

## Conclusions

The focal point of the project was the mechanical analysis, including both the dynamics (kinetic and kinematic) and static analysis.

The kinetic analysis is essential as the current state (position, velocity, acceleration) is very important to know to later carry out a full kinematic analysis. The kinematic analysis allows us to derive the appropriate formulas which can eventually be converted into state-space form. With a mathematical description of the plant, controller design is possible as well as simulations of motion and forces.

The next part consists of the static analysis of the hand while it is gripping an object. This analysis gives us the information needed to acquire the necessary parts and decide on the minimum torque required to hold the object still. Depending on the object being held, the forces may act at different angles and an analysis of the object should also be carried out to ensure it is in equilibrium ie. two fingers aren't creating a couple of moments causing rotation.

Our equations were derived by hand, while all simulations were carried out in a multi-functional Matlab script.

The next part of our report consisted of the design of the machine prototype based on rough approximations created in the Matlab script. The 3D model demonstrates several of its layouts. The controller and electronics were omitted, however the design may easily incorporate cable management and external mounts to the bushings.

The final simulations show that the motors are capable of lifting much larger objects and/or may move with larger accelerations. For our case, it is well within its operating range and even smaller motors may be considered to make the hand lighter.