Fall 2019 ME751 Final Project Report

University of Wisconsin-Madison

Simulation of Robotic Gripper Using Chrono

Mike Hagenow

December 14, 2019

**Abstract**

The text of the abstract comes here. Use font size 12 throughout the document.   
IMPORTANT NOTE: The name of the file for your Final Project report should be me751FirstnameLastname.pdf. Like me751DanNegrut.pdf. Drop this Final Project report in Canvas in the folder “FinalProject751” by Tuesday, December 14, at 2:45 PM. Do not go beyond 10 pages unless you really feel like you have to (page count doesn’t include TOC, abstract, etc.). Feel free to use a LaTeX source as long as you follow this format; in the end, you will be uploading a PDF anyway.

All code and build instructions are provided in the following repository: <https://github.com/mhagenow01/751finalproject>

Please make sure that you include in this \*abstract\* a link to the git repo for your project. Using this link (i) we will fork the project code (particularly important for multi-student teams); (ii) we will look at the progress history for your project as documented by git.   
To verify that you provided the *right* git link, click on it. It should take you to your git repo.

[If this link to your repo is missing, your score can not be higher than 98%]

Contents

[1. Problem statement 4](#_Toc531620937)

[2. Solution description 4](#_Toc531620938)

[3. Overview of results. Demonstration of your project 4](#_Toc531620939)

[4. Deliverables: 4](#_Toc531620940)

[5. Conclusions and Future Work 4](#_Toc531620941)

[References 4](#_Toc531620942)

# General information

1. Home Department: Mechanical Engineering
2. Current status: PhD student
3. Mike Hagenow (Team Leader)
4. I release the ME751 Final Project code as open source and under a BSD3 license for unfettered use of it by any interested party.

# Problem statement

We have developed a method for recognizing directions of slip when a user performs a demonstration using instrumented tongs. Our intent is then for the robot to perform a similar action. A major challenge is that slip is hard to control as it involves modulating forces to allow prescribed levels of motion. Grippers also commonly have only unilateral force sensing and control capabilities. Given the lack of available sensing, I think this is a great opportunity to use simulation to better understand the interaction of the gripper with the object to be able to think about control strategy without having to explicitly instrument the gripper further.

This project will use Project Chrono in order to develop a friction model and simulations involving a common linkage-driven robot gripper with a cylindrical handle (e.g. toaster oven, fridge). It is my hope that running simulations will give us insight as to how we should dictate our gripper force control loop to properly interact with the object.

# Solution description

Indicate how you went about implementing your solution. Explain data structures, algorithms used, code structure, function you implemented, etc. Provide a panoramic snapshot of your Final Project effort.

# Overview of results. Demonstration of your project

Explain here what you obtained, explained why the results are good/bad. This is the place where you talk about the outcomes of your Final Project effort. It is not the end of the world if your code doesn’t work as anticipated. Explain here how far you have made it.

Most often, you have a comparison against sequential code, perhaps via a scaling analysis. Make sure you include plots and/or tables to show your results.

# Deliverables:

Discuss what is delivered for this Final Project. Important points:

* This report should be in Canvas.
  + On multi-student teams, each team member should submit a final report; i.e., this document. However, the code should be in one repo
* Tell us what is in your git repo and explain how we can run your code
  + If we cannot run your code, explain why that is the case

# Conclusions and Future Work

# References

[1] Make sure to give credit where it’s due.