Accomplished this week:
The last week we have analyzed the model, obtained from the system identification, extended with a state for torque and made step responses for a closed loop system using a PID regulator. We have also worked with finding a good sampling time and a good PID regulator for the true system and looked at true step responses to compare and tune the parameters.

Since the robot has a gyro/accelerometer module we have discussed with IT project to get the information to the motor card via the CAN bus. The gyro information can be used to find the inclination of the robot and therefore adjust the distance to go so that the traveled horizontal distance will be right. The accelerometer information can be used to determine motion of the robot and together with the encoder information it can be used to detect slips on both wheels.

Also we have designed a Kalman estimator for estimating the states and in particular the unknown torque.

Current problems:
The main problem right now is that the theoretical step responses don’t match with the real step responses obtained from the motors. However the model seems to be good since it has been tested on both design and validation data, but this has to be investigated more.

The next problem is how to design a good estimator of the torque and design a state based controller. The latter problem is mainly how to obtain a regulator that doesn’t amplify the variations in torque and gives a stable closed loop. Torque variations that are not modeled in our identified system impacts the regulation in a feed-forward way and makes therefore the design of a regulator more difficult.

Action points for next week:
- Verify the model further
  - Find a regulator that works in both theory and in reality
  - Look at the sensitivity of process disturbances in the model
- Improve Kalman filter
- Design and implement methods for slip detection using accelerometer and energy consumption differences

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