Analysis of Heatpumps

Submitted to the
Albert-Ludwigs-Universität Freiburg

by Leander Marius Bürkin

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Master's Thesis

Submitted on **January 21, 2026**
to the **Albert-Ludwigs-Universität Freiburg**
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1. Enter your data.
2. Add as many bigskips as needed.

Enter your data int the Declaration.

Declaration

I hereby declare, that I am the sole author and composer of my thesis and that no other sources or learning aids, other than those listed, have been used.

Furthermore, I declare that I have acknowledged the work of others by providing detailed references of said work.

I also hereby declare that my thesis has not been prepared for another examination or assignment, either in its entirety or excerpts thereof.

Freiburg, January 21, 2026

Place, date	Leander Marius Bürkin

Acknowledgements

Thanks to my supervisor Max Mustermensch .

Further thanks go to the corporate design team at the Albert-Ludwigs-Universität Freiburg and Leander Marius Bürkin for this LaTeX-template.

Abstract

Zusammenfassung

Contents

1 Motivation

2 Fundamentals

3 Methodology

4 Results

5 Discussion

6 Conclusion

ToDos

Select the correct language in the first rows of `main.tex`. The % makes a line a comment.

Generate a PDF (Visual Studio Code: click on the green arrow in the top right corner).

Check the PDF (Visual Studio Code: click on the two rectangles with the magnifying glass in the top right corner).

Talk about this template with your supervisor: Should you add a declaration for the use of AI? Currently no official AI-declaration is given. You can find one in the pull requests of the github repository.

With CTRL pressed you can click on the PDF and jump to the corresponding place in your `.tex` files.

Check the Errors. (Visual Studio Code: bottom left) There should be one warning because the first ToDo pushes down the second one: `LaTeX Marginpar on page 2 moved.`

In the `main.tex` you can press ALT + SHIFT and the ARROW UP and DOWN keys to create a multiline cursor, comment out all the sections you are currently not working on and remove the multiline cursor with ESC.

Keep the following examples and todos till the end and check them out sometimes.

Adjust your License Notes to reflect the used programs.

For Printing: Remove the `todonotes`-package in `setup.tex` to find all ToDos.

Table 1: A nice table with a nice caption.

Value & Unit	Value	Unit
$9.82\,\mathrm{m\,s^{-2}}$	9.82	$\mathrm{m\,s^{-2}}$

For Printing: Choose the correct formating (search `print` in `setup.tex`).

You can remove the glossary and the symbolslist to make it easier, especially in a Bachelor's Thesis.

6.1 Tables and References

Table 1

This is a cited book [1].

Store and display plots and other graphs as `.pdf` files.

Include Algorithm 1 in the same way you include equations like Equation 1:

$$\begin{aligned} y &= 3x^2 + 5x^2 + 4x + 4x + 7 + 1 \\ &= 8x^2 + 8x + 8 \\ y &= 8 \cdot (x^2 + x + 1) \end{aligned} \tag{1}$$

6.2 Auto-complete in VSCode

There are also some auto-complete features: type @ + letter to get the letters greek version.

Type @v + letter for the alternative form (like φ for ϕ).

You can also use shortcuts for environments like

$$BAL \tag{2}$$

Type BAL and select the correct option from the autocomplete. Maybe you have to try various ones. The B is the base command and AL is the abbreviation for align.

If you want an environment without an index, you can use BS as base command.

Same for changes to your font, like bold or italic: FIT gives *text*

6.3 ", Quotations and Code

Use " or `file-names`, `file_names` and `code_snippets`.

Algorithm 1: The Colors from the Corporate Design of the University of Freiburg. The keywords are bold and the comments blue. This can be changed in `setup.tex`.

```
from dataclasses import dataclass

# https://cd.uni-freiburg.de/farben/

@dataclass
class MainColors:
    blue = "#344A9A"
    black = "#000000"
    white = "#FFFFFF"

@dataclass
class BackgroundColors:
    blue_100_percent = "#344A9A"
    blue_80_percent = "#5D6BAD"
    blue_60_percent = "#868DC2"
    blue_80_percent = "#AFB1D8"
    blue_20_percent = "#D7D8EC"
    dark_blue = "#00004a"
    sand_100_percent = "#f6f1e3"
    sand_50_percent = "#faf8f1"

@dataclass
class AdditionalColors:
    green_100_percent = "#00a082"
    green_80_percent = "#27b29b"
    green_60_percent = "#7bc6b4"
```

```
green_80_percent = "#afdace"
green_20_percent = "#daede7"
brown_100_percent = "#8f6b30"
brown_80_percent = "#a58959"
brown_60_percent = "#bca683"
brown_80_percent = "#d2c4ac"
brown_20_percent = "#e9e1d6"
yellow_100_percent = "#ffe863"
yellow_80_percent = "#ffed82"
yellow_60_percent = "#fff1a1"
yellow_80_percent = "#fff6c1"
yellow_20_percent = "#fffae0"
pink_100_percent = "#f5c2ed"
pink_80_percent = "#f7cef1"
pink_60_percent = "#f9daf4"
pink_80_percent = "#fbe7f8"
pink_20_percent = "#fdf3fb"
```

6.4 Clipboard Manager, Git and more

Clipboard Manager help with copying multiple different things at once. On Windows you can press WINDOWS + V to activate the history and choose older things you copied.

Use Git (click here).

6.5 Glossary

Click them, the page numbers in the glossaries are also clickable.

name one

name one

name one

long form of name two (short2)

short2

short2

$a\ symbol$

$a\ symbol$

$a\ symbol$

Big Letter at start: Name one

plural of name one

name one

Big Letter at start: Short2

short2

short2s

Big Letter at start: $A\ symbol$

$a\ symbol$

Symbols

Notation	Description	Page List
$a\ symbol$	description symbol	10, 11

List of Figures

List of Tables

List of Algorithms

Glossary

Notation	Description	Page List
name one	description one	9, 11
short2	description two	9–11

References

[1] Leander Bürkin. *LaTeX-Template*. Fachschaft TF Freiburg, 2025.

Appendix