

Readme

This is the Readme for the final capstone project for ME449 Robot Manipulation class at Northwestern University. The problem was to control and simulate a mobile manipulator where the manipulator carries the box from the initial to the final configuration.

The software used here is MATLAB.

How to use:

- a. NextState - The next state function takes in the current configuration of the robot and returns an configuration after a timestamp
- b. TrajectoryGeneratory - The trajectory generator function gives a desired trajectory of the end effector
- c. FeedbackControl - The feedback control function is a controller which takes in the current configuration and corrects it to give a better path

Runs:

There are three runs in this repository. First one where the error is minimized, second where there is an overshoot and third where we change the location of the box.

The main script that runs all the functions together is final_project.m. Inside the script, there are comments for the configuration changes for all the possible values. The main scripts solve for a desired trajectory and then uses that as a reference to calculate an actual trajectory from the current configuration of the robot. The software uses feedforward + Proportional +Integral error correction for the current path to reach a zero steady state error, so that the robot can perform the task with no error.

The lesson from this project was the use of tuning parameters like proportional and integral gain to correct the path of a bot in the right way. The initial configuration of the bot is an important thing which can be looked over as it is difficult for the robot to reach the desired trajectory from a certain configuration.

It was very surprising to see how it reacts to high K_i without tuning K_p and vice versa. The simulation with high jitters of the error was interesting to say the least. Another interesting factor was the max ang speed playing an important role in reducing the error