FH Aachen

Faculty of Aerospace Engineering

Department of Alternative
Propulsion Systems

Mini Thesis

The Title of this Thesis

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1 Introduction

> Two beer or not two beer, that is the question.

Please add your introductory text here. 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.

Paragraphs are simply separated by a blank line, LaTeX takes care of the rest.

2 A Demonstration of Some LaTeX Features

2.1 Basics

Some of the **greatest** discoveries in <u>science</u> were made by ***accident***.

Some of the greatest *discoveries* in science were made by accident.

Some of the greatest discoveries in science were made by accident.

Some of the greatest *discoveries* in science were made by accident.

2.2 Cross References

LaTeX has elaborated cross references like e.g.

- fig. 3.2 on page 12
- Did you know that on page 12 we find fig. 3.2
- section 2.4 on the following page
- chapter 3 on page 10
- section 3.1 on page 10

See `https://tex.stackexchange.com/a/83051/144487` for what you can do with it

2.3 Enumerations

You can define keywords

Example a) Internal combustion optimization

Example b) Exhaust gas aftertreatment

Example c) Friction reduction

or

  (i) Internal combustion optimization

 (ii) Exhaust gas aftertreatment

(iii) Friction reduction

2.4 Including Figures

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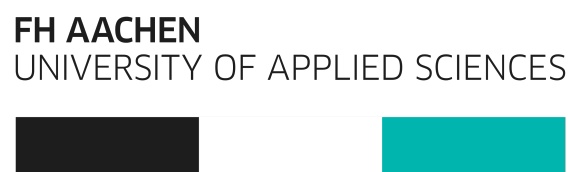

Figure 2.1: The logo of Fachhochschule Aachen

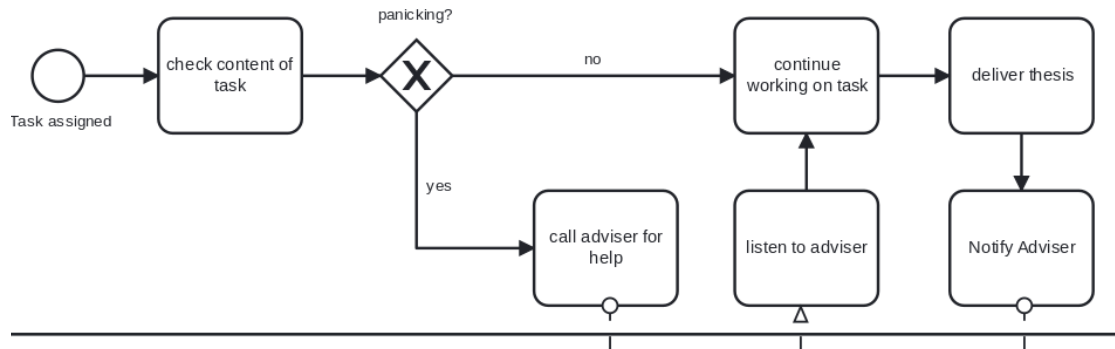It is also possible to adjust the position of the image and crop it, thereby offering the inclusion of only parts of an image (see e.g. `https://texblog.org/2012/02/23/crop-figures-with-includegraphics/`):

Figure 2.2: A cropped version of fig. 2.3
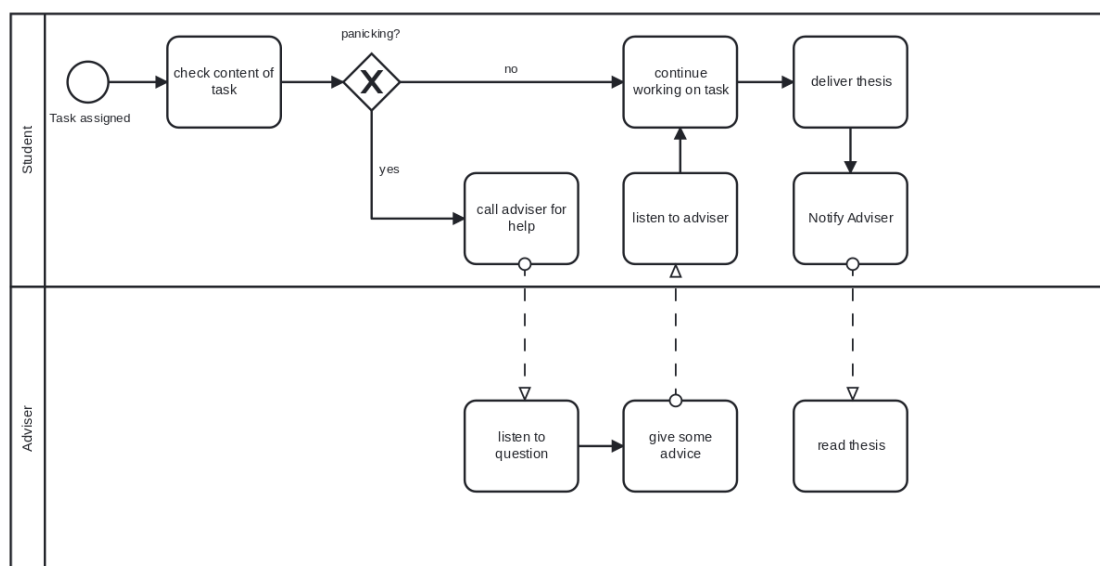
The complete figure is

Figure 2.3: The complete image

2.5 Formulas

Subscripts in math mode are written as a_b and superscripts are written as a^b. These can be combined an nested to write expressions such as

$$T^{i_1 i_2 \ldots i_p}_{j_1 j_2 \ldots j_q} = T(x^{i_1}, \ldots, x^{i_p}, e_{j_1}, \ldots, e_{j_q}) \tag{2.1}$$

We write integrals using $\int$ and fractions using $\frac{a}{b}$. Limits are placed on integrals using superscripts and subscripts:

$$\int_0^1 \frac{dx}{e^x} = \frac{e-1}{e} \tag{2.2}$$

Lower case Greek letters are written as ω δ etc. while upper case Greek letters are written as Ω Δ.

Mathematical operators are prefixed with a backslash as $\sin(\beta)$, $\cos(\alpha)$, $\log(x)$ etc.

$$\frac{\partial \rho}{\partial t} \quad + \quad div\,(\rho \boldsymbol{v}) \qquad\qquad\qquad\qquad\qquad\qquad = \quad 0 \tag{2.3a}$$

$$\frac{\partial(\rho \boldsymbol{v})}{\partial t} \quad + \quad div\,(\rho \boldsymbol{v} \circ \boldsymbol{v}) \qquad - \quad div\,\boldsymbol{\sigma} \qquad - \quad \rho \boldsymbol{b} \qquad = \quad 0 \tag{2.3b}$$

$$\frac{\partial}{\partial t}\left(\rho\left[e + \frac{\boldsymbol{v}^2}{2}\right]\right) \quad + \quad div\left(\rho\left[e + \frac{\boldsymbol{v}^2}{2}\right]\boldsymbol{v}\right) \quad - \quad div\,(\boldsymbol{v}\boldsymbol{\sigma} - \boldsymbol{q}) \quad - \quad \rho\,(\boldsymbol{v}\boldsymbol{b} - q_b) \quad = \quad 0 \tag{2.3c}$$

3 A Second Demonstration of LaTeX Features

3.1 Tables

3.1.1 Using LaTeX package `tabularx`

Table 3.1: A simple table with paragraphs

This could be a longer text and that is OK because this is what tabularx was made for	label 2	label 3	item x
item 1	item 2	item 3	item 4

3.1.2 Using a Regular LaTeX `tabular` Environment

A table generated with the Excel plugin Excel2LaTeX. Please note how we use an `adjustbox` to enforce the table to fit the page width

Table 3.2: Road situations according to VDA 702 (1/2).

Subgroup	ID$_{VDA}$	ID$_{RS}$	Evaluated road situations (RS)	EP (Time)	EP (Freq.)	Comment
Stand Maneuver	-	RS01	Standing	-	-	in addition to VDA 702
	FB040	RS02	Starting	E3	E4	
	FB100	RS03	Accelerating, slow	E3	E4	$> 1\,\mathrm{m/s^2}$
	FB100	RS04	Accelerating, fast	E2	E3	$> 1\,\mathrm{m/s^2}$
	FB120	RS05	Driving with normal deceleration (normal braking)	E4	E4	$\leq 4\,\mathrm{m/s^2}$
Speed	FB040	RS12	Driving at low speed	E3	E4	$0\ \mathrm{km/h} \leq v \leq 10\ \mathrm{km/h}$
	FB010-030	RS13	Driving at high speed	E3	-	$10\ \mathrm{km/h} < v \leq 30\ \mathrm{km/h}$
Friction	FS010	RS14	Driving on dry asphalt (normal friction coefficient)	E4	-	

3.2 Plotting

Data can easily be plotted using the package `pgfplots`. You can find the documentation at `https://ctan.org/pkg/pgfplots?lang=en`. Many nice examples can be found at `https://tikz.net/`.

Please find below some examples captured from `https://tex.stackexchange.com/questions/83888/how-to-plot-data-from-a-csv-file-using-tikz-and-csvsimple`:
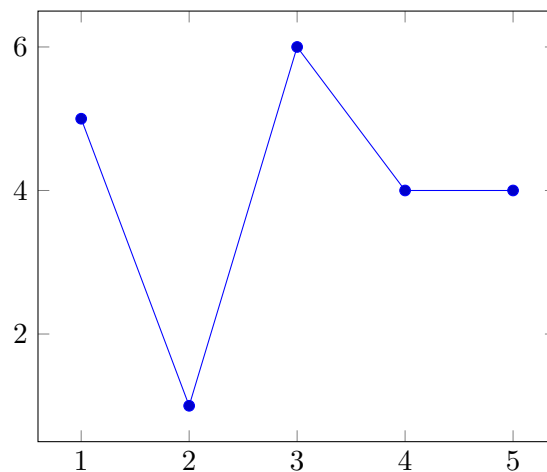

Figure 3.1: A simple x-y graph
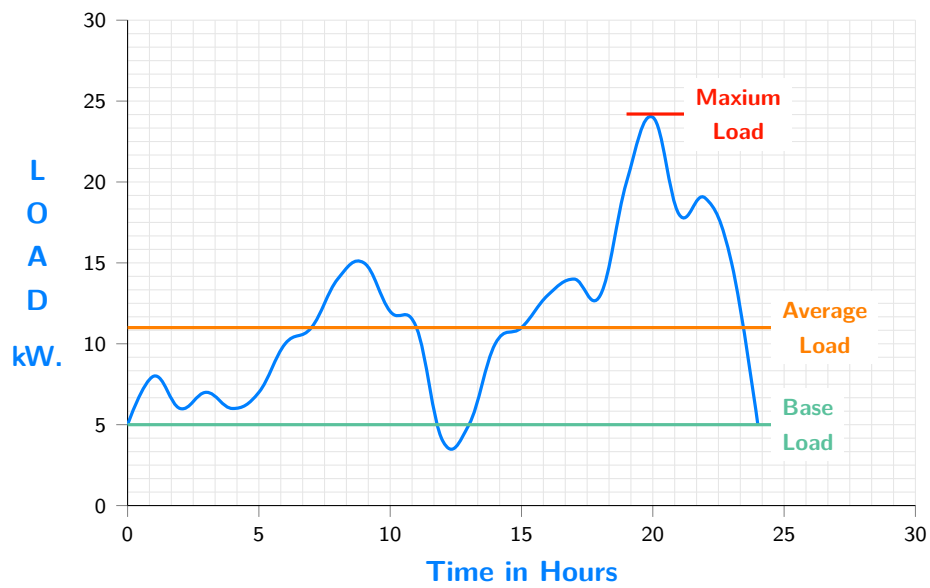
Figure 3.2: An elaborated demonstration of pgfplot capabilities

You should also take a look at `http://pgfplots.sourceforge.net/gallery.html` and check TeX Stackexchange at `https://tex.stackexchange.com/questions/tagged/pgfplots` and astonishing scientific demos at `https://tex.stackexchange.com/questions/158668/nice-scientific-pictures-show-off`
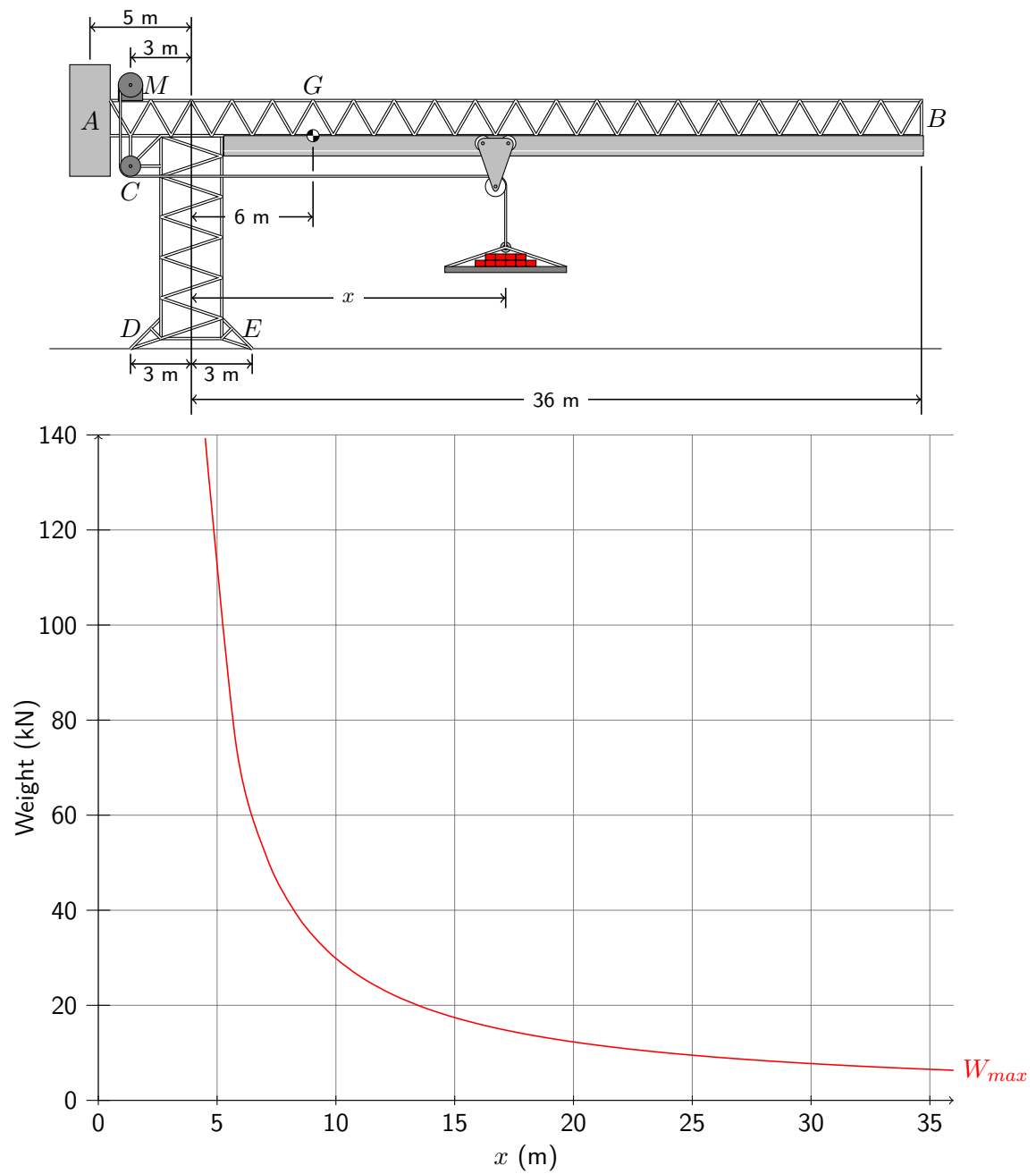
Figure 3.3: Maximum load of a crane

3.3 Citations

As one can see in [**iso_13849_part1**], functional safety is difficult.

3.4 How To Use Abbreviations

In order to use Abbreviations you can use the command \gls{ACRONYM}. The nice thing is that on first use it will display the long version together with the acronym in delimiters and on consecutive usage of the macro only show the acronym:

- First usage: *Automotive Safety Integrity Level (ASIL)*
- Second usage *ASIL*

But you can also explicitly define whether the long or short version is to be displayed:

- Long version: \glsxtrlong{ASIL} yields *Automotive Safety Integrity Level*
- Short version: \glsxtrshort{ASIL} yields *ASIL*
- Full version: \glsxtrfull{ASIL} yields *Automotive Safety Integrity Level (ASIL)*

See here some abbreviations:

C, *CEN*, *CENELEC*, *DIN*, *E*, *AELV*, *ETSI*, *EMC*, *EN*, *F*, *FIT*, *FMEA*, *FuSa*, *FSR*, *FTA*, *FZV*, *IEC*, *ISO*, *KBA*, *OEMs*, *QM*, *S*, *StVG*, *StVO*, *StVZO*, *TÜV*, *UNECE*, *VDA*, *BPMN*, *FBV*, *EU*, *EC*

4 chapter

4.1 section

4.1.1 subsection

subsubsection

paragraph

subparagraph

A Appendix Title

A.1 A First Section in the Appendix

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B List of Symbols

Symbol	Description	Unit
P	power	W
V	speed	km/h
V	speed	m/s

C List of Abbreviations

AELV autonomous, electric, light-weight vehicle 14

ASIL Automotive Safety Integrity Level 14

BPMN Business Process Model and Notation 14

C Controllability 14

CEN European Committee for Standardization (French: Comité Européen de Normalisation) 14

CENELEC European Committee for Electrotechnical Standards (fr.: Comité Européen de Normalisation Électrotechnique) 14

DIN German Institute for Standardization (German: Deutsches Institut für Normung) 14

E Exposure 14

EC European Community 14

EMC Electromagnetic Compatibility 14

EN European Standards 14

ETSI European Telecommunications Standards Institute 14

EU European Union 14

F Frequency 14

FBV Vehicle Operation Regulation (German: Fahrzeug-Betriebs-Verordnung) 14

FIT Failure in Time 14

FMEA Failure Mode and Effects Analysis 14

FSR Functional Safety Requirement 14

FTA Fault Tree Analysis 14

FuSa Functional Safety 14

FZV Vehicle Registration Law (German: Fahrzeug-Zulassungsverodnung) 14

IEC International Electrotechnical Commission 14

ISO International Organization for Standardization 14

KBA Federal Motor Transport Authority (German: Kraftfahrt-Bundesamt) 14

OEMs Original Equipment Manufacturers 14

QM Quality Management 14

S Severity 14

StVG Road Traffic Act (German: Straßenverkehrsgesetz) 14

StVO Road Traffic Regulations (German: Straßenverkehrs-Ordnung) 14

StVZO Road Traffic Licensing Regulation (German: Straßenverkehrs-Zulassungs-Ordnung) 14

TÜV Technical Monitoring Association (German: Technischer Überwachungsverein) 14

UNECE United Nations Economic Commission for Europe 14

VDA Association of the Automotive Industry (German: Verband der Automobilindustrie) 14

D Glossary

functional safety is an absence of unreasonable risk due to hazards caused by malfunctioning behaviour of E/E systems 17

functional safety concept is a specification of the functional safety requirements, with associated information, their allocation to elements within the architecture, and their interaction necessary to achieve the safety goals 17

safety goal is a high-level safety requirement as a result of the hazard analysis and risk assessment at the vehicle level and is formulated for each hazardous event 17