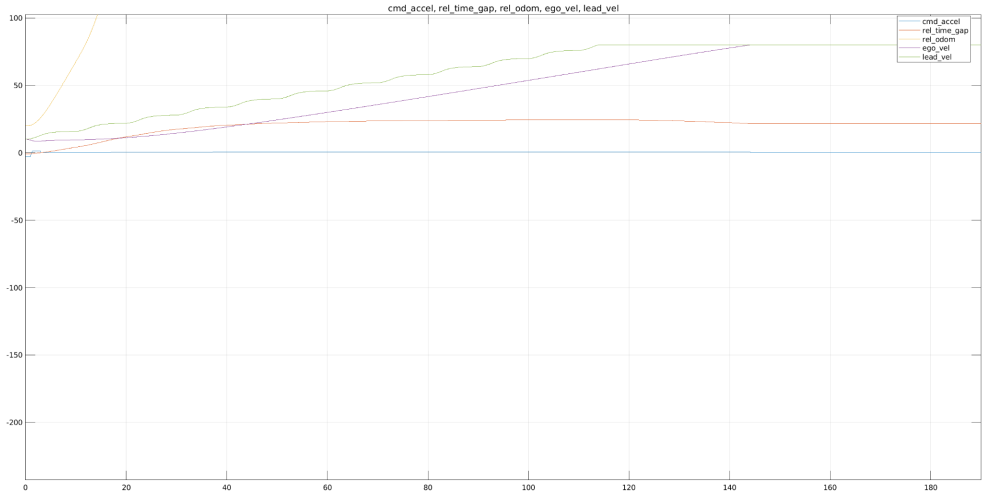
Based on the feedback we received, the main change we made to the controller is that we changed the controller from the lead distance based to the time gap based since the controller was not decelerating fast enough when needed. We tuned the controller with the gain values to produce the smoother graph. We mainly added two logics. One logic allows the controller to stop accelerating once it reaches the speed limit, and the other logic handles the dividing by 0 when calculating the time gap with the lead distance and the ego velocity.

The updated code is correctly committed to the repository.

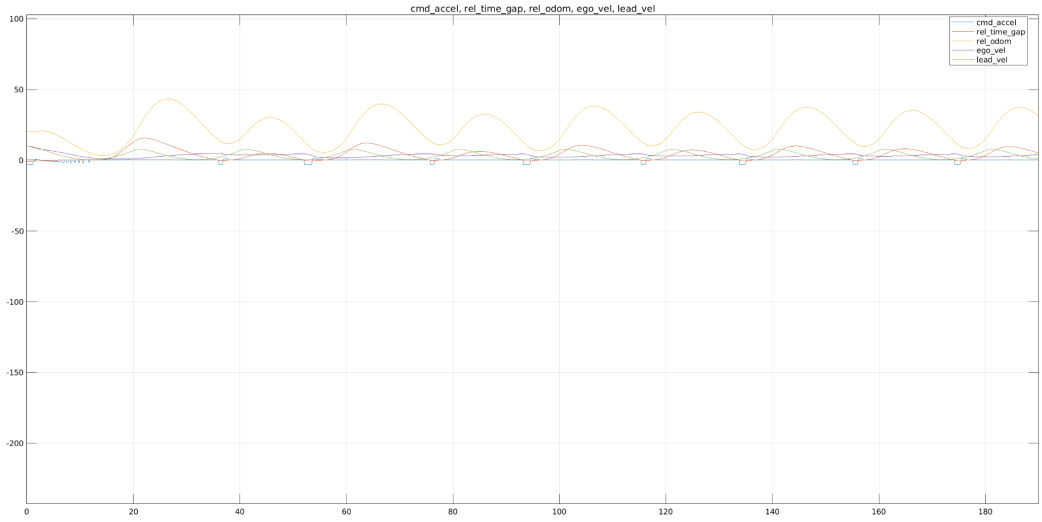
time gap should be equal to 3
speed limit should be equal to 80

Github repository link:
https://github.com/RyanTaylor37/Simulink_ROS_Car_Controller/tree/master

Lead Car Square Function Acceleration Simulation



Lead Car Spike Function Acceleration Simulation


cmd_accel, rel_time_gap, rel_odom, ego_vel, lead_vel
cmd_accel
rel_time_gap
rel_odom
ego_vel
lead_vel
100
50
0
-50
-100
-150
-200
0
20
40
60
80
100
120
140
160
180