Abstract

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Development of a Stochastic Genetic Algorithm for the Optimization of Traffic Light Signal Timings

Traffic Management of over-saturated urban networks is a great challenge in large metropolitan areas. Over-saturation is a severe traffic condition when excessive unbalance between the vehicular demand and the road network's capacity takes place, generating serious inflation of queuing lengths, waiting times, spillbacks and risk of accidents. Other environmental,psychological and economic aspects could also be related to the problem. However, adequate traffic management can successfully handle the demand in both space and time, and overcome the arising congestion dilemma. A mathematical model representing the traffic control stochastic environment has been developed. The optimum/near-optimum traffic signal timing values have been determined through the application of a genetic algorithm that feeds these values into a developed simulation model to obtain the corresponding queuing parameters. The generated signal timings significantly enhance the traffic performance and alleviate the choke points over a multiple-junction urban network.The developed approach has been applied on a network consisting of two consecutive junctions in Alexandria, Egypt using actual field data. Although the solution has not been implemented in reality nevertheless, optimization results are very promising and show that the proposed model can drastically improve the queuing parameters of the vehicular flow.