Progress report 2023-09-14

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What I've been working on:

I have repeated several tests in the experiment, this time using the higher gear ratio gearbox with a lower voltage, rather than the lower gear ratio gearbox with a higher voltage. The results are much closer to that in the model and simulation, indicating that the calibration of the lower gear ratio gearbox was flawed.

I have also done additional torque tests on the device, this time adding a weight to the device. This will allow me to validate the model's accuracy for different weights of device. I have done equivalent tests in the maths model and simulation for validation.

I have used the maths model to model the required torques throughout the lifting motion to attempt to determine the source of the discrepancy mentioned last week, that the physical device gets stuck at a certain point in the climbing motion but the maths model does not predict this. The torque required drops as the angle increases, and the normal force on the tail drops as well, so I am still not sure why there is this discrepancy. Perhaps the coefficient of friction of the tail on the ground increases as the angle of the contact increases.

I have spent a good amount of time this week writing up the maths model in the report.

What I'm working on next:

Model validation: I will perform further analysis on the experimental data obtained so that I can make conclusions about the accuracy of the simulation and math model. I will record the motor current during the climbing motion and compare that with the simulated current in the simulation and model. I am also considering building new LIMs with a different gear ratio and validating that the model can describe the motion with different gear ratios.

Improve models: I will further investigate the assumptions that lead to the model acting differently to the real device in terms of partial lifting.

Writing report: I will continue writing up sections of the report so as to be ready for the draft submission.

Unchanged:

Next iteration: While building and testing the device I have been considering potential improvements for a future version. If time allows, I would like to build a second device after I have validated the model using the first device. The design of this device

would consider lessons learned from the model, and multiple concepts could be quickly tested in simulation. The ideas I’m currently pondering include using bearings, herringbone gears, brushless dc motors, and possibly even connecting the two LIMs together with a bolt so they move rigidly together, eliminating the possibility that one moves ahead of the other.