Master Thesis

Improving the functionnality of a Soft-robotic finger

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To some special person

Preface

Thanks to whomever and other first words.

Abstract

Short summary of thesis.

Zusammenfassung

Kurzfassung der Arbeit.

Contents

List of Tables

List of Figures

Notation

Explanation of symbols.

1 Introduction

Explain scope and structure of report.

This report will guide you through the work done in the past six months at the Harvard Micro-robotics Lab.

Soft robotics are a developing field in the world of automated devices. In most of the cases conventional robots are composed of rigid links and supported by an algorithm based on the physical model to create predictable movements. These prperties are very useful for in industrial setups. With proper control repeatable tasks can be fulfilled with high precision and safety (using safeguards). Soft-robots though, are defined as having a reduced to low rigidity body and show flexibility and compliance with the environment and the objects they interact with [**?**]. Their softness makes any direct interaction safer, especially with living organisms and humans.

Biological inspiration comes from animals like cephalopods, jellyfish or human hands and elephant trunks (muscular hydrostats composed mainly of muscles). An octopus is a good example of a fully soft organism with no rigid skeleton. Composed of eight arms around a head, it is able to adapt its shape to the environment and go through various holes and complicated mazes [REF]. Squids on the other hand have a very few rigid cartilages supporting their body in an elongated nose cone-like shape allowing them to move fast in water[REF].Though both are still molluscs (invertebrate). The same analogy can be done in soft robotics where different applications require a variety of compliance and stiffness properties thanks to inner or outer structures including links, plates or rods.

Their application is very broad, the focus is , though, mainly set on interactions with fragile and sensitive objects or living organisms (humans included). Due to a similar impedance they reduce destructive contact forces allowing a safer manipulation. However this characteristic comes with a trade-off: the softer the robot the more difficult it is to manage its shape and movements without reintroducing rigid parts. It involves combining the right materials (compliance) with the right actuation making the whole structure intelligent [**?**].

DEFINING GRASPING FIRST Grasping an object is the act of embracing it with the fingers or arms (Merriam-Webster).Grasping seems to be specific to hand like manipulators, composed often of a palm to which fingers are attached. These can move either independently or simultaneously. Measuring the quality of a grasp is not a trivial task for soft robots. As opposed to rigid robotic hands and fingers, the sensing capabilities are restrained. Rigid links have the possibility through reacting forces and servoing to estimate accurately the position and other forces acting on the system. Sensors backed by accurate path planning as well as state estimation can help create a precise motion. In soft-robotics similar metrics can be applied for measuring precision. However when it come to measuring adaptability and gentleness, there is no unified and standardized method.

In this work we will try to improve WHAT??? the design of a soft finger by trying to create and use a more generalized standardized testing method which could also be used as a benchmarking system for other soft robotic manipulators (Shuguang etc...).

2 State of the art

A lot of work has already been published in the field of soft robotics. The first notable attempt of creating a compliant and soft hand was made in...

Explain work that has been done previously in the field that is related: e.g. robotic hands etc...

Then narrow down to what has been done here in the lab.

3 Great Work

This and the following chapters detail the original work.

4 Summary and Contributions

Summarize the presented work and demonstrate its contributions to the research field or institute.

4.1 Future Work

Possible ways to extend the work.

liographythesis

A Extra Stuff

Additional material such as long mathematical derivations.

B Examples

This appendix provides some additional hints and examples for the layout and style of the thesis. It is worthwhile to look at the source file `Examples.tex` for this appendix to understand how it was created.

B.1 Tables

Tables are left justified and the caption appears on top as seen in Table 1.

Table 1: Translations.

English	**German**
cell phone	Handy
Diet Coke	Coca Cola light

B.2 Figures

Figure 1 shows a simple figure with a single picture and Figure 2 shows a more complex figure containing subfigures.

Figure 1: IRIS logo.

(a) ETH logo

(b) IRIS logo

Figure 2: Two pictures as part of a single figure through the magic of the subfigure package.

B.3 Units

The SIUnits package provides nice spacing for units as demonstrated in Table 2. Use of the package also makes it easy to change the style or even the unit text in the future.

Table 2: Spacing for units.

Output	**Command**
42m	`42m`
42 m	`\unit{42}{\metre}`
42 m	`42 m`

B.4 Miscellany

Capitalization. When referring to a named table (such as in the previous section), the word *table* is capitalized. The same is true for figures, chapters and sections.

Naming of structural elements. Refer to a `\section` in LaTeX as a chapter and call a `\subsection` section. (I don't like the way `\chapter`s are rendered in the report document class. Hence the suboptimal markup/naming correspondence.)

Bibliography. Use `bibtex` to make your life easier and to produce consistently formatted entries.

Contractions. Avoid contractions. For instance, use "do not" rather than "don't."

Captions. A brief version of a caption can be provided for the list of figures and tables as demonstrated with the caption of Figure 2. The mechanism can also be used to get rid of the final period of a caption in the lists.

C Journal

This section Includes a day-to- day journal about the work done at Harvard. Serves as a track for experiments their results and other achievements and goal specifications.

C.1 08/10/18

First day at the lab meeting the team. Setting up the desktop ad different repositories.

Getting into the code and core of the subject.

Setting up goals for the thesis.

Epilogue

Final words.