Title Line 1

Title Line 2

Master Thesis

in partial fulfilment of the requirements for the degree of

Master of Science in Engineering

submitted to

Lucerne University of
Applied Sciences and Arts
Department of Electrical Engineering

on

March 1, 2019

from

Tobias Plüss, B.Sc.

Lecturers:

Name Advisor
Name Expert

this is a dedication

Declaration of academic honesty

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Horw, March 1, 2019

the author

_____

Tobias Plüss

Kurzfassung

Deutsch

Abstract

English

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This is the preface.

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Acknowledgement.
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Sydney, Australia, March 1, 2019

the author
Name

Part I

Main part

Use `\part` to divide the document into meaningful parts, e.g. theoretical part, experimental part etc.

Use `\partbacktext` to typeset some text on the backside of a part's title page if necessary.

```
\begin{partbacktext}
\part{Name}
Text
\end{partbacktext}
```

1

Chapter

a subtitle – does not appear in the TOC

Chapter author

Add some introductory text to a chapter using the motto command

Summary. this is an abstract Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Different types of chapters:

- \chapter with number, also appears in the table of contents
- \Extrachap without number but appears in the TOC, though
- \extrachap without number, hidden (no TOC entry)

1.1 Section

Different types of sections:

- \section with number, appears in the TOC
- \Extrasect without number, appears in the TOC
- \extrasect without number, not in TOC

1.1.1 Subsection

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1.1.1.1 Subsubsection

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Paragraph

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1.2 Images

Use following code to insert images:

```
\begin{figure}
  \centering
  \includegraphics{<image file>}
  \caption{This is the caption}
\end{figure}
```

Use `\begin{figure}[H]` to enforce placement at a specific position. However this is not recommended – the default LATEXalgorithm for the placement of figures gives probably better results.

Image with reference: Fig. 1.1.

Fig. 1.1. caption

If the desired image is not yet available, a placeholder of adequate size may be used; use either `example-image-a` or so, or perhaps `mpicplace`, see Fig. 1.2.

```
\begin{figure}
  \centering
  \mpicplace{4cm}{5cm}
  \caption{This is a placeholder}
  \label{fig:mpicplace}
\end{figure}
```
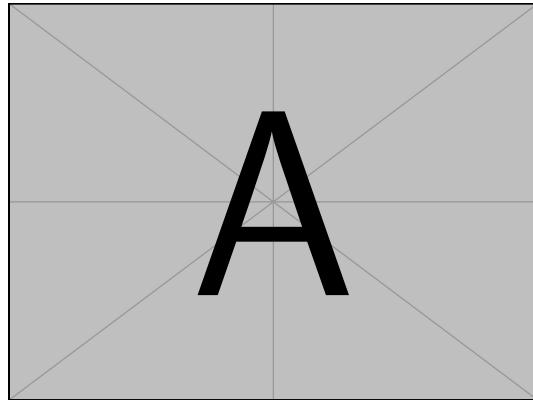
Fig. 1.2. This is a placeholder

Sidecaptions

For quite long captions it is sometimes more convenient to place the caption next to the image instead of below. See Fig. 1.3 for an example.
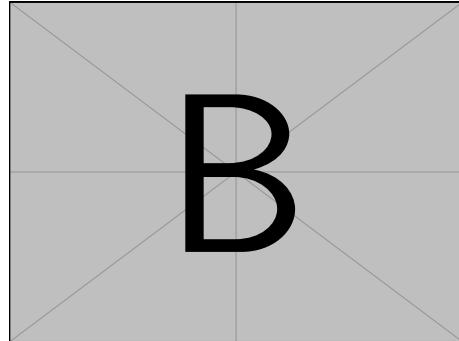
Fig. 1.3. Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text Long text

Note that the sidecaption is aligned such that it is on the right-hand side of the picture if it appears on an even page, and it is on the left-hand side of the picture if it appears on a odd page. This improves readability on two-sided prints.

```
\begin{figure}
  \sidecaption
  ...
  \caption{Text}
\end{figure}
```

`\sidecaption[t]` aligns the sidecaption at the top instead of at the bottom.
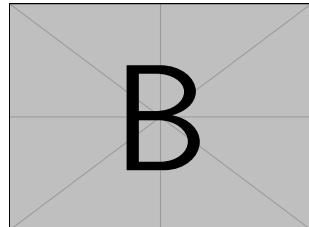
Fig. 1.4. Long text

Multi figures

Use `\leftfigure` and `\rightfigure` to place two images next to each other. See Fig. 1.5 and Fig. 1.6. Ensure both pictures do have the same height for aesthetic reasons. If the images don't have the same height, they are aligned at their bottom, such that the captions are at the same height. Use `\leftfigure[r]` to control the alignment (left or right, corresponding to `l` or `r`) of the image.
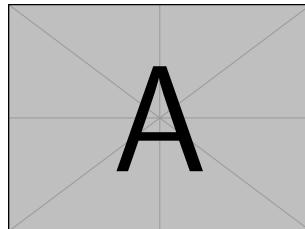
Fig. 1.5. Left image
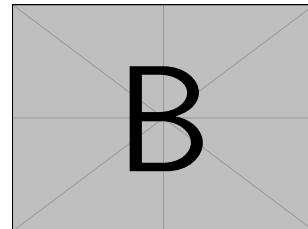
Fig. 1.6. right image
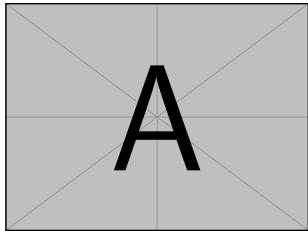
Fig. 1.7. left
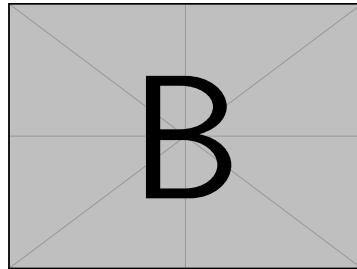
Fig. 1.8. right

Subfigures

Use \subfigures to ensure two images do have the same number with a and b as in Fig. 1.9a and Fig. 1.9b.
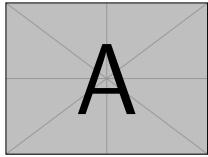
Fig. 1.9a. Long text Long text Long text Long text Long text Long text Long text Long text
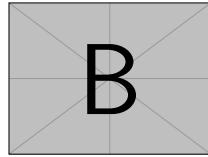

Fig. 1.9b. Long text Long text Long text Long text Long text Long text Long text Long text

If one needs more subfigures, it is probably better to use \subfloat. However, stick to only one version – use either \subfloat or \subfigures, but don't mix them (again, aesthetic reasons...).

(a) 1st subfigure   (b) 2nd subfigure   (c) 3rd subfigure   (d) 4th subfigure
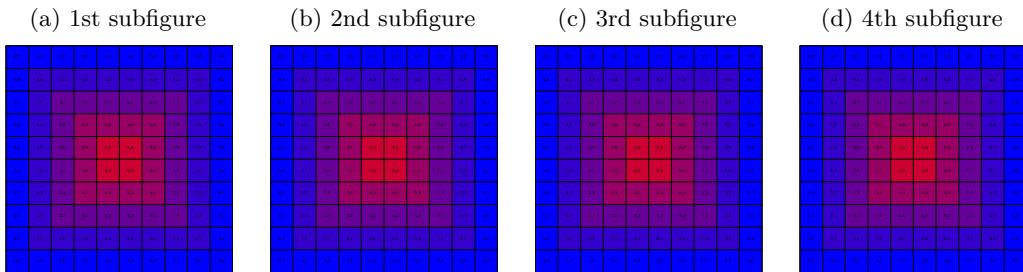
Fig. 1.10. A figure with multiple subfigures.

1.3 Equations

Maxwell's equations.

$$\oint_{\partial G} \mathbf{E} \cdot d\mathbf{s} = -\frac{d}{dt} \iint_G \mathbf{B} \cdot d\mathbf{A} \tag{1.1}$$

$$\oint_{\partial G} \mathbf{H} \cdot d\mathbf{s} = \frac{d}{dt} \iint_G \mathbf{D} \cdot d\mathbf{A} + \iint_G \mathbf{J} \cdot d\mathbf{A} \tag{1.2}$$

$$\oiint_{\partial G} \mathbf{B} \cdot d\mathbf{A} = 0 \tag{1.3}$$

$$\oiint_{\partial G} \mathbf{D} \cdot d\mathbf{A} = \iiint_G \varrho \, dV \tag{1.4}$$

$$\nabla \cdot \mathbf{J} = -\frac{\partial \varrho}{\partial t} \tag{1.5}$$

Some other stuff.

$$\mathbf{A} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \tag{1.6}$$

1.4 Misc stuff

Proof. Text $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ □

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Add items to the index with the `\index{item}` command.

gray box

$$a = b + c \tag{1.7}$$

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Input: $n > 3$, an odd integer to be tested for primality and k, a parameter that determines the accuracy of the test
Output: Composite if n is composite, otherwise probably prime

Write n-1 as $2^j d$ with d odd;
for $i \leftarrow 1$ **to** k **do**
    Pick a random integer a in the range [2, n-2];
    $x \leftarrow a^d \mod n$;
    if $x = 1$ *or* $x = n - 1$ **then**
        | **continue**
    else
        for $i \leftarrow 1$ **to** $j - 1$ **do**
            $x \leftarrow x^2 \mod n$;
            if $x = n - 1$ **then**
                | **continue**
            end
        end
    end
    ;
    return *composite*
end
return *probably prime*

Algorithm 1: Miller-Rabin algorithm

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Margin figures

place small figures in the margin. Use `marginfigure` which works quite similar as `figure`. The margin figures probably need manual adjustment of their position, e.g. `\begin{marginfigure}[-5cm]` moves the figure 5 cm upwards. Fig. 1.11 is an example of a margin figure.

If one wants to typeset a section of text with a smaller font, the `\begin{petit}` and `\end{petit}` environment can be used.

Fig. 1.11. Caption for margin figure – long text long text long text long text long text long text long text long text

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Tables

See the documentation to `booktabs` how to properly make tables. Tab. 1.1 is an example.

Tab. 1.1. this is a simple table

first column	2nd column
a	b
c	d

some text in the margin can be typeset with margintext.

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Some basic typographic rules

1. Symbols in equations are usually cursive, like impedance Z or angle α.

2. In contrast to symbols, units need to be in upright font, as follows: impedance Z in Ω (correct), vs. *not Ω* (wrong).

3. There is a difference between a minus sign and a hyphen. This is especially important if there is also a plus sign.

   Hyphen: -12 °C
   Minus sign: -12 °C
   Plus sign: $+$ (normal text), $+$ (math mode). The plus has the same width as the minus. Always use math mode for minus signs.

4. Between a number and its unit, use a small space with `\,`.

5. Temperatures: The degree sign belongs to the unit, and not to the number. 100 °C oder -30 °F, ant *not* 100°C oder -30°F.

6. Angles: no space between the number and the unit. 30°

7. Charts: follow the rules of DIN-461 for making proper charts. Fig. 2.1 is an example.

Long tables: Tab. 2.1 is an example of a quite long table. Note the "continued on next page" footer and the repeated header.

Tab. 2.1. Ambient conditions record

date		T	RH	particle counter readings					
time	sign	°C	%	0.3 μm	0.5 μm	1 μm	2.5 μm	5 μm	10 μm
08. Jan 590 GHz to 664 GHz vertical polarisation									
17:00	tp	23.5	30.7	3179	878	133	12	3	2
17:40	tp	23.9	27.9	2666	670	65	12	6	1
18:15	tp	24.7	27.2	3146	963	79	15	4	2
19:00	tp	25.4	25.0	3143	523	120	12	1	1
19:40	tp	25.6	24.6	2407	680	133	10	3	3
20:05	tp	25.6	26.4	2012	624	99	21	4	0
09. Jan 590 GHz to 664 GHz vertical polarisation									
09:00	tp	23.8	25.2	2511	924	249	28	7	5
09:45	tp	24.2	23.9	1532	689	143	19	3	2
10:10	tp	24.6	23.8	2175	820	202	26	4	3

continued on next page

date		T	RH	particle counter readings					
time	sign	°C	%	0.3 μm	0.5 μm	1 μm	2.5 μm	5 μm	10 μm
10:35	tp	24.7	23.8	2287	867	126	15	1	1
11:05	tp	24.7	24.7	2755	602	112	13	2	2
09. Jan 590 GHz to 664 GHz horizontal polarisation									
12:35	tp	23.5	25	1946	615	110	12	2	2
13:05	tp	24.2	26.1	3349	971	158	30	4	4
14:00	tp	23.3	25.4	2116	705	126	17	2	2
14:30	tp	24	25.2	2723	597	112	7	5	0
15:00	tp	24	24.5	2646	825	110	12	7	2
15:40	tp	24.2	24.4	2573	958	159	22	4	3
16:10	tp	24	26	1949	750	154	26	4	1
16:40	tp	24.4	25	1988	555	127	16	6	0
17:15	tp	24	26	1612	56	133	12	3	2
10. Jan 400 GHz to 410 GHz horizontal polarisation									
10:10	tp	23.7	26.8	7111	1996	278	30	5	3
10:25	tp	23.8	26.2	6414	2137	395	50	11	4
12:30	tp	23.5	23.8	3150	751	89	13	3	2
13:00	tp	23.6	23.8	2729	968	104	10	1	1
13:15	tp	24.2	23.9	3051	856	149	23	9	4
13:30	tp	24.5	23.5	2418	648	85	19	4	2
13:40	tp	24.7	24.8	2322	793	110	21	3	1
13:50	tp	24.6	25	2923	771	191	30	4	3
14:00	tp	25.9	20.7	2310	427	116	17	2	1
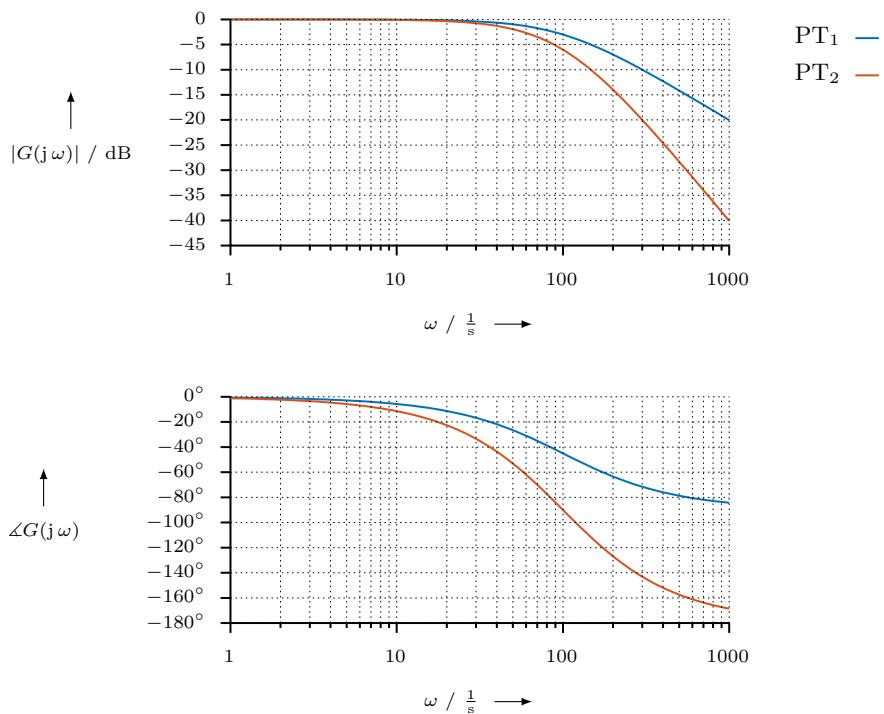
Fig. 2.1. Example chart

Extra chapter

Extra section

Part II

Appendix

Abbreviations and terms

Abbreviations

List of abbreviations

ALC	automatic levelling control	**MMIC**	microwave monolithic integrated circuit
CBN	cubic boron nitride		
CW	continuous wave	**MOSFET**	metal oxide semiconductor FET
DDS	direct digital synthesis		
DSP	digital signal processor	**NCO**	numerically controlled oscillator
ECL	emitter coupled logic		
FET	field effect transistor	**PA**	power amplifier
FFT	fast Fourier transformation	**PAE**	power added efficiency
FIR	frequency invariant reactance	**PCB**	printed circuit board
		PFD	phase-frequency detector
FM	frequency modulation	**PLL**	phase locked loop
FoM	figure of merit	**QFN**	quad flat no-leads package
GaAs	gallium arsenide	**RF**	radio frequency
GaN	gallium nitride	**RMS**	root mean square
HBN	hexagonal boron nitride	**SOA**	safe operation area
HEMT	high electron mobility transistor	**SPICE**	simulation program with integrated circuit emphasis
IF	intermediate frequency	**VFO**	variable frequency oscillator
IRL	input return loss		
ISM	industrial, scientific and medical	**VGA**	variable gain amplifier
		VCO	voltage controlled oscillator
JFET	junction FET	**YIG**	Yttrium iron garnet
LDMOS	laterally diffused MOSFET	**YTO**	YIG tuned oscillator

Glossary

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Symbols and constants

If not otherwise noted, the values of physical constants are taken from [**?**].

c speed of light, $c \approx 2.9979 \cdot 10^8\,\frac{\mathrm{m}}{\mathrm{s}}$

μ_0 permeability of vacuum; $\mu_0 \approx 1.257 \cdot 10^{-6}\,\frac{\mathrm{H}}{\mathrm{m}}$

N_a Avogadro's number, $6.022 \cdot 10^{23}\,\frac{1}{\mathrm{mol}}$

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