

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 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

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

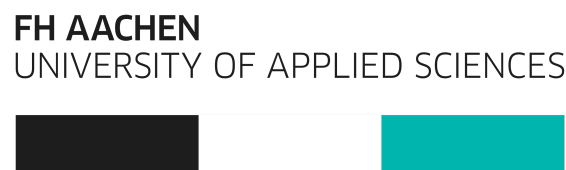


Figure 2.1: The logo of Fachhochschule Aachen

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/>):

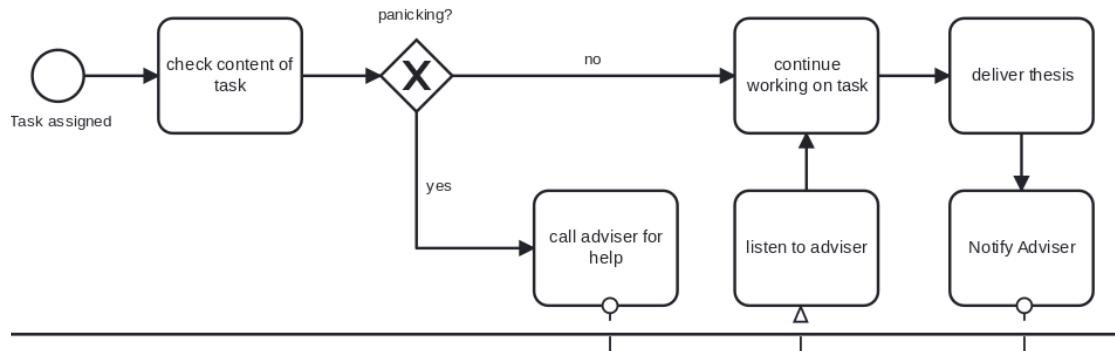


Figure 2.2: A cropped version of fig. 2.3

The complete figure is

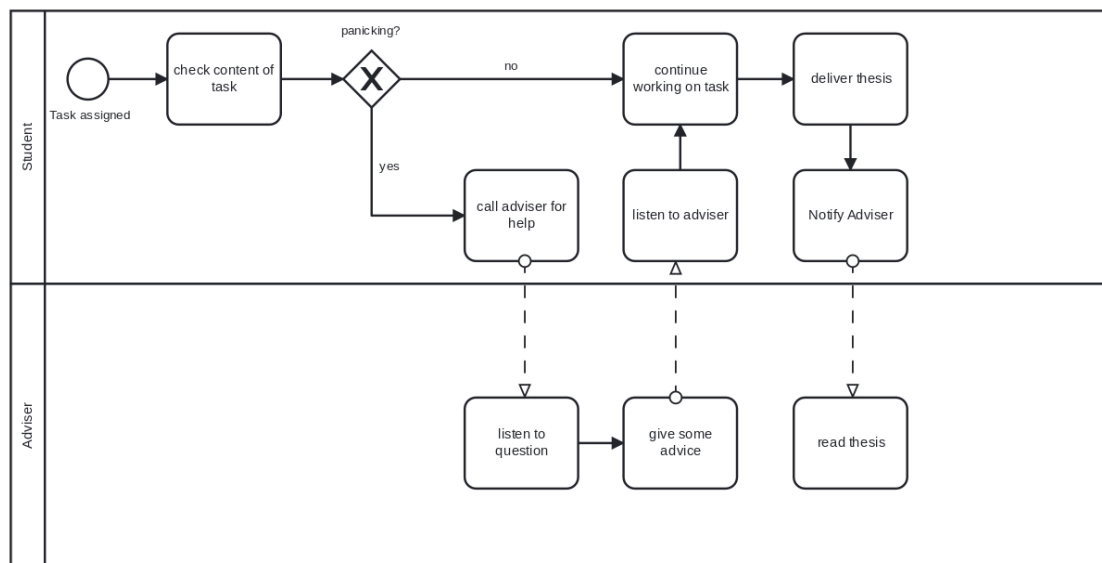


Figure 2.3: The complete image

2.5 Formulas

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

$$T_{j_1 j_2 \dots j_q}^{i_1 i_2 \dots i_p} = T(x^{i_1}, \dots, x^{i_p}, e_{j_1}, \dots, e_{j_q}) \quad (2.1)$$

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

$$\int_0^1 \frac{dx}{e^x} = \frac{e-1}{e} \quad (2.2)$$

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.

$$\frac{\partial \rho}{\partial t} + \text{div}(\rho \mathbf{v}) = 0 \quad (2.3a)$$

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

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

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	$> 1 \text{ m/s}^2$
	FB100	RS04	Accelerating, fast	E2	E3	$> 1 \text{ m/s}^2$
	FB120	RS05	Driving with normal deceleration (normal braking)	E4	E4	$\leq 4 \text{ m/s}^2$
Speed	FB040	RS12	Driving at low speed	E3	E4	$0 \text{ km/h} \leq v \leq 10 \text{ km/h}$
	FB010-030	RS13	Driving at high speed	E3	-	$10 \text{ km/h} < v \leq 30 \text{ km/h}$
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>:

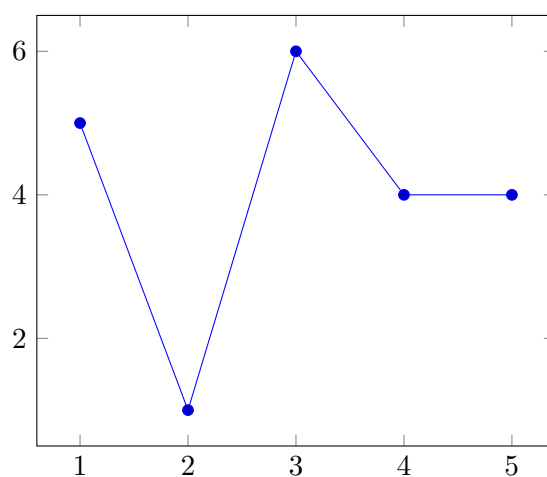


Figure 3.1: A simple x-y graph

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>

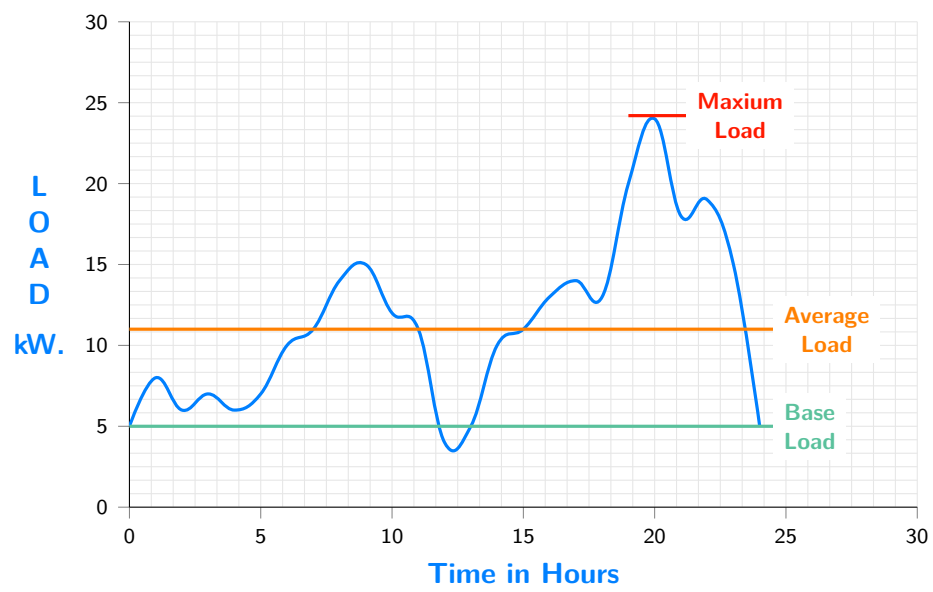


Figure 3.2: An elaborated demonstration of pgfplot capabilities

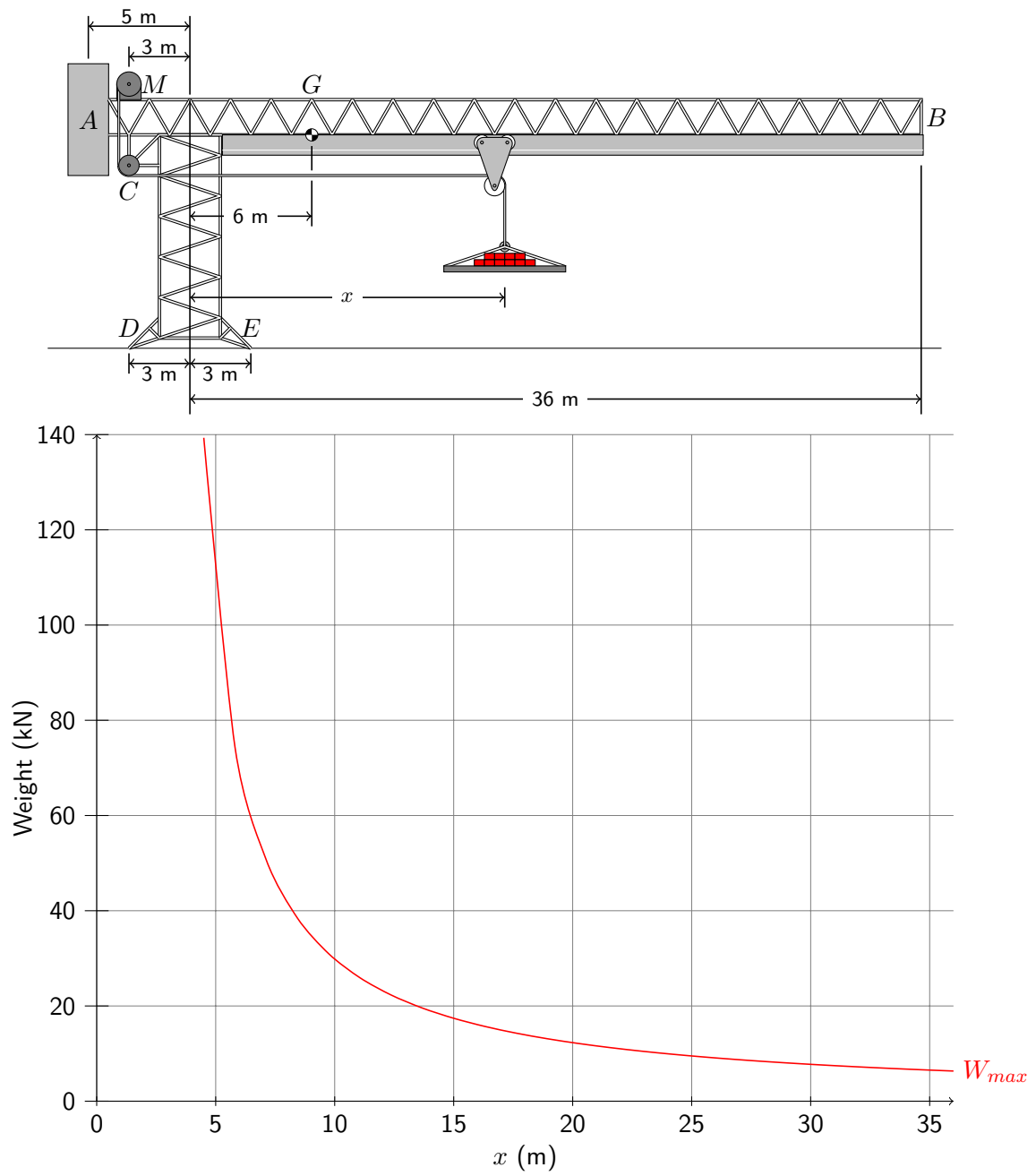


Figure 3.3: Maximum load of a crane

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)

*C CEN CENELEC DINDIN 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*

4 chapter

4.1 section

4.1.1 subsection

subsubsection

paragraph

subparagraph

5 Bibliography

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- [2] J Francke and J Visser. "Internet shopping and its impacts on mobility". In: *25th World Road Congress (PIARC)*. 2015, pp. 2–6.
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- [7] International Standards Organization. *ISO 13849-2:2012 Safety of machinery – Safety-related parts of control systems – Part 2: Validation*. en. <https://www.iso.org/standard/53640.html>. Geneva, CH, Oct. 2012.
- [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

Sed mattis, erat sit amet gravida malesuada, elit augue egestas diam, tempus scelerisque nunc nisl vitae libero. Sed consequat feugiat massa. Nunc porta, eros in eleifend varius, erat leo rutrum dui, non convallis lectus orci ut nibh. Sed lorem massa, nonummy quis, egestas id, condimentum at, nisl. Maecenas at nibh. Aliquam et augue at nunc pellentesque ullamcorper. Duis nisl nibh, laoreet suscipit, convallis ut, rutrum id, enim. Phasellus odio. Nulla nulla elit, molestie non, scelerisque at, vestibulum eu, nulla. Ut odio nisl, facilisis id, mollis et, scelerisque nec, enim. Aenean sem leo, pellentesque sit amet, scelerisque sit amet, vehicula pellentesque, sapien.

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-Zulassungsverordnung) 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 18

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 18

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 18