ME 115(a): Final Project Guidelines
(Winter 2013/14)

Overview

Instead of taking a written final exam, which will be a 5 hour open-notes take-home exam, students can optionally pursue a final project. Below are some suggestions for the ME 115(a) final project. However, you need not follow any of these suggestions for your project. While I would prefer individual projects, group projects are allowed with my consent. The quality of the group projects should be proportional to the number of students involved.

Note that the same final project option will be offered in ME 115(b). Thus, some students may wish to choose a project that can be continued into the next quarter.

The final project might take one of the following forms:

- Analysis of a mechanism or linkage.
- Construction of a mechanism or linkage.
- Geometric/Kinematic simulation of a linkage.
- Development of kinematic software.

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

Mechanism Analysis Projects

- Develop some notion of the inverse kinematics for the "Armatron" manipulators model. This is only a 5 degree-of-freedom mechanism, and therefore one needs to be clever about how to define its inverse kinematics.

Simulation Projects

- Develop a graphical simulation of the elbow manipulator using Mathematica, MATLAB, or another other software environment. Given trajectories for the joints angles, graphically display the movement of a simple physical model of an elbow manipulator. Optionally, let the user of your software define a goal, and then have your system solve the inverse kinematic problem and move the system to the goal.

Kinematic software

- Previous students have successfully developed software that will symbolically derive the forward kinematic equations and manipulator Jacobian matrix, given the Denavit-Hartenberg parameters of a manipulator mechanism.

Mechanism Construction

- Construct, and analyze, a geared 6-bar planar mechanism.
- Simple "passive" walking machines (which don't required any actuators to move downhill) are a lot of fun. Here are some web sites that might give you some ideas:
  - Cornell Biped Walkers: *http://ruina.tam.cornell.edu/research/topics/robots/index.html*.
  - Theo Janson's *strandbeest* art project: *http://www.ted.com/index.php/talks/view/id/162* ; *http://www.strandbeest.com*.
- Build and analyze a model of the Theo Jansen *Strandbeest* walking mechanisms.

Final Project Grading

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 write-up 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, software flow charts, etc.
- **The "output"** of the project. This will consist of a piece of hardware, a simulation (which is captured by images and code), or a set of equations or analyses.
- **A conclusion** that summarizes shortcomings of the project and future possible improvements.

Students who will not pursue one of the suggestions above should discuss their final project ideas with me before starting their projects so that we can define an appropriate scope and content of the projects.

Final Project Time Table

1. **Due date:** Last day of finals week (5:00 p.m.)