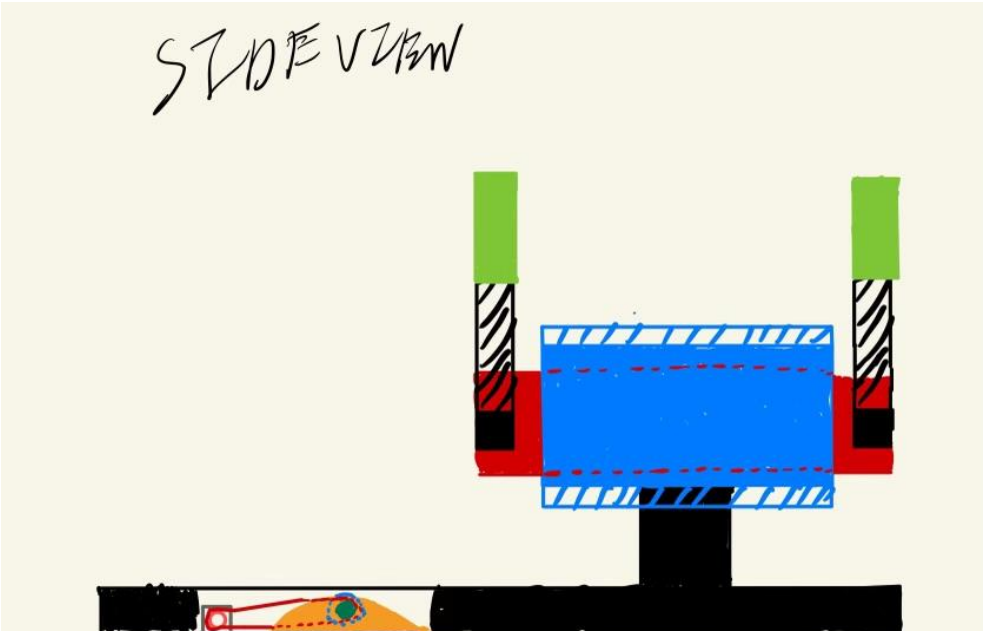
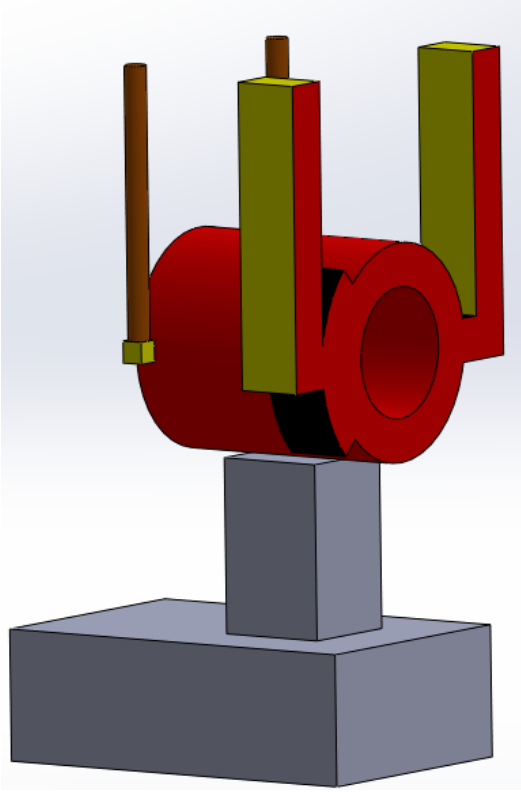
Current Progress

Over the past month, I have done a lot of research on ankle/robotic foot designs. The bulk of this research has come from papers and articles my mentor recommended to me. After doing this research and getting a foundational understanding of the task before, I began the brainstorming and sketching process. Once I had a cohesive design in mind that my mentor and I agreed upon, I started the 3D modeling phase, which is where I am now.

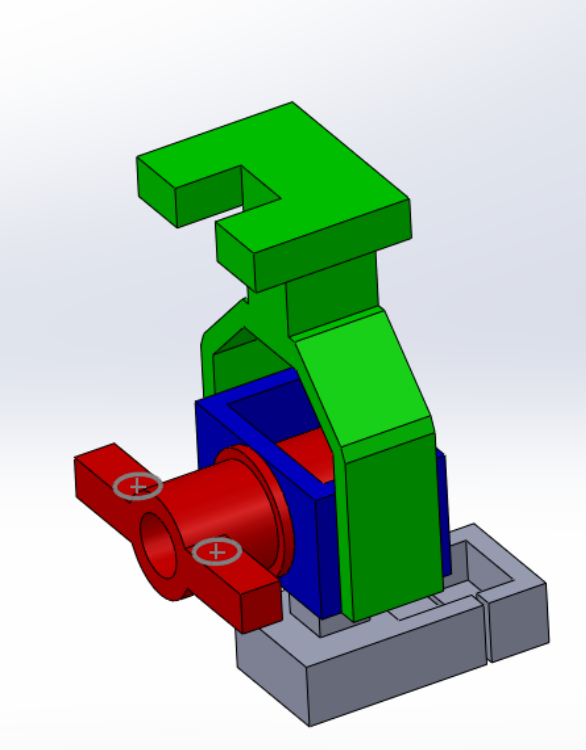
Throughout almost all of June, I was doing a lot of reading. As mentioned in my first report, I reviewed the design of the SURENA and DURUS robotic models. I had also shown some of the sketches I had drawn to get a better understanding of the double cylinder design I was working on. I have placed them below.



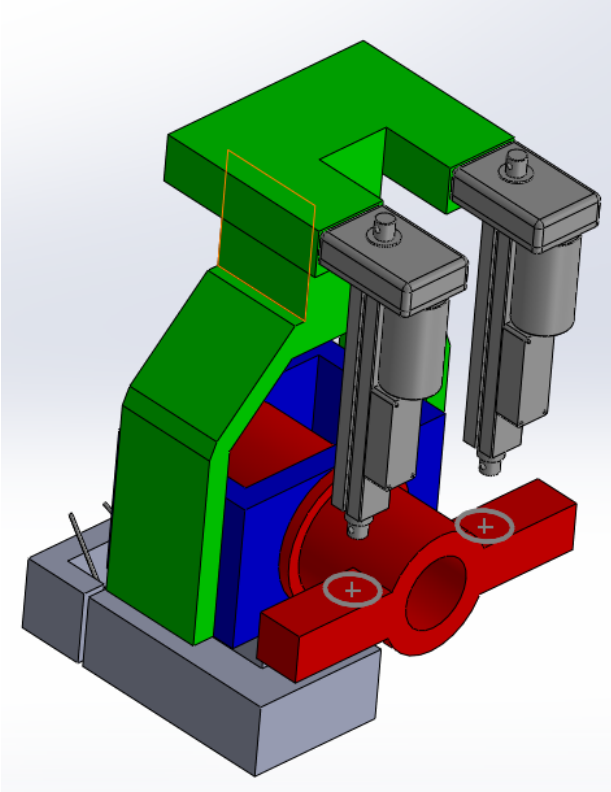
Once I had a good idea for what kind of design I was going for, I began the early modeling phase in early July. At this point I had wanted to keep the design to one cylinder due to my lack of understanding at the time. Thus, I produced the model below.



However, there was no way this would be the final design. After getting a better understanding of the double cylinder design, I pivoted to a better model. My mentor helped out a lot by sharing a rough model of a double cylinder design, and I was able to take that and rework it into a way I desired.

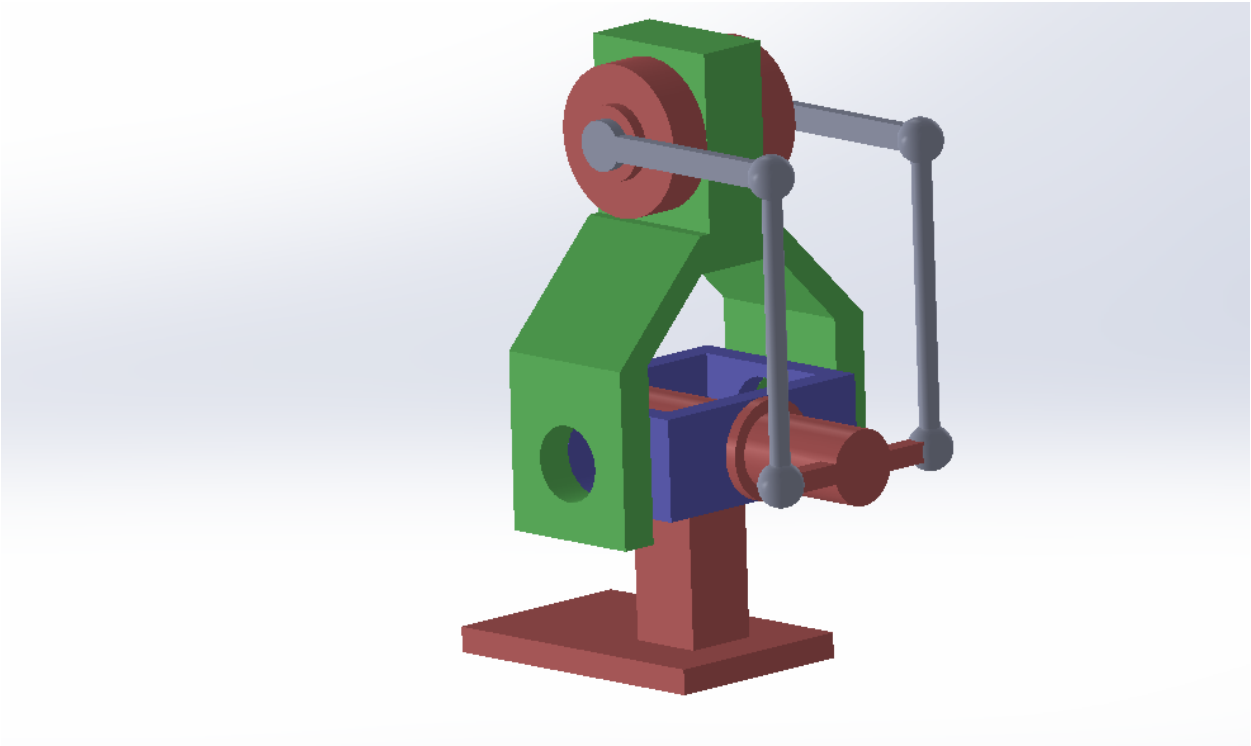


There are a few things to note about this model. First, the foot itself has a cutout and gap for some torsion springs to be placed in order to create a passive toe joint. Secondly, this design favors linear actuation instead of rotational motors as previously mentioned. This shift in thinking came from more research I did on robotic actuation. A linearly controlled system makes more sense to me and also is something I find more interesting to explore, so I hope to stay on this path in the future. I have included a picture of the ankle assembly with where the actuators and springs would be below:



Encountered Problems

One of the biggest challenges I had to face was the lack of understanding and conceptualization I had for the double cylinder design. I had a very hard time grasping the way the design works well enough for me to create a model of it while understanding how the pieces interface and work together. It took a while for me to fully get it, and eventually what helped a lot was a rough model my mentor shared with me that I was able to work off of. I have placed an image of this model below.



Another concern is if the actuators used would be fast enough to adjust the ankle during its gait. The actuators used in the assembly have a maximum speed of 1 inch per second, whereas rotationals motors could achieve a linear velocity of several times this with a potentially higher degree of accuracy. I would have to examine the motorization of the current model better and determine if more speed is needed.

Remaining Goals

The biggest task remaining is a fully fleshed out 3D model. I still have to properly determine how to make the passive toe joint, and then configure the right motorization. After that, I need to determine what materials to use for all of the pieces, and how to attach everything together (screws, nuts, bolts, etc). After all of these things are determined, I should have a viable model. Lastly, I would like to 3D print a model of the ankle design so that I can demonstrate its

capabilities and show off all of the engineering decisions that went into its creation easier. This is still fairly in line with the goals I had coming into this summer and I’m excited to achieve them!