

Your Title

Author





TALLINN UNIVERSITY OF TECHNOLOGY  
SCHOOL OF ENGINEERING

---

DEPARTMENT OF ELECTRICAL POWER ENGINEERING AND  
MECHATRONICS

**English title**

**Estonian title**

MASTER THESIS

Student: your name

Student code: your code

Supervisor: his name

Tallinn, 2017

# AUTHORS'S DECLARATION

Hereby I declare, that I have written this thesis independently.

No academic degree has been applied for based on this material.

All works, major viewpoints and data of the other authors used in this thesis have been referenced.

“.....” ..... 201....

Author: .....  
(signature)

Thesis is in accordance with terms and requirements.

“.....” ..... 201....

Supervisor: .....  
(signature)

Accepted for defence

“.....” ..... 201....

Chairman of theses defence commission: .....  
(name and signature)

TUT Department of Yours  
Chair of Yours

**MASTERS THESIS SHEET OF TASKS**

Year: 201x semester: summer

Student: Your Name, ID: xxx xxx  
Curricular: Mechatronics  
Speciality: Mechatronics  
Supervisor: His Name  
Advisor: His Name

**MASTERS THESIS TOPIC:**

(in english): English title

(in estonian): Estonian title

**Thesis tasks to be completed and the timetable:**

Nr.	Description of tasks	Timetable
1.	task 1	date 1
2.	task 2	date 2
3.	task 3	date 3
4.	task 4	date 4
5.	task 5	date 5

**Solved engineering and economic problems:**

Your problems and goals

**Additional comments and requirements:** No

**Language:** English

**Application is filed not later than:** your deadline

**Deadline for submitting the theses:** your deadline

**Student:** \_\_\_\_\_ 20th of May 2016

**Supervisor:** \_\_\_\_\_ 20th of May 2016

Confidentiality requirements and other conditions of the company are formulated as a company official signed letter.

## List of symbols

$A$	Gain
$1/f_{noise}$	Floor noise
$a$	Variable for the exponential regression
$A_p$	Active sensor surface
$b$	Variable for the exponential regression
$\beta$	Regression variable
$\beta_0$	Linear regression coefficient
$\beta_1$	Linear regression coefficient
$C_{DA}$	Dielectric capacitance
$C_{ERC2}$	Serial capacitance of the input resistor
$C_{int}$	Integrator capacitor
$D$	Kolmogorov Smirnov coefficient
$\Delta t$	Integration time
$E$	Expected value
$e_i$	Residual of the individual value
$H_0$	Null hypothesis
$H_1$	Other hypothesis
$h_i$	Individual weightings
$i_{in}$	Input current
$i_{in,max}$	Maximum input current
$i_{in,min}$	Minimum input current
$K_s$	Tuning constant
$L_{ESL}$	Serial equivalent inductance
$L_{ESL2}$	Equivalent series inductance
$O_i$	Number of Pearson chi-square samples
$Q_p$	Light intensity
$r_{adj}$	Adjusted residuals
$R_{DA}$	Dielectric memory resistance
$R_{eq}$	Individual residual
$R_{ESR}$	Equivalent resistance
$r_i$	Serial resistor leakage
$R_L$	Serial resistance of the current source
$R_s$	Regression coefficient
$R - square$	Last square regression
$s$	Robust variance
$\sigma_y(\tau)$	Allan deviation

$\sigma_y^2(\tau)$	Allan variance
$S_p$	Sensor sensitivity
$\tau$	Sampling frequency
$\tau^{-1/2}$	White noise slope
$u_i$	Weighting coefficient
$v(t)$	Time dependent voltage output
$v_o$	Voltage output
$v_{Ref}$	Reference voltage source
$W$	Shapiro-Wilk coefficient
$w_i$	Individual weight
$\hat{y}_i$	Expected value
$x$	Regression variable
$\chi^2$	Pearson chi-squared coefficient
$x_i$	Linear regression variable
$Y$	Regression function
$y$	Exponential regression function
$y_i$	Individual regression function

## List of abbreviations

AD	Analog to digital converter
BNC	Bayonet Neill-Concelman connector
CMOS	Complimentary Metal-oxide-semiconductor
DA	Dielectric absorption
DC	Direct current
DMM	Digital-multimeter
DSP	Digital signal processor
DUV	Deep ultra violet
Est.	Estimation
LED	Light emitting diode
MOSFET	Field-effect transistor
NIR	Near infra-red
NP0	Class of ceramics used for capacitors
PCB	Printed circuit board
PTFE	Polytetrafluoroethylene
RF	Radio frequency
SW	Switch
TLL	Trigger logic level



# Foreword

## **In English:**

Your 150 words in English

## **In Estonian:**

Your 150 words in Estonian



# Contents

<b>1</b>	<b>Introduction</b>	<b>11</b>
1.1	Problem definition . . . . .	11
1.2	Motivation . . . . .	11
1.3	Summary . . . . .	11
<b>2</b>	<b>Background</b>	<b>13</b>
2.1	Existing solutions . . . . .	13
2.2	Literature review . . . . .	13
<b>3</b>	<b>Methods and Materials</b>	<b>15</b>
3.1	Equations and math mode . . . . .	15
3.2	Arrays and matrices . . . . .	16
3.3	Math fonts . . . . .	16
3.4	Math symbols . . . . .	17
<b>4</b>	<b>Results</b>	<b>19</b>
4.1	The package hyperref . . . . .	19
4.2	Hyperlinks to internet sites, email and attached files . . . . .	19
4.3	Literature references . . . . .	19
<b>5</b>	<b>Conclusion</b>	<b>21</b>
5.1	Figures . . . . .	21
5.2	Tables . . . . .	21
5.3	Enumerate and itemize . . . . .	23
<b>A</b>	<b>Just an example appendix</b>	<b>25</b>
	<b>Bibliography</b>	<b>27</b>
	<b>List of Figures</b>	<b>29</b>
	<b>List of Tables</b>	<b>31</b>



# Chapter 1

## Introduction

### 1.1 Problem definition

Task description clearing out what I am trying to do Challenge description: Hypothesis: When appropriate formulate a testable hypothesis

### 1.2 Motivation

### 1.3 Summary

The head and foot of the document can be adapted using the packages *fancyhdr*. The using the commands, e.g., *pagestyle{fancy}*, *l/c/rhead/foot* or with *fancyhead/foot[EL,CO]* the respective parts can be edited as needed.



## Chapter 2

# Background

### 2.1 Existing solutions

- describe the current understanding of the problem - existing solutions - barrier of this solutions

### 2.2 Literature review

-Review the pertinent literature





## Chapter 3

# Methods and Materials

### 3.1 Equations and math mode

We are able to create automatically enumerated equation as the following one

$$f(x) = A_{ijkl}^{23}(x) \int_0^l g(y, x) \frac{\partial h(y, x)}{\partial y} dy . \quad (3.1)$$

Equation can be given a name/label. In order to refer to it later in the text the package `amsmath` has to be included. After including the package, the command to refer to labeled equation is (3.1).

Equation without a number can be created as follows

$$f(x) = A_{ijkl}^{23}(x) \int_0^l g(y, x) \frac{\partial h(y, x)}{\partial y} dy ,$$

or alternatively

$$f(x) = A_{ijkl}^{23}(x) \int_0^l g(y, x) \frac{\partial h(y, x)}{\partial y} dy .$$

You can also create a so called equation array with automatic numbering, e.g.,

$$f(x) = (x + a)^2 \quad (3.2)$$

$$= (x + a)(x + a) \quad (3.3)$$

$$= x^2 + 2xa + a^2 \quad (3.4)$$

You can refer to (3.2) and (3.4) separately. The very same can be created without any numbers as

$$f(x) = (x + a)^2$$

$$= (x + a)(x + a)$$

$$= x^2 + 2xa + a^2$$

Sometimes math content will be explained directly within the text. For these cases the math mode using `$$` can be used, e.g.,  $f(x) = x_{ijkl}^{234}$ .

## 3.2 Arrays and matrices

Arrays can be used within math environments in order to create a grid with math elements, e.g.,

$$\begin{array}{cccc}
 x + y + z & m_{1234567} & 13425436543634 & \\
 A_{ijkl}^{23}(x) \int_0^l g(y, x) \frac{\partial h(y, x)}{\partial y} dy & n_k & 123 & 
 \end{array} \quad (3.5)$$

A set of equations can also be arranged as follows

$$\begin{aligned}
 f(x) &= A_{ijkl}^{23}(x) \int_0^l g(y, x) \frac{\partial h(y, x)}{\partial y} dy \\
 &= 7x .
 \end{aligned} \quad (3.6)$$

This is an alternative to `eqnarray` with a single centered number, but some symbols may not be displayed as wanted. In order to force a full size display of a chosen element of the array the command `displaystyle` can be used

$$\begin{aligned}
 f(x) &= A_{ijkl}^{23}(x) \int_0^l g(y, x) \frac{\partial h(y, x)}{\partial y} dy \\
 &= 7x .
 \end{aligned} \quad (3.7)$$

Arrays can also be used in order to represent matrices, e.g.,

$$\left( \begin{array}{cccc}
 123123 & 324 & 214 & 4 \\
 43 & 345345645 & 45353465 & 346
 \end{array} \right) . \quad (3.8)$$

Alternatively matrices can be created with the following environments

$$\left( \begin{array}{cccc}
 123123 & 324 & 214 & 4 \\
 43 & 345345645 & 45353465 & 346
 \end{array} \right) \left[ \begin{array}{cccc}
 123123 & 324 & 214 & 4 \\
 43 & 345345645 & 45353465 & 346
 \end{array} \right] \quad (3.9)$$

## 3.3 Math fonts

Depending on what is to be presented or discussed in the work, several math fonts might be useful for different concepts. For extended fonts the package `amssymb` is needed. The basic fonts are then

default	$r$	$R$	$Sym^+$	$\gamma$	$\Gamma$
bb	$\setminus$	$\mathbb{R}$	$\mathbb{S} \curvearrowright \mathbb{D}^+$	$\gamma$	$\cong$
bf	$\mathbf{r}$	$\mathbf{R}$	$\mathbf{Sym}^+$	$\gamma$	$\mathbf{\Gamma}$
cal	$\nabla$	$\mathcal{R}$	$\mathcal{S} \updownarrow \mathcal{D}^+$	$\gamma$	$-$
frac	$\mathfrak{r}$	$\mathfrak{R}$	$\mathfrak{Sym}^+$	$\gamma$	$\mathfrak{D}$
it	$r$	$R$	$Sym^+$	$\gamma$	$\Gamma$
rm	$r$	$R$	$Sym^+$	$\gamma$	$\Gamma$
sf	$r$	$R$	$Sym^+$	$\gamma$	$\Gamma$
tt	$\mathbf{r}$	$\mathbf{R}$	$\mathbf{Sym}^+$	$\gamma$	$\mathbf{\Gamma}$
boldsymbol	$\mathbf{r}$	$\mathbf{R}$	$\mathbf{Sym}^+$	$\gamma$	$\mathbf{\Gamma}$

The commands `mathbb` and others can be changed using different packages, e.g., `euscript` and `lucida` (look for latex math fonts in stackexchange). It is very useful to define the most used fonts as new commands within your personal macros, e.g.,  $\mathbb{A}$ .

### 3.4 Math symbols

The amount of math symbols offered in latex is immense. Some of them are, e.g.,

$$\sum, \int, \iiint, \nabla, \cdot, \times, \otimes, \rightarrow, \Rightarrow, \cup, \in, \subset. \quad (3.10)$$

You will have to look for those you might need.



# Chapter 4

## Results

### 4.1 The package `hyperref`

The package `hyperref` is the package for referring to labeled elements of a document and hyperlinks. Now, chapters, sections, equations, figures, tables and other elements can be labeled and referred to, e.g., Equation 3.1, section 3.4 and chapter 4. These are clickable links which in the pdf redirects the reader to the referred element (with ALT+LEFT you can then go back to where you were reading). Here, different alternatives can be used, e.g., 4, chapter 4 or Chapter 4. Depending on which language you have to write something, you may need language options (e.g., `ngerman` for German hyperlinks).

### 4.2 Hyperlinks to internet sites, email and attached files

Hyperlinks can be added as, e.g., <http://miktex.org/> or [click me](#). Sending an email to a prescribed address can be done by [name.lastname@address.org](mailto:name.lastname@address.org). If the pdf is delivered within a folder with useful files, these files can be linked in the pdf, e.g., [manipulate](#) or [video](#).

### 4.3 Literature references

Bibtex files with literature information can be created either manually or using literature manager programs like [Mendeley](#) or [Citavi](#). The bibtex file must be included in the project with `bibliography` pointing to the file, together with `bibliographystyle` and a packages for citing commands. With the commands `cite/p` elements of the included file are then cited, e.g., [Hill \(1952\)](#) and [\(Kröner, 1977\)](#). Make sure that while compiling you have chosen a procedure including bibtex (see compiling options). Sometimes it may be necessary to delete all files but not the main.tex file in order to be able to compile again the project, if bibliography styles have been changed.



# Chapter 5

## Conclusion

### 5.1 Figures

In almost every document figures will be needed in order to explain a concept or just present something. The package *graphicx* is needed for embedding figures.

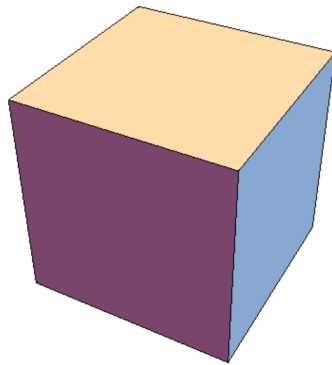


Figure 5.1: A figure caption beneath the figure for description of the depicted concept which sometimes can be very long

In Figure 5.1, for example, a PNG image is depicted (compiled with *pdflatex*). Alternatively, EPS figures can be embedded if *dvips* and *ps2pdf* compilation is used. All figures are listed in the list of figures with the command *listoffigures*.

### 5.2 Tables

Data can be presented in tables, e.g., as shown in Table 5.1.

	Property 1	Property 2
Criterion 1	764	23546
Criterion 2	3	34

Table 5.1: Exemplary table

Sometimes very long tables must be presented which may also go over pages. For this cases the packages *longtable* is useful, as used in

## 5.2. TABLES

---

$i^3$	$2i^3$	$3i^3$
1	2	3
8	16	24
27	54	81
64	128	192
125	250	375
216	432	648
343	686	1029
512	1024	1536
729	1458	2187
1000	2000	3000
1331	2662	3993
1728	3456	5184
2197	4394	6591
2744	5488	8232
3375	6750	10125
4096	8192	12288
4913	9826	14739
5832	11664	17496
6859	13718	20577
8000	16000	24000
9261	18522	27783
10648	21296	31944
12167	24334	36501
13824	27648	41472
15625	31250	46875
17576	35152	52728
19683	39366	59049
21952	43904	65856
24389	48778	73167
27000	54000	81000
29791	59582	89373
32768	65536	98304
35937	71874	107811
39304	78608	117912
42875	85750	128625
46656	93312	139968
50653	101306	151959
54872	109744	164616
59319	118638	177957
64000	128000	192000
68921	137842	206763
74088	148176	222264
79507	159014	238521
85184	170368	255552
91125	182250	273375
97336	194672	292008

---

Foot information

---



Table 5.2 – information message on top

$i^3$	$2i^3$	$3i^3$
103823	207646	311469
110592	221184	331776
117649	235298	352947
125000	250000	375000

Table 5.2: Long Table

All tables are listed with *listoftables*.

### 5.3 Enumerate and itemize

If important sequential points are to be presented the environment *enumerate* can be used as follows:

1. Some important stuff
2. More stuff

With the package *enumerate* some options can be used, e.g.,

- a) Some important stuff
- b) More stuff

or

- 1) Some important stuff
- 2) More stuff

Alternatively, points can be just presented without any enumeration with the environment *itemize*

- Some important stuff
- More stuff



## Appendix A

Just an example appendix



# Bibliography

- R. Hill. The elastic behaviour of a crystalline aggregate. *Proceedings of the Physical Society. Section A*, 65:349–354, 1952.
- E. Kröner. Bounds for effective elastic moduli of disordered materials. *Journal of the Mechanics and Physics of Solids*, 25(3):137–155, 1977.



# List of Figures

5.1 A figure caption beneath the figure for description of the depicted concept which sometimes  
can be very long . . . . . 21





# List of Tables

5.1 Exemplary table . . . . . 21  
5.2 Long Table . . . . . 23