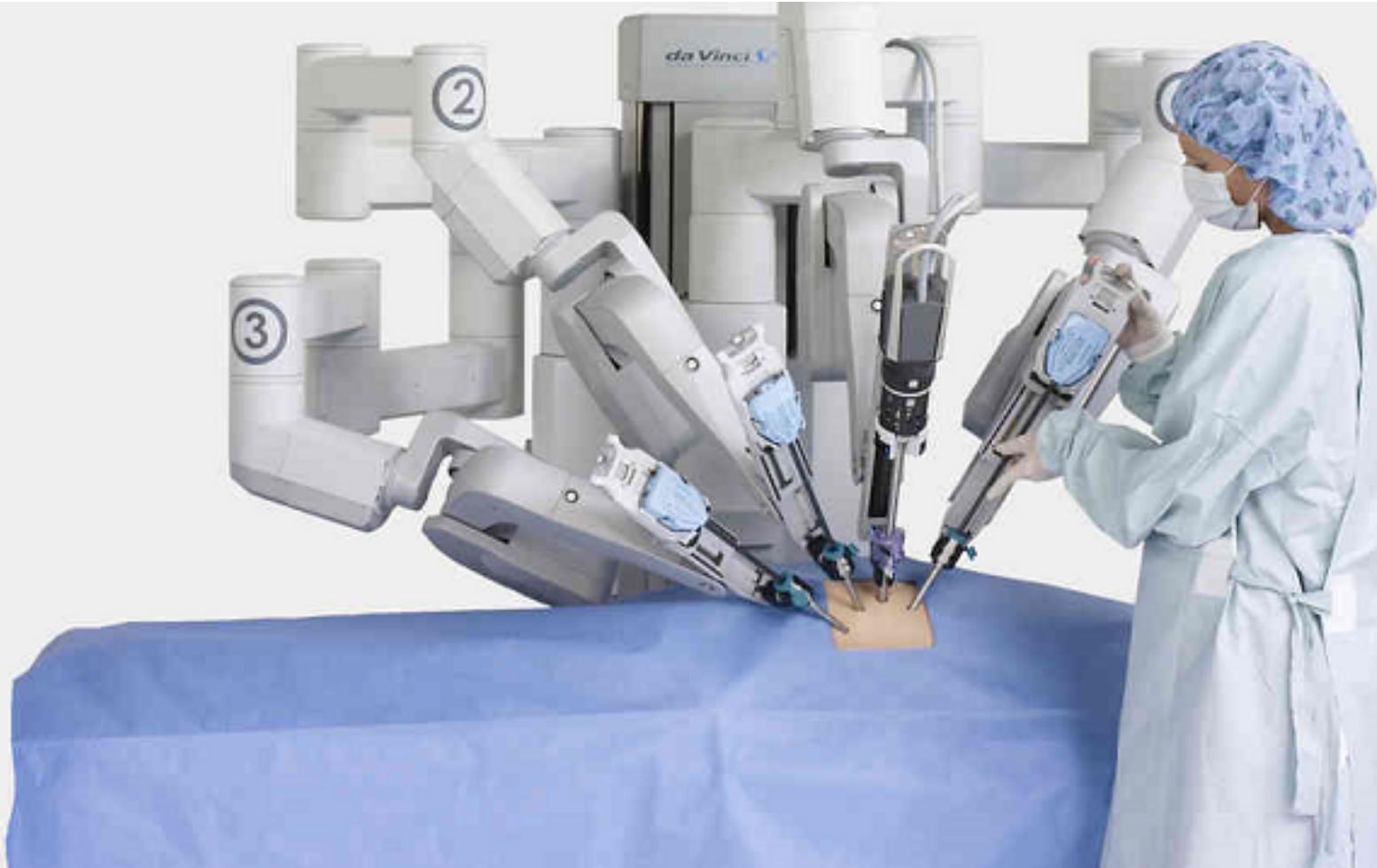


# *Da Vinci Surgical Robot Automation*

*To ensure a better world and to acquire welfare for all poor children*



**SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY**

ELECTRONICS & IT  
CONTROL AND AUTOMATION  
FINAL THESIS - CA4 Gr. 1032  
AALBORG UNIVERSITY  
MAY 27<sup>TH</sup> 2015



**Title:** Da Vinci Surgical Robot Automation

**Master Thesis:** Control & Automation

**Project period:** Feb. 2<sup>nd</sup> – May. 27<sup>th</sup> 2015

**Project group:** CA 15gr1032

**Participants:**

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Britt Louise Jakobsen



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Christian Køcks Lykkegaard



**Abstract:**

This will eventually become a synopsis.

**Supervisors:**

Prof. Rafał Wiśniewski

Postdoc. Kasper Vinther

Assist. Prof. Christoffer Sloth

Postdoc. Karl Damkjær Hansen

**Existing copies:** 6

**Pages:** 112

**Appendices:** 21 pages of appendices and

**Attached:** 1 CD



# Preface

Most control applications are based on system models which introduce multiple variables. The theme of this semester is therefore *Multivariable Control Systems*. The level is a 4<sup>th</sup> semester project rated to 30 ECTS-points within the graduate program at Control and Automation at Aalborg University.

The target group is supervisors, students, stakeholders within the heating sector and other interested parties at the School of Information and Communication Technology at the Faculty of Engineering and Science.

The majority of the project consists of model development and control structures of an absorption cycle heat pump used in a power plant in Sønderborg, a medium sized city in the southern part of Denmark.

## Reading Guide

The project is structured in three major parts where different aspects of the project is considered in each:

- I System Analysis
- II Controller Design
- III Discussion

The System Analysis will be dealing with the basic understanding of the problem and model development and contains thereby the fundamental necessities used to state a requirement specification, which in the end results in guidelines and instructions for the controller design. The controller design contains design considerations and solutions to the issues discussed. Finally, the discussion part contains a summary, discussion and reflection regarding the obtained solutions.

A Symbol- and Acronym list, which features all acronyms used in the report, is found in the very beginning of the report. In the very end of the main report a bibliography is listed which likewise contains all references used in the report. Books are indicated with author, title, publisher, year and ISBN. Web pages are indicated with author, title and year.

Appendices are found after the main report and on an attached CD. The appendices include detailed derivations, source code, a digital version of the report and other materials which are not important for the understanding of the objective of the report.

All figures, tables and equations are referred to by the index of the appropriate chapter followed by a number indicating the number of figure, table or equation in the specific chapter. Thereby they have a unique number which is printed along with its caption (equations have no caption though).

## Acknowledgements

It is the wish of the authors to express a special appreciation to..



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## General Nomenclature Remarks

- The notation is..
- Well..

## Introduction

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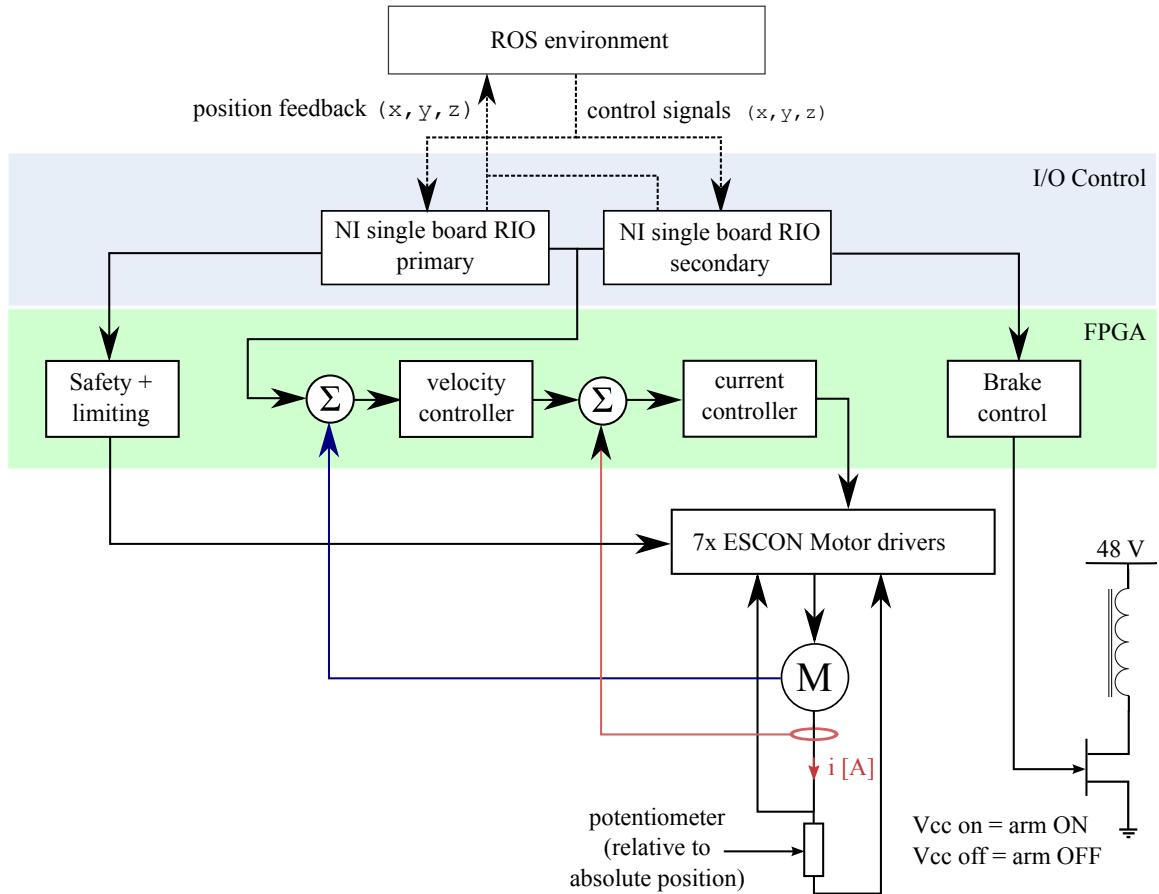
- What is da Vincy?
- State of the art? (Raven)
- operate without having to remove the heart (Sloth of Rafael)

One should certainly take the risk of patient trauma when an automated surgery is conducted into account. This is seen in Therac-25. It is therefore a necessity to formally prove that the procedure is safe as seen in [?]

### 1.1 Technical Overview

A simplified overview of the da Vinci setup is provided in figure 1.1 as a block diagram. The setup is physically located at the department of Control and Automation at Aalborg University in the laboratory. The figure is structured with the highest abstraction layer at the top (i.e. the ROS (Robotic Operation System)) and the lowest in the bottom, i.e. the actuators in form of seven XX motors.

The focus of this thesis is the highest abstraction layer, i.e. the ROS environment.



**Figure 1.1:** This is a nice figure. Here illustrated for hand roll master.

**PART**

**I**

**SYSTEM ANALYSIS**

# **Basic Concepts**

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# **Interim Conclusion**

---

# **Requirement Specification**

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A list of the requirements is probably necessary if things should remain beautiful.

**PART**

**II**

**CONTROLLER DESIGN**

# **Control System Introduction**

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PART  
**III**  
DISCUSSION

# Conclusion

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This will hopefully become a nice conclusion.

# **Perspective**

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This will become a very nice and beautiful perspective.

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## **Appendix A**

# **My First Appendix**

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## **Appendix B**

### **MATLAB Code**

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## **Appendix C**

# **Attached CD**

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**Datasheets**

**MATLAB Scripts**