FH AACHEN
UNIVERSITY OF APPLIED SCIENCES

FH Aachen

Faculty of Aerospace Engineering

Department of Alternative
Propulsion Systems

Mini Thesis

The Title of this Thesis

Potter, Harry and Granger, Hermione

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Examiner:	Esch, Thomas, Prof. Dr.-Ing
Second Examiner:	Werle, Markus, Dipl.-Ing

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1 Introduction

Please add your introductory text here.

2 A Demonstration of Some LaTeX Features

2.1 Basics

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.*

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 11
- Did you know that on page 11 we find fig. 3.2
- section 2.4 on the following page
- chapter 3 on page 9
- section 3.1 on page 9

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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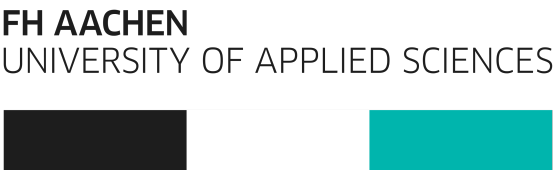

Figure 2.1: The logo of Fachhochschule Aachen

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.

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

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

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

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	-	RS01	Standing	-	-	in addition to VDA 702
Maneuver	FB040	RS02	Starting	E3	E4	
	FB100	RS03	Accelerating, slow	E3	E4	$> 1\,m/s^2$
	FB100	RS04	Accelerating, fast	E2	E3	$> 1\,m/s^2$
	FB120	RS05	Driving with normal deceleration (normal braking)	E4	E4	$\leq 4\,m/s^2$
Speed	FB040	RS12	Driving at low speed	E3	E4	$0\ km/h \leq v \leq 10\ km/h$
	FB010-030	RS13	Driving at high speed	E3	-	$10\ km/h < v \leq 30\ km/h$
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`:

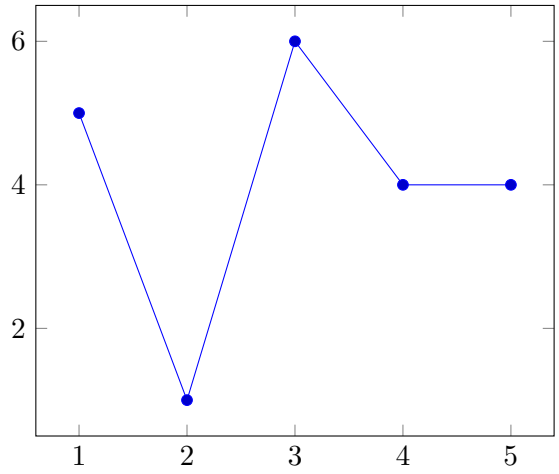

Figure 3.1: A simple x-y graph

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`

3.3 Citations

As one can see in [6], functional safety is difficult.

3.4 How To Use Abbreviations

Automotive Safety Integrity Level, *ASIL*, and *Automotive Safety Integrity Level (ASIL)*

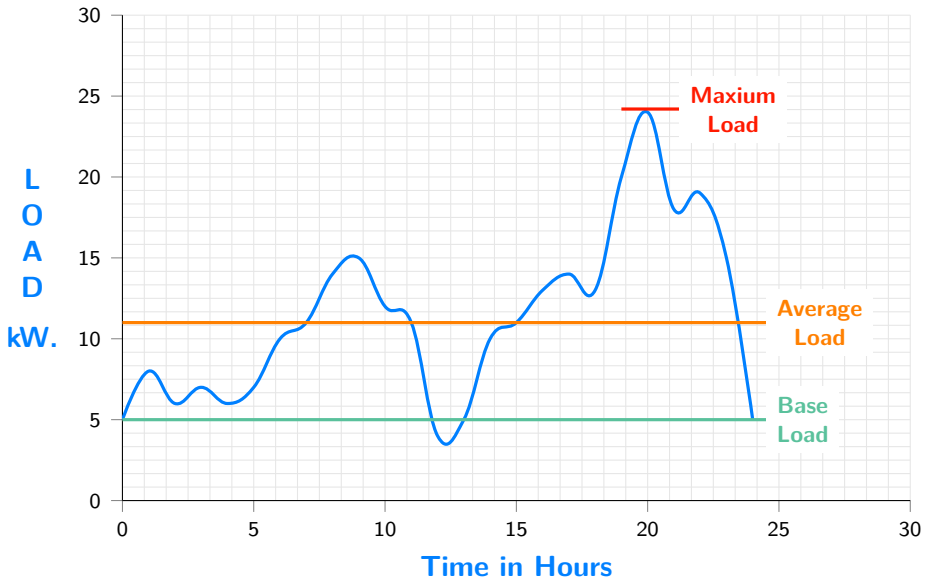

Figure 3.2: An elaborated demonstration of pgfplot capabilities

*C CEN CENELEC DIN*DIN EE *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*

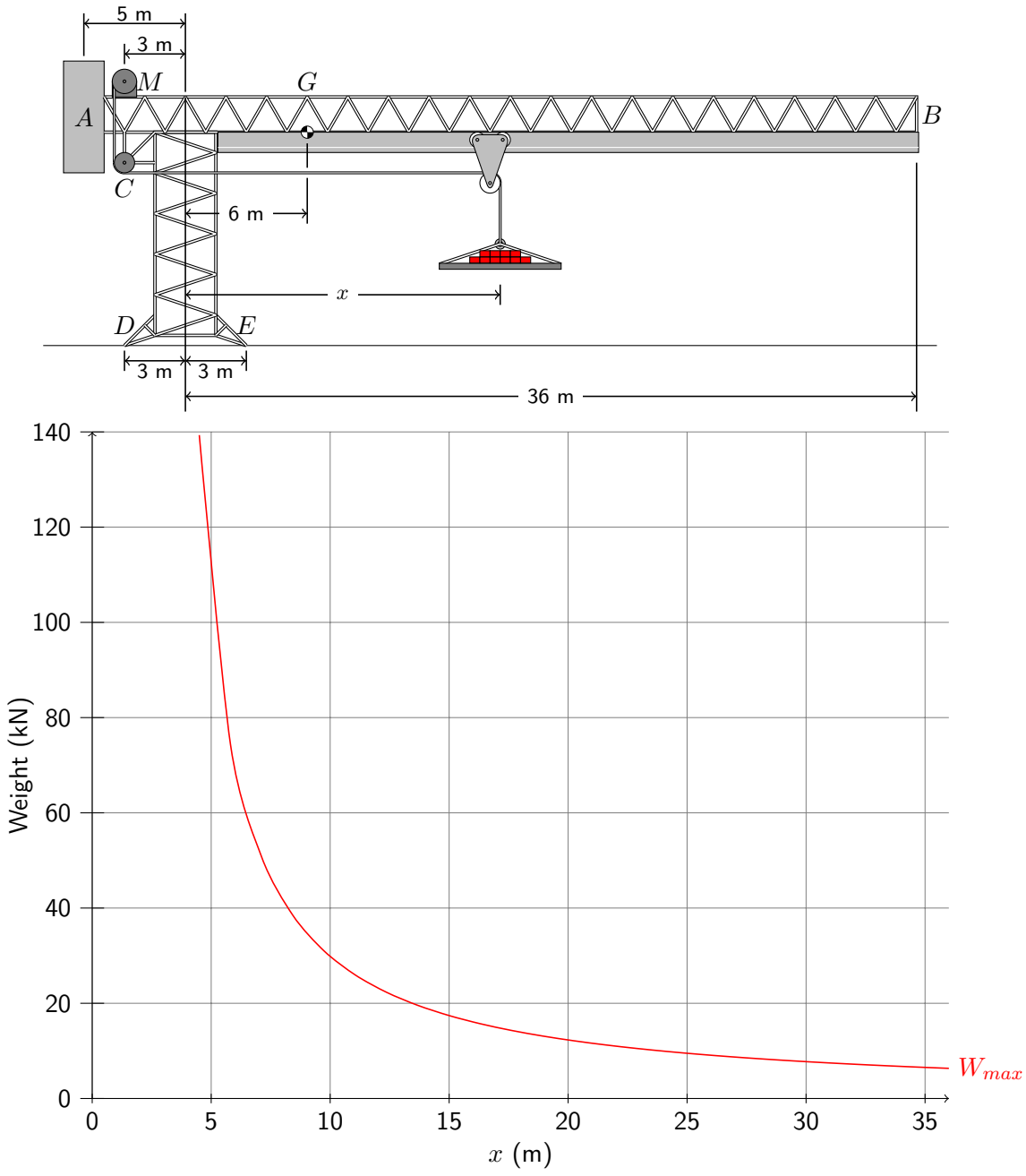

Figure 3.3: Maximum load of a crane

4 chapter

4.1 section

4.1.1 subsection

subsubsection

paragraph

subparagraph

5 Bibliography

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[5] International Standards Organization. *ISO 12100:2010 Safety of machinery – General principles for design – Risk assessment and risk reduction*. en. https://www.iso.org/standard/51528.html. Geneva, CH, Nov. 2010.

[6] International Standards Organization. *ISO 13849-1:2015 Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design*. en. https://www.iso.org/standard/69883.html. Geneva, CH, Dec. 2015.

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[8] Rolf Isermann, ed. *Elektronisches Management Motorischer Fahrzeugantriebe*. de. 2010th ed. Atz/Mtz-Fachbuch. Wiesbaden, Germany: Vieweg+Teubner Verlag, Feb. 2010.

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 11

ASIL Automotive Safety Integrity Level 10

BPMN Business Process Model and Notation 11

C Controllability 11

CEN European Committee for Standardization (French: Comité Européen de Normalisation) 11

CENELEC European Committee for Electrotechnical Standards (fr.: Comité Européen de Normalisation Électrotechnique) 11

DIN German Institute for Standardization (German: Deutsches Institut für Normung) 11

E Exposure 11

EC European Community 11

EMC Electromagnetic Compatibility 11

EN European Standards 11

ETSI European Telecommunications Standards Institute 11

EU European Union 11

F Frequency 11

FBV Vehicle Operation Regulation (German: Fahrzeug-Betriebs-Verordnung) 11

FIT Failure in Time 11

FMEA Failure Mode and Effects Analysis 11

FSR Functional Safety Requirement 11

FTA Fault Tree Analysis 11

FuSa Functional Safety 11

FZV Vehicle Registration Law (German: Fahrzeug-Zulassungsverodnung) 11

IEC International Electrotechnical Commission 11

ISO International Organization for Standardization 11

KBA Federal Motor Transport Authority (German: Kraftfahrt-Bundesamt) 11

OEMs Original Equipment Manufacturers 11

QM Quality Management 11

S Severity 11

StVG Road Traffic Act (German: Straßenverkehrsgesetz) 11

StVO Road Traffic Regulations (German: Straßenverkehrs-Ordnung) 11

StVZO Road Traffic Licensing Regulation (German: Straßenverkehrs-Zulassungs-Ordnung) 11

TÜV Technical Monitoring Association (German: Technischer Überwachungsverein) 11

UNECE United Nations Economic Commission for Europe 11

VDA Association of the Automotive Industry (German: Verband der Automobilindustrie) 11

D Glossary

functional safety is an absence of unreasonable risk due to hazards caused by malfunctioning behaviour of E/E systems 16

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 16

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 16