Department of Mechanical Engineering
Flying Squirrel
Jonathan Avila Copado
Ryan Donnellan
Justin Joy
Owen Kehl
Joey Mathews
ME 476C Section 001

To: Prof. Carson Pete

CC: Connor Gaudette

From: Flying Squirrel

Date: 3/21/2025

Re: Analysis Memo

1. Introduction

For this assignment Dr. Razavian has asked the team to complete four calculations that will be relevant to the construction of the robot. The four calculations Dr. Razavian has asked us to complete are, the torque required to drive the robot, the rpm required to drive the robot at the specified speed of one m/s, the electrical analysis required to power the robot for the specified amount of time and the voltages required for each component, and the structural analysis of each component of the robot. For the structural analysis, Dr. Razavian believed that it was too much of an undertaking for just one person, so he asked that it be broken into the top and bottom halves of the robot and one person do each half.

2. Jonathan Avila Copado

For homework four I will be doing the bottom half of the structural analysis for the robot. In this assignment I will be doing various stress analysis like on the anchor points on the robot, lifetime of the ball bearings wheels of the robot, and the amount of force the lead screws will apply to the top half of the robot. As stated above, this topic was given down to us by Dr. Razavian himself. As for an activity that could replace this, I would suggest maybe 3D printing some mock anchor points and lead screws to test some max stress and what might be the life time of these things under constant stress.

3. Ryan Donnellan

For this assignment I will be calculating the electrical draw of the robot. For presentation one, I did a simplified version of these calculations assuming a blanket efficiency with no consideration given to the required voltages. For this assignment, the efficiency and voltage will be considered for the total required power. If another activity was approved to replace this assignment, I think a good choice would be a circuit building assignment. Controlling a motor with precision and getting it to spin either direction would be helpful.

4. Justin Joy

For this assignment I will be doing velocity analysis. The velocity calculations will be dependent on cable orientation and motor torque. The speed and torque of the motors needs to be high enough to meet the minimum velocity requirements set by our client, Dr. Razavian of one meter per second. The minimum motor speed needs to be determined at the maximum angle of any two of the three cables mounted to the Flying Squirrel. This will ensure that the device will maintain the required velocity at any position it is operating in. The next calculation for velocity is the motor to lift the upper section of the robot. The velocity of the lift motor needs to meet the same velocity requirements as the x and y motion. These calculations will provide vital information for the selection of motors.

5. Owen Kehl

As per Dr. Razavian's suggestions, I will be helping Jonathan to complete a structural analysis of our design. My focus will be components in the upper, lifting portion of the Flying Squirrel. This will include stress on the driving cables, stress due to the user's arm weight on the force sensor, stress on the arm support, and stress in the threads of the lifting assembly. A suitable alternate activity might be printing a shell of top assembly and, using the force sensor or an attachment of similar dimensions and strength, testing stability under the weight of the user's outstretched arm.

6. Joey Mathews

For my analysis, I will be completing a complete analysis of the torque applied to all the motors in the Flying Squirrel robot. With the required maximum force applied by the cables being 10 Newtons, I will need to determine the maximum torque that will subsequently be applied onto the motors, both while moving and while stationary. Figuring out the angles of the cables as they leave the robot will be the first step, and then those angles will be used to ultimately calculate the torque while at any given position or elevation. I will also have to complete an analysis to determine the maximum torque that will be applied to the motor for the lifting mechanism, as we are currently planning to use one motor with a gear train to all three corkscrew lifts so it will raise them all at the same time with the same speed. These maximum torque calculations will help us determine the type of motors we need and will help us find motors that provide the necessary torque for the required movement.