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Distributed Coordination of Connected and Automated Vehicles at Multiple Interconnected Intersections

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Abstract : In connected vehicle systems where wireless communication is available among the involved vehicles and intersection controllers, it is possible to design an intersection coordination strategy that leads the connected and automated vehicles (CAVs) travel through the road intersections without the conventional traffic light control. In this paper, we present a distributed coordination strategy for the CAVs at multiple interconnected intersections that aims at improving system fuel efficiency and system mobility. We present a distributed control solution where in the higher level, the intersection controllers calculate the road desired average velocity and optimally assign reference velocities of each vehicle. In the lower level, every vehicle is considered to use model predictive control (MPC) to track their reference velocity obtained from the higher level controller. The proposed method has been implemented on a simulation-based case with two-interconnected intersection network. Additionally, the effects of mixed vehicle types on the coordination strategy has been explored. Simulation results indicate the improvement on vehicle fuel efficiency and traffic mobility of the proposed method.

Keywords : connected vehicles, automated vehicles, intersection coordination systems, multiple interconnected intersections, model predictive control
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