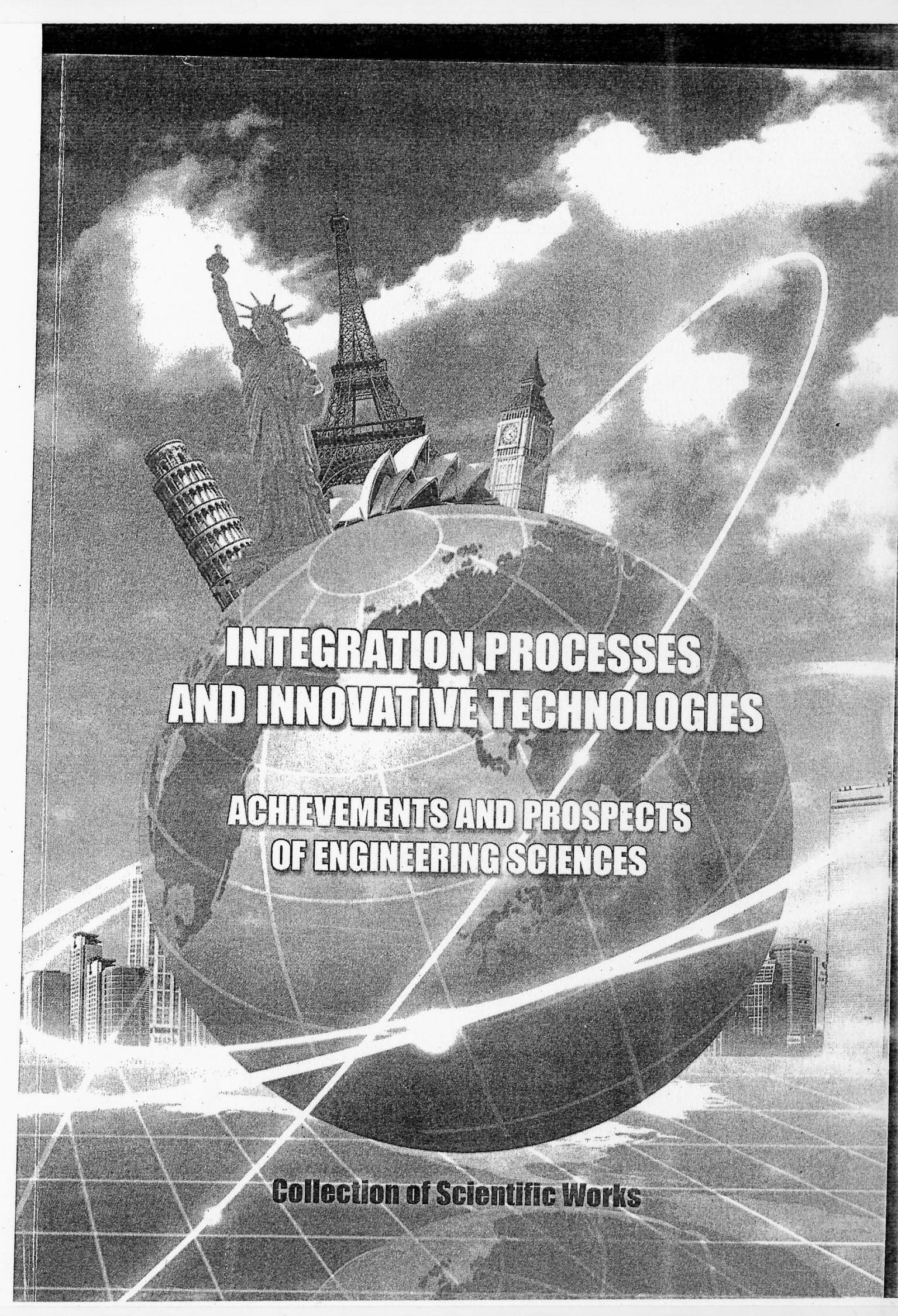




# **INTEGRATION PROCESSES AND INNOVATIVE TECHNOLOGIES**

## **ACHIEVEMENTS AND PROSPECTS OF ENGINEERING SCIENCES**

**Collection of Scientific Works**

Ministry of Education and Science of Ukraine

KHARKIV NATIONAL AUTOMOBILE AND HIGHWAY UNIVERSITY

Faculty of Transportation Systems

Department of Foreign Languages №1

**INTEGRATION PROCESSES AND INNOVATIVE  
TECHNOLOGIES: ACHIEVEMENTS AND PROSPECTS  
OF ENGINEERING SCIENCES  
(IN FOREIGN LANGUAGES)**

**ІНТЕГРАЦІЙНІ ПРОЦЕСИ ТА ІННОВАЦІЙНІ  
ТЕХНОЛОГІЇ. ДОСЯГНЕННЯ ТА ПЕРСПЕКТИВИ  
ТЕХНІЧНИХ НАУК  
(ІНОЗЕМНИМИ МОВАМИ)**

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## PROBLEM FORMULATION ON DRIVER'S CONSIDERATION IN EMPIRICAL-STOCHASTIC MODELS OF TRAFFIC FLOW

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*Abstract. The method of obtaining experimental data needed for the implementation of the previously proposed method of taking a driver into consideration in empirical-stochastic models of traffic flow is proposed.*

*Key words: empirical-stochastic model, traffic flow, coefficient of driver's decisiveness.*

## ПОСТАНОВКА ЗАДАЧІ УРАХУВАННЯ ВОДІЯ В ЕМПІРИКО- СТОХАСТИЧНИХ МОДЕЛЯХ ТРАНСПОРТНИХ ПОТОКІВ

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*Анотація. Запропонована методика отримання експериментальних даних, необхідних для реалізації раніше запропонованого способу урахування водіїв в емпірико-стохастичних моделях транспортних потоків.*

*Ключові слова: емпірико-стохастична модель, транспортний потік, коефіцієнт рішучості водія.*

The growth of tension in the operation of the transport systems of large cities causes a necessity for continuous improvement in technological means of road traffic management (RTM) in the direction of the creation of the Automatic Traffic Control System (ATCS) for a large part of the road network of city, for example, a central business district, which should maximally use not only separate areas, but also the entire Road Network (RN). The most difficult task of the creation of the ATCS is the development of the software of the controller because of contradictory requirements:

- sufficient accuracy of the models of traffic flows;
- a need for the prediction of the situations progress on the areas of a road network and the identification of problem areas;
- a number of areas of a road network;
- a number of simultaneously moving objects ( tens of thousands );
- a need to select in real time the best option from dozens of options of road traffic management.

At present, there are several approaches to modeling the movement of transport flows:

- macroscopic models that are built on hydro-gas or electrodynamic analogies [1, 7];
- microscopic models that use a description of each object and their interaction in flows [2, 4 - 7];
- mesoscopic models [3, 7] as an attempt to unite the advantages of macro and microscopic models.

Macroscopic models are simple enough, but from the point of view of their use in ATCS, they have a number of significant shortcomings. Firstly, they do not allow to simulate discrete and continuous flows that are common to a city's road network where the objects move in "packages", i.e. a conditional and continuous flow can be viewed within a single package only, but between packages the continuity is not available. This does not allow to simulate the interaction of conflicting flows.

Microscopic models allow to accurately simulate the interaction of flows and consequently to predict the development of the situation in the road network, but do not guarantee required performance because the mathematical model based on the microscopic approach for thousands of elements of the road network and tens of thousands of moving objects contains from hundreds of thousands to millions of equations and conditions.

Attempts to obtain the desired result when using a mesoscopic model can lead to integration of disadvantages of macro- and microscopic models rather than their advantages.

The empirical-stochastic approach to modeling transport flows, which is proposed in [8,9] and provides the parameters of flows as random variables on the basis of the experimentally obtained the probability distributions of their values, allows to create the model of the movement of transport flows that meets the requirements of both forecasting accuracy and responsiveness. The behavior of a driver can be introduced by the coefficient of decisiveness as follows [9]:

$$K_p = \frac{\tau_r}{\tau_\phi},$$

where  $\tau_r$  - time that is theoretically required for maneuver;  $\tau_\phi$  - real selected time that the driver considers to be sufficient for maneuver safety.

It is obvious that the  $K_p$  of a driver depends not only on his experience, character, psycho-physiological state etc., but on the type of maneuver, traffic intensity, road conditions etc.

Information on the study of the correlation between the driver's decisiveness and the factors mentioned is not available in literature. It does not allow to practically use the driver's decisiveness in the models of traffic flow at present.

Since the decisiveness of driver may be different when selecting parameters of driving or making a decision to perform a maneuver, a general task can be divided into separate tasks:

1. When driving in a "package":
  - choice of the speed of the first vehicle in the "package" by driver;
  - choice of the distance by drivers of following vehicles;
  - choice of lanes (when alternatives are available);
  - making a decision to overtake.
2. At the entrance to the main road on congested crossroads:
  - turn to the right;
  - when crossing an intersection;
  - turn to the left.

Basic statistical data to make the probability distribution of decisiveness coefficients for all the above separate tasks can be generated by processing the video images of movements of real traffic flows on the road network of cities. Video image should be obtained with different intensity of traffic as it can be assumed with a high degree of probability that the heavier the intensity of traffic, the higher the decisiveness of drivers.

The further choice of the decisiveness coefficient of a specific driver (a moving object) can be made on the basis of the distribution of probability values of decisiveness coefficients using any "random number generator" on the well-known procedure.

Since video imagery and statistical data on the proposed method of taking into account the impact of drivers on the movement of transport flows are based on a real combination in the overall flow of vehicles with drivers with a different degrees of decisiveness, it can be expected that it will increase the accuracy of modeling in contrast to the models where the model, of an "ideal" or "average" driver are used.

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