Modelling of Backward Travelling Holes in Mixed Traffic Conditions

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A variety of vehicles, differentiated based on their static and dynamic characteristic, is prevalent in most of the developing economies. Concurrently, simulation time for large scale scenario is another emerging concern due to rapid increase in sizes of the cities. Thus, the present study investigates the complex heterogeneous traffic modelling with the help of a computationally efficient framework to model such traffic conditions more realistically.

An multi agent based simulator, MATSim, is chosen in which daily plans of all agents are loaded simultaneously on the network using a so-called "queue model" which is computationally more efficient than other simulators. In an iterative process, agents learn and adapts to the system. In a previous study, the traditional queue model's *first-in-first-out* sorting approach was replaced by *earliest-link-exit-time* to allow passing of smaller vehicles by faster vehicles in free flow regime. The present study, continues with the above approach by introducing the more realistic behaviour, *backward travelling holes*, in the queue simulation which resembles with the Newell's simplified kinematic wave model (KWM) [1].

The idea behind the backward travelling holes approach is that during jammed regime, if a vehicle leaves the downstream end of link, space will not available instantly on upstream end of link. Instead, it will take some time for the free space to reach the upstream end of link [2, 3]. This space is termed as 'hole' which has the same passenger car unit that of the leaving vehicle. Thus holes differ in their sizes but a constant speed is assigned for all holes by which they travel towards upstream end of the link. This speed corresponds to the speed of the backward travelling kinematic wave in the KWM. The holes implicitly introduce an inflow link capacity, in addition to the existing outflow link capacity.

The queue model with holes eliminates the unclear dynamics of the queue model in jammed regime. To validate the model, fundamental diagrams for homogeneous and heterogeneous traffic conditions and bike passing rates are presented with the help of a triangular test network. Furthermore, the sensitivity of the model is tested for different modal splits and number of lanes combinations. Since, the queue model model accounts only for the vehicles behaviour during link entry and exit, the computational efficiencies are maintained which is suitable to simulate large scale scenario in realistic time domain.

References

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