



WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF FUNDAMENTAL PROBLEMS OF TECHNOLOGY

Bachelor/Master thesis

Title of the thesis

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To my ...

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Chapter 1

Introduction

1.1 Motivation

Sed ut perspiciatis, unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam eaque ipsa, quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt, explicabo. Nemo enim ipsam voluptatem, quia voluptas sit, aspernatur aut odit aut fugit, sed quia consequuntur magni dolores eos, qui ratione voluptatem sequi nesciunt, neque porro quisquam est, qui dolorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt, ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim ad minima veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur? Quis autem vel eum iure reprehenderit, qui in ea voluptate velit esse, quam nihil molestiae consequatur, vel illum, qui dolorem eum fugiat, quo voluptas nulla pariatur?

At vero eos et accusamus et iusto odio dignissimos ducimus, qui blanditiis praesentium voluptatum deleniti atque corrupti, quos dolores et quas molestias excepturi sint, obcaecati cupiditate non provident, similique sunt in culpa, qui officia deserunt mollitia animi, id est laborum et dolorum fuga. Et harum quidem rerum facilis est et expedita distinctio. Nam libero tempore, cum soluta nobis est eligendi optio, cumque nihil impedit, quo minus id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum hic tenetur a sapiente delectus, ut aut reiciendis voluptatibus maiores alias consequatur aut perferendis doloribus asperiores repellat.

1.2 Aim and scope

Sed ut perspiciatis, unde omnis iste natus error sit voluptatem accusantium doloremque laudantium, totam rem aperiam eaque ipsa, quae ab illo inventore veritatis et quasi architecto beatae vitae dicta sunt, explicabo. Nemo enim ipsam voluptatem, quia voluptas sit, aspernatur aut odit aut fugit, sed quia consequuntur magni dolores eos, qui ratione voluptatem sequi nesciunt, neque porro quisquam est, qui dolorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt, ut labore et dolore magnam aliquam quaerat voluptatem. Ut enim ad minima veniam, quis nostrum exercitationem ullam corporis suscipit laboriosam, nisi ut aliquid ex ea commodi consequatur? Quis autem vel eum iure reprehenderit, qui in ea voluptate velit esse, quam nihil molestiae consequatur, vel illum, qui dolorem eum fugiat, quo voluptas nulla pariatur?

At vero eos et accusamus et iusto odio dignissimos ducimus, qui blanditiis praesentium voluptatum deleniti atque corrupti, quos dolores et quas molestias excepturi sint, obcaecati cupiditate non provident, similique sunt in culpa, qui officia deserunt mollitia animi, id est laborum et dolorum fuga. Et harum quidem rerum facilis est et expedita distinctio. Nam libero tempore, cum soluta nobis est eligendi optio, cumque nihil impedit, quo minus id, quod maxime placeat, facere possimus, omnis voluptas assumenda est, omnis dolor repellendus. Temporibus autem quibusdam et aut officiis debitis aut rerum necessitatibus saepe eveniet, ut et voluptates repudiandae sint et molestiae non recusandae. Itaque earum rerum hic tenetur a sapiente delectus, ut aut reiciendis voluptatibus maiores alias consequatur aut perferendis doloribus asperiores repellat.

Chapter 2

Some chapter title

2.1 Typography

This document was generated using [L^AT_EX](#) — a professional and free typesetting environment. When writing scientific texts, it is much better to use L^AT_EX than Word [1]. You can install L^AT_EX on your computer or use online environments like [Overleaf](#).

2.2 This and that

In the English typography, the space after the dot ending a sentence is wider than other spaces. Therefore, you should inform L^AT_EX explicitly whenever a dot does not end a sentence, like in e.g. or i.e. or some other cases. You can achieve it by using the backslash-space sequence, `\ ,` right after the dot in the source `.tex` file.

An example equation could be

$$E = mc^2, \tag{2.1}$$

where E denotes ...

Note that in the `.tex` file, an equation description that follows right after the equation should be continued without an empty line in between the equation and its description because an empty line starts a new paragraph in the compiled document.

A new paragraph is indented. If for some specific reason you do not want a new paragraph to be indented, use `\noindent` command at the beginning of that paragraph.

Equation [\(2.1\)](#) looks familiar. Note a convenient link reference to the equation in the text. This is done easily using a dedicated label, as you can check in the source `.tex` file. Similarly, you can (and should) link figures (see Fig. [2.1](#)), tables

(see Tab. 2.1), sections (e.g. Sec. 1.2), and chapters (e.g. Chap. 3). And this is a sentence with a book citation [3] and an article citation [4].

2.3 Figures

Figures which do not present photographs should be generated as *vector graphics*. This is particularly important for plots (like in Fig. 2.1) and flowcharts (like in Fig. 2.2). Suitable formats for this type of graphics which can be handled by L^AT_EX are *Encapsulated PostScript* (EPS) and *Portable Document Format* (PDF).

2.3.1 Flowcharts

A free and convenient online tool for creating flowcharts is draw.io. It enables export to vector graphics via `File | Export as | PDF`.¹ Once you have selected `Extras | Mathematical Typesetting`, you can easily add *mathematical expressions* to your flowchart. Figure 2.2 shows an example flowchart generated in draw.io.

2.3.2 Figure and table placement

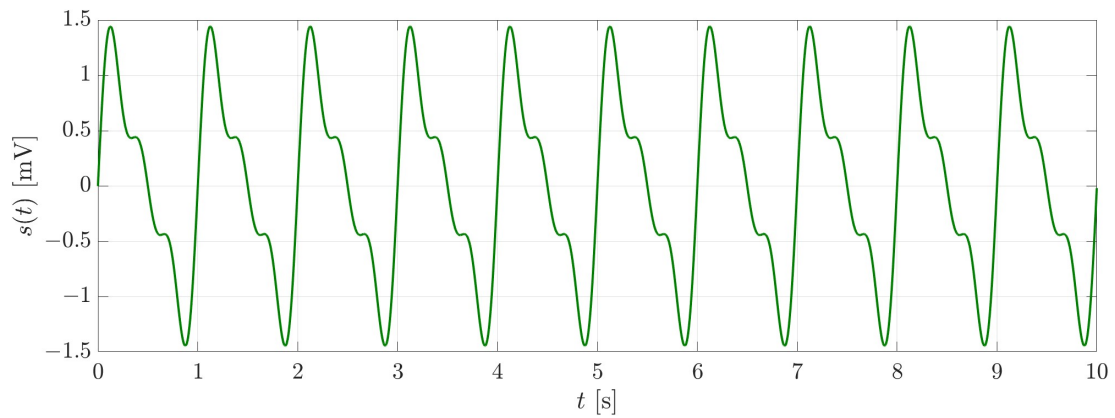
You can be surprised that L^AT_EX places figures and tables at locations that may appear not optimal to you. Do not worry — in 99.(9)% of cases, L^AT_EX is right and really knows it better. Note that in every professionally typeset book, figures and tables are placed either at the top or at the bottom of a page (or on a separate page, when a figure or table is large enough), not in between some text fragments. This is the way L^AT_EX does it and it really should be done so. Forget your old habits in this respect. If you really have to place a figure or a table at some particular location, there is a simple way to do it [1].

2.4 Tables

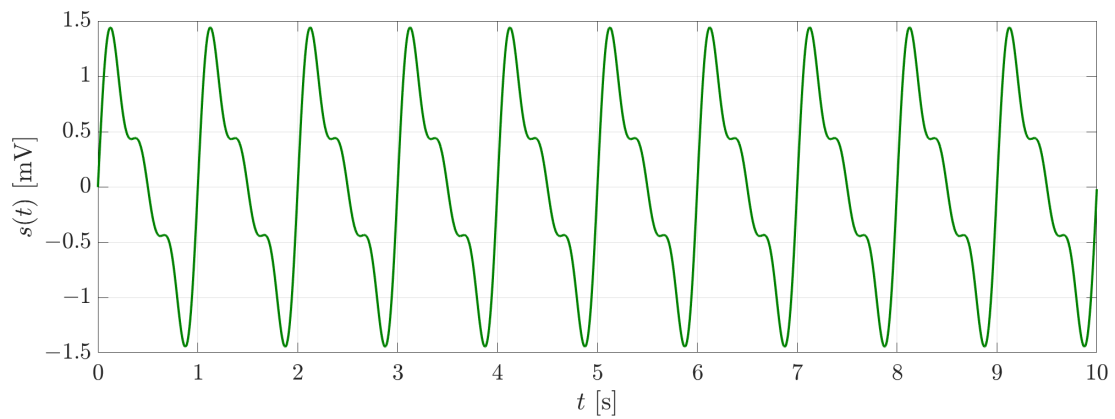
It is very easy to create simple tables in L^AT_EX. When a more complex layout is needed, it may be helpful to use the generator available at https://www.tablesgenerator.com/latex_tables.

In contrast to figures, tables usually have their captions above rather than below them.

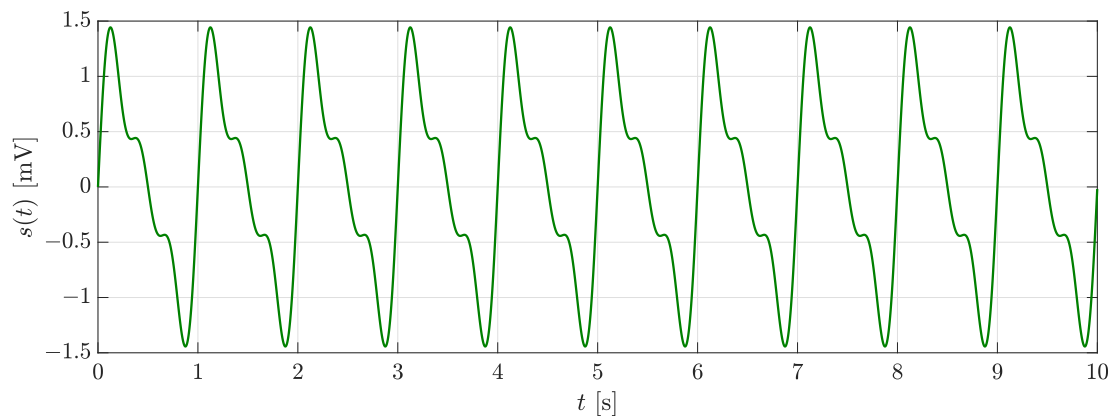
¹ Do not forget to mark the `Crop` option to avoid unnecessary white margins.



(a) Ugly, compressed JPG. Enlarge it on screen to better see compression artefacts.



(b) Somewhat nicer PNG, yet, it is still a [raster image](#).



(c) Nice, [vector-graphics](#) EPS. It can be enlarged on screen to better see details.

Figure 2.1: Differences in graphics quality depending on the format used. Always remember to label each axis correctly, including physical units. For good readability, it is important to use a large enough font size in the labels.

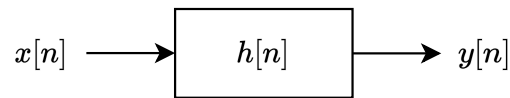


Figure 2.2: An example flowchart created in draw.io. Note that it is a [vector graphic](#). Flowcharts should *never* be [raster graphics](#). Do not forget to describe in the caption what the flowchart depicts. Here, an input $x[n]$ goes through a filter $h[n]$, which outputs $y[n]$.

2.5 Fragments of code

In case you need to show a fragment of code of your computer program, place it in the `verbatim` environment. This will result in a *monospaced font*, like in a typical programming environment. Here is a MATLAB code generating Fig. 2.1c. Let us remind that it is good practice to comment the code.

```

set(groot, 'DefaultAxesTickLabelInterpreter', 'LaTeX');
set(groot, 'DefaultLegendInterpreter'          , 'LaTeX');
set(groot, 'DefaultTextInterpreter'           , 'LaTeX');
set(0      , 'DefaultFigureColor'              , 'w'      );

fs = 1e3; % Sampling frequency [Hz].
t = 0 : 1/fs : 10 - 1/fs; % Discrete time domain [s].
f = 1 : 3; % Some frequencies [Hz].

s = zeros(size(t));
for ii = 1 : length(f)
    s = s + sin(2 * pi * f(ii) * t) / ii;
end

figure('Position', [1e2 1e2 15e2 5e2])
plot(t, s, 'Color', [0 .5 0], 'LineWidth', 2); grid
xtickformat('$%g$'); ytickformat('$%g$') % For proper minuses.
set(gca, 'FontSize', 20)
xlabel('$t$ [s]'); ylabel('$s(t)$ [mV]')

set(gcf, 'renderer', 'painters') % For vector-graphics output.
exportgraphics(gcf, 'someSignal.eps')
  
```

Such a code is, of course, too trivial to be shown in a thesis; here it only serves as an illustrative example.

Table 2.1: Typical formatting mistakes. *Risky* means that the physical unit can move to the next line while the number will remain in the preceding line, which is not desired. Source: [2].

| Incorrect | | Correct | |
|-----------------|----------------|-------------------|----------------|
| Syntax in .tex | Effect in .pdf | Syntax in .tex | Effect in .pdf |
| 20mV | 20mV | 20~mV | 20 mV |
| \$20mV\$ | 20mV | \$20~{\rm mV}\$ | 20 mV |
| 20 mV | Risky | 20~mV | 20 mV |
| \$2 * x\$ | $2 * x$ | \$2 x\$ | $2x$ |
| \$2 * 3\$ | $2 * 3$ | \$2 \cdot 3\$ | $2 \cdot 3$ |
| MxN | MxN | \$M \times N\$ | $M \times N$ |
| -1 | -1 | \$-1\$ | -1 |
| \$\sin(x)\$ | $\sin(x)$ | \$\sin(x)\$ | $\sin(x)$ |
| \$\max(x)\$ | $\max(x)$ | \$\max(x)\$ | $\max(x)$ |
| \$s_{\rm out}\$ | s_{out} | \$s_{\rm out}\$ | s_{out} |
| \$u_{\rm ij}\$ | u_{ij} | \$u_{ij}\$ | u_{ij} |
| \$\bf U^T\$ | \mathbf{U}^T | \$\bf U^{\rm T}\$ | \mathbf{U}^T |

2.6 Typical mistakes

Typical formatting mistakes and ways out are explained in Tab. 1 and [related text](#) [2]. One should also carefully distinguish between the [hyphen](#) (-), [dashes](#) (–, —), and the [minus sign](#) (−). The minus sign requires using the *math mode*; for example, `-1` in the `.tex` file results in `−1` in the `.pdf` file. Let us also recall that unlike in programming languages, the star (*) in mathematics does not denote plain multiplication but [convolution](#). Therefore, it should not be used to denote plain multiplication in mathematical expressions.

2.7 Referring to sources of information

Avoid [plagiarism](#) by all means. Remember to correctly cite the source material, also in figure and table captions.

In the bibliography list at the end of your thesis, include only those items that you cite in the main text. Likewise, each item of the list should be cited in the main text. This is easy to achieve in L^AT_EX — see [BibTeX](#), which will also format the items according to the style that you specified with the `\bibliographystyle` command in the `.tex` file.

Chapter 3

Discussion

A well written thesis should contain a well written discussion of the results obtained, with references to the exiting literature as well as to the aim of the thesis.

Bibliography

- [1] T. Oetiker, M. Serwin, H. Partl, I. Hyna, and E. Schlegl. *The Not So Short Introduction to L^AT_EX*. Free Software Foundation, Inc., 2023. <https://tobi.oetiker.ch/lshort/lshort.pdf>. 9, 10
- [2] Cezary Sielużycki. Krótko o pisaniu, czyli kilka wskazówek dla studentów PWr. <https://ibp.pwr.edu.pl/cs/Krotko-o-pisaniu.pdf>, 2024. 13
- [3] A. B. Surname and C. D. Last Name. *Book Title*. Famous University Press, Cambridge, UK, 2020. 10
- [4] E. Surname and F. G. Surname. Article title. *Journal Name*, 10(2):12–34, 2022. 10

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