DESIGN OF A LOW RADAR CROSS-SECTION RIG FOR CONTROLLED MOTION OF A CALIBRATED RADAR TARGET

OBJECTIVE

The objectives of the project were :

- Rig must be able to travel a distance of up to 50 meters
- The rig must be able to lift the test objects to a maximum height of 2 meters and a minimum of 30 centimeters.

METHODOLOGY

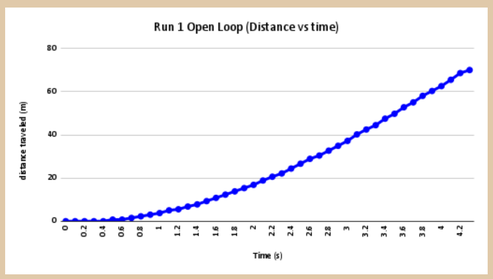
The model of development was a V-model. The problem was broken into 2 parts, the lifting mechanism, and the motor drive subsystems:

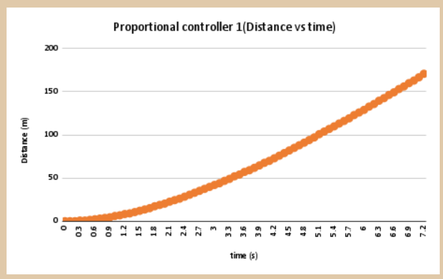
- The motor drive system uses 2 DC motors to drive the back wheels of the rig . Use an optical encoder to measure the speed and position of the wheels. Develop a speed controller and positions calculating algorithm to control the distance and speed of the rig.
- The lifting mechanism uses 2 servo motors that are attached to pulleys. And the pulleys pull the scissor lifting mechanism. Developed a method of relating rotations of the servo to the height lifted by scissor lift.

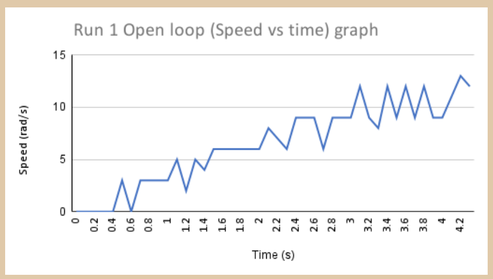
RESULTS/FINDINGS

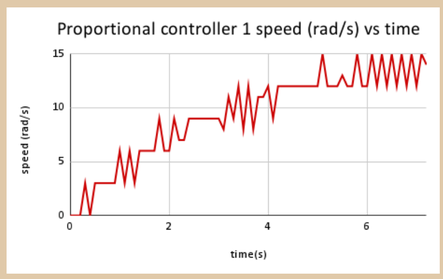
There were two types of tests/experiments No-Load Tests and Loaded Tests. The motor drive system and the lifting mechanism both have these experiments run on the..The results shown below are a summary of the no-load test, mainly because the Loaded Tests did not produce data, this is because of hardware design difficulties faced in the project

MOTOR DRIVE SYSTEM RESULTS







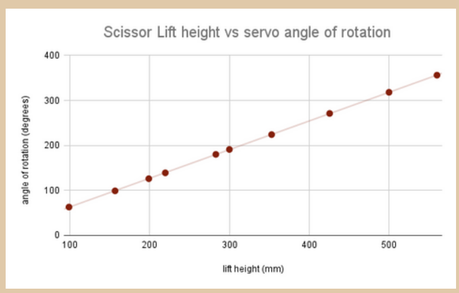


DISTANCE COVERED AND SPEED OF RIG WHEELS IN OPEN LOOP TESTING

DISTANCE COVERED AND SPEED OF RIG WHEELS IN CLOSED LOOP (PROPORTIONAL CONTROLLER) TESTING

DISTANCE COVERED AVERAGE ACCURACY

LIFTING MECHANISM SYSTEM RESULTS



LIFT HEIGHT ACCURACY

INTRODUCTION AND BACKGROUND

Testing the functionality of radar systems is an important step in design, thus it is important to have a calibrated target to test the radar on. The test rig which carries the radar targets (reflective metallic objects), offers controlled motion to control the distance to travel and height to which the rig must raise the test objects.

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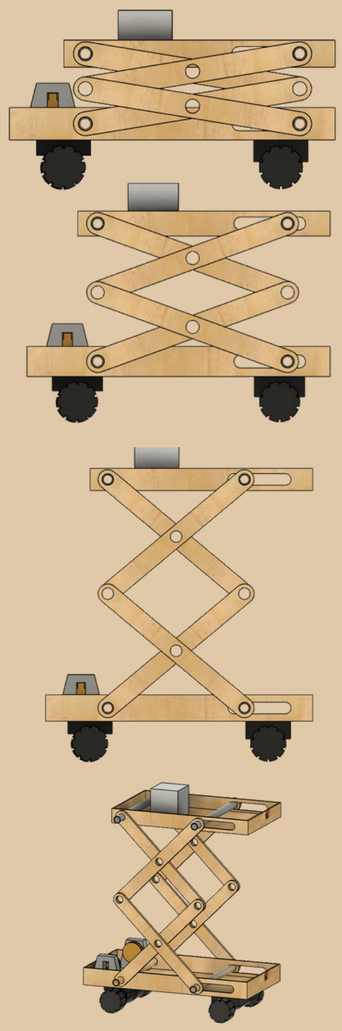

ANALYSIS

The No load results provide a quantitative representation of the the functionality of subsystems. The subsystem's results can be analysed as follows:

- The open loop speed vs time plot does not follow a first order response and the proportional controller aided in speed control to a certain extent.
- The distance travelled by the rig was 99.8% accurate to the distance inputted by the user.
- The servo provided a 99.6% accurate lifting height in relation to a input height

CONCLUSION

In conclusion the project provided some important findings, despite the challenges faced in the research. The distance travelled by the motor (in the no-load tests) is highly accurate which meets one of the main requirements of the project and the lifting mechansim algorithm provided accurate results apon testing. Even though the Load tests culd not be conducted sue to hardware design misteps, this research paper provides an important foundation into furthering the research in this particular field

RELATED LITERATURE

No related literature since this is heavily design orientated