



Advanced CAD Course Overview

Rohawks 3419 -- Celina, Nathan, Lili -- 2019-2020

I. Summary

Advanced CAD class is a course meant to introduce more intermediate CAD concepts through the examination of directly applicable techniques, the exploration of mechanisms in standout CADs, and the application of these concepts in a couple of CAD projects.

II. Goals

- To act as a segue between the basics of CAD and direct applications.
- To put all students in a position where they'd be comfortable being asked to CAD parts in the workshop.

III. Trajectory

Students will begin by learning a couple of advanced CAD techniques that are incredibly applicable to CADing during the build season. This will include constraints in assemblies, importing parts (especially from McMaster), using GrabCAD, the tenets of 3D printing, and the tenets of CNC milling. In the second half of the class, students will analyze the CADs of exceptional mechanisms, breaking down how they work and how they were conceived. Finally, students will then attempt to CAD a mechanism of their own choice.

A. Week 1: Constraints and Assemblies

- Show the entire assembly of our 2019 robot, then go into one mechanism on our robot that's good at demonstrating a few constraints
- Demonstrate assembly properties, describe general reasons to look at those (weight limits, possibility of robot tipping)

B. Week 2: McMaster, CAD and Constrain a Mount

- Examine a mount on our 2019 robot
- Demonstrate how to import from McMaster
- Allow students to use that import to CAD a mount
- Use last week's class to pop the mount onto the assembly

C. Week 3: GrabCAD and Tenets of 3D Printing

- Create a GrabCAD folder for the Advanced CAD class beforehand
- Downloading and setting up GrabCAD

- Allow students to upload their mount
- Allow students to download/sync all the files
- Allow students to try to open up someone else's mount
- Pass down divine rules of editing in GrabCAD, encourage exploration
- Teach tenets of 3D printing: when to add supports/no supports, teardrop shaped holes, adding embedded nuts etc, what to use 3D printing for
- Teach eiger.io
- Pick a random mount uploaded on GrabCAD to print for one lucky student

D. Week 4: Sweeps and Lofts

- Introduction to sweeps and lofts.
- Exercise using sweeps and lofts.

E. Week 5: CAD Analysis Part 1 - Swerve Analysis

- Examine 2910 (Jack in the Bot)'s Swerve CAD
- Go into how one can animate/move around different parts in the CAD
- Talk about how different types of parts (gears, bearings, sheet metal, wheel) are brought together in a piece as complex as a swerve module

F. Week 6: CAD Analysis Part 2 - Elevator Analysis

- Potentially analyze 148 (Robowrangler's) 2018 elevator CAD (<https://www.robowrangers148.com/resources.html>)

G. Week 7: CAD Analysis Part 3 - Intake/Climb

- A good intake example could be 254 in 2018 or 1114 in 2015
- A climber example could be 2056 in 2016 or us in 2017
- Focus on the details that make them successful

H. Week 8: Final Project Part 1 - In-Class CADing

- OPTION 1:
- Split everyone into groups and assign each group a subsystem from an old game. This will build practical knowledge and prepare students for build season.
- Intake: Aerial Assist (2014)
- Drivetrain: Stronghold (2016)
- Shooter: Steamworks (2017)
- Elevator: Recycle Rush (2015)
- Minibot: Locomotion (2011)
- Climber: Frenzy (2004)

- OPTION 2:
- Allow students to choose a mechanism that they find most interesting and attempt to recreate it in their own way.
- Can be individual or group, their choice!

1. Week 9: Final Project Part 2 - Presentations

- Everyone presents their designs to the rest of the class (3-5 minutes). This will let students learn from each other's designs and get an idea of the diversity of challenges that next year's robot will graciously and professionally face.
- Constructive criticism
- Feedback about the class in general
- Snacks :)