

TITLE

OPTIONAL SUBTITLE

TITLE

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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.

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



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<https://repository.tudelft.nl/>.

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 GitLab¹. It is designed to work with all versions of LaTeX. However, if you want to strictly adhere to the TU Delft corporate design style², 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 Arial³ with Roboto Slab⁴ or Roboto⁵ with Roboto Slab. The GitLab project mentioned earlier supports the font Utopia⁶ using the L^AT_EX package Fourier⁷ 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 adipiscing 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].

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;
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

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

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

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 *promotiereglement* 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.

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)
\cite{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 listed with the `\authors` command. 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 `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 Zotero³, Mendeley⁴, EndNote, or JabRef⁵.

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 adipiscing 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.

³Open source, desktop and online version available from <https://www.zotero.org>

⁴Desktop and online version available from <https://www.mendeley.com/>

⁵Open source, specialised *.bib file editor; desktop only, available from <http://jabref.sourceforge.net/>

`\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 documentclass 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 Arev⁶ 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:

```
\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 80000 [2] defines that in mathematical typesetting, only variables should be italicised. 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 [3, §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.

⁶A version of Bitstream Vera Sans with \LaTeX math support

The rotational speed of the earth around the sun is approximately $\Omega_{\text{earth}} = 2\pi \text{radyear}^{-1} \approx 0.1991 \mu\text{rads}^{-1}$.⁷

The unnormalised sinc function is defined as follows:

$$\text{sinc } x = \begin{cases} 0 & \text{where } x = 0 \\ 1/\sin x & \text{else} \end{cases} \quad (1.1)$$

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

$$e^{i\pi} + 1 = 0 \quad (1.2)$$

Here's a nice equation used as a demo by the \LaTeX font catalogue⁸

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

1.6. FOURIER

The package `fourier` loads the Utopia font in \LaTeX . Use this information to your advantage when creating your figures Υ .

☞ It has a more classical feel than the TU corporate style.

☞ It offers an upright `\patial: ð`

☞ It has some nice ☞ ornaments ☞

☞ It offers the official euro symbol €, which you may use instead of the default €, if you like.

☞ We few, we happy few, we band of brothers; ☞ For he to-day that sheds his blood with me ☞ Shall be my brother; be he ne'er so vile, ☞ This day shall gentle his condition.

△ this may be over the top.

⁷In \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.

⁸<https://tug.org/FontCatalogue/>

REFERENCES

- [1] A. Einstein. “Eine neue Bestimmung der Moleküldimensionen”. In: *Annalen der Physik* 324.2 (1906), pp. 289–306. DOI: [10.1002/andp.19063240204](https://doi.org/10.1002/andp.19063240204).
- [2] ISO/TC 12 Quantities and units. *ISO 80000-1:2009: Quantities and units – Part 1: General*. Tech. rep. ISO, 2009. URL: <https://www.iso.org/standard/30669.html>.
- [3] Bureau International des Poids et Mesures. *The International System of Units (SI)*. 2019. URL: <https://www.bipm.org/en/publications/si-brochure/>.

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 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`’ files 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`’.

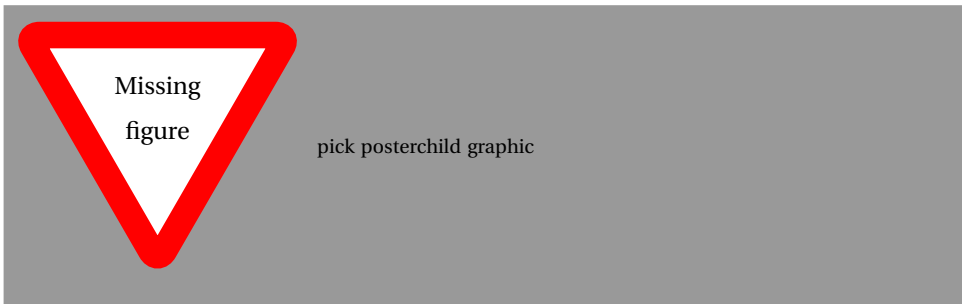
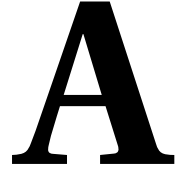


Figure 2.1.: This graphic compellingly sums up my research.

BIBLIOGRAPHY

- [1] A. Einstein. “Eine neue Bestimmung der Moleküldimensionen”. In: *Annalen der Physik* 324.2 (1906), pp. 289–306. DOI: [10.1002/andp.19063240204](https://doi.org/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](https://doi.org/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](https://doi.org/10.1002/andp.19053220806).



L^AT_EX 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 T_EXstudio you can set the spelling check at:
T_EXstudio Options → Configure T_EXstudio... → 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
- 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]+[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]r1.*[^\#]" 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]" *.tex` (or *.bib 'weird' characters (that may look normal) probably caused by copying something from the a pdf file, which might cause L^AT_EX 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
 - ChkT_EX (<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
Luitpold Gymnasium, München (1892–1895)
Aarau, Switzerland (1895–1896)

1896–1900 Undergraduate in Mathematics & Physics
Eidgenössische Polytechnische Schule Zürich

1905 PhD. Physics
Eidgenössische Polytechnische Schule Zürich
Thesis: Eine neue Bestimmung der Moleküldimensionen
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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1002/andp.19053220806)