MECA 482 - Control Systems
California State University, Chico

Control Systems Report:
Edge Bot X-Axis Modeling

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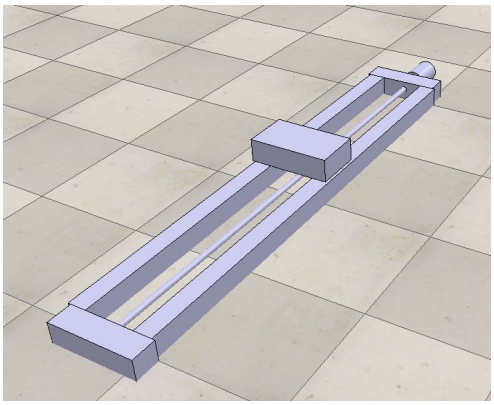
Introduction

The Haas Edge Bot machine is essentially a 5 axis milling machine. The team will investigate the rotational motion of a DC brushless motors that run each of the motion along the 5 axisb . A mathematical model of the system and a designed control system will also be developed. This project design will also be used for other needed translation in the milling machine.

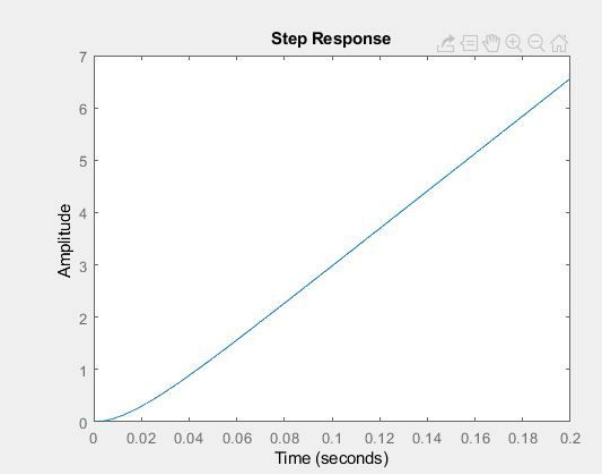
Modeling



For the project we started with breaking down the mathematical components to then simulate. First found the transfer function for an open-looped step response of the motor that would run our system. We utilized Matlabs computational power to find the following equation.

```
P_motor =

                  0.0274
  ----------------------------------------
  8.878e-12 s^3 + 1.291e-05 s^2 + 0.0007648 s

Continuous-time transfer function.
```

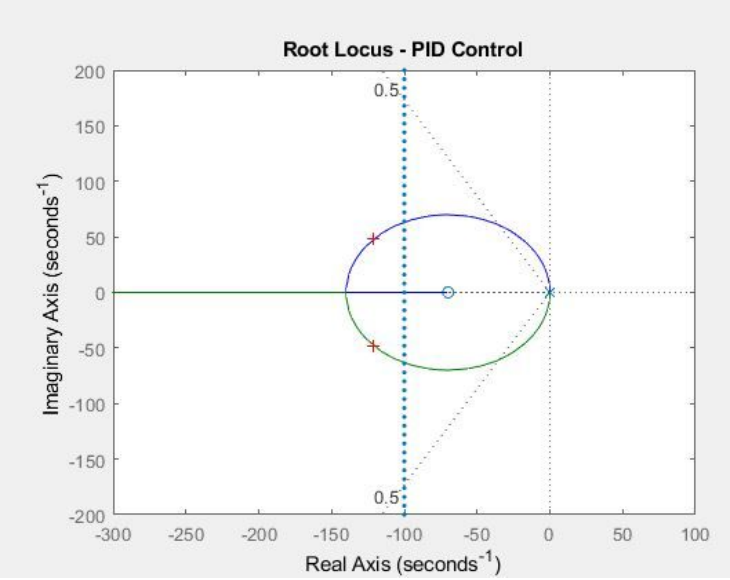
This inturned yielded a graphical representation which displace the step response, which is the amplitude in relationship to the change in time.



he next thing we did was find a closed-loop transfer function and got the following equation.

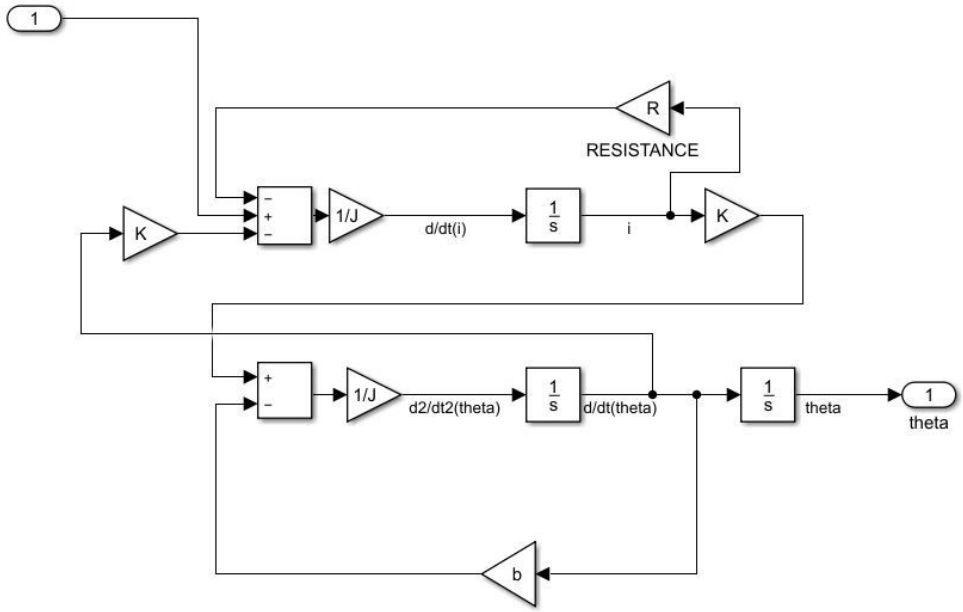
```
sys_cl =

                       0.0274
  ----------------------------------------------------
  8.878e-12 s^3 + 1.291e-05 s^2 + 0.0007648 s + 0.0274

Continuous-time transfer function.
```

With the Root Locus graph below we can see which values would give us the fastest response time while keeping the minimal overshoot time. With this we know that in actual use that the system will not only work but work efficiently.

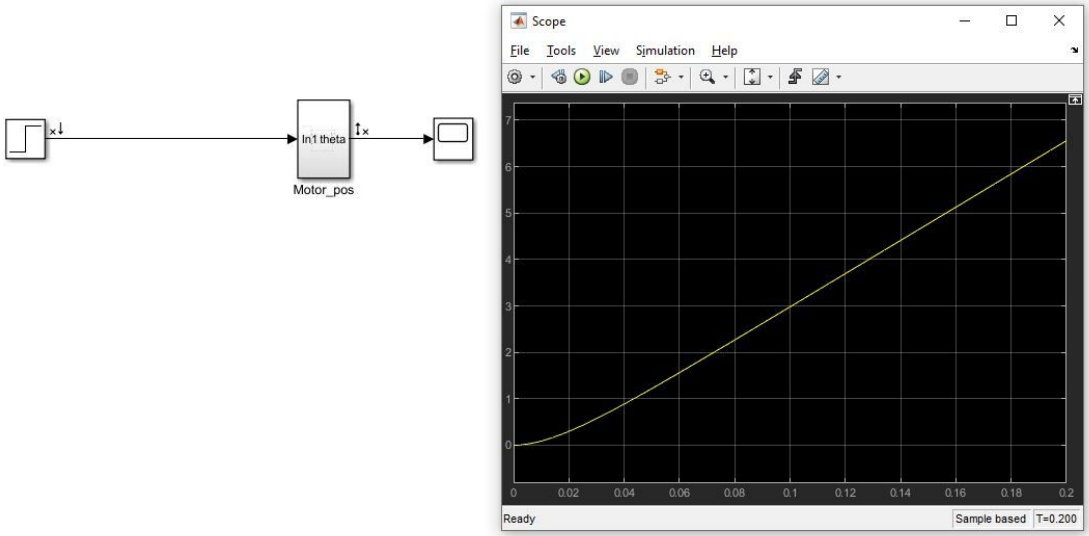


Controller Design and Simulations

Using the simulink controller design program to simulate the DC motor system.



After we built it then we changed it to be an open-loop system so we could find the position of the motor.



Conclusion

For this project we were able to get all the individual programs to work but ran into problems with the communications between them. Due to this we were unable to finish the project and not able to fully show the aspects of the controller on the linear motion of the x-axis that we will be building for the edgebot project.