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DESIGN OF THE DYNAMIC IMITATIONAL MODEL OF THE ENTERPRISE REVENUE

Nowadays, the imitational modelling has found its implementation in different fields of professional activities: in the industry, in the economy, in the ecology, in the transportation, in the information security and services, as well as in the studies of the social and state relationships. The scope of tasks that could be successfully solved by the means of the imitational modelling is quite broad: science (experiments planning, determination of the statistical properties of random factors, verification of the statistical hypotheses); automatic control; organisation, assessment and prediction of human relationship; educational activities; simulation of game situations. Herein the following objects correspond to the mentioned tasks: production process, business flows, market and concurrency, logistics, transportation and transport processes, population growth dynamics etc.

The investigation of the cited objects, whose behaviour can be described by the algebraic-differential equations, are based on the tools of model units implemented in the simulation environment of MATLAB-SIMULINK. This software allows the user designing of various natural systems by the means of visual diagrams, the so-called S-models, throughout the user-defined layout [1].

The system is considered to be built, at the basis of this kind of modelling, as a set of interconnected time varying fluxes (money, goods, human resources etc.).

Some assumptions and simplifications have to be introduced. Despite such assumptions and simplifications, the unit imitational models are very effective when studying different economical and technical systems [2].

The **main objective** of this work is the development of the interface of the imitational model that will be used in the studies of the dynamics of the gross product at the enterprise in the conditions of the uncertainty pricing.

Problem formulation. Given a private enterprise that is responsible for the production of the good A. Let for the production of the 1 piece of good it is needed 4 pieces of the original equipment manufacturer (OEM) components of B, 3 pieces of OEM components C and 2 pieces of OEM components D that can be bought by an uncertain prices at the market. The base values of those prices are estimated to be known, as well as the uniform random corrections varying with the own frequency. All the dispenses are given as the percentage from the total cost of the B, C and D OEM components. The seller's price of the ready-to-use good A depends on the fixed value added tax (VAT), seasonal factor that has the own amplitude and frequency. They vary with normal distribution law for the random numbers that are considered

to be known too. The price being regulated by the enterprise is the object of the prediction of the gross product taking into account all the uncertainties.

Determination of the relationships between input and output indexes resulting in the equality or inequality. According to the problem formulation, we introduce the following parameters [3]:

Known parameters are:

$a_i, i = \overline{1,3}, a_i > 0$ are the base values for the OEM components.

$k_i, i = \overline{1,3}, k_i \geq 0$ is the quantity of the OEM components needed for one unit A production.

b is the percentage of the dispenses from the total price of the components B, C and D.

c is the fixed coefficient for the VAT.

Unknown parameters are:

$x_i, i = \overline{1,3}$ are corrections for the price of the EOM components.

$S(t)$ is the seasonal factor at the given time instant.

d_t is the random partial supplement to the prime cost.

The prime cost for one piece of the product A is determined as:

$$b \cdot \sum_{i=1}^3 k_i \cdot (a_i + x_i). \quad (1)$$

The enterprise will have the supplement over the prime cost as:

$$c \cdot b \cdot \sum_{i=1}^3 k_i \cdot (a_i + x_i). \quad (2)$$

The enterprise revenue, taking into account the seasonal factors and random partial supplements, is given as:

$$c \cdot b \cdot \sum_{i=1}^3 k_i \cdot (a_i + x_i) + d_t + S(t). \quad (3)$$

The function that describes the value of the overall gross product and uncertainties in the model is given in the following form:

$$\int_y^{+\infty} (c \cdot b \cdot \sum_{i=1}^3 k_i \cdot (a_i + x_i) + d_t + S(t) - b \cdot \sum_{i=1}^3 k_i \cdot (a_i + x_i)) dt. \quad (4)$$

Establishment the laws of the distribution for the key parameters. The formulation of the problem counts the supplement over the prime cost as the uniform random number. This can be simulated using the block Uniform Random Number and is the source of discrete signal. The supplement over the prime cost is the governed by the normal distribution law and is imitated by the block Random Number.

Development of the model from the available blocks.

In constructing the S-model used the following Simulink blocks:

1. Constant (Cina1, Cina2 Cina3) – provides the base values for the OEM components prices;
2. Uniform Random Number provides the correction to the OEM components prices every varying with the own frequency;

3. The blocks Gain, Gain1 and Gain2 imitate the number of OEM components needed for the production of the final product. Gain3 replicates the percentage of the dispenses from the total price of the B, C, D and Gain4 is the fixed supplement over the prime cost;

4. Random Number is the normal distribution law of the partial supplement;

5. Sine Wave is the block providing the sine signal with given amplitude, frequency and phase. It imitates the seasonal factor at current time;

6. Discrete-Time Integrator is the block that is used for the integration operation in the discrete systems;

7. Mux is the multiplexor and is destined for the mixing of the typical signals into one output;

8. The block Scope is used for the monitoring of the process output signals.

The Fig.1 presents the proposed imitational model for the discussed problem.

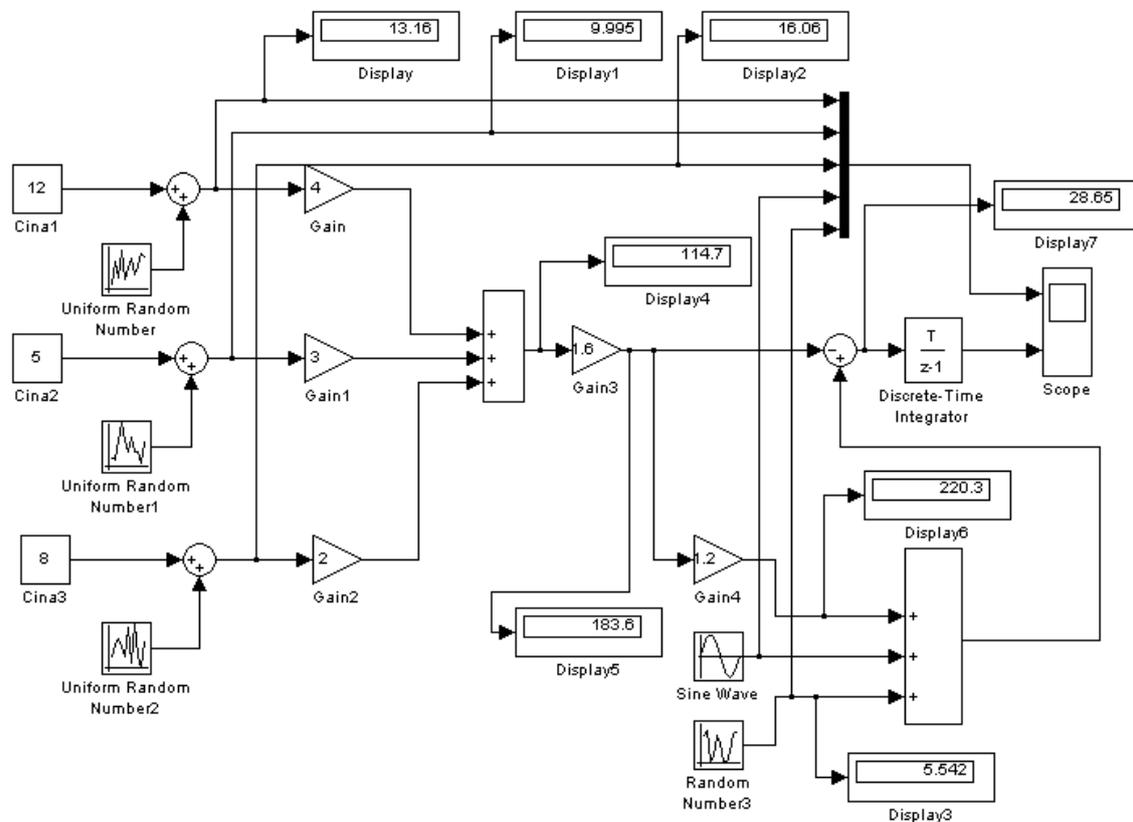


Fig.1. Imitational model for the revenue savings of the enterprise

References

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