University of Stuttgart
Institute for Control Engineering
of Machine Tools and Manufacturing Units
(ISW)

Master's Thesis

How to train a hamster

submitted by

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from Stuttgart

Degree program	M. Sc. Mechatronics
Examined by	Prof. Dr.-Ing. Oliver Riedel
Supervised by	My supervisor, M.Sc.
Submitted on	July 26, 2024

Declaration of Originality

Master's Thesis of Max Mustermann (M. Sc. Mechatronics)

Address	Seidenstraße 36, 70174 Stuttgart
Student number	1234567
English title	*How to train a hamster*
German title	*Wie man einen Hamster trainiert*

I now declare,

- that I wrote this work independently,

- that no sources other than those stated are used and that all statements taken from other works—directly or figuratively—are marked as such,

- that the work submitted was not the subject of any other examination procedure, either in its entirety or in substantial parts,

- that I have not published the work in whole or in part, and

- that my work does not violate any rights of third parties and that I exempt the University against any claims of third parties.

_____

Stuttgart, July 26, 2024

Kurzfassung

Deutsche Kurzfassung hier.

Abstract

Add the english abstract here.

Keywords: hamster, training, guide

Contents

1. Introduction

The aim of student theses is to show that students are able to work on tasks from their own field independently and according to scientific methods and that they can present their results appropriately. These objectives, defined in the examination regulations, raise a number of questions:

- What does "working according to scientific methods" actually mean?

- What belongs to the proper presentation of results?

- Which standards and guidelines apply at the Institut für Steuerungstechnik der Werkzeugmaschinen und Fertigungseinrichtungen (ISW)?

- What is to be considered in general when writing student theses at the ISW?

Read the guidelines for the preparation of student theses at ISW! The chapters used in this template are for inspiration only. Each thesis is different and the chapter headings and their order should be adapted accordingly.

2. Examples

In the following some examples for the conversion in LaTeX are listed. For formal requirements, please have a look at the guidelines for the preparation of student theses at the ISW.

2.1. Listings

An introduction for list environments with LaTeX can be found at `https://en.wikibooks.org/wiki/LaTeX/List_Structures`.

An unordered enumeration can look like this:

- Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

- Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

- Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

Use the `enumerate` environment for ordered lists.

1. Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

2. Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

3. Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

Descriptions are set with the `description` environment.

Mosquito Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

Emu Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

Armadillo Fusce tincidunt consectetur nisl a pretium. Nam sed eleifend nunc. Nulla feugiat nisl ac mauris varius, eu viverra tellus condimentum. Nullam tempus dolor a elementum con-vallis. Nam sagittis, nisi non tempor luctus, enim ex pretium nunc, lacinia suscipit arcu augue id sem.

2.2. Cite

Cite with the `\cite{}` command [2], [4]. You can mention authors and titles as well with `\citeauthor{}` and `\citetitle{}`: E.g., Feuersänger developed `pgfplots` and describes it in the documentation Manual for Package pgfplots.

Use tools for literature management as JabRef or Citavi.

2.3. Typing math

An introduction for typing math with LaTeX can be found at `https://de.wikibooks.org/wiki/LaTeX-Kompendium:_F%C3%BCr_Mathematiker`. The Wikipedia page for typesetting math is worth a visit as well (`https://de.wikipedia.org/wiki/Formelsatz`).

You can use \(...\) to typeset fomulas in text e.g., $\sqrt{a^2}$) or $\begin{bmatrix} a & b & c \end{bmatrix}^{\mathsf{T}}$ (`\bmat` and `\T` are self-defined macros from `settings.tex`).

Multiline math environments can e.g. be set with the `align` environment. A & character helps with the vertical alignment.

$$
\begin{aligned}
c^2 &= a^2 + b^2 \\
\Leftrightarrow \quad c &= \pm\sqrt{a^2 + b^2}
\end{aligned}
\tag{2.1}
$$

Only number equations that will be referenced later, such as Equation 2.1. \nonumber suppresses the generation of an equation number.

2.4. Tables

Tasbles are set in a `table` environment, as shown in Table 2.1. They must always be referenced and explained in the previous text. The package `booktabs` faciliates the consistent use of horizontal line strenghts.

Article		
Animal	Description	Price (€)
Mosquito	per gramm	13.65
	per piece	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33
Armadillo	frozen	8.99

Table 2.1.: Example table using the booktabs package

2.5. Graphics

Simple graphics can be integrated with \includegraphics. Always use a `figure` environment for graphics. Reference graphics before they appear in the text, such as Figure 2.1, and assign meaningful captions to them.

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der Werkzeugmaschinen und
Fertigungseinrichtungen (ISW)

Figure 2.1.: The logo of the ISW at the University of Stuttgart

Some graphics with TikZ and PGFplots are shown on Figure 2.2, Figure 2.3a, Figure 2.3b and Figure 2.4 which might be helpful or inspirational for your thesis.
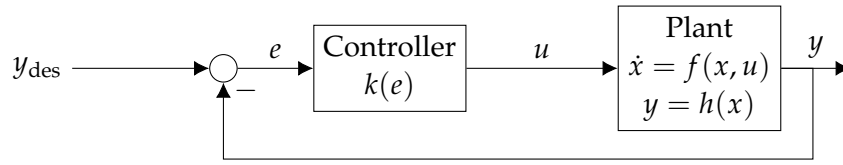
Figure 2.2.: A simple block diagram

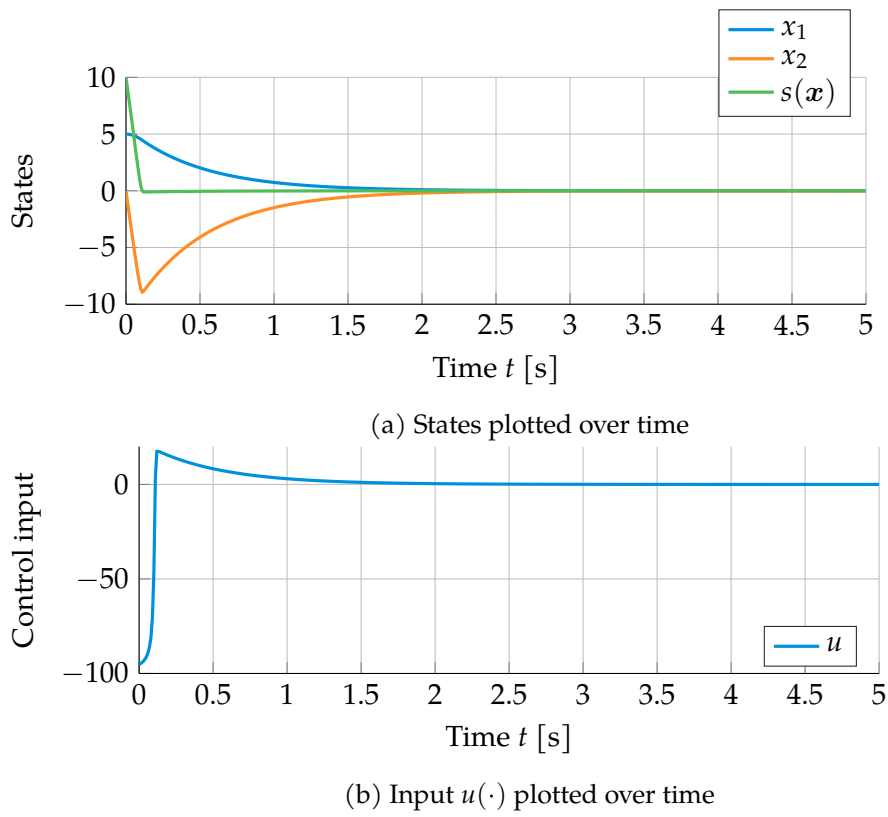(a) States plotted over time

(b) Input $u(\cdot)$ plotted over time

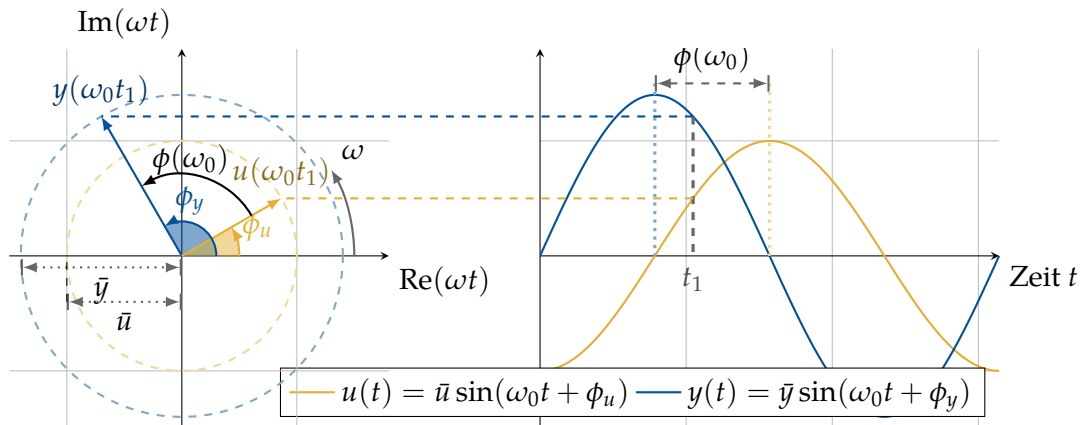Figure 2.3.: Example for exports from MATLAB with `matlab2tikz`

Figure 2.4.: Analytical calculation of a phasor diagram with TikZ [7]

2.6. Code

The listings package, for example, is suitable for code excerpts. Make sure that you only include necessary code, Listing 2.1 is a bad example and should not be included.

```cpp
#include <iostream>

using namespace std;

int main(void){
    cout << "Hello world." << endl;
    return 0;
}
```

Listing 2.1: This code does not provide any insights and should not be included.

2.7. Abbreviations

For abbreviations you can use the package acronym.

The command \ac{} introduces the abbreviation at the first use, for example ISW and several Speicherprogrammierbare Steuerungen (SPS). Then the abbreviations ISW and SPS will be used automatically. The definition of the abbreviations can be done in a separate file, the example document includes chapters/Acronyms.

We recommend resetting the acronym package after the abstract with \acreset, so they will be reintroduced in the introduction chapter.

3. Tooling

3.1. Recommended Editors

There are several options for working on your LaTeX document. All of them have individual strong suits and drawbacks. For locally installed editors it is highly recommended to use version control (see section 3.3).

3.1.1. Overleaf

By far the easiest and fastest setup is provided by `overleaf.com`. After creating an account, you can search for the ISW thesis template and start working on your thesis right away. Overleaf allows simultaneous editing of by multiple persons and provides integrated version control and document compilation. However, sometimes it is not possible to have your work hosted on public servers due to Non-Disclosure Agreements (NDAs). Ask your supervisor if you're allowed to use overleaf!

3.1.2. Visual Studio Code

VSCode is also a valid choice for editing latex documents. Just install the `LaTex Workshop` extension. You should also consider installing the `LTex` extension for integrating LanguageTool (see section 3.2).

3.1.3. TexStudio

All ISW pool computers come with the TeXstudio[1] latex editor and the MiKTeX[2] LaTeX distribution pre-installed. If they are missing from your ISW-machine, you can install them using the OPSI software-on-demand utility. Remember to select both for installation.

In TeXstudio, remember to set `lualatex` as the standard compiler and `biber` as the bibtex backend.

3.2. Checking of grammar, spell and style

As with all word-processing tasks, it is highly recommended to use at least some sort of spell-checking software. For this purpose TexStudio provides integration with Lan-

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[1] `https://www.texstudio.org/`
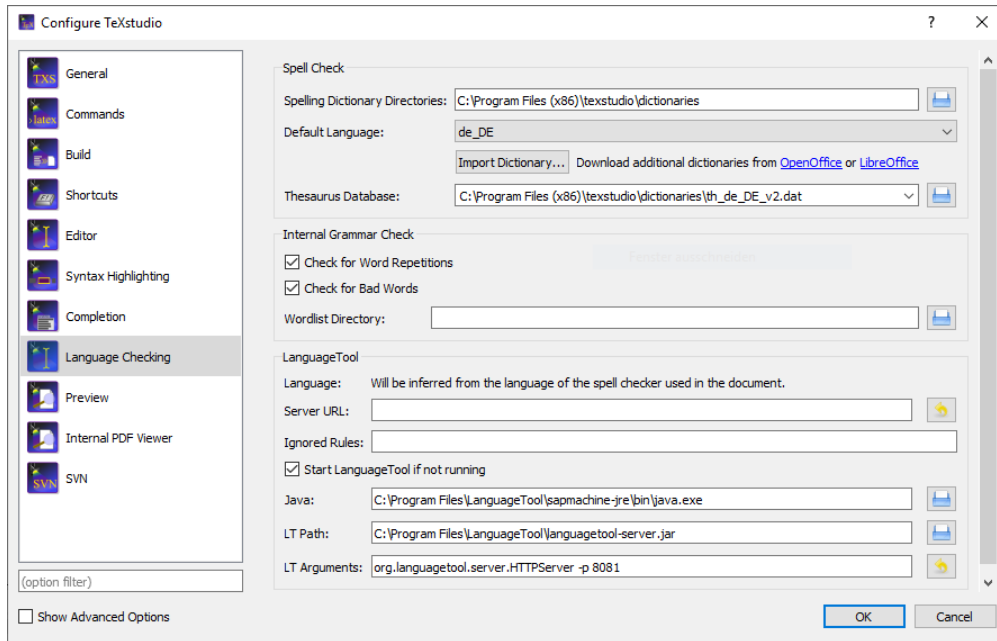[2] `https://miktex.org/`

Figure 3.1.

guageTool³. LanguageTool is a java based application, so make sure to install a Java Runtime Environment. On ISW pool-computers you can again install LanguageTool using OPSI software-on-demand. The necessary settings for ISW pool-computers are shown in Figure 3.1. Further information on the integration of LanguageTool with TexStudio can be found at the LanguageTool Wiki ⁴.

3.3. Version control

Whenever working on a document, it is desirable to have some sort of version control. For this task, ISW provides a gitlab server found at `https://git.isw.uni-stuttgart.de/`. Once you are logged in to gitlab, you can create your own repository for tracking your thesis files. A `.gitignore` file is necessary to not track all changes to automatically generated files. You may use the `.gitignore` provided by this template. Again, if `git` is not installed on your ISW-machine, you can install it using OPSI software-on-demand.

You can achieve a rudimentary integration with TeXstudio by defining macros such as the git commit macro shown in Listing 3.1. Note that macros can also be called by using shortcuts.

```
%SCRIPT
dialog = new UniversalInputDialog()
```

---

³`https://languagetool.org`
⁴`http://wiki.languagetool.org/checking-la-tex-with-languagetool#toc2`

```
dialog.setWindowTitle("Git commit")
dialog.add("", "Message", "comment")
dialog.add(false, "Commit all files","allfiles")
if (dialog.exec() != null) {
comment = dialog.get("comment")
if ((dialog.get("allfiles")) == true){
buildManager.runCommand(
"git commit -a -m \"" + comment + "\"", editor.fileName())
}else{
buildManager.runCommand(
"git commit " + editor.fileName() + " -m \"" + comment +
"\"", editor.fileName())
}
}
```

Listing 3.1: `git commit` macro

4. Conclusions

Bibliography

[1]   M. Kohm and J.-U. Morawski, *KOMA-Script – ein wandelbares LaTeX-2-Paket*, 2013. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/koma-script/doc/scrguide.pdf`.

[2]   T. Cubitt, *The cleveref package*, 2013. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/cleveref/cleveref.pdf`.

[3]   S. Fear, *Publication quality tables in latex*, 2005. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/booktabs/booktabs.pdf`.

[4]   S. Cochran and V. Karen-Pahlav, *The subfig package*, 2005. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/subfig/subfig.pdf`.

[5]   C. Heinz, B. Moses, and J. Hoffmann, *The listings package*, 2014. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/listings/listings.pdf`.

[6]   A. Sommerfeldt, *The rotfloat package*, 2004. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/rotfloat/rotfloat.pdf`.

[7]   T. Tantau, *Tikz & pgf*, 2013. [Online]. Available: `http://mirrors.ctan.org/graphics/pgf/base/doc/pgfmanual.pdf`.

[8]   C. Feuersänger, *Manual for package pgfplots*, 2014. [Online]. Available: `http://mirrors.ctan.org/graphics/pgf/contrib/pgfplots/doc/pgfplots.pdf`.

[9]   P. Lehman, P. Kime, A. Boruvka, and J. Wright, *The biblatex package*, 2013. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/biblatex/doc/biblatex.pdf`.

[10]   W. May and A. Schedler, *An extension of the latex-theorem environment*, 2011. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/ntheorem/ntheorem.pdf`.

[11]   American Mathematical Society, *User's guide for the amsmath package*, 1999. [Online]. Available: `http://mirrors.ctan.org/macros/latex/required/amslatex/math/amsldoc.pdf`.

[12]   American Mathematical Society, *Sample paper for the amsmath package*, 1999. [Online]. Available: `http://mirrors.ctan.org/macros/latex/required/amslatex/math/testmath.pdf`.

[13]   N. Talbot, *User manual for glossaries.sty v4.09*, 2014. [Online]. Available: `http://mirrors.ctan.org/macros/latex/contrib/glossaries/glossaries-user.pdf`.

List of Acronyms

ISW Institut für Steuerungstechnik der Werkzeugmaschinen und
Fertigungseinrichtungen der Universität Stuttgart

SPS Speicherprogrammierbare Steuerung

NDA Non-Disclosure Agreement

List of Figures

List of Tables

List of Symbols

This section is optional. Ask your supervisor whether it is required for your thesis. If you have more than 10 formulas involved it probably is.

There are two ways to build a list of symbols:

- If you just want to get it done, then use a `longtable` and fill your symbols in, see table below.

- If you want it fancy, then package `glossaries` (maybe `glossaries-extra`) may be your way to go. Be warned that although it automates symbol handling (e.g. sorting and referencing of symbols), it comes with some administrative overhead. You can find a discussion on different ways to achieve this on https://tex.stackexchange.com/a/366282.

Symbol	Unit	Description
ψ	rad	Heading angle of hamster
$\dot{x}$	m/s	Linear velocity of hamster
$\ddot{x}_0$	m/s^2	Initial acceleration of hamster

A. Example appendix chapter