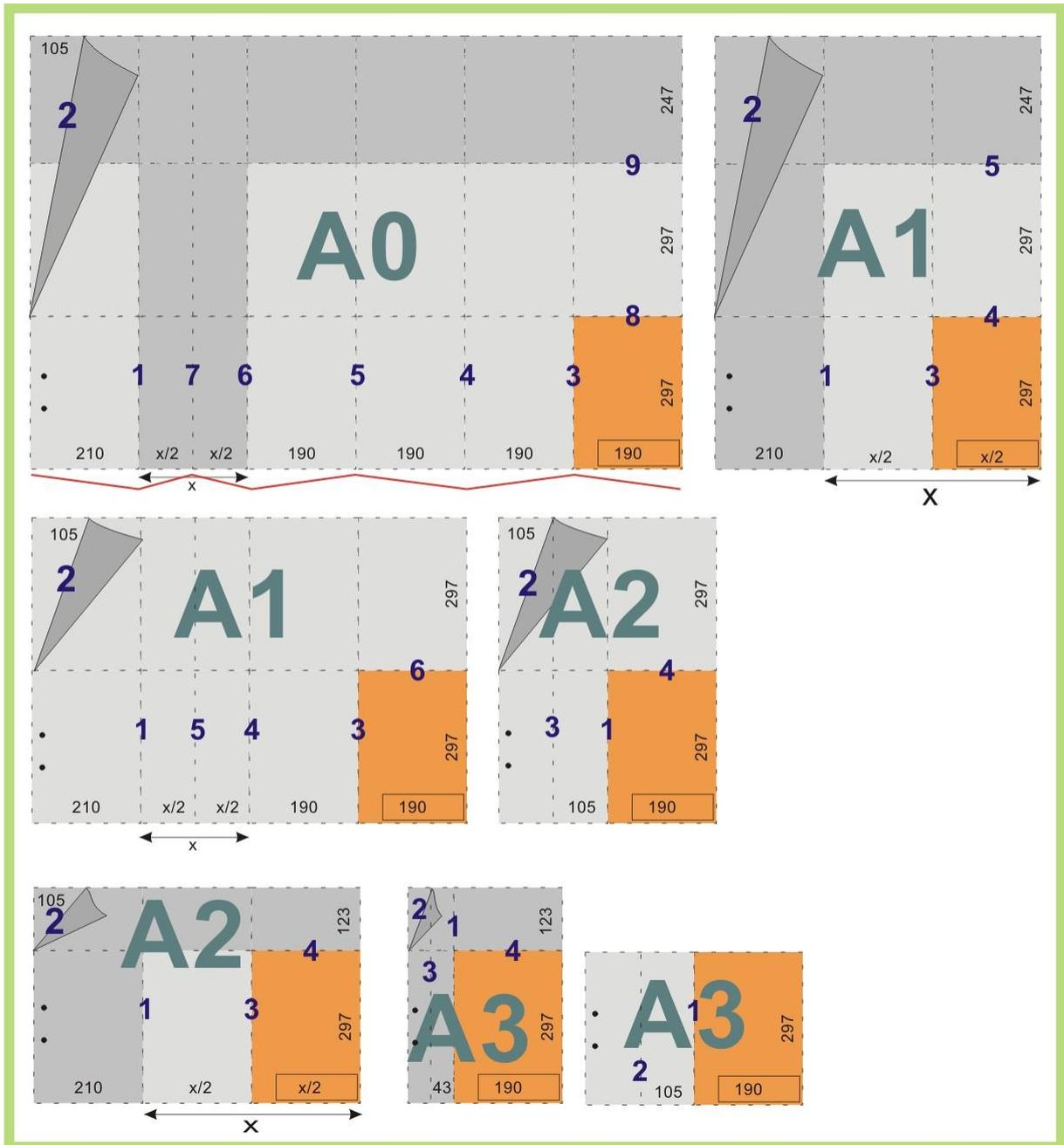
DETERMINATION OF FATIGUE LIFE OF MATERIALS WITH THE USE OF SPECTRAL METHOD TAKING INTO ACCOUNT THE STATIC COMPONENT

The thesis presents a proposal of an algorithm which takes into account the mean stress value in the process of fatigue life determination with the use of spectral method. The proposed solution is defined in the frequency domain. Existing solutions have been described as well as chosen mean stress compensation models used in the fatigue life determination process for non-zero mean stresses. These models due to their linear character, have been used in the process of determination of the transformed power spectral density (PSD) of the stress due to mean stress. The thesis undertakes the verification of the proposed algorithm on the basis of own research of the S355JR steel as well as research data obtained out of the literature. The impact of chosen factors which influence the fatigue calculations with the use of spectral method have been properly described and analyzed.

WYZNACZANIE TRWAŁOŚCI MATERIAŁÓW METODĄ SPEKTRALNĄ Z UWZGLĘDNIENIEM SKŁADOWEJ STATYCZNEJ

W pracy przedstawiono propozycję algorytmu uwzględniania wartości średniej naprężenia w procesie wyznaczania trwałości zmęczeniowej metodą spektralną. Przedstawione ujęcie zdefiniowane jest w dziedzinie częstotliwości. Opisano istniejące rozwiązania jak również przedstawiono wybrane modele naprężeniowe stosowane w celu uwzględniania wartości średniej podczas obliczania trwałości zmęczeniowej. Modele te, ze względu na ich liniowy charakter, zostały wykorzystane do wyznaczenia funkcji gęstości widmowej mocy (GWM) naprężenia transformowanego ze względu na wartość średnią. W pracy podjęto się weryfikacji zaproponowanego podejścia na bazie badań własnych stali S355JR oraz wyników zaczerpniętych z literatury. Przedstawiono oraz przeanalizowano wpływ czynników wpływających na obliczenia zmęczeniowe przeprowadzane metodą spektralną.

FOLDING PROCESS OF GREAT FORMATS FOR ANNEXES



Source:

<http://www.drukwielformatowy.we.wroclawiu.pl/PolGer%20pliki%20index/skladanie%20rysunokow%202%20d.jpg>

In the end I wish You good luck and every success possible.