Monte Carlo Simulation of Vehicular Traffic Flow for Kinetic Model with Distance Oriented Interactions

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For spatially homogeneous vehicular traffic flow we consider a kinetic model with acceleration variable included in the set of phase coordinates. It means that single vehicle state probability density $f(v, a, t)$ is function of velocity v, acceleration a and time t. In the framework of this model previously we constructed the basic linear integral equation of the second kind. The latter equation describes evolution of the vehicle system and associates with a Markov chain. It enables us to use Monte Carlo algorithms and estimate various functionals of $f(\cdot)$: velocity and acceleration distributions, fundamental diagram, mean velocity dependence on vehicle density, etc.

In this work we consider the distance oriented interactions instead of pairwise interactions with relative velocity dependence, which was studied in our previous works. It means that the vehicle changes its acceleration when crossing deterministic distance thresholds which depend on velocity of this vehicle.

Numerical results show the efficiency of usage of the basic integral equation and corresponding Markov chain in vehicular traffic problems. Moreover, it enables us to study parametric dependencies of our functionals of interest.