

Technical Manual

# **mcidoc L<sup>A</sup>T<sub>E</sub>X Class**

---

D. T. McGuinness, Ph.D

Version: 0.43

# Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
1.1	Purpose of Making . . . . .	2
<b>2</b>	<b>The mcidoc Class</b>	<b>4</b>
2.1	Class Declarations . . . . .	4
2.2	Initial Packages and Class Macros . . . . .	7
2.3	State: Document Type . . . . .	8
2.4	State: Bibliography . . . . .	9
2.5	State: Language Control . . . . .	10
2.6	State: Defining Departments . . . . .	10
2.7	State: Language Support . . . . .	11
2.8	Thesis Specific Configurations . . . . .	11
2.9	Report Specific Configurations . . . . .	17
2.10	Additional Configurations . . . . .	20
<b>3</b>	<b>Examples</b>	<b>24</b>
3.1	Thesis Main . . . . .	24
3.2	Report Main . . . . .	27
3.3	A Chapter . . . . .	29
3.4	References Bib File . . . . .	34

# Chapter 1

## Introduction

This is a  $\text{\LaTeX}$  document formatting designed to cater to all possible student requirements regarding:

- document preparation,
- presentation,
- poster,
- and thesis writing.

All the aforementioned documents are bundled up as a class called `mcidoc`.

### 1.1 Purpose of Making

The main ethos of this class is to standardise and streamline document creation which abides to the standards set by the institution with regards to:

- the font-size,
- page spacing,
- line spacing,
- caption style,
- languages specific settings
- header/footer styles

and so on so forth.

A second goal it to create a repository to house a standard class to minimise any friction between your work and the presentation. Therefore care was given to how the class behaves to minimise the dependencies it needs and give you key/value pairs to modify the document as you see fit.

[!TIP] NOTE: This class has been tested on different computers, different OSs and LuaTeX and pdfTeX. However, as with everything, there will always be edge cases and I am sure to that end, if you let me know anonymously or just let me know via email, I can squash the bugs or add any feature it may seem necessary.

[!CAUTION] WARNING: While I will try to help with any problem this class might have, it is by no means I am providing any kind of WARRANTY or TECHNICAL SUPPORT. There will be documentation and some example documents which should compile without any additional configuration. Nevertheless, I can only help with the errors from code and not with your personal L<sup>A</sup>T<sub>E</sub>X development environment (i.e., TeXStudio).

**Copyright Information**

Copyright 2025, D.T. McGuiness, Ph.D

This program may be distributed and/or modified under the conditions of the L<sup>A</sup>T<sub>E</sub>X Project Public License, either version 1.1 of this license or (at your option) any later version.

The latest version of this license is in <http://www.latex-project.org/lppl.txt> and version 1.1 or later is part of all distributions of L<sup>A</sup>T<sub>E</sub>X version 1999/06/01 or later.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

This program consists of the `mcidoc.cls` and its related example files.

# Chapter 2

## The mcidoc Class

The following section is written for people who wants to see how the class was written and implemented. For people who just want to get work done and not bother with the implementation, please visit Examples chapter.

### 2.1 Class Declarations

We start with defining the class header where we define the:

- Which version of  $\text{\LaTeX}$  is required,
- Give an information about the package

#### Header

---

```
1 \NeedsTeXFormat{LaTeX2e}[13-02-2025]
2 \ProvidesClass{mcidoc}[13-02-2025 A documentclass for mci MECH Students]
```

---

#### Declaring Keys

We now define the keys which is needed for the class to work and some information regarding it.

---

```
1 \DeclareKeys{
2   state.store      = \KEY@DOCUMENTSTATE,    % Declare the document state (Thesis | Report)
3   lang.store       = \KEY@LANGUAGE,          % Define document language   (EN | DE)
4   degree.store     = \KEY@DEGREE,            % Define degree level         (BSc | MSc)
5   dept.store       = \KEY@DEPARTMENT,        % Define department           (MECH)
6   bib-active.store = \KEY@BIBLIOGRAPHY,      % (true | false)
7   bib-style.store  = \KEY@BIBSTYLE,          % (ieee)
8   column-type.store = \KEY@COLUMNTYPE,       % (one | two)
9 }
```

---

The keys and their values are as follows:

**Document State** Stored in \KEY@DOCUMENTSTATE. This value control the major behaviour of the document and depending on which value it is chosen, some command will become available or disabled. The options are:

- Thesis
- Report

**Language** Stored in \KEY@DOCUMENTLANGUAGE. Every language has their way of writing whether it is the comma or dot as a thousand separator or the titles of headers to their appendix, or additional documentation. This controls the behaviour by using two options:

- EN
- DE

**Degree** Stored in \KEY@DEGREE. Currently MCI offers two degree level diploma and this key value control various aspects of the document:

- Title of a B.Sc and M.Sc can be slightly different,
- In reports the cover page changes slightly if it is in M.Sc

It accepts two options:

- BSc
- MSc

**Department** Stored in \KEY@DEPARTMENT. Departments can require different customisation to their thesis and this variable is there so someone else can do it. Currently only the Mechatronics department is supported. The option is:

- MECH

**Activate Bibliography** Stored in \KEY@BIBLIOGRAPHY. Depending on the type of work, one may need or not a bibliography. This key value basically allows you to turn on or off the bibliography requirements of the thesis report.

**Bibliography Style** Stored in \KEY@BIBSTYLE. Allows the change of the way bibliography is written. Currently only `ieee` is supported but additional ones could be implemented.

**Column Type** Stored in \KEY@COLUMNTYPE. Some lecturers may need lab reports or assignments to be in two column to save up on unnecessary space. It supports two options:

- one
- two

And let's not forget to process the Keys. The following command executes the chosen options for each selected option.

---

```
1 \ProcessKeyOptions\relax
```

---

## Global Tokens

It is the time to define some tokens to store the user input.

In detail these are:

Defintions on tokens and where are they used.

Token	Description	Thesis	Report
\StudentName	Name of the student (Name and Surname)	X	X
\StudentID	The ID of the student (i.e., 2XXXXXXXXX)	X	X
\Cohort	The Cohort in which the student belongs to	-	X
\Module	The Module code of the lecture	-	X
\Lecture	The name of the Lecture	-	X
\Lecturer	The name of the Lecturer	-	X
\Group	The names of the group (Optional)	-	X
\Supervisor	The Name, Surname, and Title of the Supervisor	X	-
\Title	Title of the Work	X	X
\TitleHeader	The sub-title of work	-	X

We declare the tokens as such:

---

```
1 \newtoks\Cohort
2 \newtoks\Module
3 \newtoks\Lecture
4 \newtoks\Lecturer
5 \newtoks\Group\Group{nil}
6
7 \newtoks\Title
8 \newtoks\TitleHeader
9 \newtoks\Semester
10 \newtoks\StudentName
11 \newtoks\StudentID
12
13 \newtoks\Department
14 \newtoks\StudyProgram
15 \newtoks\Supervisor
16 \newtoks\PrimaryAssessor
17 \newtoks\SecondaryAssessor
```

---

## 2.2 Initial Packages and Class Macros

Below are the packages and command(s) used within the development of the class. The packages are written in the same order as they are executed.

This is worth stressing over. For anyone who like to reproduce the functionality of this class, please be careful about the **order** in which the packages are loaded, (i.e., loading `geometry` too early may cause problems) as some packages interfere with other packages definitions.

### Package: `ifthen`

`ifthen` is a great package which allows simple if-else statements to be executed from  $\text{\LaTeX}$ .

---

```
1 \RequirePackage{ifthen}
```

---

### Package: `tikz`

We then need to load `tikz` to allow precise customisation of the title pages of the different classes. We also need to load the `calc` library as we need calculation to position images onto the document.

---

```
1 \RequirePackage{tikz}
2 \usetikzlibrary{calc}
```

---

### Package: `graphicx`

The `graphicx` package allows quick loading of images.

---

```
1 \RequirePackage{graphicx}
2 \usetikzlibrary{}
```

---

### Private Command: `if@State`

We now need to define a non-user command (i.e, having `@` in the command) to create a short-hand to select document state (to choose whether to load `Thesis`, or `Report`)

#### Arguments

- `#1` : The state of the document (i.e., `Report`, `Thesis`, ...)
- `#2` : The action to be taken



---

```
1 \newcommand{\If@State}[2]{%
2   \ifthenelse{\equal{\KEY@DOCUMENTSTATE}{#1}}
3   }{%
4     #2
5   }{%
6     %
7   }%
8 }
```

---

## 2.3 State: Document Type

The following section describes the various states the class can use. Currently there are two classes mciDoc uses to create the documents which are:

- Thesis
- Report

### Thesis Class

We load the KOMA-Script class and describe the following options. There are points worth discussing.

- We set the font-size 10pt to **not** waste paper and to avoid the superfluous filling of thesis.
- We set the value of twoside as true to allow margins to change between even and odd.
- We also set it to openright to make sure chapters are opening on the RIGHT.

---

```
1 \If@State{Thesis}{%
2   \LoadClass[%
3     chapterprefix = true,%
4     DIV           = 11,%
5     paper         = A4,%
6     fontsize      = 10,%
7     twoside       = true,%
8     openright%
9   ]{scrreprt}%
10 }
```

---

### Report Class

Last, but certainly not least, we define another class which is used for writing assignment and other related works. This class is based on the scrreprt class from KOMA with additional options.

This class behaves similar to the Thesis class with an additional option of `column`type. This option changes the way the document is presented by adding a second column.

By default the `column`type is set one.

---

```

1 \If@State{Report}{
2   \ifthenelse{
3     \equal{\KEY@COLUMNTYPE}{one}
4   }{
5     \LoadClass[
6       chapterprefix = true,
7       DIV            = 22,
8       paper          = A4,
9       fontsize       = 10,
10      twoside         = false,
11    ]{scrreprt}
12  }{
13    \LoadClass[
14      chapterprefix = true,
15      DIV            = 22,
16      paper          = A4,
17      fontsize       = 10,
18      twoside        = false,
19      twocolumn
20    ]{scrreprt}
21  }
22 }
```

---

We now invoke `\ExecuteOptions` which applies all the options you specify in the argument, in order, as our selected defaults.

---

```

1 \ExecuteOptions{}
```

---

## 2.4 State: Bibliography

If the document requires references, this option automatically sets up the bibliography. The control of this is done by the variable `\KEY@BIBLIOGRAPHY` variable.

---

```

1 \ifthenelse{%
2   \equal{\KEY@BIBLIOGRAPHY}{true}
3 }{%
4   \RequirePackage[
5     backend = bibtex,
6     style   = \KEY@BIBSTYLE,
7   ]{biblatex}
8 }{}%
```

---

In addition one can also control the style of the reference (i.e., plain, ieetr, apa, . . . ) based on what bibtex in what is installed in the users computer. The style variable is set using \KEY@BIBSTYLE.

## 2.5 State: Language Control

As MCI is an institution which uses more than one language to create and review documentation, the class has two options to make sure correct typography and rules are set for each language:

- **English** Define a control sequence to allow certain controls if the language is English.

**#1** [Mandatory] Action to be taken if English. If empty, no action will be done

---

```
1 \newcommand{\Lang@English}[1]{%
2   \ifthenelse{\equal{\KEY@LANGUAGE}{EN}}{
3     }{%
4       #1
5     }{%
6     }%
7 }%
```

---

- **German** Here we define a control sequence to allow certain controls if the language is German.

**#1** [Mandatory] Action to be taken if German. If empty, no action will be done

---

```
1 \newcommand{\Lang@German}[1]{%
2   \ifthenelse{\equal{\KEY@LANGUAGE}{DE}}{
3     }{%
4       #1
5     }{%
6     }%
7 }%
```

---

## 2.6 State: Defining Departments

Here we define the departments supported by the mcidoc class. Currently only one department is supported, which is the department the author belongs to, Mechatronics. This option was designed as a backdoor to enable further customisation if a department requires a unique or interesting request.

Using the language if/else we define the English and German text for Mechatronics:

**English** Mechatronics

**German** Mechatronik

---

```
1 \ifthenelse{%  
2   \equal{\KEY@DEPARTMENT}{MECH}%  
3 }{%  
4   \Lang@English{\def\Department{Mechatronics}}%  
5   %  
6   \Lang@German{\def\Department{Mechatronik}}  
7 }{%}
```

---

## 2.7 State: Language Support

Currently this class supports two languages. If the reader is not aware of these choices by the time they reached this part of the documentation. Here is a quick run-down:

**EN** English language formatting

**DE** German language formatting

---

```
1 \ifthenelse{\equal{\KEY@LANGUAGE}{EN}}%  
2 }{%  
3   \RequirePackage[english]{babel}    % <-- Allows english settings and typography  
4 }{%  
5   \RequirePackage[ngerman]{babel}    % <-- Allows german settings and typography  
6 }%
```

---

## 2.8 Thesis Specific Configurations

Below are the configurations which are only accesible using the Thesis sub-class.

### Public Command: DeclarationOfNovelty

The `\DeclarationOfNovelty` command, as the name suggest, generates a boilerplate text, written either in German (DE), or in English (EN), regarding their work and declare of the works originality. The bottom of the generated page also has two places for handwritten text/signature:

- Left side for the Place
- Right side for Signature

The command takes **NO** arguments as the only thing needed is the invokation of the command **after** `\TableOfContents`

At the end of the command a `\cleardoublepage` is used so the next content is always occuring in the odd page.

---

```
1 \newcommand\DeclarationOfNovelty{%
```

---

We start with defining the English text. The text is **NOT** user accesible.

---

```
1 \section*{Declaration in Lieu of Oath}
2
3 I hereby declare, under oath, the thesis titled,
4 %
5 \begin{center}
6   \textit{\the\Title}
7 \end{center}
8 %
9 has been my independent work and has not been aided
10 with any prohibited means as declared
11 by the program and/or the institution. \\
12
13 I declare, to the best of my knowledge and belief, that
14 all passages taken from published, unpublished sources
15 have been reproduced as original, slightly changed,
16 have been mentioned and sources have been cited
17 accordingly as required by academic academic standards
18 decreed by the institution and the program \\[5\baselineskip]
19
20 \vspace{\fill}
21
22 \rule{5cm}{0.2pt}\hfill\rule{5cm}{0.2pt}\\
23 \phantom{Placeholder}Place, Date\hfill Signature\hspace{15mm}
```

---

Here we write the German text, which same as English, is **NOT** user accesible.

---

```
1 \section*{Eidesstattliche Erklärung}
2 Ich erkl\are hiermit an Eides statt, dass ich die vorliegende
3 Arbeit selbst\andig angefertigt habe. Die aus fremden
4 Quellen direkt oder indirekt \ubernommenen Gedanken sind
5 als solche kenntlich gemacht. Die Arbeit wurde bisher weder
6 in gleicher noch in \ahnlicher Form einer anderen
7 Pr\ufungsbeh\orde vorgelegt und auch noch nicht
8 ver\offentlicht.\\[5\baselineskip]
9
10 \vspace{\fill}
11
12 \rule{5cm}{0.2pt}\hfill\rule{5cm}{0.2pt}\\
13 \phantom{Datum }Ort, Datum\hfill Unterschrift\hspace{15mm}
```

---

The command requires the \Title token to be defined.

## Public Command: ThesisEmbargoRequest

Some thesis is written by companies and therefore may require the information within the thesis to be restricted to public access for certain duration of time, which is generally set for 5 years.

The command `\ThesisEmbargoRequest` is a boilerplate text which writes in an odd page the embargo request.

Of course the request could be 5 years or 50 depending on what the requirements are, in which case the command takes a single optional argument:

**#1** [Optional] The number of years the embargo is requested. Default is 5.

At the end of the command a `\cleardoublepage` is used so the next content is always occurring in the odd page.

---

```
1 \newcommand{\ThesisEmbargoRequest}[1][5]{
```

---

We start with defining the English text. The text is **NOT** user accesible.

---

```
1 \section*{Preclusion from Public Access}
2
3 I have requested preclusion from public
4 access for the work titled,
5 %
6 \begin{center}
7   \textit{\the\Title}
8 \end{center}
9 %
10 which was approved by the \the\year\, study program,
11 and therefore has been blocked from
12 public domain until the
13 date of 31.07.\fpeval{\the\year + #1}.
14
15 \vspace{\fill}
16
17 \rule{5cm}{0.2pt}\hfill\rule{5cm}{0.2pt}\\
18 \phantom{Placeholder}Place, Date\hfill Signature\hspace{15mm}
```

---

Here we write the German text, which same as English, is **NOT** user accesible.

---

```
1 \section*{Ausschluss vom öffentlichen Zugang}
2 Ich habe den Ausschluss der öffentlichen
3 Zugänglichkeit für die Arbeit mit dem Titel
4 %
5 \begin{center}
6   \textit{\the\Title}
7 \end{center}
8 %
9 beantragt, die vom Studienprogramm \the\year\, genehmigt
```

---

```
10 wurde und daher gesperrt wurde
11 bis zum Datum 31.07.\engord{\numexpr{\the\year + #1}\relax}
12 gemeinfrei.
13
14
15 \vspace{\fill}
16
17 \rule{5cm}{1pt}\hfill\rule{5cm}{1pt}\\
18 \phantom{Datum }Ort, Datum\hfill Unterschrift\hspace{15mm}
```

---

The command requires the \Title token to be defined.

## Public Command: TableOfContents

The \TableOfContents is a command which wraps commands together to make sure

- A \listoffigures and then \listoftables are added after the main \tableofcontents.
- Page after the table of contents start arabic
- A double clearpage is inserted so the next content start in an odd page.
- Make sure the header and footer style is changed.

---

```
1 \newcommand{\TableOfContents}{
2   \tableofcontents
3   \listoffigures
4   \listoftables
5   %
6   \clearpage
7   \pagenumbering{arabic}
8   %
9   \pagestyle{scrheadings}
10 }
```

---

## Public Command: MakeTitlePage

This command simply generates the cover page for the thesis and automates the correct placement of the objects within the page.

- Takes NO arguments.

---

```
1 \newcommand\MakeTitlePage{
2   %
3   % Make sure the page has no header/footer
4   \pagestyle{empty}
5   %
```

---

---

```

6  % Break geometry and create a new one
7  \newgeometry{%
8    margin = 3cm,
9    top    = 3cm,
10 }%
11 % Put the title on centre-stage
12 \begin{titlepage}
13   \vspace*{15ex}
14   \begin{center}
15     \LARGE \noindent\kern-1pt\textbf{\the\Title}
16   \end{center}
17   %
18   \centering
19   %
20   % Put the mci-logo on the page in upper right.x
21   %
22   \begin{tikzpicture}[remember picture, overlay]
23     \node at (7,5) {\includegraphics{img/mci-logo.pdf}};
24   \end{tikzpicture}
25
26   % Put the subtitle text whether it is M.Sc or B.Sc
27   \begin{center}
28     \ifthenelse{%
29       \equal{\KEY@DEGREE}{MSc}%
30     }{%
31       \ifthenelse{%
32         \equal{\KEY@LANGUAGE}{EN}%
33       }{%
34         \LARGE \textbf{Master Thesis}%
35       }{%
36         \LARGE \textbf{Master Arbeit}%
37       }%
38     }{%
39       \ifthenelse{%
40         \equal{\KEY@LANGUAGE}{EN}%
41       }{%
42         \LARGE \textbf{Bachelor Thesis}%
43       }{%
44         \LARGE \textbf{Bachelor Arbeit}%
45       }%
46     }%
47   \end{center}
48
49   \vspace{4ex}
50
51   % Add the fullfilment text
52   \ifthenelse{%
53     \equal{\KEY@LANGUAGE}{EN}%
54   }{%
55     \Large In partial fulfillment of the requirements for the degree%
56   }{%
57     \Large zur Erlangung des akademischen Grades%

```

---



```
58 }%
59
60 \vspace{1ex}
61
62 % Add which degree is it from.
63 \ifthenelse{%
64   \equal{\KEY@DEGREE}{BSc}%
65 }{%
66   \Large {\em Bachelor of Science in Engineering}%
67 }{%
68   \Large {\em Master of Science in Engineering}%
69 }%
70
71 \vspace{\fill}
72
73 % Add a third (!?) declaration of degree
74 \ifthenelse{%
75   \equal{\KEY@DEGREE}{BSc}%
76 }{%
77   \Large {Bachelor Program}%
78 }{%
79   \Large {Master Program}%
80 }%
81
82 \vspace{1ex}%
83
84 {\normalsize Mechatronics \& Smart Technologies:}
85
86 \vspace{1ex}
87
88 {\normalsize Management Center Innsbruck}
89
90 \vspace{8ex}
91
92 {\Large Supervisor}
93
94 \vspace{1ex}
95
96 {\Large \the\Supervisor}
97
98 \vspace{8ex}
99
100 {\Large Author}
101
102 \vspace{1ex}
103
104 {\Large \the\StudentName}
105
106 \vspace{1ex}
107
108 {\Large \the\StudentID}
109
```

```
110 \end{titlepage}
111 %
112 %
113 \restoregeometry
114 %
115 \cleardoublepage
116 }%
```

---

## Header and Footer Settings

The below are the header footer settings for the thesis class.

- As this is a derivative of KOMA, we load the excellent package `scrlayer-scrpage` to define and then control the header and footer of the document.
- Make sure the chapter on the header is uppercase and always place is away from binding.
- Put the section name towards the binding.
- Put the student name in footer towards the binding.
- Put the page number away from binding.

---

```
1 \RequirePackage[
2 automark,
3 headsepline,
4 footsepline,
5 autooneside = false
6 ]{scrlayer-scrpage}
7
8 \clearpairofpagestyles
9
10 \ihead{\MakeUppercase{\leftmark}}
11 \ohead{\rightmark}
12 \ofoot{\thepage}
13 \ifoot{\the\StudentName}
14 \renewcommand{\headfont}{\normalfont}
```

---

## 2.9 Report Specific Configurations

Below are the commands and configurations used specifically by the Report class.

### Public Command: MakeTitlePage

This command simply generates the cover page for the thesis and automates the correct placement of the objects within the page.

- Takes NO arguments.

---

```

1 \newcommand{\MakeTitlePage}{
2
3   \pagestyle{empty} % Define page style as empty (i.e., no header & footer)
4
5   % Define new geometry for the title page (this will be reset later)
6   \newgeometry{
7     margin = 3cm,
8     top    = 3cm}
9
10  \begin{titlepage}
11    %
12    \begin{tikzpicture}[overlay, remember picture]
13      \node at ([xshift=-7cm, yshift=7cm]current page.center) {
14        \includegraphics[scale=7]{img/mci-logo-outline.pdf}
15      };
16    \end{tikzpicture}
17    %
18    \begin{flushleft}
19      %
20      % Include \noindent and \kern as a patch for the beginning line
21      {\Large\the\TitleHeader \[\baselineskip]
22       {\Huge\textbf{\textcolor{black}{\the\Title}}}\} \[\baselineskip]
23       {\Large\the\Cohort} \[\baselineskip]
24       {\Large \the\Lecture}
25       \normalsize
26
27     \end{flushleft}
28     %
29
30     \vspace{\fill}
31
32     \newcolumnntype{b}{X}
33     \newcolumnntype{s}{>{\hspace=.5\hspace}X}
34     \newcolumnntype{g}{>{\hspace=.8\hspace}X}
35
36     \Lang@English{
37       \begin{table}[!b]
38         \centering
39         \normalsize
40         \renewcommand{\arraystretch}{1.2}%
41         \begin{tabularx}{\textwidth}{s|b}
42           \textbf{Author(s)} & \the\StudentName \\\
43           \textbf{Student ID(s)}\phantom{Circus} & \the\StudentID \\\
44           \textbf{Supervisor} & \the\Supervisor \\\
45           \textbf{Cohort} & \the\Cohort \\\
46           \ifthenelse{\equal{\the\Group}{nil}}{}{
47             \textbf{Group} & \the\Group \\\
48           }
49           \textbf{Lecturer} & \the\Lecturer \\\
50         \end{tabularx}

```

---

```
51     \end{table}
52   }
53
54   \Lang@German{
55     \begin{table}[!b]
56       \centering
57       \normalsize
58       \renewcommand{\arraystretch}{1.2}%
59       \begin{tabularx}{\textwidth}{g|b}
60         \textbf{Autor(en)}           & \the\StudentName \\
61         \textbf{Studierendenausweis(e)} & \the\StudentID   \\
62         \textbf{Supervisor}          & \the\Supervisor  \\
63         \textbf{Kohorte}             & \the\Cohort      \\
64         \ifthenelse{\equal{\the\Group}{nil}}{}{
65           \textbf{Gruppe}            & \the\Group       \\
66         }
67         \textbf{Lektor}              & \the\Lecturer   \\
68       \end{tabularx}
69       \normalsize
70     \end{table}
71   }
72 \end{titlepage}
73 \restoregeometry
74 \cleardoublepage
75 }
76
```

---

## Public Command: TableOfContents

The `\TableOfContents` is a command which wraps commands together to make sure

- Automatically a `\listoffigures` and then `\listoftables` are added after the main `\tableofcontents`.
- Page after the table of contents start arabic
- A double clearpage is inserted so the next content start in an odd page.
- Make sure the header and footer style is changed.

---

```
1 \newcommand{\TableOfContents}{
2   \tableofcontents
3   \listoffigures
4   \listoftables
5   %
6   \clearpage
7   \pagenumbering{arabic}
8   %
9   \pagestyle{scrheadings}
10 }
```

---

## Header and Footer Settings

The below are the header footer settings for the thesis class.

- As this is a derivative of KOMA, we load the excellent package `scrlayer-scrpage` to define and then control the header and footer of the document.
- Make sure the chapter on the header is uppercase and always place is away from binding.
- Put the section name towards the binding.
- Put the student name in footer towards the binding.
- Put the page number away from binding.

---

```
1 \RequirePackage[
2 automark,
3 headsepline,
4 footsepline,
5 autooneside = false
6 ]{scrlayer-scrpage}
7
8 \clearpairofpagestyles
9
10 \ihead{\MakeUppercase{\leftmark}}
11 \ohead{\rightmark}
12 \ofoot{\thepage}
13 \ifoot{\the\StudentName}
14 \renewcommand{\headfont}{\normalfont}
```

---

## 2.10 Additional Configurations

Below are the additional configurations which are used by all the previously mentioned classes.

### Package: fontenc

We set the font of the document in a sans-serif font for better legibility to read the document in a digital display.

---

```
1 \RequirePackage{Gudea}
2 \RequirePackage[T1]{fontenc}
```

---

### Package: Set Space

We set line separation a little bit more than standard so the text doesn't look like it is suffocating.

---

```
1 \RequirePackage{setspace}
2 \setstretch{1.25}
```

---

### Package: geometry

Load geometry as it would not be possible otherwise to change page style.

---

```
1 \RequirePackage{geometry}
```

---

### Package: siunitx

No STEM paper would be written without using siunitx.

---

```
1 \RequirePackage{siunitx}
```

---

### Package: tabularx

We need the package to handle the lower part of the titlepage for the Report class.

---

```
1 \RequirePackage{tabularx}
```

---

### Package: booktabs

We use this to add lines to the tabular environments.

---

```
1 \RequirePackage{array, booktabs, multirow}
```

---

### Package: enumitem

This package is particularly useful to add or modify the behaviour of itemize, enumerate environments. Here we change the label of itemize environment.

---

```
1 \RequirePackage{enumitem}
2 \setlist[itemize]{label=$\blacksquare$}
```

---

### Package: pgfplots

We use pgfplots for plotting figures but it is here for mostly demonstrative purposes used in the example document. This can freely be removed if required.

---

```
1 \RequirePackage{pgfplots}
```

---

### Package: caption

We use the package to change the behaviour of the captions under figures and tables. Here we change the font of the text to small and make it bold.

---

```
1 \usepackage[font=small,labelfont=bf]{caption}
```

---

### Package: ams

This just goes without saying.

---

```
1 \RequirePackage{
2   amsmath,
3   amssymb
4 }
5
```

---

### Package: listings

listings is a versatile package to print out the code in a uniform way. Below are the configurations set to the package. Currently a global setting is given called `mainStyle` however, this can easily be changed.

---

```
1 \RequirePackage{listings}
2
3 \definecolor{codegreen}{rgb}{0,0.6,0}
4 \definecolor{codegray}{rgb}{0.5,0.5,0.5}
5 \definecolor{codepurple}{rgb}{0.58,0,0.82}
6 \definecolor{backcolour}{rgb}{0.95,0.95,0.92}
7
8 \lstdefinestyle{mainStyle}{
9   backgroundcolor      = \color{white},
10  commentstyle         = \color{codegreen},
11  keywordstyle          = \color{magenta},
12  numberstyle           = \tiny\color{codegray},
13  stringstyle           = \color{codepurple},
14  basicstyle            = \ttfamily\footnotesize,
```

---

```
15     breakatwhitespace = false,
16     breaklines         = true,
17     captionpos         = b,
18     frame               = 1,
19     keepspaces         = true,
20     numbers            = left,
21     numbersep          = 10pt,
22     showspaces         = false,
23     showstringspaces   = false,
24     showtabs           = false,
25     tabsize            = 2
26 }
27 \lstset{style=mainStyle}
```

---



# Chapter 3

## Examples

### 3.1 Thesis Main

Below is the explanation of a thesis class document which should be included with the `mcidoc`. This section is focused on the explanation of how to use `Thesis` in an application.

The contents of this section should be available in `Main-Thesis.tex`.

Below is the example of how the main file looks like. We first define the `documentclass` optional arguments with their required values:

---

```
1 \documentclass[
2 state          = Thesis,                % (Report | Thesis)
3 lang           = EN,                    % (DE      | EN)
4 degree         = MSc,                   % (BSc     | MSc)
5 dept          = MECH,                   % (MECH    | SBT)
6 bib-active     = true,                  % (true    | false)
7 bib-style      = ieee,                  % (ieee)
8 column-type    = two,                   % (one     | two)
9 ]{mcidoc}
```

---

Next we have our preamble where it is in good put and post configuration we may need to have in our document.

Here we have a sample bibliography as well.

And at the lower end we have some variables which need defining for the thesis template.

---

```
1 % CUSTOM COMMANDS -----
2 %
3 % Please enter any custom command/packages you require here for easy tracking
4
5 % For example, bibliography setting are added. Bibtex is the standard but if you prefer
6 % there are other options on the market such as biber. Style has been chosen as IEEE but if
7 % are from another discipline, please feel free to change it.
8
```

---

```

9
10
11
12 \bibliography{references.bib} % Here we add our file where we store our references.
13 %
14 % -----
15
16 % DOCUMENT PARAMETERS -----
17
18 \Title{%
19   On the Study of Different Rotor Geometry Configuration for use in High-Speed
20   Induction Motors
21 }%
22
23 \StudentName{Jason Smith}
24 \StudentID{2024000095}
25
26 \StudyProgram{Mechatronics \& Smart Technologies}
27 \Supervisor{Colin Stevens}

```

---

Here we load the necessary command required by the Report class. There are only two commands

`\MakeTitlePage` Generates the title page based on what was entered previously,

`\DeclarationOfNovelty` Generates a page of standard text.

`ThesisEmbargoRequest` Creates a page of standard text.

`\TableOfContents` Creates a table of contents containing:

- List of headings,
- List of figures,
- List of tables.

Please put your abstract (EN) , abstract (DE), and Acknowledgement after `\ThesisEmbargoRequest`.

---

```

1 \begin{document} % #####
2
3 \MakeTitlePage
4
5 \DeclarationOfNovelty
6
7 \ThesisEmbargoRequest[5]
8
9 \TableOfContents
10
11 % REPORT CONTENT -----
12

```

---

---

```

13 % ----
14 % Your report content should go here and should follow structure befitting of a scientific
15 % report and should be written in a scientific format. For more information please look at
16 % MCI guidelines on how it should be done.
17 % ----
18
19 % Include Chapter - introduction
20 \include{chapter/introduction.tex}
21
22 % Include Chapter - literature survey (contains minted code)
23 %\include{chapter/literature-survey.tex}
24
25 % ----
26 % Add as many chapters as you see fit for your content. For easy legibility and for dynamic
27 % adjustment of content it would be suggested to write your files and place them similar to
28 % the aforementioned examples.

```

---

Here we add any additional post document configurations we may need, such as:

- Bibliography,
- Nomenclature,
- Glossary,
- Index.

These options require you to use external packages (`\usepackage`) please look into the corresponding packages and their documentation for more information. Here as I have loaded bibtex I can use `\printbibliography` to make the reference list appear at the end of the document.

---

```

1 % REPORT POSTAMBLE -----
2
3 % ----
4 % In this section, please put all the thing you deem are necessary for the thesis but does have
5 % no substance as materials (i.e., technical drawings, patents, massive code bases).
6 % ----
7
8 \printbibliography
9
10 % \makeindex
11 % \printnomenclature
12 % \printglossaries
13
14 \end{document} % #####

```

---

## 3.2 Report Main

Below is the explanation of a report class document which should be included with the `mcidoc`. This section is focused on the explanation of how to use `Report` in an application.

The contents of this section should be available in `Main-Report.tex`.

Below is the example of how the main file looks like. We first define the `documentclass` optional arguments with their required values:

---

```

1 \documentclass[
2 state          = Report,                % (Report | Slide | Thesis)
3 lang           = DE,                    % (DE | EN)
4 degree        = MSc,                   % (BSc | MSc)
5 dept          = MECH,                   % (MECH | SBT)
6 bib-active    = true,                   % (true | false)
7 bib-style     = ieee,                   % (ieee)
8 column-type   = one,                   % (one | two)
9 ]{mcidoc}

```

---

Next we have our preamble where it is a good practice to put and configurations we may need to have in our document such as:

- Additional packages,
- Package settings,
- Newcommands or revising old commands,
- Loading libraries,
- Declaring file paths.

Here we have a sample bibliography as well.

And at the lower end we have some variables which need defining for the report template.

The `\Group` is an optional token and if it does not apply to your current situation, please remove it.

---

```

1 % CUSTOM COMMANDS -----
2 %
3 % Please enter any custom command/packages you require here for easy tracking
4
5 % For example, bibliography setting are added. Bibtex is the standard but if you prefer
6 % there are other options on the market such as biber. Style has been chosen as IEEE but if
7 % are from another discipline, please feel free to change it.
8
9 \bibliography{references.bib} % Here we add our file where we store our references.

```

---

---

```

10 %
11 % -----
12
13 % DOCUMENT PARAMETERS -----
14
15 \TitleHeader{Laboratory Report 3}%
16
17 \Title{%
18   On the Study of Different Rotor Geometry Configuration for use in High-Speed
19   Induction Motors
20 }%
21
22 \Lecture{Drive Technologies}%
23
24 \Lecturer{Daniel T. McGuinness, Ph.D}%
25
26 \Cohort{BA-MECH-22}%
27 \Group{BA-MECH-22-4A}%
28
29 \StudentName{Jason Smith}%
30 \StudentID{2024000095}%
31
32 \Supervisor{Colin Stevens}%

```

---

Here we load the necessary command required by the Report class. There are only two commands

`\MakeTitlePage` Generates the title page based on what was entered previously,

`\TableOfContents` Creates a table of contents containing:

- List of headings,
- List of figures,
- List of tables.

---

```

1 \begin{document} % #####
2
3 \MakeTitlePage
4
5 \TableOfContents
6
7 % REPORT CONTENT -----
8
9 % ----
10 % Your report content should go here and should follow structure befitting of a scientific
11 % report and should be written in a scientific format. For more information please look at
12 % MCI guidelines on how it should be done.
13 % ----
14
15 % Include Chapter - introduction
16 \include{chapter/introduction.tex}

```

---

---

```

17
18 % ----
19 % Add as many chapters as you see fit for your content. For easy legibility and for dynamic
20 % adjustment of content it would be suggested to write your files and place them similar to
21 % the aforementioned examples.

```

---

Here we add any additional post document configurations we may need, such as:

- Bibliography,
- Nomenclature,
- Glossary,
- Index.

These options require you to use external packages (`\usepackage`) please look into the corresponding packages and their documentation for more information. Here as I have loaded `bibtex` I can use `\printbibliography` to make the reference list appear at the end of the document.

---

```

1 % REPORT POSTAMBLE -----
2
3 % ----
4 % In this section, please put all the thing you deem are necessary for the thesis but does have
5 % no substance as materials (i.e., technical drawings, patents, massive code bases).
6 % ----
7
8 \printbibliography
9
10 % \makeindex
11 % \printnomenclature
12 % \printglossaries
13
14 \end{document} % #####

```

---

### 3.3 A Chapter

The following is a generic template which show a wide variety of features you may need in your thesis work.

The contents of this section should be available in `chapter/introduction.tex`.

---

```

1 \chapter{Introduction}
2
3 \section{The Need for Speed}

```

---

---

```

4
5 In recent years, improvements in manufacturing, transportation and process industry
6 technologies bring about an increase in optimal operation speed in drive systems. In this
7 respect, recently developed high speed gear-less or direct-drive electrical drives have seen an
8 increase in interest based on the reduction in the total structural volume of the drive
9 system. Due to the significant development of cost-effective, fast switching and compact
10 variable frequency drives technology, wide speed range operations of different type AC motors
11 has become feasible. The speed definition of an induction motor can be seen in Eq.\ \ref{eq:speed}

```

---

Make sure you label your equations.

---

```

1 \begin{equation} \label{eq:speed}
2   n = \frac{120 f}{p},
3 \end{equation}

```

---

A text showing how citations are inserted into the document along how units should be entered using `\SI` command.

---

```

1 In literature, there are several descriptions for the term "high-speed". As a mechanical
2 engineer, peripheral speed over \SI{150}{\meter\per\second} is considered to be high speed
3 \cite{gieras2011performance}. From the motor manufacturer's point of view, a two-pole machine
4 which is supplied higher than 50 to \SI{60}{\hertz}, can be considered as a high-speed machine.
5 However, the most important point of view for the high-speed term is explained by development
6 at power electronics. Nowadays, up to few hundreds hertz frequencies can be produced by
7 variable frequency drives. However, voltage qualities of these are not satisfactory due to
8 limited switching frequency of high-power IGBT technology. Thus, high-speed levels might be
9 calculated for frequencies in the range of 100 to \SI{400}{\hertz} are considered to be
10 high-frequencies \cite{pyrhonen1991high}. Owing to brush and commutator structure causing
    ↪ mechanical and
11 electrical problems, DC drives are not allowed to be used for high-speed applications. In
12 addition to the aforementioned statement, the structure is not appropriate for large
13 centrifugal forces. Nevertheless, as high-speed drive applications, there are different type
14 of AC motor concepts proposed in literature
15 \cite{gieras2011performance, pyrhonen1991high, lahteenmaki2002design, saari1998thermal}:
16 Laminated/solid induction, permanent
17 magnet synchronous and switched reluctance synchronous motors.

```

---

Here is an example of how a table could be written using `tabular`. But of course there are many packages which allow typesetting tables such as

- `tabularray`
- `tabularx`
- `nicearray`

---

```

1 \begin{table}
2   \begin{tabular}{rll} \toprule

```

---

---

```

3   \parbox[t]{5cm}{\textbf{Admission requirements}}           \\ for Mathematics
   ↪ (MSc)}} & \parbox[t]{5cm}{\textbf{Courses completed \\ before start}}} &
   ↪ \parbox[t]{2.5cm}{\textbf{Date of \\ completion}}} \\ \midrule
4   Mathematical Analysis (30 ECTS) & Mathematical Analysis 1 & 22.04.2014 \\
5   ~                               & Mathematical Analysis 2 & 15.02.2013 \\
6   ~                               & Complex Analysis      & 01.07.2015 \\ \midrule
7   Algebra/Linear algebra (22.5 ECTS) & Advanced Algebra      & 17.02.2013 \\
8   ~                               & Abstract Algebra      & 01.06.2015 \\ \midrule
9   Geometry/Topology (15 ECTS) & Topology              & 01.11.2014 \\
10  ~                               & Vector Analysis       & 15.06.2015 \\
11  ~                               & Differential Geometry  & 15.02.2013 \\ \bottomrule
12 \end{tabular}
13 \caption{As can be clearly seen, this table has absolutely no reason to be here aside from
14 taking space. But it is a nice table to show how it should look and a template to write your
15 own tables.}
16 \end{table}

```

---

If you need spacing between two paragraphs use \\ to add a space between the paragraphs

---

```

1 It is due to remarkable improvements of power electronics, frequency inverters and AC
2 variable-speed drives, which allows a wider use of applications of solid-rotor induction motor
3 (SRIM). SRIM's are used in drive application ranging from a few kW's to 10 MW's. Fans,
4 compressors, pumps, gas turbines, sewing machines, space and aeronautics, auxiliary motors for
5 starting turbo-alternators, eddy current brakes, two-phase servomotors are a few examples of its
6 areas. \\
7
8 Below are the advantages of SRIM compared to CRIM:

```

---

Using `enumitem` package you can add additional embellishments to the `itemize`, `enumerate`, and `description` environments. Here we use `itemsep=0pt` to control the distance between each item in the list

---

```

1 \begin{itemize}[itemsep=0pt]
2 \item Structural and Mechanical integrity, Rigidity, Reliability and Strength of
3   Material
4 \item High thermal properties
5 \item High speed in high power applications (high moment density)
6 \item Low noise and vibrations in high speed applications
7 \item Simple to protect against aggressive chemicals
8 \item Ease of Manufacturing
9 \item Low level of noise and vibrations (If the rotor has no slots)
10 \item Linearity of torque-speed characteristics throughout the entire speed range
11 \item The possibility of obtaining steady-state stability.
12 \end{itemize}
13

```

---

```

14 In 1950s, Solid-Rotor topologies for induction machines operating at high speeds
15 have gained a lot of interest. From its inception to 1970s, various scientists and engineers
16 have contributed to the development and the theory of solid rotor construction, where significant
17 interest was seen the 1990s for using solid rotor structure for high speed applications.

```

---



One of the great things about latex is that you can draw really good looking images using TiKZ and pgfplots which you can see below

Drawing graphs can take some time to compile so if you are interested in using Overleaf (why?) perhaps use external software to draw your work.

```

1 \begin{figure}[!t]
2   \begin{tikzpicture}
3     \begin{axis}[width=15cm, height=6cm,
4       minor tick num    = 2,
5       grid              = both,    % have a grid that is bitchin
6       % GRID OPTIONS
7       minor grid style = {
8         densely dotted,
9         line width = 0.1,
10        gray!30
11      },
12      major grid style={
13        densely dotted,
14        line width = 0.3,
15        gray!30
16      }]
17      \addplot+ [
18        const plot mark right,
19        ] coordinates {
20        (0,0.1)   (0.1,0.15) (0.2,0.5)  (0.3,0.62)
21        (0.4,0.56) (0.5,0.58) (0.6,0.65) (0.7,0.6)
22        (0.8,0.58) (0.9,0.55) (1,0.52)
23      };
24    \end{axis}
25  \end{tikzpicture}
26  \caption{The authors interest in the topic as years go on.}
27 \end{figure}

```

Here is a good example of how to add footnote to your text which, when compiled, will show up on the bottom of the page it was invoked.

```

1 As the rotor does not contain any trace of copper \footnote{the rotor
2   consists of a solid body of steel or similar ferromagnetic material}{windings}, the eddy currents
3 roam in the rotor without any conductive path restriction and cause the motor to
4 have different characteristics compared to a Cage Rotor Induction motor (CRIM), an industry
5   ↪ standard
6 construction.
7 While eddy currents are the main principle of its operation, these currents also causes
8 the motor to have lower efficiency in slow speed applications and this indirectly
9 decreases its power factor. But in high speed application where the speed is
10 around 30000 rpm the losses become far less and SRIM becomes the better choice for high speed
11 applications.

```

---

```

12 \subsection{Report Structure} %~~~~~
13
14 In this report for Drive Technologies, the high-speed performance of the four
15 different types of rotors are investigated and compared using finite element analysis:
16 cage, smooth solid, axially slitted, coated is designed using a finite-element
17 analysis (FEA). All rotors are designed with similar geometries and construction parameters
18 to minimise the effect of unwanted effects.

```

---

Finally, if you need to show some code in your work, I would suggest using `lstlisting` as it is easier to setup. A default style is given in the class but feel free to adjust depending on your needs.

---

```

1 \begin{lstlisting}[language=C++]
2 // C++ program to find all string
3 // which are greater than given length k
4
5 #include <bits/stdc++.h>
6 using namespace std;
7
8 // function find string greater than
9 // length k
10 void string_k(string s, int k)
11 {
12     // create an empty string
13     string w = "";
14     // iterate the loop till every space
15     for (int i = 0; i < s.size(); i++) {
16         if (s[i] != ' ')
17
18         // append this sub string in
19         // string w
20         w = w + s[i];
21         else {
22
23         // if length of current sub
24         // string w is greater than
25         // k then print
26         if (w.size() > k)
27             cout << w << " ";
28             w = "";
29         }
30     }
31 }
32 \end{lstlisting}

```

---

```

1 The number of turns per stator slot is selected so as to obtain the
2 same stator current in rated operation. All four motors were analyzed using FEA
3 tools for 20 different speeds in order to obtain the combined torque-speed
4 characteristics. To illustrate visually the differences in the distributions of the
5 magnetic flux and the eddy current the results for 11300 rpm are presented and the
6 core loss, the total loss and the efficiency for the specific speed are compared for all

```

---

7 the motors. The designed four motors will be also compared for winding currents,  
8 induced voltages, flux linkages, electromagnetic torque, copper losses, iron losses,  
9 solid rotor losses and efficiency.

---

## 3.4 References Bib File