Portfolio

CHRIS JOYCE

OLIN COLLEGE CLASS OF 2015

MECHANICAL ENGINEER

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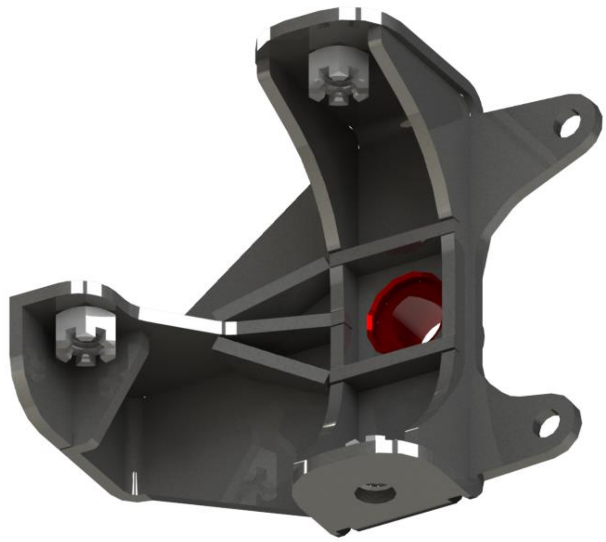
SAE MiniBaja

Team: Too long to list, my contributions highlighted



My freshman year, I worked heavily on the steering system. I was partly responsible for the design of the knuckles and the geometry of our steering system – camber, Ackermann angle, kingpin inclination, etc. Since then, I have taken over responsibility for maintaining last year's car, as well as administrative and design responsibilities. My responsibilities this year fall into two categories:

<u>Design</u>

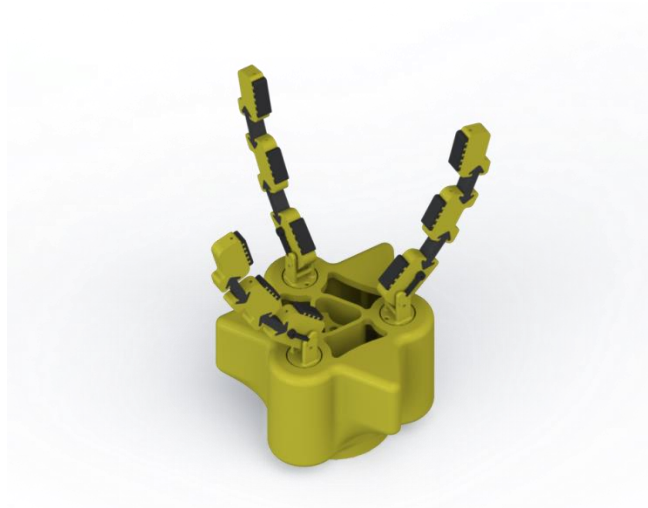
- Suspension subteam senior member
- Solved problems with:
    - Stripping of ball-end threads
    - Slop in steering column
- Focus on steering system
    - Modifications to knuckle design
- Mentor for first-years on the subteam
    - Talk with them about baja, answer questions
    - Explain my thinking as I design parts for the car
    - Review their designs and help improve them
    - Tutorials (Part creation, CAD good practice, FEA, etc.)

<u>Leadership</u>

- Purchasing Manager
    - Fill all purchase requests
    - Coordinate financial matters with the College administration
    - Handle team funds to keep team financially solid
- Old Car Czar
    - Coordinate fixes of the car
    - Understand each subsystem well enough to fix it or talk to the right person about fixing it
    - Know the operational status of the car and make sure others do as well – i.e., make sure that Drivetrain doesn't disassemble when Electrical wants to test

Under-Actuated Hand

Team: Morgan Bassford '15, Mary Morse '15, Tom Pandolfo '13

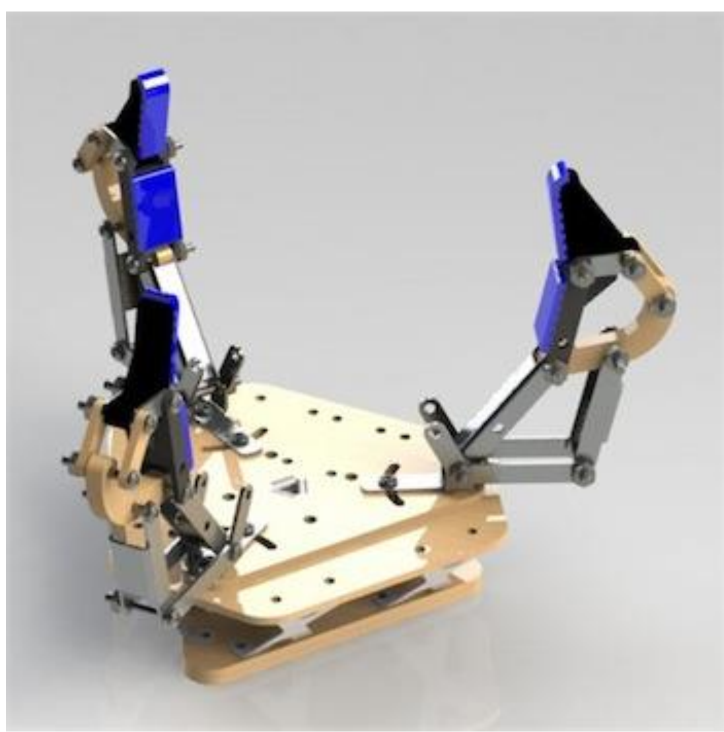


We constructed an underactuated hand, with three iterations. Our first iteration was 3D printed, our second iteration was constructed of sheet metal and plywood, and our final iteration was a combination of both materials.

We first attempted to use fingers that were actuated by cables with flexible polymers to allow each knuckle to flex. This created a major issue: the polymer would twist as well as bend, so our finger had very little rigidity. We liked the addition of a soft, grippy polymer to the tips of the fingers to increase grip.

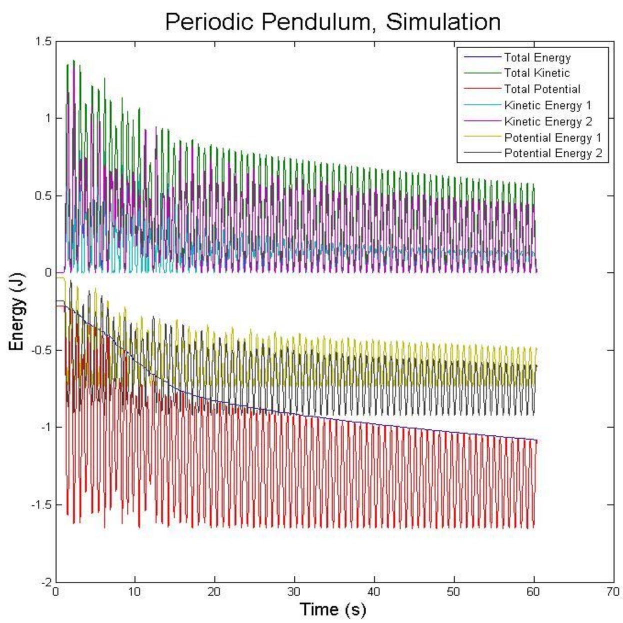
Our second iteration used linkage-driven fingers. These fingers were far more rigid, but our sheet metal gripping surfaces were slipperier than we would have preferred. We also found that our cables, as they were pulling from different angles, caused different closure rates of our fingers.

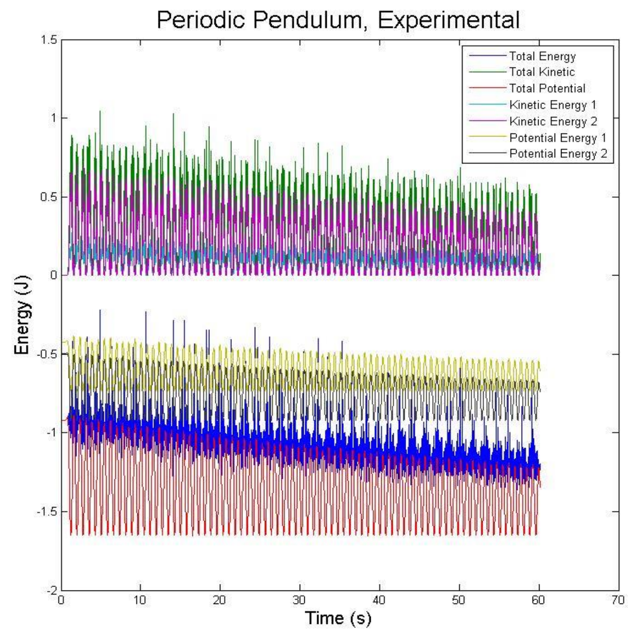
Our final prototype attempted to take the best and worst aspects from each of our hands and combine them into one cohesive and functional device. This attempt was a success – we kept the linkage finger design from prototype #2, we moved the cable actuation to the center as it was in prototype #1, and we used the grippy polymer on the finger tips from prototype #1.



Double Pendulum System Analysis

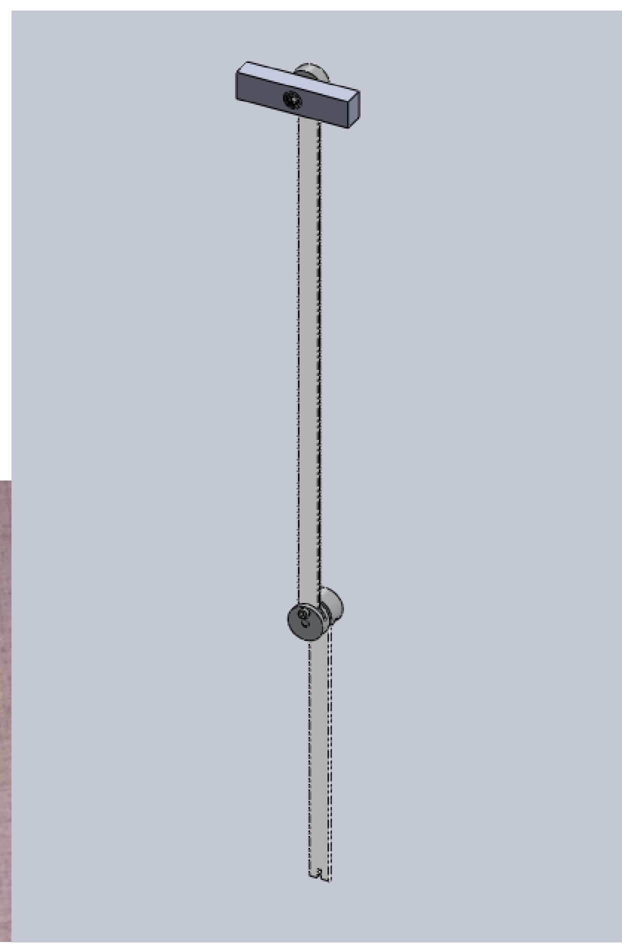
Partner: Brooks Willis ‘15





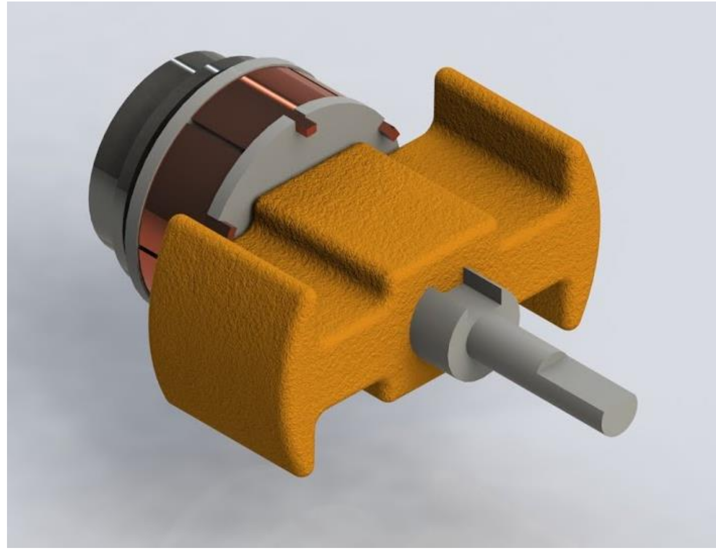
Energy versus time graphs for a simulation and experimental case of our pendulum.

We investigated the behavior of double pendulums using nonconservative Lagrangian mechanics. This involved deriving the nonconservative Lagrangian, applying it to a double pendulum system, and determining the viscous drag coefficient of the bearings used in the construction of the physical system.



Electric Motor

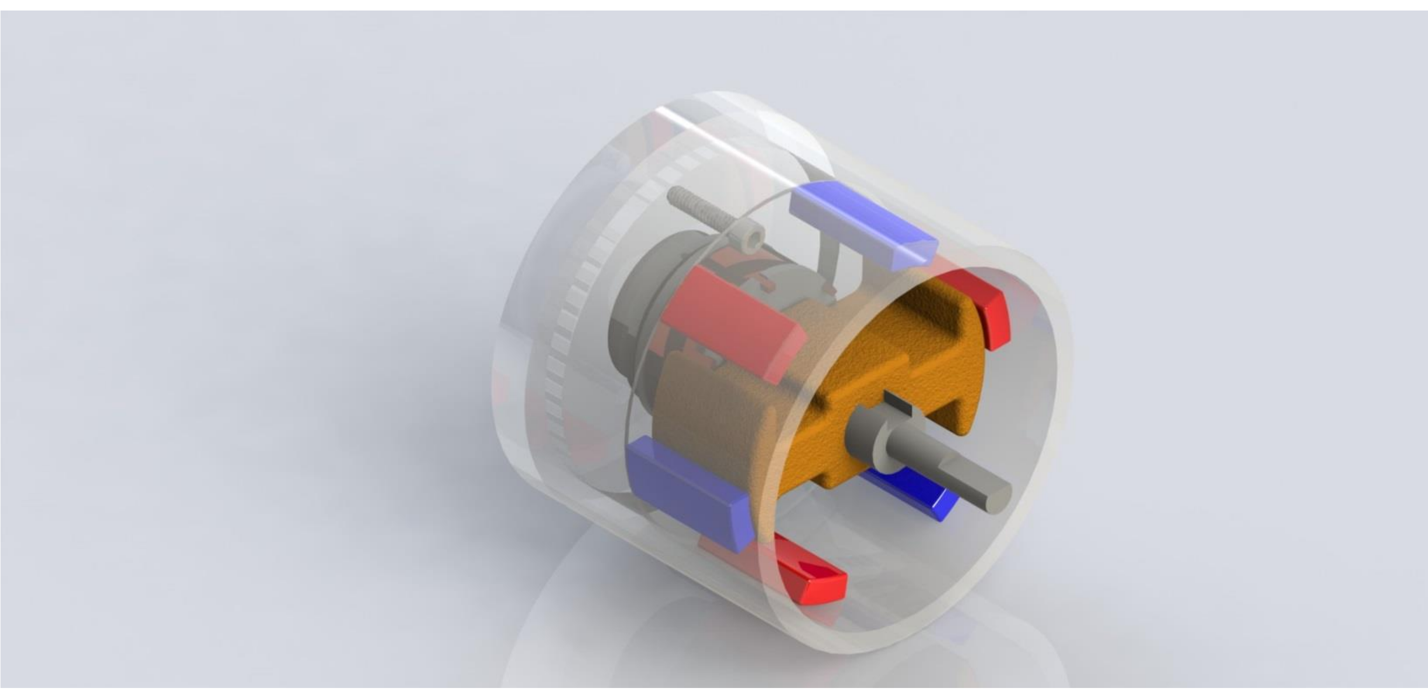
Team: James Nee '15, Evan Simpson '15, Shane Skikne '15



We constructed an electric motor from scratch for our Project-Based E&M class. My main contribution was mechanical design and fabrication of the motor. Our motor was designed with the ability to switch core materials in mind. The question we attempted to answer is, how does the core material of an electric motor affect its performance?

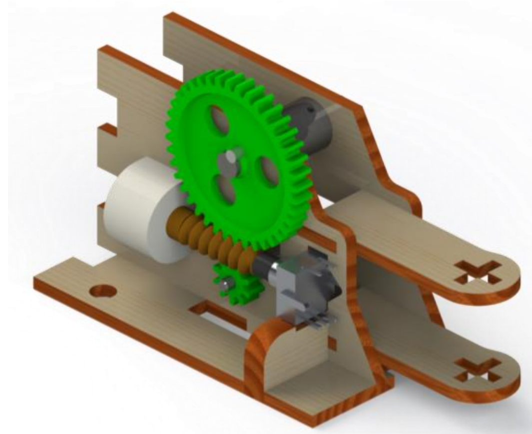
Process:

- Specified magnets to use based on strength and desired size of motor
- Identified goals for this specific motor:
  - Easily changeable core materials
  - Observable in operation
- This drove design choices
  - Acrylic for the endcaps so we could watch the motor
  - 3D printed rotor with cavities for core materials, integral key
  - Axle with slot for rotor key
  - 6-pole commutator integral with rotor and axle piece
  - 2 screws to hold wire brushes against copper tape commutator plates



Self-Playing Violin

Team: Philicia Chow '15, Allie Duncan '15, Kyle McConnaughay '15, Kevin O'Toole '15



For our Principles of Engineering class, we created a self-playing violin. The goal of Principles of Engineering is to create a prototype that contains nontrivial software, electrical, and mechanical components. As the only mechanical engineer on the team, my primary contribution was leading and doing the bulk of the mechanical design.

Some of the design considerations were:

- Ease of prototyping. To fill this requirement, the violin is designed primarily out of laser-cut wood.
- Ability to withstand high tension from 4 taut violin strings. This is accomplished through novel cross-bracing designs that use the wood in its orientation of maximum strength.
- Transmitting vibrations to the electrical system cleanly. This was done through the use of a thin bridge that is disconnected from the violin frame.
- Accounting for warping. Done by adding spreader bars to guarantee critical dimensions.