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Improving Robotic Grasping using Iterative Learning Control

Project supervisor: Professor Christopher Freeman

Second examiner: Doctor Nicolas Green

A project report submitted for the award of

MEng Electrical and Electronics Engineering

# Abstract

* Current needs on robotics assistance in industry
* Potential future needs that cant be fulfilled now
  + Grab water, food for physically challenged
  + Universal grip
* Issue with current gripper
  + Not able to grip diff objects
  + Do not learn from own mistakes (Current one only previous mistakes)
* How ILC can overcome issues
  + Grip different objects (mass)
  + Learn from all mistakes
  + Robust to external repeated disturbances
* Explain briefly the novelty
* Compare with Impedance control. Easy to implement with good results.

# Statement of Originality

I have acknowledged all sources, and identified any content taken from elsewhere.

I have not used any resources produced by anyone else.

I did all the work myself, or with my allocated group, and have not helped anyone else.

The material in the report is genuine, and I have included all my data/code/designs.

I have not submitted any part of this work for another assessment.

My work did not involve human participants, their cells or data, or animals

# Acknowledgements

I would like to thank…….

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# Report Structure

Chapter 1:

# Review of Robotic Gripping Controller

Talk about why it is important

* Amazon have competition
* Grocery factory operates better
* Not tired, fatigue
* Does not make uncharacteristics mistakes
* Can find stats on number of robots use or projected industry value
* World around us custom for humans, where we have hands. So robot has to be able to grip also

## Problem Analysis

Talk about what is the current issue

* Robotic gripping is very slow
* Can only operate in a tight environment
* Can only operate on 1 specific item

## A History of Controllers for Robotic Gripping

* Process of gripping. (Planning, trajaction, etc)
* Different types of controller, their problems and advantages

## Overview of Impedance Control

* Simple impedance control explanation
* Put related equations.
* Explain in quite simple terms with help of pictures for robotic gripping

## Overview of Iterative Learning Control

* Could do diff model and non-model based controller
* Say why ILC is good. Able to correct repetitive error etc
* Say which ILC algo has potential for gripping. Can review thesis to get some idea

# Detailed Specification

* A quick review on diff controllers advantages and issues based on literature review
* Say the problem in problem statement is still present, although P and D ILC manage to solve abit
* Say a novel approach to solve is to use Norm-Optimal ILC and why.

## Design Requirements

Add more to explain each part and what this section is about

* Model in Simulation
  + Add more points, like what the model should behave/achieve
* Grasping properties
  + Reach and grasp object **accurately**
  + Reach and grasp object in a **short duration**
  + Reach and grasp object with **least amount of Force**
  + **Stable** reach and grasp operation for different object mass
  + Converge as fast as possible

# Design Overview

Talk about how general approach of design and test will be

* Mostly very high level stuff of the design idea/philosophy behind it
* Decide and choose which approach would be feasible

## Simulation Environment

* Talk about different environment and why choose matlab. Find some articles or something highlighting good and bad
* Decide on model to use and justify why
* Draw out a high level plan on how the whole environment would look like.
  + Break down the design requirement of it and how to approach and justify
* Talk about approach should be taken when building the model and why

## Controller Specification

* Give high level overview of the controller
* Break down DR and justify them
* Do for ILC and Impedance

# Design Strategies

12 pt text for main body

## First Try

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# Conclusions

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References

1. Hardware Costs
2. Selected Listings

1 begin

2 c := c+1;

3 end