# Title

Optional Subtitle

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Optional Subtitle

## Dissertation

for the purpose of obtaining the degree of doctor
at Delft University of Technology
by the authority of the Rector Magnificus, prof. dr. ir. T.H.J.J. van der Hagen,
chair of the Board for Doctorates
to be defended publicly on
[date= weekday (word) day (number), month (word) year (number)] at
[hh:mm (number)] o'clock

by


## Albert EINSTEIN

[highest academic title, name university, country]
born in [town/city, country of birth]

This dissertation has been approved by the promotors.

Composition of the doctoral committee:

| | |
|---|---|
| Rector Magnificus, | chairperson |
| Prof. dr. A. Kleiner, | Delft University of Technology, *promotor* |
| Dr. A.A. Aaronson, | Delft University of Technology, *copromotor* |

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*Other members:*

| | |
|---|---|
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| Dr. ir. Q. de Zwart, | Delft University of Technology |

Prof. dr. ir. J. de Wit of Delft University of Technology has contributed greatly to the preparation of this dissertation.


*Keywords:* . . .

*Printed by:* Johannes Gutenberg

*Cover by:* Beautiful cover art that captures the entire content of this thesis in a single illustration.



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*Einsteins work is to make physics more philosophical (in a good sense).*

Hendrik Antoon Lorentz

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# SUMMARY

Summary in English. . .

# SAMENVATTING

Samenvatting in het Nederlands. . .

# PREFACE

Preface goes here. This chapter is optional.

This is the TU Delft dissertation template for LaTeX. The source files can be found at GitLab[1]. It is designed to work with all versions of LaTeX. However, if you want to strictly adhere to the TU Delft corporate design style[2], you need to use XeLaTeX, as it supports TrueType and OpenType fonts. This is needed to get Arial working.

This Overleaf template only supports the combination of Arial[3] with Roboto Slab[4] or Roboto[5] with Roboto Slab. The GitLab project mentioned earlier supports the font Utopia[6] using the LaTeX package Fourier[7] as well, and has many more features which were removed here for the sake of simplicity.

*Albert Einstein*
*Delft, January 2013*

[1] https://gitlab.com/novanext/tudelft-dissertation
[2] https://www.tudelft.nl/en/tu-delft-corporate-design
[3] https://en.wikipedia.org/wiki/Arial
[4] https://fonts.google.com/specimen/Roboto+Slab
[5] https://fonts.google.com/specimen/Roboto
[6] https://fonts.adobe.com/fonts/utopia
[7] https://ctan.org/pkg/fourier

# 1

# INTRODUCTION

## Albert Einstein

*Nature and nature's laws lay hid in the night;*
*God said 'Let Newton be!' and all was light.*

Alexander Pope

*It did not last: the devil shouting 'Ho.*
*Let Einstein be!' restore the status quo.*

Sir John Collings Squire

*Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.*

Parts of this chapter have been published in Annalen der Physik **324**, 289 (1906) [1].

1

This document is intended to be both an example of the TU Delft dissertation template for LaTeX, as well as a short introduction to its use. It is not intended to be a general introduction to LaTeX itself,[1] and we will assume the reader to be familiar with the basics of creating and compiling documents.

Instructions on how to use this template under Windows and Linux, and which LaTeX packages are required, can be found in `README.txt`.

## 1.1. DOCUMENT STRUCTURE

Since a dissertation is a substantial document, it is convenient to break it up into smaller pieces. In this template we therefore give every chapter its own file. The chapters (and appendices) are gathered together in `dissertation.tex`, which is the master file describing the overall structure of the document.

`dissertation.tex` starts with the line

```
\documentclass{_style/dissertation}
```

which loads the dissertation template. The template is based on the LaTeX `book` document class and stored in `dissertation.cls`. The document class accepts several comma-separated options. By default, hyperlinks are shown in cyan, which is convenient when reading the dissertation on a computer, but can be expensive when printing. They can be turned black with the `print` option. This will also turn the headers dark gray instead of cyan. Moreover, it will add a 3 mm bleed around the page including crop marks. This will help the printer with the thumb indices, since they run right up to the page borders. Finally, the `fourier` option can be used to override the automatic font selection (see below).

A dissertation is a big document, which makes it easy to miss warnings about the layout in the LaTeX output. In order to locate problem areas, add the `draft` option to the `\documentclass` line. This will display a vertical bar in the margins next to the paragraphs that require attention.

The contents of the dissertation are included between the `\begin{document}` and `\end{document}` commands, and split into three parts by

1. `\frontmatter`, which uses Roman numerals for the page numbers and is used for the title page and the table of contents;
2. `\mainmatter`, which uses Arabic numerals for the page numbers and is the style for the chapters;

[1] We recommend http://en.wikibooks.org/wiki/LaTeX as a reference and a starting point for new users.

3. \appendix, which uses letters for the chapter numbers, starting with 'A'.

The title page is defined in title.tex in the title folder and included verbatim with \include{title/title},[2] (see below). Additionally, it is possible to include a preface, containing, for example, the acknowledgements. An example can be found in preface.tex. The table of contents is generated automatically with the \tableofcontents command. Chapters are included after \mainmatter and appendices after \appendix. For example, \include{introduction/introduction} includes introduction/introduction.tex, which contains this introduction.

## 1.2. TITLE PAGE

The title pages are defined in title/title.tex, which you will have to modify according to your needs. Note that these pages are subject to the requirements of the *promotieregelement* and cannot be changed at will. The title page may be written in the English or Dutch language; preferably in the same language as the dissertation. Apart from the names and dates, most of the text is dictated literally.

Since the thesis title and name of the author appear several times throughout the document (on the title page, but also in, *e.g.*, the preface and cv), special commands are provided so they only have to be specified once. The title (and optional subtitle) can be specified with

```
\title[Optional subtitle]{Title}
```

The name of the author is specified with

```
\author{First name}{Last name}
```

Note that the first and last name are separate arguments, since they may be printed in different font shapes. The \title and \author commands also ensure that the title and author appear in the metadata of the final PDF.

See title/title.tex for detailed documentation on the comment and layout of the title pages. Logos of institutes that have contributed financially to the dissertation may be included on reverse side of the title page. A few example logos can be found in the _logos folder.

[2] Note that it is not necessary to specify the file extension.

1

## 1.3. CHAPTERS

Each chapter has its own file. For example, the LaTeX source of this chapter can be found in `introduction/introduction.tex`. A chapter starts with the command

```
\chapter{Chapter title}
```

This starts a new page, prints the chapter number and title and adds a link in the table of contents. If the title is very long, it may be desirable to use a shorter version in the page headers and the table of contents. This can be achieved by specifying the short title in brackets:

```
\chapter[Short title]{Very long title with
many words which could not possibly fit on
one line}
```

The command `\frontmatter` sets page numbering to lower case Roman, and removes the chapter numbering. `\mainmatter` sets both numberings to Arabic ('normal') numbers. `\appendix` sets the chapter numbering to upper case Latin letters. `\backmatter` removes the chapter numbering again.

If (parts of) the chapter have already been published elsewhere, it is customary to add a reference. This can be done with the special unnumbered footnote command `\blfootnote`. For example,

```
\blfootnote{Parts of this chapter have been
published in Annalen der Physik \textbf{324},
289 (1906)
\autocite{Einstein1906}.}
```

generates the footnote at the beginning of this chapter. Because this footnote is unnumbered, the `hyperref` package may throw a warning, which safely be ignored.

If multiple people have contributed significantly to this chapter, they can be lister with the `\authors` command.[3] This can be followed by a quotation using `\epigraph` as shown above. Finally, it is customary for a dissertation to include an abstract for every chapter (except perhaps the introduction). This can be accomplished with the `abstract` environment. The abstract should be followed by `\newpage` to start the chapter text on a new page.

In a dissertation, each chapter has its own list of references. These can be generated with the special command `\references{dissertation}` from `dissertation.bib` at the end of the chapter. Note that this means that you need to run a command like

[3] de Lange-Achternaam [2] would be disappointed if his contribution were not acknowledged.

`biber chapter-1/chapter-1` for each chapter. The template will automatically generate clickable hyperlinks if a URL or DOI (digital object identifier) is present for the reference. Although it is possible to manage the bibliography by hand, we recommend using Zotero[4], Mendeley[5], EndNote, or JabRef[6].

Chapters are subdivided into sections, subsections, subsubsections, and, optionally, paragraphs and subparagraphs. All can have a title, but only sections and subsections are numbered. As with chapters, the numbering can be turned off by using `\addsec{...}` instead of `\section{...}`, and similarly for the subsection.

## 1.4. \SECTION{...}

### 1.4.1. \SUBSECTION{...}

#### \SUBSUBSECTION{...}

**\paragraph{...}** Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

\subparagraph{...} Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

## 1.5. FONTS AND COLORS

The fonts used by this template can be chosen via a document-class option. If you leave the option (as given in the template) `\documentclass[fourier]{_style/dissertation}`, Latex will use Utopia for titles and the main text, Fourier for math, and Latin Modern for sans-serif and monospaced text. If, on the other hand, you remove this option and use `\documentclass{_style/dissertation}`, you will get Roboto Slab for titles, Roboto (if you use PdfLatex) or Arial (if you use XeLatex or LuaLatex) for the main text, Courier New for monospace and Arev[7] for math. This is in line with the current Corporate style of the TU Delft.

This template supports the use of drop caps, a large colored initial at the beginning of a chapter or section, via the `\dropcap` command:

[4] Open source, desktop and online version available from https://www.zotero.org

[5] Desktop and online version available from https://www.mendeley.com/

[6] Open source, specialised `*.bib` file editor; desktop only, available from http://jabref.sourceforge.net/

[7] A version of Bitstream Vera Sans with LaTeX math support

1

```
\dropcap{L}{orem} ipsum...
```

The first argument is the capital that will be printed on two lines (in the title color), and the second argument is the rest of the word. Depending on the font, the latter may be printed in small caps.

The corporate colors of the TU Delft are cyan, black and white, available, respectively, via `\textcolor{tud primary}{...}`, `\textcolor{black}{...}` and `\textcolor{white}{...}`. Apart from these three, the house style defines the following basic colors, that can be used via `\textcolor{tud`*colorname*`}{...}`:

- **navy**
- **topaz**
- **blue**
- **purple**
- **pink**
- **shiraz**
- **grapefruit**
- **orange**
- **yellow**
- **green**
- **teal**

ISO 80 000 [3] defines that in mathematical typesetting, only variables should be italised. This means that constants (numbers, units, functions such as $J_0$, sin etc.) and other text should be upright. A more accessible source for these typesetting rules is the SI brochure [4, §2.3.1]. A few examples of correctly typeset math are shown below. The packages `siunitx` and `amsmath` (here loaded via `mathtools`) makes typesetting math correctly significantly easier.

The rotational speed of the earth around the sun is approximately $\Omega_{\text{earth}} = 2\pi\,\text{rad}\,\text{year}^{-1} \approx 0.1991\,\mu\text{rad}\,\text{s}^{-1}$.[8]

The unnormalised sinc function is defined as follows:

$$\operatorname{sinc} x = \begin{cases} 0 & \text{where } x = 0 \\ 1/\sin x & \text{else} \end{cases} \tag{1.1}$$

The following equation, commonly known as Euler's identity, consists of constants numbers only, and hence all symbols should be set upright:

$$e^{i\pi} + 1 = 0 \tag{1.2}$$

[8] In TEX, math mode is *toggeled* using `$...$`, which is still what many people use. In LATEX, we can do this too, but we can also use a clear beginning and end of math mode, as `\(...\)`, which will make your code and possible error messages easier to understand.

Here's a nice equation used as a demo by the LaTeX font catalogue[9]

$$\boldsymbol{B}(P) = \frac{\mu_0}{4\pi} \int \frac{\boldsymbol{I} \times \hat{r}'}{r'^2} \mathrm{d}l = \frac{\mu_0}{4\pi} I \int \frac{\mathrm{d}\boldsymbol{l} \times \hat{r}'}{r'^2} \tag{1.3}$$

We would like to acknowledge Kelvin [5] for his nice temperature scale, and the challenge posed by citing his name in a sensible manner.

## 1.6. ROBOTO

The TU Delft style prescribes Roboto Slab together with Arial.[10] Since Arial is not available in pdfLaTeX, we will use regular Roboto instead. Not surprisingly, this looks great together with Roboto Slab.

Roboto (Sans) has a dual nature. It has a mechanical skeleton and the forms are largely geometric. At the same time, the font features friendly and open curves. While some grotesks distort their letterforms to force a rigid rhythm, Roboto doesn't compromise, allowing letters to be settled into their natural width. This makes for a more natural reading rhythm more commonly found in humanist and serif types.

Roboto Serif is designed to create a comfortable and frictionless reading experience. Minimal and highly functional, it is useful anywhere (even for app interfaces) due to the extensive set of weights and widths across a broad range of optical sizes. While it was carefully crafted to work well in digital media, across the full scope of sizes and resolutions we have today, it is just as comfortable to read and work in print media.

Roboto has several styles of digits:

- 'Normal' lining numbers
  - Proportional: 1234567890
  - Tabular: 1234567890
- Ols style numbers
  - Proportional: 1234567890
  - Tabular: 1234567890

Furthermore, the font is available in many different weights:

- robotoThin
- robotoLight
- robotoRegular
- **robotoMedium**
- **robotoBold**
- **robotoBlack**

[9] https://tug.org/FontCatalogue/
[10] https://www.tudelft.nl/huisstijl/bouwstenen/typografie

1

The documentation for the LaTeX package can be found on ctan[11]; The original truetype fonts are available at google[12] and are licensed under the Apache or OFL licenses; the texts may be found in the doc directory. The opentype and type1 versions were created using fontforge and cfftot1. The support files were created using autoinst and are licensed under the terms of the LaTeX Project Public License. The maintainer of this package is Bob Tennent (rdt at cs.queensu.ca)

[11] https://ctan.org/pkg/roboto
[12] http://www.google.com/webfonts

# REFERENCES


[1] A. Einstein. “Eine neue Bestimmung der Moleküldimensionen”. In: *Annalen der Physik* 324.2 (1906), pp. 289–306. doi: 10.1002/andp.19063240204.

[2] A. B. C. D. van de Lange-Achternaam Jr. *Private communication*. 1983.

[3] ISO/TC 12 Quantities and units. *ISO 80 000-1:2009: Quantities and units – Part 1: General*. Tech. rep. ISO, 2009. url: https://www.iso.org/standard/30669.html.

[4] Bureau Internationaldes des Poids et Mesures. *The International System of Units (SI)*. 2019. url: https://www.bipm.org/en/publications/si-brochure/.

[5] W. Thomson Baron Kelvin of Largs. “On an absolute thermometric scale founded on Carnot’s theory of the motive power of heat, and calculated from Regnault’s observations.” In: *Philosophical Magazine* (Oct. 1848). doi: 10.1017/cbo9780511996009.040.

# 2

# CONCLUSION

This is a concluding chapter explaining the scientific and technical implications for society of the research findings in considerable detail. We would also like to remind the reader of our outstanding results, visualised elegantly in fig. 2.1. This reference was inserted using the package 'cleveref'.

Furthermore, we want to boast about the relevance to society. A list of of all todonotes can be generated (preferably at the very end of the document) using the command `\listoftodos`. If you want to include more than just a few words of computer code, it is highly recommended to use either the package `listings` or `minted` to get syntax highlighting, amongst others, instead of the command `\verb`.

'todonotes' like these can be used to keep track of unfulfilled ambitions. If not all ambitions are fulfilled before the document is handed in, they can be hidden in the final version by adding the document option 'final'.


Figure 2.1.: This graphic compellingly sums up my research.

# BIBLIOGRAPHY


[1] A. Einstein. “Eine neue Bestimmung der Moleküldimensionen”. In: *Annalen der Physik* 324.2 (1906), pp. 289–306. doi: 10.1002/andp.19063240204.

[2] A. Einstein. “Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?” In: *Annalen der Physik* 323.13 (1905), pp. 639–641. doi: 10.1002/andp.19053231314.

[3] A. Einstein. “Über die von der molekularkinetischen Theorie der Wärme geforderte Bewegung von in ruhenden Flüssigkeiten suspendierten Teilchen”. In: *Annalen der Physik* 322.8 (1905), pp. 549–560. doi: 10.1002/andp.19053220806.

# A

# LaTeX QUALITY ASSURANCE

Before handing your work over to others, there are a few things you can do as a basic quality assurance (QA):

- Check your output for missing references (indicated by a double question mark, you may use `pdftotext` to automate this) or look at the blg and log files, where these will be indicated as well
- Use a spelling checker
  - Overleaf checks your spelling by default.
  - In TeXstudio you can set the spelling check at: TeXstudio Options → Configure TeXstudio. . . → Language Checking.
  - You can use Aspell (`http://aspell.net/`) to check the spelling in *.tex files from the command line.
  - If all else fails, you can open a tex file in MS Word and use their spelling and grammar checker
- Check consistency of capitalisation in the table of contents
- Consistency in bibliography
  - Capitalisation of titles
  - Notation of author names
  - Abbreviation and spelling of journals
  - Some Dutch names are capitalized differently depending on wether they are preceded by initials or given names.[1]. For this, you may use the biblatex command `\autocap`. The same holds for Arabic names, but not, for instance Belgian or German.

[1] https://onzetaal.nl/taalloket/hoofdletters-namen-nederland

A

- Search through your code for words you have likely misspelled (or mix British and American spelling)
  - In Windows: `ls -R *.tex | sls 'teh'`
  - In Linux: `grep -iR 'teh' *.tex`
- Both of these can search for regular expressions (regex), e.g.:
  - `"\s[\"']\w"` (grep) or `'\s[''"]\w'` (sls): A space, newline, etc. followed by closing single or double quotes, followed by a word character (e.g. a letter). Most likely, these should be replaced by opening quotes (‘ or “).
  - `"\b(\w+) \1\b"` repeated word
  - Word starting with two capitals:
    - In Windows:
      `ls *.bib | sls -CaseSensitive "\b[A-Z][A-Z]+[`
    - In Linux: `grep -PR "\b[A-Z][A-Z]+[a-z]"`
  - In your *.bib files:
    - `"author\s*=.*\w\.\w"` initial without following space.
    - `"author\s*=.*\b\w\s\w"` initial without following period.
    - `"url\s*=.*doi"` DOI given as URL instead of DOI directly
    - `"doi\s*=.*doi\.org"` DOI including ‘doi.org’
    - `"[Uu]rl.*[^\\]#"` Forgot to escape # in URL
  - Depending on your citation style:
    - space before `cite`
    - no space before `cite`
    - parenthesis around `cite`
    - no parenthesis around `cite`
    - ...
  - `grep -rnPiR "[^\x09\x0D\x20-\x7E\xBF-\xFF]" *.te` (or `*.bib` ‘weird’ characters (that may look normal) probably caused by copying something from the a pdf file, which might cause LaTeX to error.
  - When not using ’french spacing’: patterns which likely confuse periods indicating an abbreviation with end of sentence and vice versa.

- Check your output for missing references (indicated by a double question mark, you may use `pdftotext` to automate this) or look at the log files, where these will be indicated as well
- ChkTeX (https://www.ctan.org/pkg/chktex) is written specifically to search for common errors in *.tex files
- All of these suggestions work best when automated, for instance in a Makefile. Doing it by hand is way too boring, so you are very likely to forget running some of these tests on the final version of your thesis.

# EPILOGUE

This is an optional epilogue.

# ACKNOWLEDGEMENTS

This is an optional chapter containing acknowledgements.

# CURRICULUM VITæ

## Albert Einstein

| | |
|---|---|
| 14-03-1879 | Born in Ulm, Germany. |

### EDUCATION

| | |
|---|---|
| 1892–1896 | Grammar School<br>Luitpold Gymnasium, München (1892–1895)<br>Aurau, Switzerland (1895–1896) |
| 1896–1900 | Undergraduate in Mathematics & Physics<br>Eidgenössische Polytechnische Schule Zürich |
| 1905 | PhD. Physics<br>Eidgenössische Polytechnische Schule Zürich<br>*Thesis:* Eine neue Bestimmung der Moleküldimensionen<br>*Promotor:* Prof. dr. A. Kleiner |

### AWARDS

| | |
|---|---|
| 1922 | Nobel Prize in Physics |
| 1925 | Copley Medal |
| 1929 | Max Planck Medal |
| 1999 | Time magazine’s person of the century |

# LIST OF PUBLICATIONS


3. A. Einstein. “Eine neue Bestimmung der Moleküldimensionen”. In: *Annalen der Physik* 324.2 (1906), pp. 289–306. doi: 10.1002/andp.19063240204

2. A. Einstein. “Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?” In: *Annalen der Physik* 323.13 (1905), pp. 639–641. doi: 10.1002/andp.19053231314

1. A. Einstein. “Über die von der molekularkinetischen Theorie der Wärme geforderte Bewegung von in ruhenden Flüssigkeiten suspendierten Teilchen”. In: *Annalen der Physik* 322.8 (1905), pp. 549–560. doi: 10.1002/andp.19053220806