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**XXXI International Seminar on  
Stability Problems for Stochastic Models**

**and  
VII International Workshop "Applied Problems in  
Theory of Probabilities and Mathematical  
Statistics Related to Modeling of Information  
Systems"**

**and  
International Workshop "Applied Probability  
Theory and Theoretical Informatics"**

**Book of Abstracts**



**2013**

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Mathematics and Cybernetics  
Moscow State University  
(CMC MSU)

Institute of Informatics  
Problems  
Russian Academy of Sciences  
(IPI RAN)

Department of Probability Theory  
and Mathematical Statistics  
Peoples' Friendship University of Russia  
(PTMS PFUR)

# **XXXI International Seminar on Stability Problems for Stochastic Models**

and

## **VII International Workshop**

**“Applied Problems in Theory of Probabilities and Mathematical  
Statistics Related to Modeling of Information Systems”**

and

## **International Workshop**

**“Applied Probability Theory and Theoretical Informatics”**

23 – 27 April  
Moscow, Russia

## **Book of Abstracts**

Edited by  
Prof. Victor Yu. Korolev and Prof. Sergey Ya. Shorgin

Moscow  
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2013

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**XXXI International Seminar on Stability Problems for Stochastic  
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The book includes the abstracts of communications submitted to the XXXI International Seminar on Stability Problems for Stochastic Models (ISSPSM'2013), associated VII International Workshop “Applied Problems in Theory of Probabilities and Mathematical Statistics Related to Modeling of Information Systems” (APTP + MS'2013) (Spring Session) and International Workshop “Applied Probability Theory and Theoretical Informatics”.

**XXXI Международный семинар по проблемам устойчивости  
стохастических моделей (ISSPSM'2013), VII Международный рабочий  
семинар “Прикладные задачи теории вероятностей и математической  
статистики, связанные с моделированием информационных систем”  
(APTP + MS'2013) и Международный рабочий семинар “Прикладная  
теория вероятностей и теоретическая информатика”. Сборник тезисов.  
– М.: ИПИ РАН, 2013. - 135 с. - ISBN 978-5-91993-020-4.**

В сборник включены тезисы докладов, представленных на XXXI Международный семинар по проблемам устойчивости стохастических моделей (ISSPSM'2013), VII Международный рабочий семинар “Прикладные задачи теории вероятностей и математической статистики, связанные с моделированием информационных систем” (APTP + MS'2013) (весенняя сессия) и Международный рабочий семинар “Прикладная теория вероятностей и теоретическая информатика”.

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the financial market we use the Markowitz type model. We consider construction of the sample market graph as a multiple decision statistical procedures. In our investigation we consider the class of unbiased multiple decision statistical procedures in the sense of Lehmann. We construct the conditional multiple statistical procedure for the identification of the true market graph. This procedure is based on tests of the Neyman structures and Pearson tests for generating hypothesis. The result is obtained by application of the Lehmann's theory of multiple decision problems to the method of construction of the market graph. The equations for calculating the thresholds for tests of the Neyman structure are given and analyzed. The numerical results of comparison for Pearson test and conditional test are given.

## **Development of mathematical model for description of grain market of Russia**

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The purpose of this paper is the presentation of the ideas and concepts that form the basis of the concept of mathematical model control some processes occurring in the Russian market of cereals. The estimated model must have a stochastic nature, i.e. constitute some random process. Indeed, in a free market there are objectively random factors that cannot be described by deterministic.

In a basis of the concept of control processes occurring in the market of grain are supposed to put developed by P.V.Shnurkov stochastic Semi-Markov model with periodic external impacts.

In this model assumes the existence of periodic external impacts, which are controlled. Once the process reaches some specified set of boundary conditions, which will be known as valid, it is subjected to external impact, which consists in forcibly transfer inside the set limit (the importance of the process of forcibly transferred from one state to another in accordance with specified discrete probabilistic distributions, which describe the system control). Then the process begins to evolve again without external influences (control) until again won't be out of the permissible limits.

In theory, the problem of optimal control in the Semi-Markov model is a task of identifying two discrete probability distributions, which describe the transfer process from the top or bottom of the inside the plenty of states. Optimal distributions of some fixed functionality are extreme-quality score - this is an indicator of control quality. It is proved that the optimal distributions are confluent, but optimum control strategy-deterministic. Such optimal strategy can be defined as the point of extremum of a specified function of two integer variables  $I(k_0, k_1)$ , where  $k_0, k_1$  - states from plenty of internal (valid)

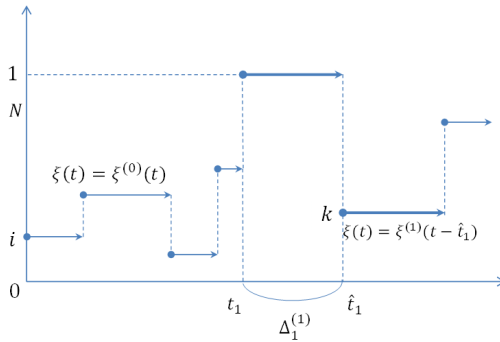


Figure 1: The graph characterizing theoretical model - trajectory of semi-Markov process

states, which should be transferred from the lower or upper boundary levels respectively.

The main components of the mathematical model of the market of cereals are parameters describing the condition and control.

Now we shall provide the short description of application of this mathematical model. As a basic parameter characterizing the state of the object (grain market) would naturally consider price per unit volume (tonne) grain, which is formed as a result of trades on the stock exchange. Price control is carried out by means of intervention. There are two types of interventions-purchasing and inventory. According to the contents they are characterized as follows: either a purchase of grain available on the market (purchased grain is placed in the Interventional Fund) or selling grain from the intervention fund.

The general concept of the proposed mathematical model of control is as follows. The control is at times when the price goes from a given set of allowed values and takes either the top or bottom is invalid an invalid value. Direct control action leads to return valid values in a variety of prices, i.e. the one allowable levels.

Optimal control of the price of grain is carried out in accordance with the above theoretical results for semi-Markov model with periodic external impacts.

## References

1. P.V. Shnurkov , T.N. Doynikova. *Optimal control in semi-Markov model with periodically occurring external impacts.* The international conference "Probability Theory and Its Applications" is devoted to the 100 anniversary since the birthday of B. V. Gnedenko. Moscow, June 26 - 30,

## Developing a new approach to the problem of optimal control in the open dynamical model of a three-sector economy

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In some works of V. A. Kolemaev it was developed and analyzed a dynamic model of three-sector economy. The zero sector produces job objects, the first- means of labor, the second-consumables. In particular, in [1] there was considered an open version of the model, taking into account the impact of foreign trade.

Here is a list of the main indicators of this model:

$Y_j$  - the volume of output in the j-th sector;

$K_j$  - the main production funds (capital) in the j-th sector;

$L_j$  - the number of employed in the j-th sector;

$I_j$  - the volume of investments in the j-th sector;

$X_j$  - imports of goods-sector j (j = 1, 2);

$Z_0$  - the export volume of materials.

$v$  - the growth rate of employment;

$q_0$  - the world price of exported materials;

$q_1^+$ ,  $q_2^+$  - world prices of imported consumer goods and investment;

$\mu_j$  - wear out factor of MPF j-th sector

$\lambda_j = \mu_j + v$  - the coefficient of reduction of assets through depreciation of physical capital and the increase in the number of employed j-th sector.

An analytical study of dynamic model of three-sector economy will be produced in the unit settings. This small Latin letters are indicated by the appropriate amount related to the volume of labour resources in the sector and small Latin letters with cover are related to the total. (In addition  $\theta_j = \frac{L_j}{L}$  to the j-th-share sector in the allocation of labor resources).

The basic dynamic and balance sheet ratios describing the open model of three-sector economy are given in [1].

### New mathematical optimal control problem

New statement of a problem of optimal control may be developed. In order to do this, we introduce some additional assumptions in the original model.

Problem management is considered in the specified target timescale  $[0, T]$ .

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