



Degree in Industrial Technologies

Bachelor's or Master's final project

This is the title of your project

Author  
Author's Name

Supervised by  
Prof. Dr. Mc Great<sup>a</sup>  
Prof. Dr. Mc Amazing<sup>b</sup>

<sup>a</sup> Institute of Greatness

<sup>b</sup> Amazing University

München 2022



Thank yous

And other important information



## **Abstract**

Abstract content



# Contents

<b>List of Symbols</b>	<b>xv</b>
<b>Acronyms</b>	<b>xvii</b>
<b>1 An overview of L<sup>A</sup>T<sub>E</sub>X</b>	<b>1</b>
1.1 Basics of L <sup>A</sup> T <sub>E</sub> X	1
1.1.1 Text styles	1
1.1.2 Structure of a L <sup>A</sup> T <sub>E</sub> X document	2
1.1.3 Structure of a L <sup>A</sup> T <sub>E</sub> X paragraph	3
1.1.4 Enumerations, bullet points and descriptions in L <sup>A</sup> T <sub>E</sub> X	3
1.1.5 Mathematical notation	5
1.1.6 References	7
1.1.7 Bibliography	7
1.1.8 Tables, images and floating environments	8
1.2 Glossaries	12
1.3 Automatic loading and formatting of code	13
1.4 Creating beautiful plots in 2D and 3D	13
1.5 Automatic formatting of table data	13
1.6 Some extra bits of knowledge	15
1.6.1 How do I prevent L <sup>A</sup> T <sub>E</sub> X from splitting a word, number, etc?	15
1.6.2 Can I put two figures, tables, etc; side to side?	15
1.6.3 How can I edit graphics in L <sup>A</sup> T <sub>E</sub> X?	17
<b>Bibliography</b>	<b>21</b>
<b>A This is an appendix</b>	<b>23</b>





# List of Figures

1.1	Overview of FEM mesh used for the final analysis. . . . .	11
1.2	FEM boundary conditions. . . . .	18



# List of Tables

1.1	Text styles in <code>L<sup>A</sup>T<sub>E</sub>X</code> . . . . .	2
1.2	Different reference mechanisms. . . . .	7
1.3	Example of a table. . . . .	12
1.4	Glossary and acronym types. . . . .	13
1.5	Automatically formatted table using <code>pgfplotstable</code> . . . . .	15
1.6	Simulated steps and their boundary conditions. . . . .	19



# Listings



# List of Algorithms





# List of Symbols

Notation	Description
test	This is a test entry for glossaries



# Acronyms

Notation	Description	Page List
BC	Boundary Condition	19
FEM	Finite Element Method	11, 13
HRP	Hot Radial Pressing	19



# Chapter 1

## An overview of L<sup>A</sup>T<sub>E</sub>X

In this section, a few basic tools will be presented. In following sections more advance functionality and complex tools will be showcased. **Use this guide as an example and to your advantage!**

**IMPORTANT:** this template uses LuaL<sup>A</sup>T<sub>E</sub>X, a modern L<sup>A</sup>T<sub>E</sub>X engine. You should setup your editor to use LuaL<sup>A</sup>T<sub>E</sub>X, otherwise it will not be able to generate the document. Overleaf, for example, does not change the L<sup>A</sup>T<sub>E</sub>X engine automatically, so you have to do it yourself (it is very easy!).

**IMPORTANT:** read the documentation of the packages that you will use! Also, read general documentation about L<sup>A</sup>T<sub>E</sub>X! While the following guide below explains some of the most basic and cooler topics of L<sup>A</sup>T<sub>E</sub>X, the explanations are swallow. I do not cover details nor issues that may appear and how to fix them. Some really good resources are:

- [L<sup>A</sup>T<sub>E</sub>X's Wikibook](#)
- [Overleaf's L<sup>A</sup>T<sub>E</sub>X resources](#)
- [The not so short introduction to L<sup>A</sup>T<sub>E</sub>X](#) book
- [The packages' manuals!](#)
- Any searh engine.

### 1.1 Basics of L<sup>A</sup>T<sub>E</sub>X

#### 1.1.1 Text styles

The following table showcases some of the more common text styles in L<sup>A</sup>T<sub>E</sub>X.

Style	Code	Ouput
Quotes	<code>``Quotes''</code>	“Quotes”
Boldface	<code>\textbf{Boldface}</code>	<b>Boldface</b>
Italics	<code>\textit{Italics}</code>	<i>Italics</i>
Emphasis	<code>\emph{Emphasis}</code>	<i>Emphasis</i>
Underline	<code>\underline{Underline}</code>	<u>Underline</u>
Typewriter	<code>\texttt{Typewriter}</code>	Typewriter
Small caps	<code>\textsc{small caps}</code>	SMALL CAPS
Mathematical	<code>\$\text{Mathematical}^{\pi\cdot i}\$</code>	$\text{Mathematical}^{\pi\cdot i}$
$\LaTeX$ Comments	<code>% Some text</code>	

Table 1.1: Text styles in  $\LaTeX$ .

### 1.1.2 Structure of a $\LaTeX$ document

For this template, which is based in the `book` class, we have the following major sections:

1. `\part{}`: Parts are fully self-contained portions of information. They leave a full blank page with only the title of the part. **This is not used in this template and not recommended!**
2. `\chapter{}`: Your normal chapters, as you can see above. We are in the “*An overview of  $\LaTeX$ .*”
3. `\section{}`: Normal sections for a chapter. We are in “*Basics of  $\LaTeX$ .*”
4. `\subsection{}`: Subsections. We are in “*Structure of a  $\LaTeX$  document.*”
5. `\subsubsection{}`: Subsubsections. This level tends to be quite deep and will most likely not appear in the index unless we include `\setcounter{secnumdepth}{3}`<sup>1</sup> in the preamble<sup>2</sup>.
6. `\paragraph{}`: One step deeper. By default paragraphs are not numbered.

You just have to write what you want between the `{}` for each command, and  $\LaTeX$  does the rest. It typsets the titles/sections, it adds them to the table of contents and numbers them consistently!

---

<sup>1</sup>There is also `\tocdepth`, which only affects the Table of Contents.

<sup>2</sup>The preamble is the part before `\begin{document}`, basically, the setup section.

### 1.1.3 Structure of a $\text{\LaTeX}$ paragraph

$\text{\LaTeX}$  gives us full control on how paragraphs appear in our text, but it is not obvious to know how to control such appearance.

Paragraphs can be separated by a simple empty line between themselves, with a double backslash `\` or both. However, the results these methods produce is different. Lets take a look

```
0 This is a test without double backslash. Take a look at how the next paragraph is
   indented. This is the main difference with respect to the next method shown below.

This would be the beginning of the new paragraph. There is no blank line with the
previous one.
```

This is a test without double backslash. Take a look at how the next paragraph is indented. This is the main difference with respect to the next method shown below.

This would be the beginning of the new paragraph. There is no blank line with the previous one.

```
0 Now, lets see how the new paragraph is formatted when we end this paragraph with a double
   backslash (\verb|\) and without an empty line. \
This would be the beginning of the new paragraph. This paragraph was not indented.
```

Now, lets see how the new paragraph is formatted when we end this paragraph with a double backslash (`\`) and without an empty line.

This would be the beginning of the new paragraph. This paragraph was not indented.

```
0 Now, lets see how the new paragraph is formatted when we end this paragraph with a double
   backslash (\verb|\) and an empty line. \

This would be the beginning of the new paragraph.
```

Now, lets see how the new paragraph is formatted when we end this paragraph with a double backslash (`\`) and an empty line.

This would be the beginning of the new paragraph.

### 1.1.4 Enumerations, bullet points and descriptions in $\text{\LaTeX}$

Enumerated lists can be created with the `enumerate` environment.

1. First item.
2. Second one.
  - (a) Going deeeper.
3. Third.

```

0 \begin{enumerate}
    \item First item.
    \item Second one.
    \begin{enumerate}
        \item Going deeeper.
5    \end{enumerate}
    \item Third.
\end{enumerate}

```

Bullet points or lists can be created with the `itemize` environment. The structure is the same as the `enumerate` environment!

- First item.
- Second one.
  - Going deeeper.
- Third.

```

0 \begin{itemize}
    \item First item.
    \item Second one.
    \begin{itemize}
        \item Going deeeper.
5    \end{itemize}
    \item Third.
\end{itemize}

```

Descriptions are quite nice if you need to describe different concepts. They are created with the `description` environment and the `\item` entry requires the optional argument: `\item[Some text]`.

**My favourite** First item. Lets write some more text to see the full formatting of the `description` environment.



**Continuation** Second one.

**Finally** Third.

```
0 \begin{description}
    \item[My favourite] First item. Lets write some more text to see the full
    formatting of the \verb|description| environment.
    \item[Continuation] Second one.
    \item[Finally] Third.
\end{description}
```

### 1.1.5 Mathematical notation

L<sup>A</sup>T<sub>E</sub>X provides several way to include symbols and write mathematical formulas. The most basic way is to include mathematical notation or symbols into the text. This is known as *inline* and can be done with  $\dots$ . Whatever is between the  $\$$  symbols, is typeset in mathematical notation. This is an example:  $2 = \frac{4}{2}$ . This is produced using `$2 = \frac{4}{2}$`.

Another method is to write mathematical formulas in *display* mode, which is separated from the text. This can be done by wrapping the text in `\[...\]`. **This is not recommended** as the next method is better. Here is an example:

$$2 = \frac{4}{2}$$

Normally, the best way is to use mathematical environments. This environments will provide more functionality and generally number the equations and allows them to be labelled. Here are a few examples:

$$2 = \frac{4}{2} \tag{1.1}$$

The equation above, **eq. (1.1)**, is produced by writing:

```
0 \begin{equation} \label{eq:simpleeq}
    2 = \frac{4}{2}
\end{equation}
```

Lets showcase more environments that help us write beautiful formulas! The `\begin{array}` environment helps us write vertically aligned formulas!

$$f(t) = \begin{cases} A_0 + A \cdot e^{-\frac{t-t_0}{t_d}} & \text{for } t \geq t_0 \\ A_0 & \text{for } t < t_0 \end{cases} \quad (1.2)$$

```

0 \begin{equation} \label{eq:abaqus-exponential-decay}
  f(t) = \left\{
    \begin{array}{lcc}
      A_0 + A \cdot e^{-\frac{t-t_0}{t_d}} & \text{for } t \geq t_0 \\
      A_0 & \text{for } t < t_0
    \end{array}
  \right.
5 \end{equation}

```

The `\begin{aling}` environment may be easier to use, but it has a few quirks. Read the documentation<sup>3</sup> for more information.

$$a_{11} = b_{11} \qquad a_{12} = b_{12} \qquad (1.3)$$

$$a_{21} = b_{21} \qquad a_{22} = b_{22} + c_{22} \qquad (1.4)$$

```

0 \begin{align}
  a_{11} &= b_{11} & \\
  a_{12} &= b_{12} & \\
  a_{21} &= b_{21} & \\
  a_{22} &= b_{22} + c_{22} & \\
5 \end{align}

```

The `\begin{subequations}` allows us to have several formulas numbered into the same reference. As shown in eq. (1.5), with the first entry being eq. (1.5a).

$$\text{XSYMM} \equiv U1 = UR2 = UR3 = 0 \qquad (1.5a)$$

$$\text{ZSYMM} \equiv U3 = UR1 = UR2 = 0 \qquad (1.5b)$$

```

0 \begin{subequations} \label{eq:symmetry-bc}
  \begin{equation} \label{eq:x-symmetry-bc}
    \texttt{\texttt{XSYMM}} \equiv U1 = UR2 = UR3 = 0
  \end{equation}

```

---

<sup>3</sup><http://tug.ctan.org/info/short-math-guide/short-math-guide.pdf>

5

The different types of references are shown in [table 1.2](#).

Package	Command	Result
L <sup>A</sup> T <sub>E</sub> X	<code>\ref{eq:simpleeq}</code>	1.1
	<code>\pageref{eq:simpleeq}</code>	5
hyperref	<code>\autoref{eq:simpleeq}</code>	Equation 1.1
	<code>\autoref{fig:textstyles}</code>	Table 1.1
	<code>\autopageref{eq:simpleeq}</code>	page 5
cleveref	<code>\cref{eq:simpleeq}</code>	eq. (1.1)
	<code>\Cref{eq:simpleeq}</code>	Equation (1.1)
	<code>\cpageref{eq:simpleeq}</code>	page 5
	<code>\cref{eq:simpleeq,eq:symmetry-bc}</code>	eqs. (1.1) and (1.5)
	<code>\crefrange{eq:simpleeq}</code>	eqs. (1.1) to (1.5)
	<code>{eq:symmetry-bc}</code>	

Table 1.2: Different reference mechanisms. **The author recommends `\cleveref`!**  
It is included in this template.

### 1.1.7 Bibliography

Bibliography management is another strong point of L<sup>A</sup>T<sub>E</sub>X! We just need to add bibliographic entries to the bibliography database, which for this template it is the `main.bib` file. Here is what such an entry can look like:

0

```
author = {Lovecraft, H. P.},  
title = {El élerigo malvado y otros relatos},  
publisher = {Alianza Editorial},  
year = {2016},  
5 address = {Madrid},  
isbn = {9788491042105}  
}
```

In order to cite the entry we just have to use `\cite{}` with the entry’s identifier, like so `\cite{lovecraft2016el}` [1]. We can also have multiple cites in the same command, [1, 2] (`\cite{lovecraft2016el,norton_creep}`). It is that simple! They get automatically printed in the bibliography section.

**IMPORTANT:** this template uses **biblatex** as the management system, which is a powerful, flexible and modern tool. Therefore, you will need to run the **biber** command to build the bibliography after the first compilation of your document; then you will have to recompile the document after **biber** has run. Most editors do this by default.

You can also use third-party tools like Zotero<sup>4</sup> to manage your **.bib** database. Most bibliography management tools are capable of dealing with **.bib** entries!

### 1.1.8 Tables, images and floating environments

Probably, the part of L<sup>A</sup>T<sub>E</sub>X that causes the most confusion among new users, are the so called *floating environments*. **Tables, images, algorithms, etc are floating environments.** This means that L<sup>A</sup>T<sub>E</sub>X can position them where it sees fit, not where they are written by the user. In reality, L<sup>A</sup>T<sub>E</sub>X is trying to optimise your document’s layout and leave as little empty space as possible.

Sooo... How do we solve L<sup>A</sup>T<sub>E</sub>X moving our floating environments? Here are a few solutions:

- We don’t solve it. L<sup>A</sup>T<sub>E</sub>X referencing tools allow us to easily point the reader to the table, image, etc. Therefore, it is not that problematic that the *floats* may not be where we put them!
- We can ask L<sup>A</sup>T<sub>E</sub>X to try to place the image where it appears in our document. This is done with the “*here*” [h] placement modifier. More on placement modifiers later. **This is not a definitive solution.** This will just tell L<sup>A</sup>T<sub>E</sub>X to try hard to do what we are asking. There is the [h!] modifier, which is even stronger.
- **A really good solution is to use \FloatBarrier.** It comes from the **placeins** package, included in this template. **\FloatBarrier** forces L<sup>A</sup>T<sub>E</sub>X to

---

<sup>4</sup><https://www.zotero.org/>

put all floating environment that have already appeared before the position where `\FloatBarrier` appears. This is very useful to force L<sup>A</sup>T<sub>E</sub>X to put all floats before another section that may not be related to the topic of those floats. Here is an example:

```
0 \section{Some topic}
  \begin{figure}
    XXX
  \end{figure}
5 \begin{table}
  XXX
  \end{table}
10 \FloatBarrier % All previous floats will appear before this point.
  \section{Some unrelated topic}
  XXX
```

- We can use the placement modifier [H] to force the float to appear *HERE*. This is provided by the `float` package. However, **this solution is not recommended!** It can lead to some wierd and nasty document layouts!

Now, how do we actually include figures, tables, etc? They all follow the same structure, here are some examples:

**Figures** are declared in the `figure` environment (*SHOCK!*). You can see the image rendered in [fig. 1.1](#).

```
0 \begin{figure}
  \centering % Center image horizontally
  \includegraphics[keepaspectratio, trim = 1050 12 150 30, clip, width=0.5\linewidth, height=0.3\textheight]{Images/monoblock-material-overview-mesh.png}
  \caption[Overview of \glsentryname{FEM} mesh used for the final analysis.]{Overview of \glsxtrshort{FEM} mesh used for the final analysis.}
  \label{fig:monoblock-overview-mesh}
5 \end{figure}
```

The key here is `\includegraphics`, it is what loads the graphics and allows us to set its properties. The above example is rather complex, most times you do not need these many options. Nonetheless, here is what they do:

**keepaspectratio** Keeps the size ratio of the image. Very useful if you set **height** and **width** at the same time. `\includegraphics` will use the most restrictive length to size the image.

**trim** It allows us to trim/cut the image. It cuts X amount of pixels from the **left**, **bottom**, **right**, **top**. This is useful if your image is too large and you only care about a small portion of it.

**clip** Only show the trimmed image.

**width and height** Sets the maximum size with respect to the width and height. We use `\linewidth` and `\textheight` to limit the size of the image in the page by using the page's natural lengths.

Then we have `\caption`, which is what adds the text to the image. We use `\caption[]` here, to modify the text that will appear in the “List of Figures”, as I do not want my acronym **FEM** to be linked there, and therefore I use `\glsentryname` to control that. But more about acronyms and glossaries in [section 1.2](#) Finally, we have `\label{}` is what allows us to give an identifier to our image so that we can reference it.

**Tables** are fairly easy to do once we get used to their nature. It uses the **table** floating environment with another environment that allows us to type tabulated data. A basic example is given below and shown in [table 1.3](#).

```

0 \begin{table}
   \centering % To center the table
   \begin{tabular}{lcr}
     \toprule
     Heading 1 & Heading 2 & Heading 3 \\
     \midrule
     Left aligned & Center aligned & Right aligned \\
     \cmidrule{2-3} % Example of a defined size rule
     Some info & Some info & Some info \\
     \bottomrule
10 \end{tabular}
    \caption{Example of a table.}
    \label{tab:example-table}
  \end{table}

```

**IMPORTANT:** the `&` symbol is used as a column separator in all alignment environments! Go back to the mathematical environments and see if you can see its use there.

The column alignment options for the `tabular` environment can be `l`, `c`, `r`, `m` or `p` among others. They refer to left, center, right alignment and

the `m` and `p` refer to a limited size column whose vertical alignment is either centered or natural. You could use them as `m{0.3\linewidth}` for example. If you want to align the text horizontally with `m` or `p` you would write `>\centering\arraybackslashm{0.3\linewidth}`. You can change the `\centering` for a `\raggedright` for a right aligned column. But this is getting too advance! One final bit of knowledge about very long tables and dynamically sized columns. This template includes the package `xltabular`, which includes the well-known `tabularx` environment and merges it with the `longtable` environment (for tables that can span more than one page) generating its own `xltabular` environment. Please read the documentation of the `tabularx`, `longtable` and `xltabular` packages if you need to build complex tables!

There are also two packages `multicolumn` and `multirow` that allows the content of a cell to span several columns/rows. These packages are included in this template. Take a look at their documentation.

Also, **there are online tools to help you generate  $\text{\LaTeX}$  tables from Excel sheets**. One such example (which I am not very familiar with nor endorse) is [Tableconvert](#).

Finally, if you have `.csv` files or similar and you want to print them in your  $\text{\LaTeX}$  document, you can see [section 1.5](#), which shows how [table 1.5](#) was automatically generated using `pgfplotstable`.

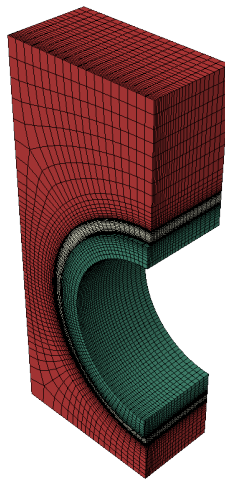


Figure 1.1: Overview of **FEM** mesh used for the final analysis.

Heading 1	Heading 2	Heading 3
Left aligned	Center aligned	Right aligned
Some info	Some info	Some info

Table 1.3: Example of a table.

## 1.2 Glossaries

Creating glossaries in L<sup>A</sup>T<sub>E</sub>X is surprisingly easy. However, it does require a bit of understanding.

For this template, the entries for the glossaries and acronyms (which are just a different type of glossary) are loaded from the `glossaries.tex` and `acronyms.tex` files. This is just to keep things organised. So, let's define some entries for our glossary and acronym list.

For glossary entries we use the `\newglossaryentry{}{...}` command. Here is an example:

```
0 \newglossaryentry{identifier}
  {
    name={name}, % Mandatory, what gets printed
    description={description of the entry}, % Mandatory, description that appears in the
      glossary index
    plural={plural-name}, % Optional, in case the plural is more complex
5   sort={alphanumeric entry}, % Optional, how should the entry be sorted
    symbol={\ensuremath{associated symbol}}, % Optional, prints the symbol of the entry
      with \glsymbol{identifier}
  }
```

For acronyms, we could use the code above, but there is a simpler and more direct way of doing it with `\newabbreviation[]{}{}{}`. Here is how it works:

```
0 \newabbreviation{Identifier}{ACRONYM}{Description Of Acronym}
```

`\newabbreviation[]` supports a long set of options. For example, the `[longplural={...}]` option allows us to write the plural form in case it is more refined. There are many other options. The abbreviation functionality is provided by the `glossaries-extra` package.

Once your own personal entries have been created, you can use them with the following commands.



Type	Command	Result
Glossary	<code>\gls{test}</code>	test
	<code>\Gls{test}</code>	Test
	<code>\glspl{test}</code>	tests
	<code>\Glspl{test}</code>	Tests
	<code>\glsentryname{test}</code>	test
	↑ this does not produce a link	
Acronyms	<code>\glsxtrshort{FEM}</code>	FEM
	<code>\glsxtrshortpl{FEM}</code>	FEMs
	<code>\glsxtrlong{FEM}</code>	Finite Element Method
	<code>\glsxtrfull{FEM}</code>	Finite Element Method (FEM)
	<code>\glsentryname{FEM}</code>	FEM
	<code>\gls{FEM}</code>	Finite Element Method (FEM)
What?	<code>\gls{FEM}</code>	FEM

Table 1.4: Glossary and acronym types.

Wait, what happened in the second `\gls{FEM}` entry in the acronym section? Why did it produce a different result (`\glsxtrshort{FEM}`) when compared to the first one (`\glsxtrfull{FEM}`)?

Simple. This template uses the `\setabbreviationstyle[acronym]{long-short}` style. The first time an acronym is used, it will show the full form. After that, the short form is used. All of this automatically! Isn't this magical? If you would like to show always the short form, you can delete that line from the `report.tex` or use `\setabbreviationstyle[acronym]{short-nolong}` (or any other style that you like!).

**IMPORTANT:** in order to show the list of glossaries and acronyms in their table of contents, you will have to run `makeglossaires`. Some editors will do that automatically for you, as they will detect you have a glossary in your document.

## 1.3 Automatic loading and formatting of code

## 1.4 Creating beautiful plots in 2D and 3D

## 1.5 Automatic formatting of table data

The following table, [table 1.5](#), is formatted using the following general setup for `pgfplotstable`. The following `LATEX-pgfplotstable` is only needed once, and it

applies to “all” the automatically loaded table.

```

0 % Configure the general setting of pgfplotstable
\pgfplotstableset{
  every odd row/.style={
    before row={\rowcolor{gray!20}}
  },
5  every head row/.style={
    before row=\toprule,
    after row=\midrule,
    % Don't print the row name or the row index!
    output empty row
10  },
  every last row/.style={
    after row=\bottomrule
  },
  header=false,
15  format=file,
  col sep=tab,
  search path={Data},
  font={\small}
}

```

And then the actual loading of the table. The following code setups the header (names, columns, etc) and then loads the data.

```

0 \begin{table}
  \newcommand{\prop}{Expansion}
  \newcommand{\propunit}{[\unit{milli}{meter}\per{celsius}\per{milli}{meter}]}
  \centering
  \pgfplotstabletypeset[
5  every head row/.append style={
    before row={
      \toprule
      \multicolumn{2}{c}{\glsentryname{Cu-OFHC}} \\\
      \midrule
10  \multirow{2}{\widthof{\propunit}}{\centering \prop\ \propunit} & \multirow
{2}{\widthof{Temperature}}{\centering Temperature [\unit{celsius}]} \\\
      \\\
    },
  },
  ]{ITER Cu You-harden for WPDIV phase II_\prop_f_T.txt}
15 \caption{Automatically formatted table using \texttt{pgfplotstable}.}
  \label{tab:automatic-reading-csv}
\end{table}

```

Whats even cooler is that `pgfplotstable` uses the package `siunitx` to format the values as it is included in this template!

OFHC-Cu	
Expansion [mm °C <sup>-1</sup> mm <sup>-1</sup> ]	Temperature [°C]
1.68 · 10 <sup>-5</sup>	20
1.7 · 10 <sup>-5</sup>	50
1.72 · 10 <sup>-5</sup>	100
1.74 · 10 <sup>-5</sup>	150
1.76 · 10 <sup>-5</sup>	200
1.78 · 10 <sup>-5</sup>	250
1.79 · 10 <sup>-5</sup>	300
1.81 · 10 <sup>-5</sup>	350
1.82 · 10 <sup>-5</sup>	400
1.84 · 10 <sup>-5</sup>	450
1.85 · 10 <sup>-5</sup>	500
1.87 · 10 <sup>-5</sup>	550
1.88 · 10 <sup>-5</sup>	600
1.9 · 10 <sup>-5</sup>	650
1.91 · 10 <sup>-5</sup>	700
1.93 · 10 <sup>-5</sup>	750
1.96 · 10 <sup>-5</sup>	800
1.98 · 10 <sup>-5</sup>	850
2.01 · 10 <sup>-5</sup>	900

Table 1.5: Automatically formatted table using `pgfplotstable`.

## 1.6 Some extra bits of knowledge

### 1.6.1 How do I prevent L<sup>A</sup>T<sub>E</sub>X from splitting a word, number, etc?

L<sup>A</sup>T<sub>E</sub>X will automatically break some words or numbers in order to have a nice layout of the paragraph. However, sometime we don't want that. This can be solved with `\mbox{XXX}`. This, however, may generate unexpecte behaviour! For example: `XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX`.

## 1.6.2 Can I put two figures, tables, etc; side to side? One on the left page and another thing on the right page.

Yes! With the package `dpfloat`, included in the template. **However, it can generate a lot of errors** if L<sup>A</sup>T<sub>E</sub>X cannot put enough text around the floating environments<sup>5</sup>. The easiest solution is to write a bit more text or place the floats more deeply into your text.

Here is a demonstration of an example from my thesis. Inside your **figure**, **table**, etc, use the `leftfullpage` environment around the contents to place something in the left page. Then in the next float environment, which should be written directly next to the previous one, use the `fullpage` environment. Here is an example with [fig. 1.2](#) and [table 1.6](#).

```

0 \begin{figure}
  \begin{leftfullpage} % Place in the left page
  \centering
  \def\svgwidth{0.6\linewidth}
  \import{Data}{BCs.pdf_tex} % Import LaTeX graphics generated by Inkscape!
5  \caption[\glsentryname{FEM} boundary conditions.]{Boundary conditions applied on the
    monoblock.}
  \label{fig:boundary-conditions}
  \end{leftfullpage}
\end{figure}

```

```

0 \begin{table}
  \begin{fullpage} % Put it in a right page
  \centering
  \footnotesize \begin{tabularx}{\linewidth}{>\raggedright\
arraybackslash}X >{\centering\arraybackslash}X >{\centering\arraybackslash}X >{\
centering\arraybackslash}X >{\centering\arraybackslash}X >{\centering\arraybackslash
}X}
  \toprule
5   & Pressure increase & Exponential drop of temperature & Rapid drop of
temperature & Cutting of cooling pipe & Cutting of the part \\
  \cmidrule(r){2-4} \cmidrule(l){5-6}
  Duration & \qty{10}{\second} & \qty{55000}{\second} & \qty{1000}{\second}
& \qty{1}{\second} & \qty{1}{\second} \\
  \midrule
  Temperature & \qty{580}{\celsius} & \qtyrange[range-units=single
]{580}{76}{\celsius} & \qtyrange[range-units=single]{76}{20}{\celsius} & \qty{20}{\
celsius} & \qty{20}{\celsius} \\
10  \midrule

```

<sup>5</sup>The error tends to be Output loop---100 consecutive dead cycles.

```
15      .  
      .  
      .  
      \bottomrule  
    \end{tabularx}  
    \caption{Simulated steps and their boundary conditions.}  
    \label{tab:fem-steps}  
  \end{fullpage}  
\end{table}
```

### 1.6.3 How can I edit graphics in L<sup>A</sup>T<sub>E</sub>X?

In the **figure** explanation at the beginning of the chapter I show how you can clip the graphics in L<sup>A</sup>T<sub>E</sub>X. However, if you would like to add text, arrows and similar things to your graphics, **the best way is to use Inkscape**. It is a vector/image manipulation program that can output files to be loaded and typesetted by L<sup>A</sup>T<sub>E</sub>X! You can see [fig. 1.2](#), which is generated with Inkscape (file named `BCs.svg` in the `Data` directory). [This forum post](#) explains how to do it.

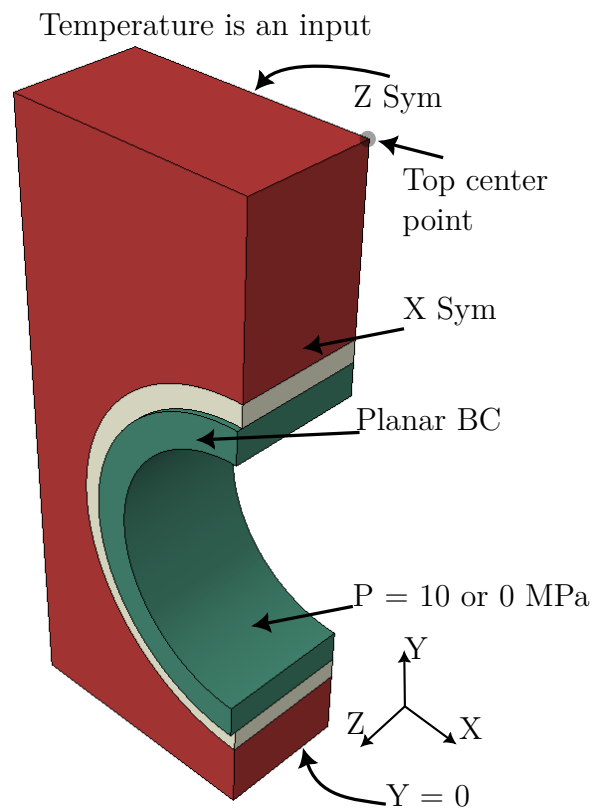


Figure 1.2: Boundary conditions applied on the monoblock.

	Pressure increase	Exponential drop of temperature	Rapid drop of temperature	Cutting of cooling pipe	Cutting of the part
Duration	10 s	55 000 s	1000 s	1 s	1 s
Temperature	580 °C	580 to 76 °C	76 to 20 °C	20 °C	20 °C
HRP pressure	0 to 10 MPa	10 MPa	10 to 0 MPa	—	—
Tie constrains	✓	✓	✓	✓	✓
X Symmetry plane	✓	✓	✓	✓	✓
Z Symmetry plane	✓	✓	✓	✓	✓
Y = 0 bottom plane	✓	✓	✓	✓	—
Planar BC	✓	✓	✓	—	—
Vertical fix of top and bottom center point	—	—	—	—	✓

Table 1.6: Simulated steps and their boundary conditions.





# Bibliography

- [1] H. P. Lovecraft. *El clérigo malvado y otros relatos*. Madrid: Alianza Editorial, 2016. ISBN: 9788491042105.
- [2] F. H Norton. *The creep of steel at high temperatures*. McGraw-Hill, 1929. URL: <https://archive.org/details/creepofsteelathi00nort>.

## *BIBLIOGRAPHY*

---

# Appendix A

This is an appendix

