# Preface

Here you should mention that yout bachelor thesis is written at the Department of Mechanical and Marine Engineering at Western University of Applied Scienes (WNUAS) and in which of the five study programs it is located. Do not forget to mention who your supervisor(s) was/were. If the the project was in cooperation with a company or another institution, these and relevant people have to be listed here as well.

You can also mention people who have helped along the way and possible funding sources. If you want to thank someone for the help you have received, do so in the foreword. It's important to spell people's name correctly. It may be polite to write the title (Dr. or Professor) of the people you are grateful, especially if you are writing in English. In the preface, you can also tell if the work has been carried out within a specific project and possibly project number.

The preface can also be omitted especially for short reports / articles. Thanks to people, sources of funding and projects can then be written directly to conclusions before the reference list. This section can be baptized 'Thanks to'. See Scientific Articles for Formulation Examples when you write this for the first time in the future.

Place the foreword on odd page numbers.

Note that this document begins on page 3, an odd page number. Page 1 begins on the Title page that is in front of the Cover page, as is common in books.

Also note that you must always write the meaning of abbreviations (IMM, HVL, WNUAS) for the first time they mention in a report.

Under the preface, you can add a logo of the company/institution you have worked with or for on this page after removing the text box below. Ask the company/institution for permission.

**Preface and the two abstract must not have a chapter number!**

**Do not modify the title page other than putting in title, author names and other relevant information by replacing the placeholders with the information you are supposed to put into their place!**

The printout starts on this page or the first page of the Abstract.

Print two-sided!

The title pages and last pages have to be printed two-sided and put in front of the first and the last page of the printout of this document.

You find the template for the title page and backmatter in the file called

Forsider\_Bachelor\_engelsk.docx

**Remove this textbox before printing and pdf-export of the version that is to be submitted!.**

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**Remove the textbox and keep the page!**

# Abstract

The abstract (summary) should be read free of the rest of the report. It should be short, intelligent and attract readers. The abstract describes the main features of the report's content and conclusion. At the same time, the summary should help the reader decide whether he / she is interested in reading the full report. It is important that the abstract is well written because it is the part of a report (as well as the title) that is read by most people. The summary should contain relevant keywords (in case it is included in literature search systems). Figures must be avoided in the summary. Sub headings and references must also be avoided. Abbreviations must be defined both in summary and again in the report. Wait to write the summary until the rest of the report is complete, so that the summary really matches what is stated in the report. The abstract cannot contain any information other than that in the report. It should be a summary in English and one in Norwegian (Sammendrag). Ask your supervisor to help you with the Norwegian version if Norwegian is not yout mother language. The summary in the language that the rest of the report is written in will be positioned first. Both abstracts are placed on odd page numbers, so that you have it on the right side when you print the document double-sided.

All text within sections from now on should be in font Times New Roman or Cambria with font size 11 or 12. Settings are made in the style template function in Word.

In all sections other than Preface, we are not permitted to write ‘we’ sentences, rewrite passively: "The work is done", not "We are doing the work".

Avoid writing as you talk, so do not use words like: check, talk to plot.

Throughout the report, it looks best to have block adjustment on the text column, that is, the text is adjusted to the left and right side. Keep the style of this report simple.

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# Sammendrag

Include an abstract in Norwegian here. Must be placed on an odd number page

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Use the word processor to generate Table of Contents. Then chances are the best that it will be right. Use the style templates for chapters as done in this sample report. The page reference should of course be given in the listing. Attachments must also be included. Keep in mind that only the report's main sections from introduction to conclusion should be numbered. Attachments can be numbered as shown in the list above. It is optional to have a list of Figures and Tables as well as Nomenclature and Attachments.

The table of contents is also placed on odd page numbers.

You can choose if you want to place the beginning of the main sections 1, 2, 3, 4 and 5 on odd page numbers, as is typical for chapters in books. This is not done in this report.

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# Nomenclature (optional)

A nomenclature is only needed if you have many equations in the report, that is, many equations with more than 20 different symbols in total. Example of nomenclature:

*A* = amplitude of oscillation [m]

*ρ* = density [kg/m3]

*P*= pressure [kg/m2]

*Cx* = force coefficient in the *x* direction

*Cy* = force coefficient in the *y* direction

d*t* = time step [s]

*Fx* = *X* component of the resultant pressure force acting on the vehicle [N]

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# Introduction

The introduction should begin with background and refer to references that have similar / previous work within the area. It should be noted that time has been spent on learning about the problem. Use the word processor to generate References, so chances are that their numbering will be correct. An example is given in this report and there is a separate file for how to write references by IMM [1]. For how to refer to other text programs than Word, refer to Google.

Do not use empty lines for formatting. You can use the paragrapgh meny to insert some space before or after paragraphs and use the ‘Style’-menu to make different styles for different kind of text blocks quickly accessible. It is probably best to use the paragraph style as it is now, which has a line spacing of 1.0 and 12 points space before each paragraph.

If you want to begin the next paragraph or chapter on a new page, do not fill up the current page with empty lines! Insert a ‘page break’ from the left part of the ‘Insert’ menu!

Once the background for the project has been described, you write more specifically about the problem of the particular assignment in a new paragraph. From now on, the report must be written in present tense as if the work is performed while the report is being written. It is only permissible to refer to previous work that you or someone else has done in another project.

It is important that the reader understands the problem early and why it is interesting. Keep in mind that what you write should be understood by people who do not work within the subject for a long time or do not have the same theoretical background. Evade equations and difficult explanations, this comes later in the Method section of the report. If the task is convenient, it is a good idea to introduce the test object with a first pretty figure, but the purpose is not to go into details about the object. Suggestion for text: In this task, MarinLab, Wester norway University of Applied Sciences with the model shown in Figure 1, is attempted. Always refer to figures / tables with large ‘F’, ‘Table’, etc. in the text to make them better. Refer to the text before the chart / table appears in the report and use the text program cross-reference system: Insert -> Cross-reference and select Figure, and select only label and number to be displayed. If you have inserted a caption (right click on figure) correctly, the characters will appear in a list. Figures and tables must be centered.

The introduction can be terminated with the figure, or proceed with a brief overview of how the report is built to increase the chances that the reader follows. In total, the introduction should not last longer than two A4 pages and sub-chapters should be avoided, use the order with background and problem in different sections.

Figur 1: Modellskip i MarinLab, HVL.

# Method

This section may have different names, Analysis is also a common choice. This includes theory and procedures for how the problem has been solved, ie the methods used. In this example, the theoretical method and experimental method are used. There are also analytical and numerical methods, among many other solution methods. It is important to motivate why you attack the problem in the given way. Begin by describing how this Section 2 is built up and divide the section into sub-sections in a logical order. Sometimes you begin with the theory and present equations, sometimes you choose to begin by describing the test object if there is a focus on experiment. Both parts must be included. As a matter of fact, the sectional section depends on the method used to solve the task, depending on the type of project. Be nice to the one who reads by structuring this chapter clearly and having good transitions between sections. Always put yourself in a perspective where you do not know anything about the task and read it for the first time.

## Theoretical approach

For example, start writing theory using sketched shapes and formulas. Everything must be clearly referenced and defined. For example: The flow past an object can be divided into laminar and turbulent flow, see Figure 2.

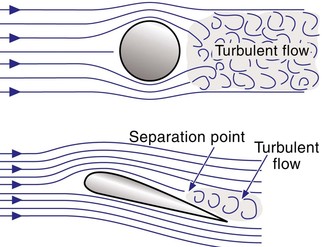
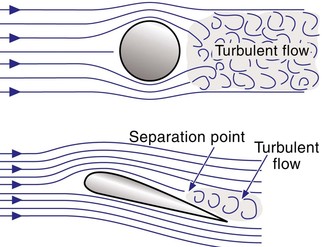


Figure 2: Flows around two different objects.

If the image is taken from a specific source, that source should be included in the reference list and the reference should be placed at the end of the caption (Flow around an object [x].). Make sure you have the okay from the copyright owner to place the the figure in your report, as it may be made publicly accessible by WNUAS.

Formulas should be included exactly as shown below, as if they are part of the sentence on their own line and centered. Example: Reynolds number is given by

,

Where ρ is the density of the fluid, V is the velocity of the fluid, L is the length dimension of the object and μ is the dynamic viscosity of the fluid. Formulas should be in the same font and size as the text, which may be difficult when Microsoft has decided that everyone should use Cambria, but in the above formula, the following method is used: Insert -> Oject and select Microsoft Equation 3.0. Then you can set the font yourself. Symbols are inserted via Insert -> Symbol, think about making variables from formulas italic when describing them in the text so that they look better. You must define all parts in a formula the first time they are mentioned in the report, even when you have a nomenclature.

Equations must be numbered and Microsoft Word has no good solution for this known. The easiest way is to create a 1x3 table in the same width as the text, where you put the formula in the middle and the number to the right as shown below. Afterwards, remove the borders of the table. With this method one has to be careful when referring to the formula later, since the reference is not updated as done with the cross reference method used for Figures / Sections. Please feel free to find a better method for this!

|  |  |
| --- | --- |
|  | (1) |

Remember to erase the frame lines of this table by selecting both cells and assign ‘no frame lines’ to them in the format meny for the table or the paragraph menu

|  |  |
| --- | --- |
|  | (1) |

Do not make exact calculations in the theory section, this belongs to results or attachments. Here, the basic principles and formulas that have been used should be described so that the reader understands the process of solving the task. Since you have not found all the wheels yourself, it is also important to refer to the book (not Wikipedia!) or report or research article where you have read the theory and found the formulas. For basic formulas such as center of gravity, moment of momentum, etc., this is not necessary. One must assume that the reader has basic knowledge in engineering technology.

## Experimental method

If you have an experimental task, it is important to describe the test object, equipment and procedure in which the tests are performed, preferably with clear image. Test plan and background for choosing a certain number / type of tests must be explained. What do you expect from the tests? This question should be answered later in Results.

## Sources of error

This section is optional and the content can also be included in the method.

# Results

Results must be clearly explained and Figures and Tables are introduced properly and explained before they appear in the report. Results usually contain more sub-sections. They should be sorted in a logical order, at least equal to the order as method is described so that the reader easily recognizes the red thread in the task. If the survey reveals new areas, this should be described in the profit section. Before beginning the subdivisions, the result section should be introduced with an overall sentence of what is expected, for example: The following section presents results for hydrostatic and hydrodynamic calculations. There have been 4 model tests where ship resistance from experiment is carried out using the different calculation methods mentioned in Section 2.1.

## Results from hydrostatics experiments

Try typing text between the characters so that there are not a lot of shapes and tables that come after each other. Figure and Table Text (Caption) should describe the figure so that you roughly understand what appears without reading the text. Shafts must be described with unit. All text shown in figures must not be less than half the text height in the report. It is nice to have the same size as the report text. Too much text often looks childish. Consider the report being able to print in black and white and that many people are color blind, therefore, think that lines in the graph have different line type / marker type and do not refer to colors when the graph is described in the text. Also refer to the dotted, solid line if you need it, but really the legend in the figure itself must be self explanatory.

Example of how closely such a figure below can be explained in the performance section: Figure 3 shows the results from crank test for two different center of gravity placements in the model vessel. Experiments are approximated with linear curve approximation using the least squares method. The experiment with the steep climb is a part of the low center of gravity test. Sample 2 corresponds to the high center of gravity, and it is seen that the stability of the ship is reduced with higher center of gravity, since a larger angle for the same crank moment is achieved. The rate of increase from the approach is used to find the meta center height using Formula X.



Figur 3: Curb moment and resulting crank angle.

You must clearly explain what is seen and what you can conclude from a graph and refer to numbered formulas or section numbers (by their numbers and not by ‘above’ or ‘below’ -> use crossreferenes!) in the theory section that are directly related to the results. Theoretical background must be explained in the method section from the beginning so that the reader does not get surprises and better understand the relationships. Do not refer to software used to draw such simple graphs, it's common computing tools used and every engineer should be able to do any of these well. Also, present graphs showing clearly with good resolution and quality.

Dedicated software must, however, be mentioned, where the calculation itself in that software is a major part of the task, such as, for example, CFD software (Computational Fluid Dynamics). An important software should be introduced already in the method section, but think of mentioning it only once and not for advertising purpose. Always refer to a manual for the program in References [7].

## Results from hydrodynamics experiments

Template and example for creating and describing table: In Table 1, the towing weight and speed of the various hydrodynamic model tests are assembled.

|  |  |  |
| --- | --- | --- |
| Model test no. | Towing mass [g] | Towing speed [m/s] |
| 1 | 260 | 0.142 |
| 2 | 600 | 0.461 |
| 3 | 860 | 0.613 |
| 4 | 1500 | 0.869 |

Tabell 1: Towing mass and speed in different towing tests.

Follow up with results and think about linking Method and Result so that it is clear that the method has been used to achieve the results.

# Discussion

The size of this section depends entirely on the type of report. If there is little discussion then it can be included in the conclusion as a paragraph as directed under Conclusions and then this section is not needed. The discussion may also contain things that has not been possible to mention earlier in the report and which will be conveyed there. It may be that you have considered other solutions and in the discussion you get the opportunity to explain more openly why you have addressed a certain solution in the report and not another one. One can also mention general uncertainties in the problem solving method and refer to articles where similar uncertainties have been discovered in the subject.

# Conclusion

The conclusion begins with a clear replay of the most important results. A reader should be able to read the introduction and conclusion and understand the main results without reading the rest of the report.

If you do not have your own section for discussion, start a new paragraph and discuss things right after you have presented the main results.

The last paragraph of the conclusion shall contain proposals for the way forward for the project. How can you continue the project and what do the authors recommend that you think about. Should you validate results further, how to improve results, etc.

The conclusion should be short and concise, between 1/4 and a maximum of 2/3 of an A4 page.

# Referances

|  |  |
| --- | --- |
| [1] | B. Szabo and I. Babuska, *Finite Element Analysis*, Wiley & Sons, Inc., 1991. |
| [2] | K. J. Rawson and E. C. Tupper, *Basic Ship Theory*, 5th edition, Jordan Hill, Oxford and Woburn, MA, Elsevier Butterworth-Heinemann, p. 91, 2001. |
| [3] | K. Garme and A. Rosén, "Time-domain simulation and full-scale trials on planing craft in waves," *International Shipbuilding Progress*, Vol. 50, pp. 177-208, 2006. |
| [4] | K. Garme and A. Rosén, "Experimental pressure investigation on high-speed craft in waves," in *International Conference on Hydrodynamicd of High-Speed Craft*, RINA, UK, 2000. |
| [5] | A. Keller, "Loads and responses for planing craft in waves," (PhD Thesis), Royal Institute of Technology, December 2004. |
| [6] | NASA Langley Research Center, "The X-48B blended wing body," January 2012, <http://www.nasa.gov/vision/earth/improvingflight/x48b.html> |
| [7] | The MathWorks, Inc., "Matlab - Primer R2013b," Version 8.2, September 2013. |

x

It is recommended to learn EndNote. The above is a replay of the style types for references from the document Litteraturhenvisning\_ved\_IMM.pdf:

[[1](#Sza91)] book

[[2](#Etk96)] book chapter

[[3](#Gar06)] journal article

[[4](#Gar00)] conference paper

[[5](#Kel04)] For PhD or Master's thesis, use Miscellaneous and the comment field to enter the thesis type and school.

[[6](#CDA01)] web page

[[7](#The13)] For a manual, use Miscellaneous and Comments to specify Version.

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Figure 2: Flows around two different objects. 14

Figur 3: Curb moment and resulting crank angle. 16

# List of tables (optional)

Tabell 1: Towing mass and speed in different towing tests. 16

# Attachment 1

Here are, for example, drawings from CAD programs, or Data sheets for equipment used, or accurate calculations and lists of results or calculations that do not need to be included in the report to understand the progress method.

Paste the last double page from the document Forsider\_Bachelor\_engelsk.docx

after this page. The side of the page with the image on is to be on the outside/backside- the real last page of the document

**Remove this textbox before printing and pdf-export!**