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MATHEMATICAL SIMULATION OF SYSTEMS WITH MOVING OBJECTS

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Different methods of movement simulations to optimize and plan moving of object in a system are described in this current work.

Keywords: movement, simulations, transport flow.

Movement optimization and planning for different systems is an important issue. A transport infrastructure is one of the most crucial infrastructures, therefore a lot of works are done in these area. However movement optimization and planning can be applied to biological systems for migrations, elements and pollutants transfers and etc. For the reason that movement simulation in transportation systems are well developed, it is better to use this theory as a foundation. The main task of mathematical models is to determine and prognosis all parameters to support systems functioning, such as traffic intensity it all elements of the system, transportation amount, average movement speed, delays, time lost and others.

There are a lot of different mathematical models that can be applied to analyze transport systems. Those models can solve different tasks, use variousmathematical approaches and have specific accuracy. It can be determined three classes of mathematical models based on their functions, they are: forecasting models, imitation models and optimization models.

Forecasting models are used to resolve tasks when a geometry, transport system properties and location of sources of transport flow are determined. It is required to forecast transport flow in such system. Forecasting includes calculation of bulk characteristics of the system. It can be calculation of average value of movements between different areas, traffic intensity, transport objects distribution and others.Imitation models are aimed to reproduce all details of the transport flow, including time processes. In that case distribution of objects on the routes are determined and used as a source data. Forecasting and imitation models are supplement to each other. Optimization models are used to resolve transport flow distribution to minimize costs for the whole system.

To build a mathematical model it is required to describe its elements. The base elements is a road graph, nodes of a graph describe street crosses and curves describe element of roads. Another elements are arrival and departure points. Fundamentals for modeling are criteria of evaluating route, that criteria called generalized costs. The main property of simulation of transport systems is reverse interaction, whenroutes chosen by users effect on another users chose, that is called reverse interaction

To simulate transport systemsa calculation of correspondences model can be used. Numerical amount of movement in the system is a matrix of correspondences. Elements in this matrix are rates of transport flow between different areas. All trips can be derived in different groups in dependence on the means and the purpose of movement, different matrix for different groups. Input information is an amount oftransport flows in arrival and departure points. All users are derived into classes, for each class matrix of correspondences is calculated and distributed on the transportation system. The most common calculation of correspondences models are gravity models, entropy models, and models of competitive possibilities.

Another group of models to simulate transport systems are models of distribution of transport flows. Traffic load is determined by all transport objects that move on elements of the system (routes). An input data is a matrix of distribution of transport objects on routes andarrival and departure points. Those models differ from correspondence models because locations and routs of every user is considered. There are various models of distribution of transport flows. A model that determines a transport system loads based on behavior strategies is called a model of optimal strategies. The most effective model that considers interaction between objects is a model based on equilibrium distribution.

Movement simulation of different systems is important issue , because planning and optimization of movement objects flow can help to decrease expenses for movement in means of time and materials.