

CDS 270: Final Project Guidelines

Overview

Instead of taking a written final exam, which will be a limited time, open notes, take home exam, students can optionally do a final project. Below are some final project suggestions. Alternatively, you can select your own project, subject to my approval. Group projects are allowed with my consent. The quality of the group projects should be proportional to the number of students involved.

The final project might take one of the following forms:

- Implementation of one of the algorithms discussed in the course (see examples below)
- Theoretical analysis of a given robot hand geometry
- Simulation of a robot hand operation

Listed below are some more detailed suggestions for projects. This is by no means an exhaustive list of ideas. It is only meant to stimulate your creativity.

- **Linear Matrix Inequality.** Implement the linear matrix inequality (LMI) approach for determining force closure of a given grasp. It is perfectly fine to limit your computations to planar grasps involving a small number of fingers (e.g., 2 or 3 fingers) and simple object shapes (e.g, polygonal object boundaries). With your implementation, verify that it correctly determines the state of force closure on an object where you can analytically assess the same grasp.
- **Simulation.** Develop a graphical simulation of a robot hand—the “Barrett hand” is a commonly used model, and there exists open source simulators on the web to help you get started. Using the simulator, depict the grasping operation of a simple object (such as a sphere or tetrahedron).
- **Grasp Planning.** Choose a grasp planning strategy (e.g., one based on force closure, immobilization, or caging). You can then select an already existing algorithm, or develop your own, to implement your strategy. Test and demonstrate your strategy on a simple hand and object
- **Review a Grasping Paper.** Carefully read, and then provide a solid review of a paper in grasp modeling or grasp planning.
- **() Power Grasping.** We didn’t have time in this course to discuss power grasps. Read a paper on power grasping and construct all the power grasps for a simple object (such as a planar polygon).

Final Project Mechanics

Since the possibilities for the final project are quite varied, the details of how I grade your project will vary with the style of the project. However, the final project documentation of each completed project should consist

- **A summary** that details the nature of the project, the motivation for the project, the scope of the project, and the approach taken to solve the project.
- **The details** of how the project was solved. This might consist of analytical derivations, algorithm pseudo-code, software flow charts, etc.
- **The “output”** of the project. This will consist of a piece of a simulation whose operation can be graphically visualized, graphical summary of your calculations (e.g., representation of all immobilizing grasps of an object), or a set of equations or analyses.
- **A conclusion** that summarizes shortcomings of the project and future possible improvements.

Final Project Time Table

1. **Project Preproposal:** If you will undertake a project of your own choice, (i.e., not one of the suggested topics above), then you must turn in a project preproposal on Wednesday, May 25. The preproposal consists of an approximately 1 page summary of what project you chose to do, how you plan to solve the problem, and the intended scope of your project.
2. **Due date:** Last day of finals week (5:00 p.m.)