# Table of Contents

**Preface** ix

**Acknowledgements** xi

**1 Introduction** 1
- 1-1 Problem Definition . . . 1
- 1-2 Goal of the Thesis . . . 1
- 1-3 Literature Study Approach . . . 1
- 1-4 Nomenclature . . . 1

**2 Reinforcement Learning Preliminaries** 3
- 2-1 Markov Decision Process . . . 3
- 2-2 Value and Policy Iteration . . . 3
- 2-3 Reinforcement Learning for Continuous Space . . . 3
  - 2-3-1 Function Approximation . . . 3
- 2-4 Actor-Critic Structure . . . 3

**3 Reinforcement Learning for Tracking Problem: A Survey** 5
- 3-1 Dynamic Tuning via Reinforcement Learning . . . 5
  - 3-1-1 Case Study: PI Tuning using Reinforcement Learning . . . 5
- 3-2 Nonlinear Compensation for Tracking via Reinforcement Learning . . . 5
  - 3-2-1 Case Study: 1-DOF Robot Gravity Compensation . . . 5
- 3-3 Reinforcement Learning for Optimal Tracking Control . . . 5
- 3-4 Self-Proposed Controller [tentative] . . . 5

**4 Simulation & Verification** 7
- 4-1 Simulated Setup . . . 7
- 4-2 Simulation Result and Analysis . . . 7
- 4-3 Discussion . . . 7

**5 Future Work and Experiments Plan** **9**
5-1 Experimental Setup: UR5 Robot . . . . . 9

**6 Conclusion** **11**

**A Appendix** **13**
A-1 Simulation Program . . . . . 13
A-1-1 A MATLAB listing . . . . . 13

**Glossary** **15**
List of Acronyms . . . . . 15
List of Symbols . . . . . 15

**Bibliography** **15**