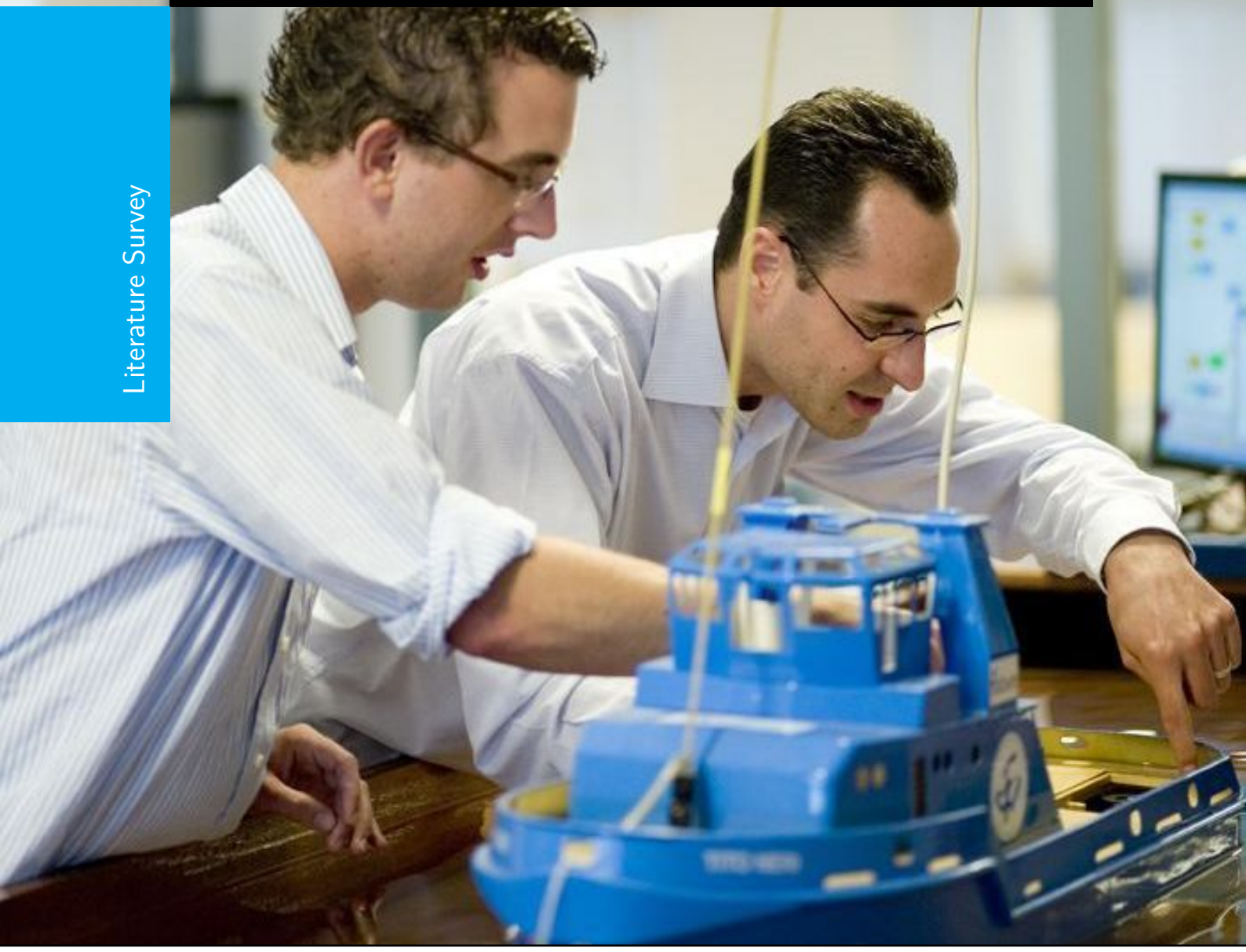
Reinforcement Learning for Tracking Control in Robotics

Yudha Prawira Pane

Literature Survey



TU Delft Delft University of Technology

Delft Center for Systems and Control

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Literature Survey

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December 13, 2014

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The implementation work in this thesis was done at DCSC's robotics lab.

Abstract

This is an abstract.

Table of Contents

List of Figures

List of Tables

Preface

According to WikipediA, a preface (pronounced "*preffus*") is an introduction to a book written by the author of the book. In this preface I can discuss the interesting story of how this thesis came into being.

This is document is a part of my Master of Science graduation thesis. The idea of doing my thesis on this subject came after a discussion with my good friends Tweedledum and Tweedledee...

Acknowledgements

I would like to thank my supervisor for his assistance during the writing of this thesis...

By the way, it might make sense to combine the Preface and the Acknowledgements. This is just a matter of taste, of course.

Delft, University of Technology
December 13, 2014

Yudha Prawira Pane

"In the future, airplanes will be flown by a dog and a pilot. And the dog's job will be to make sure that if the pilot tries to touch any of the buttons, the dog bites him."

— *Scott Adams*

Chapter 1

Introduction

Reference or trajectory tracking is one of the most basic task in robotics. Given a desired path/trajectory, the robot must be able to follow it as quickly as possible with minimum error. In order to achieve this, a controller is needed. However, robots are identical with non-linearities, noises, and external disturbance that are difficult to model, let alone identify.

1-1 Problem Definition

1-2 Goal of the Thesis

1-3 Literature Study Approach

1-4 Nomenclature

Chapter 2

Reinforcement Learning Preliminaries

2-1 Markov Decision Process

This chapter will cover figures and math.

2-2 Value and Policy Iteration

2-3 Reinforcement Learning for Continuous Space

2-3-1 Function Approximation

2-4 Actor-Critic Structure

Chapter 3

Reinforcement Learning for Tracking Problem: A Survey

This is real chapter for Delft Center for Systems and Control (DCSC), ok? We will use it as a demo for the different headings you can use to structure your text.

3-1 Dynamic Tuning via Reinforcement Learning

This is the first section .

3-1-1 Case Study: PI Tuning using Reinforcement Learning

This is the subsection of the first section.

3-2 Nonlinear Compensation for Tracking via Reinforcement Learning

This is second section.

3-2-1 Case Study: 1-DOF Robot Gravity Compensation

3-3 Reinforcement Learning for Optimal Tracking Control

This is third section.

3-4 Self-Proposed Controller [tentative]

Chapter 4

Simulation & Verification

4-1 Simulated Setup

This chapter will cover figures and math.

4-2 Simulation Result and Analysis

4-3 Discussion

Chapter 5

Future Work and Experiments Plan

5-1 Experimental Setup: UR5 Robot

Chapter 6

Conclusion

Appendix A

Appendix

Appendices are found in the back.

A-1 Simulation Program

A-1-1 A MATLAB listing

```
%
% Comment
%
n=10;
for i=1:n
    disp('Ok');
end
```

Glossary

List of Acronyms

DCSC Delft Center for Systems and Control