MPC Description

Model

The model and state vector are described as following equations.

x\_[t+1] = x[t] + v[t] \* cos(psi[t]) \* dt

y\_[t+1] = y[t] + v[t] \* sin(psi[t]) \* dt

psi\_[t+1] = psi[t] + v[t] / Lf \* delta[t] \* dt

v\_[t+1] = v[t] + a[t] \* dt

cte[t+1] = f(x[t]) - y[t] + v[t] \* sin(epsi[t]) \* dt

epsi[t+1] = psi[t] - psides[t] + v[t] \* delta[t] / Lf \* dt

x = state[0]

y = state[1]

psi = state[2]

v = state[3]

cte = state[4]

epsi = state[5]

Timestep Length and Elapsed Duration (N & dt)

I set following parameters.

N:10

dt:0.1

Tuning procedure is as following.

1. I fix T (N\*dt) 1.0 second.

2. I set N as large as possible.

3. I set dt by adjusting T and N.

Polynomial Fitting and MPC Preprocessing

To facilitate the calculation, I converted global coordinate to vehicle coordinate as the preprocessing.

Model Predictive Control with Latency

I run a simulation using the vehicle model starting from the current state for the duration of the latency. The resulting state from the simulation is the new initial state for MPC.