Optimal Vehicle Coordination at Intersections

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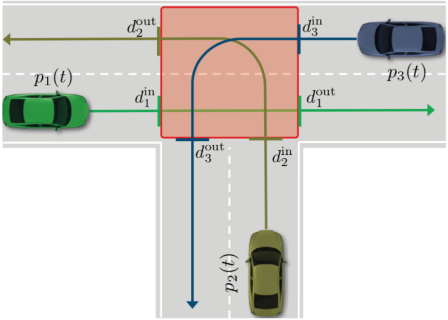
Introduction

- What we will do is to find the control policies under a given precedence order without any collision at intersection.
- Assmptions
  i. Given precedence
  ii. No more than one vehicle at intersection all the time
  iii. Minimal changes from initial states.
  iv. ......



Problem Formulation

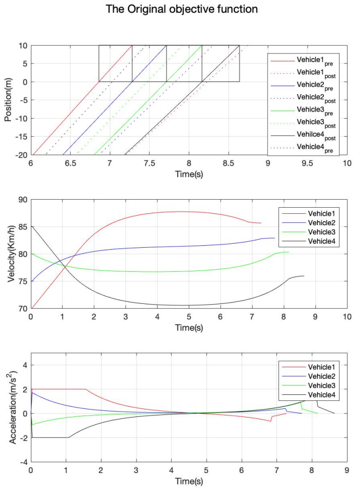
Continuous time

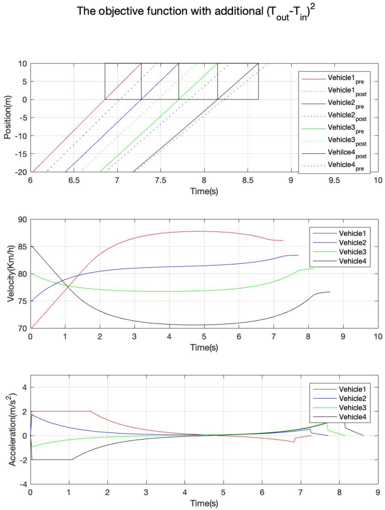
$$\min \int_0^t ||v - v_{ref}||_Q^2 + ||a||_R^2 + \underline{||t_{out} - t_{in}||_V^2}$$
$$s.t. \;\; (p(t_{i,in}), p(t_{i,out}))^T = (p_{in}, p_{out})^T; \;\; t_{i,in} \geq t_{i-1,out}$$
$$\dot{v} = a; \;\; \dot{p} = v + at$$

Discretized time

$$\min \sum_{k=0}^{N-1} Q(v_i^{ref} - v_{i,k})^2 + Ra_{i,k}^2 + \underline{V(t_{out} - t_{in})^2}$$
$$s.t. \;\; (p(t_{i,in}), p(t_{i,out}))^T = (p_{in}, p_{out})^T; t_{i,in} \geq t_{i-1,out}$$
$$v_{i,k+1} = v_{i,k} + Ta_{i,k}; \;\; p_{i,k+1} = p_{i,k} + Tv_{i,k} + \frac{1}{2} Ta_{i,k}^2$$

Simulation Result





Summery and Discussion

- method of computation for NLP
- Distributed Algorithm Augmented Lagrangian based Alternating Direction Inexact Newton method (ALADIN)

The End
Thank You