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MODELING OF TRANSPORT AIR POLLUTION IN THE CITIES

Abstract

Traffic flows have been augmenting due to permanently increasing number of the vehicles' in the cities. Demand for the vehicles is also increasing. The consequences are air pollution, congestion in the streets etc. The transport system itself requires reorganization considering of two related principles – environment protection and efficiency of transport system. It is important to assess how the transport could be efficiently distributed in the existing infrastructure of the urban streets, where the density of traffic is relatively high. Besides, the slow speeds, frequent acceleration and deceleration characterize traffic. It is also necessary to try to avoid the congestion, maximize traffic flows and minimize the harmful traffic emission in the cities.

The main variables, as speed, density and flow, describe and characterize the traffic. Equations of traffic flow help to determine such important and usual characteristic as the situation after a traffic light turns green, traffic stopped by a red light or the effect of an accident. In this way traffic situations resulting form the complex interaction of many vehicles are analyzed rather than the behavior of individual cars. Traffic flow has traditionally been viewed either as a stochastic process, or as a kinematic fluid. In the latter situation traffic has been viewed as having continuos differentiable density (perhaps with occasional shocks). Though it is not possible to call the real situation of traffic in the streets of Lithuania as continuos process, this tendency exits sometimes. We are investigating the nearly uniform traffic flow by introducing the traffic density wave. This is more typical for the real traffic flow in our cities.

The network of downtown's streets is the mixed graph (both direction traffic streets are undirected edges, pedestrian zones aren't included). The identity matrixes are created according to the principles of the graph theory where every element of matrix characterizes the particular segment of the streets' network. The cost function is assigned for the every edge of the graph. It evaluates the length of the street, penetrability, peculiarities of the road's coating, the traffic lights, specific features of the main or side street etc. Application of the Dejkstra's algorithm allows to find out the shortest path in the graph i.e. the efficient one according to the determined values of the cost function of every segment. It is important to organize the efficient traffic in the existing network of the city, especially in the downtown, where the traffic density is high and non-decreasing.

The statistical traffic model is a way of simulating traffic flow. It aims to model flow in congested and non-congested conditions allowing for traffic joining and leaving the road via on and off ramps. The model uses the Matlab mathematical software. The model is a solid foundation on which to build further modules (such as system control, or incident, traffic pollution analysis).

MODELOWANIE ZAPYLENIA W TRANSPORCIE MIEJSKIM

STRESZCZENIE: Systemy transportowe w miastach muszą odpowiadać dwóm podstawowym zasadom: ochrony środowiska naturalnego oraz ekonomice. W artykule omówiono czynniki wpływające na zmiany tych zasad oraz metody rozwiązania modeli matematycznych opisujących ruch uliczny.