is the position in the global coordinate system. Double check the scale from to .

State Space Interval overall with regulator / controller (Removed last column and row to get rid of the estimator commonet)

Overall System

and are the process noise of the movement. and are the process noise of the motors. is the measurement noise of encoders

When the substitution for A, B, C, D, E is done

is non-linear. is non-linear so is non-linear also.

Kalman filter uses the fast update (And keeps a history) to get the current state variables. Once we get a slow update, rewind time until the slow update capture and use that in the filter, then update to present using the rest of the history.

Basic Kalman  
 Use model to predict current state variables

Get output error between predicted and real

Update state variables using error (Used for calculations of state)

Update output using the new state (Used for calculations of output)

With a few assumptions, we can just make this in terms of velocity

Where , , and is some coefficient that ties the coefficient of friction to the reduction of speed. should be less than 1.