Cellular Automata Model for Car Accidents at a Signalized Intersection

Authors : Rachid Marzoug, Noureddine Lakouari, Beatriz Castillo Téllez, Margarita Castillo Téllez, Gerardo Alberto Mejía Pérez

Abstract : This paper developed a two-lane cellular automata model to explain the relationship between car accidents at a signalized intersection and traffic-related parameters. It is found that the increase of the lane-changing probability P_{ch} increases the risk of accidents, besides, the inflow α and the probability of accidents P_a exhibit a nonlinear relationship. Furthermore, depending on the inflow, P_a exhibits three different phases. The transition from phase I to phase II is of first (second) order when $P_{ch}=0$ ($P_{ch}>0$). However, the system exhibits a second (first) order transition from phase II to phase III when $P_{ch}=0$ ($P_{ch}>0$). In addition, when the inflow is not very high, the green light length of one road should be increased to improve road safety. Finally, simulation results show that the traffic at the intersection is safer adopting symmetric lane-changing rules than asymmetric ones.

Keywords : two-lane intersection, accidents, fatality risk, lane-changing, phase transition

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