Typesetting guidelines for writing a Master's thesis

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June 21, 2017

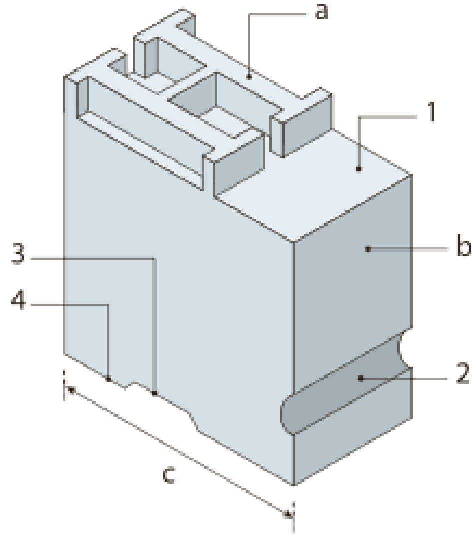
Abstract

This document contains some typesetting guidelines for writing a Master's thesis. You should follow these guideline when you write your thesis.

1 What is typesetting

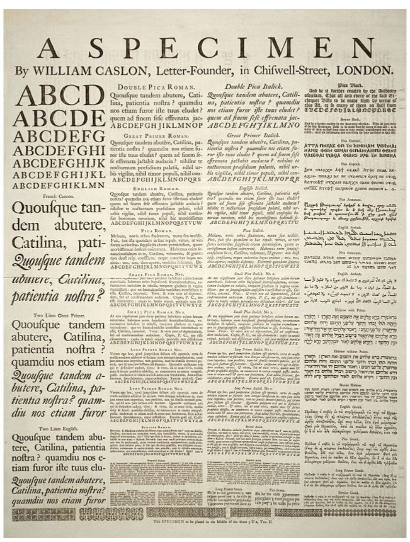
Typesetting is the process of arrange *types*, cf. Figure 1.1a, when printing and/or publishing text. In the past, typesetting was done manually by hand and by using a so-called linotype machine, cf. Figures 1.1b and 1.1d. Nowadays, typesetting is done by computers.

Typesetting is very important because it helps your reader understand your text more easily. If the typesetting quality is low, chances are that the reader misunderstands what he/she is reading, lose interest in the text and simply stop reading. There are also pure aesthetical aspects of typesetting; there is an intrinsic value to a beautifully typeset text or book. If the typesetting quality is high, it shows that the author really cares about the text he/she has written.

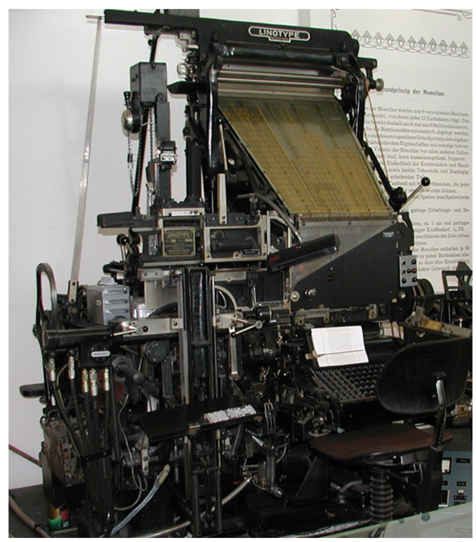


(a) Diagram of a cast metal type. (Wikimedia Commons)

(b) Mosaic of a typesetter. (Wikimedia Commons)



(c) Example of typeset text. (Wikimedia Commons)



(d) A linotype machine. (Wikimedia Commons)

Figure 1.1: Typesetting.

2 Typesetting math

Mathematical and physical quantities should always be printed in *italic* (sloping) type. The following conventions should also be applied:

- Scalars should be printed in italic type, e.g. I, E.
- Vectors should be printed in roman, lowercase, bold italic type, e.g. $\boldsymbol{a}$, $\boldsymbol{b}$.

Example: if you are writing the symbol for Young's modulus it should look like this: "E" not "E". Here, formatting of the letter "E" conveys information because if the "E" is italicized it tells the reader the it is Young's modulus whereas "E" is just an "E". Compare the two equations below:

$$\sigma = \mathrm{E}\varepsilon, \tag{2.1}$$

$$\sigma = E\varepsilon. \tag{2.2}$$

Equation (2.2) is the correct way of typesetting Hooke's law. The difference might be subtle but technical writing needs be concise and clear such that the reader never has to think about what the "E" actually represents. This is why typesetting quality matters.

2.1 Subscripts

The same rules about italics apply to subscripts: a subscript should be italicized if, and only if, it is a mathematical or physical quantity. Example: "yield"[*] is often denoted "y", which is the same letter used for the "y"-axis. Compare the two equations below:

$$\sigma_\mathrm{y} = 100\,\mathrm{kPa}, \tag{2.3}$$

$$\sigma_y = 100\,\mathrm{kPa}. \tag{2.4}$$

Equation (2.3) says that the "yield stress equals one hundred kilopascal" whereas Equation (2.4) says that the "normal stress in y-direction equals one hundred kilopascal." Equations (2.3) and (2.4) tell two completely different stories just by the way "y" is formatted!

[*] yield, as in yield stress.

2.2 Multiplication

Never use the letter "x" or the star symbol "*" to indicate multiplication. Use the appropriate multiplication symbols "$\times$" or "$\cdot$". Try to be consistent when using multiplication symbols and avoid mixing between "$\times$" and "$\cdot$". A multiplication symbol is necessary to have between numbers but not between algebraic letters:

$$3 \times 4 = 12, \tag{2.5}$$

$$ab = c. \tag{2.6}$$

A multiplication symbol is not necessary between a number and an algebraic letter if the number is written to *the left* of an algebraic letter:

$$3ab = c, \tag{2.7}$$

but is necessary if the number is written to *the right* of an algebraic letter:

$$3ab = ab \times 3 = c. \tag{2.8}$$

3 Units

Always include units when typesetting numbers. Very few quantities have no unit, one example is strain, ε. Units should be typeset without italics, e.g. m^3, kN, not m^3 or kN. There should be sufficient spacing between a number and its unit, like so: 100 GPa, but not between the prefix (G) and the unit. This is because "100 GPa" represents a multiplication between 100 and GPa.

Example: if you want to typeset "the normalforce is equal to ten Newton" mathematically, it should look like this:

$$N = 10\,\mathrm{N}, \tag{3.1}$$

but not like this

$$\mathrm{N} = 10N, \tag{3.2}$$

because Equation (3.2) reads "Newton is equal to ten normalforce". Here, "N" and "N" represent two completely different things. As a writer you always know if you mean "Newton" or "normal force" when writing an equation and might therefore use "N" without thinking how the "N" is formatted. But for the reader it is not always obvious if it should be "Newton" or "normal force". This is especially true if the topic/concept is new to the reader.

3.1 Units in calculations

Units should also be included in calculations. Example: assume that $E = 200\,\mathrm{GPa}$, $L = 2\,\mathrm{m}$ and $I = 2.3 \times 10^{-6}\,\mathrm{m}^4$ and you are supposed to calculate the Euler buckling load, N_b. This is how *not* to do it:

$$N_\mathrm{b} = \frac{\pi^2 EI}{L^2} = \frac{\pi^2 \times 200 \times 10^9 \times 2.3 \times 10^{-6}}{2^2} = 113.5\,\mathrm{kN}. \tag{3.3}$$

This is a very common error, even found in published textbooks. The problem here is that the answer 113.5 kN has a unit whereas the term $\frac{\pi^2 \times 200 \times 10^9 \times 2.3 \times 10^{-6}}{2^2}$ has no unit. Still, there is an equal sign between the two term which obviously is wrong because anything without a unit can never equal something with a unit. The correct way of typesetting this calculation is in this way:

$$N_\mathrm{b} = \frac{\pi^2 EI}{L^2} = \frac{\pi^2 \times 200 \times 10^9\,\mathrm{Pa} \times 2.3 \times 10^{-6}\,\mathrm{m}^4}{(2\,\mathrm{m})^2} = 113.5\,\mathrm{kN}, \tag{3.4}$$

i.e., units should always be included. By including units, it is very easy to do a unit analysis of the term $\frac{\pi^2 \times 200 \times 10^9\,\mathrm{Pa} \times 2.3 \times 10^{-6}\,\mathrm{m}^4}{(2\,\mathrm{m})^2}$ to verify that is has a unit of newton (N).

4 Graphs

Always include axis labels, units and legends in graphs, cf. Figure 4.1. Also, make sure that you distinguish between the plots in the graph such that the reader can tell the plots apart even if the thesis is printed in black and white[†].

You should also arrange the plots in the graphs such that the order of the plots is the same as the order of the legends. In Figure 4.1, the solid plot is above the dashed plot, and the legend for the solid plot is therefore above the legend of the dashed plot.

[†]also note that your reader might be colour-blind.

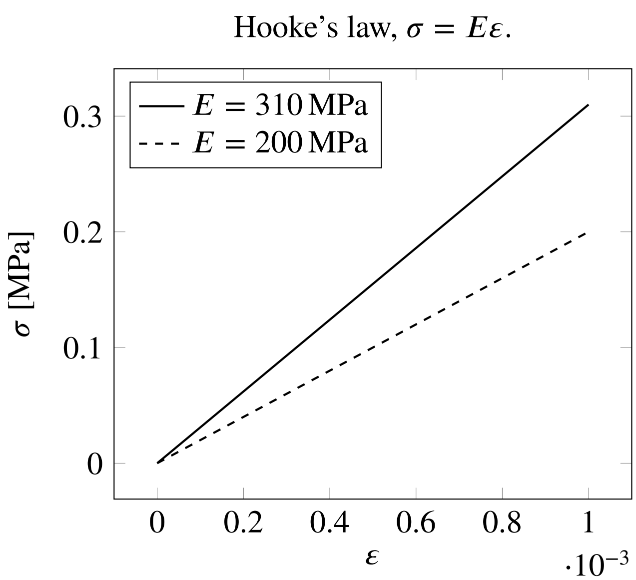


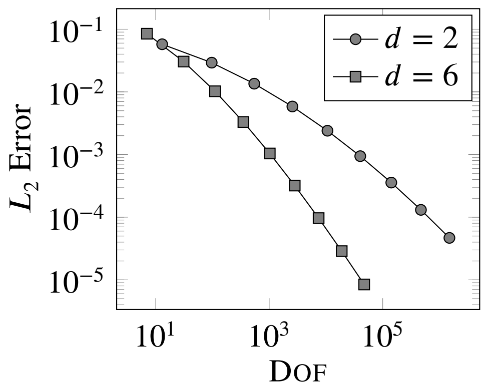
Figure 4.1: Example of a graph.

4.1 Data marks and lines

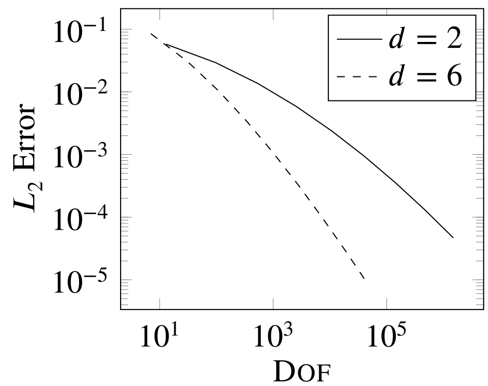
In general, all data points in a graph should be marked. In Figure 4.2a, the actual data are the circles and squares whereas the lines are just a linear interpolation between the data. If the marks are removed, as in Figure 4.2b, it becomes impossible to tell where the actual data is. If there is no clear trend between the data points or if the data points are far apart such that a linear interpolation cannot be made, then only the data points should be marked as in Figure 4.2c.

Only if the data points are so dense such that the data markers overlap should you removed the markers as in Figure 4.2b. For such conditions, *all* data markers should be removed.

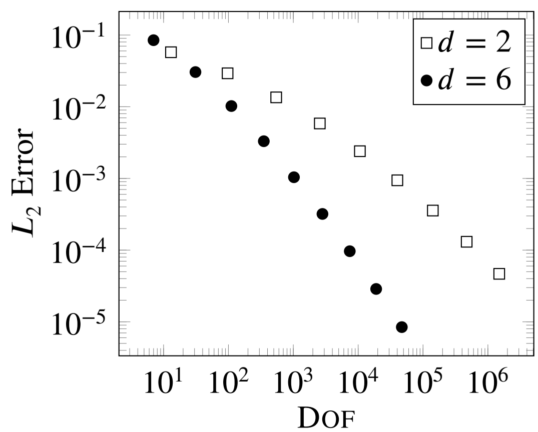
If you have very few data points, consider making a table instead of a graph. No markers should be used if you graph an analytical function, cf. Figure 4.1.



(a) Marked data with linear interpolation.



(b) Un-marked data with linear interpolation.



(c) Marked data without any interpolation.

Figure 4.2: Different ways of plotting the same data.

5 Tables

Vertical lines in tables should be avoided at all cost. Compare the two tables below:

Table 5.1: An ugly table.

Animal	Description	Price ($)
gnats	gram	$13.65
	each	.01
gnu	stuffed	92.50
emu		33.33
armadillo	frozen	8.99

Table 5.2: A beautiful table.

Item		
Animal	Description	Price ($)
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33
Armadillo	frozen	8.99

Tables 5.1 and 5.2 provide the same information. However, Table 5.2 is much easier to read simply because it is typeset differently. As you can tell, the vertical lines in Table 5.1 do not help the reader in separating the different columns. Notice how the top and bottom horizontal lines in Table 5.2 are thicker than the two other lines in order to mark the beginning and end of the table. The following guidelines apply to tables:

- Avoid vertical lines.
- Minimize the need for horizontal lines.
- Avoid creating boxes around the items in the table.
- Units should be places in the column heading.

- The caption of a table should be printed above the table, as opposed to under (as for figures).

6 Cross referencing

When cross-referencing in running text to a specific section, equation, figure, etc., the first letter should always be capitalizes, like so: “see Equation (3.2)”. When cross-referencing to any non-specific section, equation, figure, etc., letter capitalization should not be used, like so: “see the previous section”.

6.1 Numbering

Numbering/indexing of equations, figures and tables should be made based on the section in which the equation/figure/table is located. The first index is the section number and the second index is a running index within the section. Example: Equation (2.2) has number 2.2 because it appears as the second equation in Section 2. Similarly, Figure 4.1 has number 4.1 because it is the first figure in Section 4 and Table 5.2 is the second table in Section 5.

7 Fonts

As a general recommendation, never use more than four different fonts in a document. If possible, use only one. The important thing is to be consistent: if you use a certain font for your body text and a different font for graphs, then use the same font consistently for all graphs.

8 Quotation

Quotation marks should be curly, not straight, they should be in pairs of two and the beginning and end quotation marks curly in opposite directions. Here are a few examples of how *not* to typeset quotation marks: "a quote", ’a quote’, “a quote“, ”a quote”. The correct way looks like this: “a quote”. Notice how the beginning and end quotation marks curl in opposite directions.

9 Choice of software

These guidelines apply regardless of which software you use for writing your thesis. However, the choice of software will influence how much time you will spend on these typesetting matters and on the final typesetting quality of your thesis.

9.1 Microsoft Word

Microsoft (MS) Word is an extremely popular word processor which you most likely are familiar with. However, the mathematical typesetting capabilities of MS Word are frankly quite poor because MS Word is a word processor and was never intended to be used for typesetting scientific writing. In order for you to follow these guideline you will have to spend a lot of time with the equation editor if you choose to use MS Word.

9.2 LaTeX

LaTeX is a (free) typesetting system for computers. The typesetting quality of LaTeX is excellent and if you chose to use LaTeX you will follow these guidelines with almost no extra work. However, there is a learning curve to LaTeX which needs to be considered.

There are many good tutorials on the Internet for learning LaTeX, e.g. `https://www.youtube.com/watch?v=SoDv0qhyysQ`. A LaTeX template for writing a Master's thesis can be found here:
`https://github.com/FilipNilenius/Chalmers-undergraduate-thesis`.

References

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