

English Title

German Title

Scientific work for obtaining the academic degree

Master of Science (M.Sc.)

at the TUM School of Engineering and Design of the Technical University of Munich

Supervised by	Prof. Dr.-Ing. Michael Zäh Chair of Industrial Management and Assembly Technologies
Submitted by	Jan Nalivaika Lerchenauerstrasse 10 80809 Munich
Submitted on	March 15, 2024 in Garching

Aufgabenstellung

**Titel der Bachelor's Thesis/der Master's Thesis/der Semesterarbeit/des interdisziplinären Projekts:
Entwicklung...**

(English Title of the Bachelor's/Master's Thesis/Semester Thesis/Interdisciplinary Project:) Development...

Verfasser:in:

Ausgabe: tt.mm.jjjj

Betreuer:in:

Abgabe: tt.mm.jjjj

Ausgangssituation:

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Zielsetzung:

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Vorgehensweise und Arbeitsmethodik:

- Arbeitspaket 1.
- Arbeitspaket 2.
- etc.

Vereinbarung:

Durch die Betreuung von Herrn/Frau (B.Sc.) „Name Verfasser:in“ fließt geistiges Eigentum des *iwb* in diese Arbeit ein. Eine Veröffentlichung der Arbeit oder eine Weitergabe an Dritte bedarf der Genehmigung durch den Lehrstuhlinhaber. Der Archivierung der Arbeit in der *iwb*-eigenen und nur für Mitarbeitende des *iwb* zugänglichen Bibliothek als Bestand und in der digitalen Studienarbeitsdatenbank des *iwb* als PDF-Dokument stimme ich zu.

Garching, den tt.mm.jjjj

Prof. Dr.-Ing.
Name Professor

(B.Sc.)
Name Student:in

Abstract

Place your abstract here.

Zusammenfassung

Hier könnte Ihre Kurzzusammenfassung stehen.

Contents

List of Abbreviations	ix
1 LaTeX-Tutorial	1
1.1 Titelseite	1
1.2 Zitation	1
1.3 Abkürzungen	2
1.4 Glossar	2
1.5 Abbildungen	2
2 Kapitelname	5
2.1 Abschnittname	5
2.2 Abschnittname	5
2.2.1 Unterabschnittname	6
2.2.2 Unterabschnittname	6
2.2.3 Unterabschnittname	6
2.3 Abschnittname	6
3 Kapitelname	7
3.1 Abschnittname	7
3.2 Abschnittname	7
3.2.1 Unterabschnittname	8
3.2.2 Unterabschnittname	8
3.2.3 Unterabschnittname	8
3.3 Abschnittname	8
4 Kapitelname	9
4.1 Abschnittname	9
4.2 Abschnittname	9
4.2.1 Unterabschnittname	10
4.2.2 Unterabschnittname	10
4.2.3 Unterabschnittname	10
4.3 Abschnittname	10
A Anhangname	11
Glossary	13

List of Abbreviations

AP Arbeitspaket

ROS Robot Operating System

Chapter 1

LaTeX-Tutorial

Dieses Tutorial liefert eine Kurzeinführung in die Verwendung von Latex.

1.1 Titelseite

Die Titelseite wird in `./main.tex` definiert. Der Studienarbeitstyp wird durch Ein- und Auskommentieren der Befehle

- `\IWbstudentthesisTitlePageCustomMastersThesis`,
- `\IWbstudentthesisTitlePageCustomBachelorsThesis` und
- `\IWbstudentthesisTitlePageCustomSemesterThesis`

ausgewählt und die Seite entsprechend der Argumente gesetzt. Die Professoren und Lehrstühle können mittels der Makros

- `\IWbnamesProfReinhart \newline \IWblangChairMWIWBLBM` oder
- `\IWbnamesProfZaeh \newline \IWblangChairMWIWBLWF`

ausgewählt werden.

1.2 Zitation

Zum Zitieren stehen die Standardbefehle `\textcite` und `\parencite` zur Verfügung. Soll der Autorename im Satz verwendet werden, eignet sich ersteres, z.B. **Bayerlein2018** bezieht sich auf **Bayerlein2016469**. Soll das Zitat in Klammern nach die Aussage gestellt werden empfiehlt sich zweiteres (**Zaeh2018385**). Sammelzitationen am Satzende schreiben sich wie folgt (**Kleinwort2018658**; **Kleinwort20189**; **Kleinwort2018631**). Die Zitation von Online-Quellen kann schwierig sein, da nicht immer der Autor und das Erscheinungsjahr verfügbar sind. Vergleicht man **Heuss2018** und **iwb-Startseite**, stellt man fest, dass bei zweiteren der Seitentitel statt des bekannten Schemas eingesetzt wird.

Normen werden als **ISO.10218-2** dargestellt. Im Bibtex-Export des verwendeten Literaturverwaltungsprogramm sind bestimmte Einstellungen vorzunehmen. Dokumententyp ist “@book” mit folgenden Einträgen:

- Normtyp und Nummer als “title”
- Langtitel als “subtitle”
- Verlag als “publisher”
- Jahr als “date”
- “author” darf nicht belegt werden!

1.3 Abkürzungen

In ./source/abbreviations.tex können Abkürzungen definiert werden. Es gibt Besonderheiten zu Ausdrücken, deren Pluralendung nicht auf s endet. Hier müssen ggf. Kurz- und Langformen des Ausdrucks auch für den Plural definiert werden.

- `\gls{ros}`: schreibt beim ersten Auftreten im Dokument ausführlich Robot Operating System (ROS), ab dem zweiten Auftreten wird abgekürzt ROS
- `\glspl{ap}` verwendet den Plural in Langform Arbeitspakete (APs) und danach in Kurzform APs

1.4 Glossar

In ./source/glossary.tex können Begriffe erklärt, abgegrenzt oder definiert werden. Begriffe erhalten einen Namen und eine Beschreibung als Glossareintrag sowie ein Label zum Referenzieren im Text. Ein Glossar ist Optional.

- `\gls{latex}`: Schreibt den Namen aus dem Glossarverzeichnis mit Verweis auf den Glossareintrag Latex

1.5 Abbildungen

Graphiken und Bilder können in beliebigen Dateiformaten eingebunden werden, vergleiche fig. 1.1. Vektorgraphiken sind im Allgemeinen Pixelgraphiken in Schärfe und Speicherbedarf überlegen.

Für Nutzer mit perfektionistischen Anspruch empfiehlt sich die Nutzung von TikZ. Vorteil ist, dass die Erzeugung von Daten und die Darstellung komplett getrennt werden. Die Darstellung erfolgt einheitlich gemäß eines generischen Mark-Ups, vergleiche figs. 1.2 and 1.3.

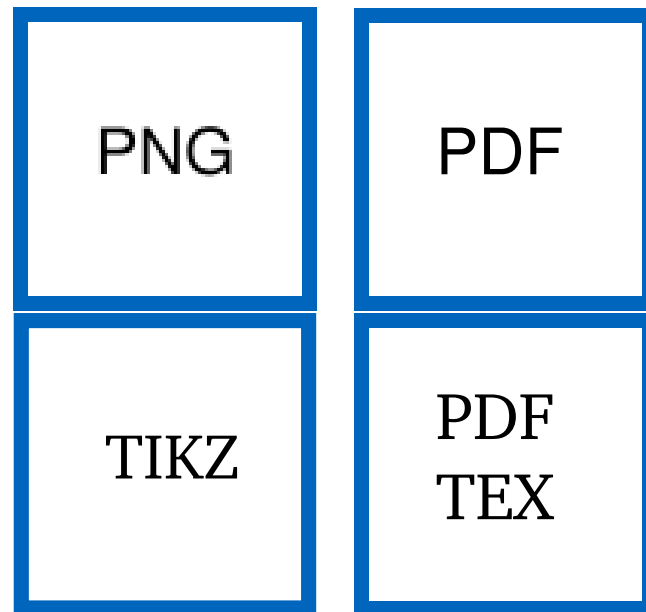


Figure 1.1: Beschreibung des Bilds.

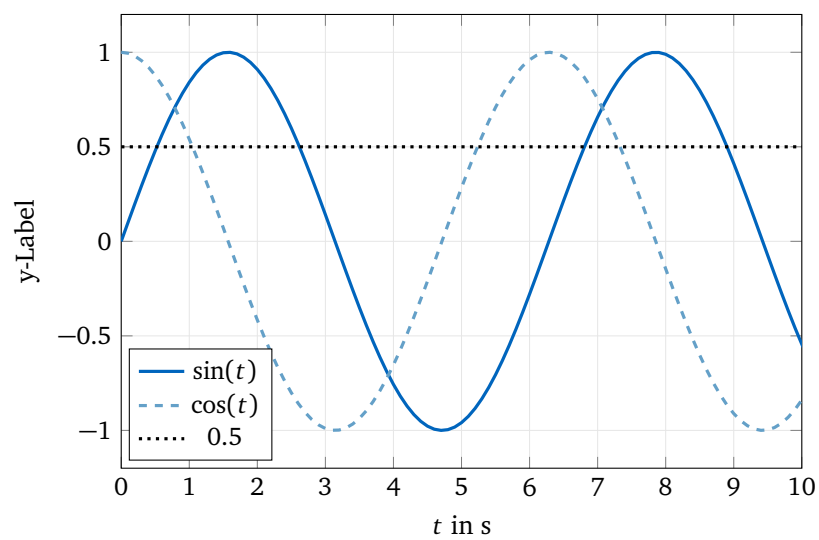


Figure 1.2: Beschreibung des Plots.

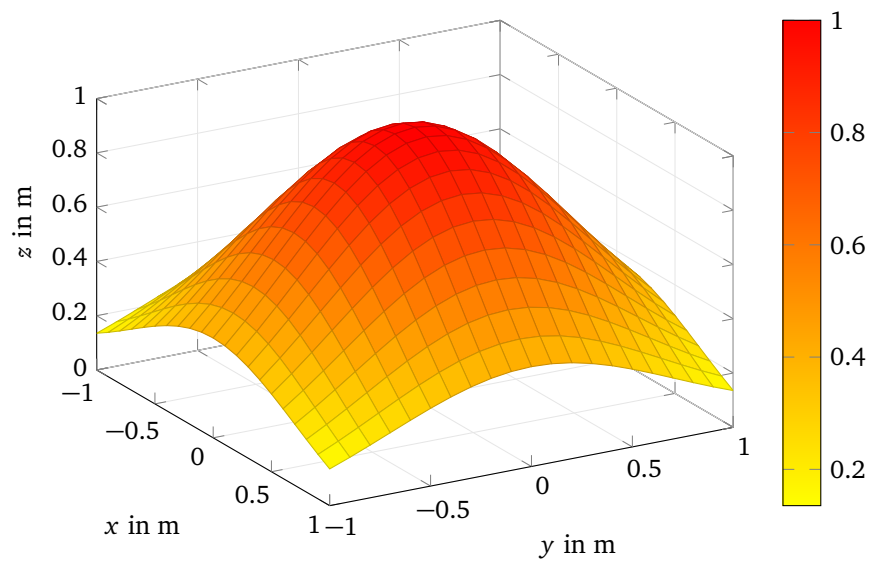


Figure 1.3: Beschreibung des Plots.

Chapter 2

Kapitelname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

2.1 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

2.2 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

2.2.1 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

2.2.2 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

2.2.3 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

2.3 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Chapter 3

Kapitelname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

3.1 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

3.2 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

3.2.1 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

3.2.2 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

3.2.3 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

3.3 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Chapter 4

Kapitelname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

4.1 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

4.2 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

4.2.1 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

4.2.2 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

4.2.3 Unterabschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

4.3 Abschnittname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Appendix A

Anhangname

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

This is the second paragraph. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

And after the second paragraph follows the third paragraph. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

After this fourth paragraph, we start a new paragraph sequence. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected

font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Glossary

Latex	Generische Mark-up-Sprache zum Erstellen wissenschaftlicher Texte. Sie ist in jeder Hinsicht Word überlegen, welches einem visuellen Mark-Up entspricht. Das X von \LaTeX wird als ç (Stimmloser palataler Frikativ) ausgesprochen, vergleiche deutsche Aussprache von <i>ch</i> .
TikZ	Frontend-Paket, das auf PGF-Plot aufbaut und zum Erstellen von Graphiken dient.
Tutorial	Kurze Gebrauchsanleitung welche ein Thema, einen gewissen Vorgang oder eine Funktion erklärt. Hat nicht den Anspruch auf Vollständigkeit.

Disclaimer

I hereby declare that this thesis is entirely the result of my own work except where otherwise indicated. I have only used the resources given in the list of references.

Garching, March 15, 2024

(Signature)