L is an mxn matrix with non-negative entries, whose entries on the main diagonal are the singular values of the matrix U and V are two unitary matrices consisting of left and right singular vectors, respectively.

In Wolfram Mathematica, the singular value decomposition can be obtained using the following formula:

{u,l,v}=SingularValueDecomposition[M1];

Approximate matrix

$$M_k=U_kL_kV_k^T,$$

U_k, L_k, V_k are obtained from singular value matrices by cutting off up to k first columns. The ArrayPlot [Abs [M1-M2] //Chop] command allows you to graphically highlight the anomalous values of the matrix (Fig. 1b).

Elements that are very different from the corresponding elements of a matrix of small rank will be considered anomalous.

Conclusion. The process of anomaly detection is a very important issue in predicting equipment breakdowns, identifying abnormal demand for consumed products.

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DETERMINING THE GOALS OF THE GREENHOUSE SYSTEM ON THE BASIS OF THE SYSTEM-ANALYTICAL APPROACH

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Keywords: greenhouse, system analysis, system modeling, goal tree.

The emergence of automatically controlled greenhouses and conservatories has revolutionized agriculture, increasing the efficiency of growing heat-loving plants in cold climates. At the heart of any automatic greenhouse are sensors, actuators, monitoring and control systems, which makes it possible to optimize many factors and conditions for the growth of crops. In most cases, greenhouses are used in conditions where efficiency should approach the maximum. With the minimum expenditure of resources, it is necessary to obtain as much yield as possible [1, p. 91].

Maximum efficiency with minimal human involvement can be achieved by developing a decision-making algorithm for the greenhouse management system. To develop such an algorithm, it was decided to apply the methods of system analysis. As a result of structural and functional decomposition, derivation of goals, system synthesis, modeling, development and testing of the algorithm on virtual and real models, it is planned to develop a greenhouse control algorithm based on decision-making, on the analysis of previous states and pre-calculated models.

Modeling of systems according to the methods of system analysis should be carried out after the structural and functional analysis of the system and the allocation of the goal of the system. This article will consider the process of identifying a goal for a greenhouse system that has passed the stage of structural and functional analysis, based on a system-analytical approach.

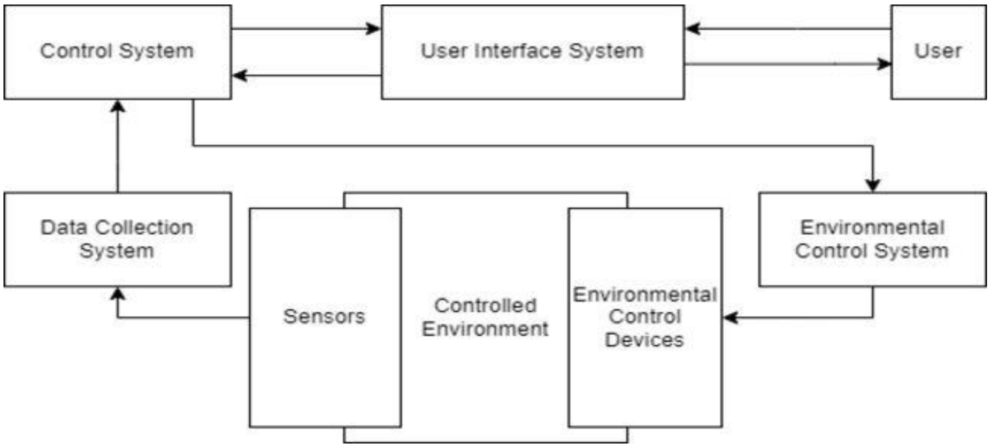

Figure 1 – Functional scheme of automatic greenhouse system

Material and methods. The greenhouse system is studied after the stages of structural and functional analysis using methods of system analysis. It is assumed that the selection of the goals of the entire system and subsystems will greatly simplify the modeling. The concept of goal is considered, a tree of goals is built for the system under consideration.

Findings and their discussion. One of the many definitions of a system is "the system is a way to achieve the goal" [2]. Any system must have a goal, otherwise it ceases to be a system according to the expediency criterion.

As follows from the expediency criterion the composition and structure of the system are subordinate to the goal. For artificial systems, this property can be regarded as fundamental. In the considered system the main goal is to maintain the parameters of the controlled environment, all parts of the system exist to achieve this goal, therefore the system can be considered expedient.

The concept of "goal" is worth defining. Consider the set of states of the controlled environment of the system (Y) as "satisfactory" – "Yt" and "unsatisfactory" – "Yf". Thus, for a greenhouse system, the goal can be the state of the environment in the subset Yt, and the process of transition from Yf to Yt can be the achievement of the goal. Since the transition from one state to another cannot be instantaneous, they should be considered with reference to time. From the foregoing it follows that the process of achieving the goal itself can be represented as a graph of Y* from time [3].

Therefore, the main goal for building a goal tree can be considered the achievement of satisfactory environmental conditions. Let's determine what each of the subsystems at a given level of decomposition can do for this:

- "User Interface System" (UIS) - processes information from the user and transfer it to the control system.
- "Control System" (CS) - generates a control signal that transfers the system from the current state to the target state in the shortest possible time.
- "Data Collection System" (DCS) - collects data from sensors.
- "Environmental Control System" (ECS) - changes environment using devices.

The "User Interface System" is excluded from further decomposition and building of the goal tree. Since its further decomposition for this goal does not give any results.

Further structural and functional decomposition of the "DCS" and "ECS" leads us to sensors, devices for the regulation of various parameters, and controlling devices for each system. In real systems, there may be a different number of parameters and regulation devices. However, for research purposes, we only consider parameters such as air temperature, substrate temperature, irrigation liquid temperature, substrate moisture, air humidity and CO2 level. Each of the parameters can be adjusted using special regulation devices.

Thus, the main goals of these systems at this level will be providing data (sensors), regulation of parameters (regulation devices) and maintaining communication with the "Control System" (communication device).

The "Control System", upon further decomposition, is decomposed into a model analyzer and a decision maker algorithm. The first one, based on the analysis of models, generates control signals. The second one, based on the current readings of the sensors, corrects the analyzer signals and makes decisions on switching the environment regulation devices.

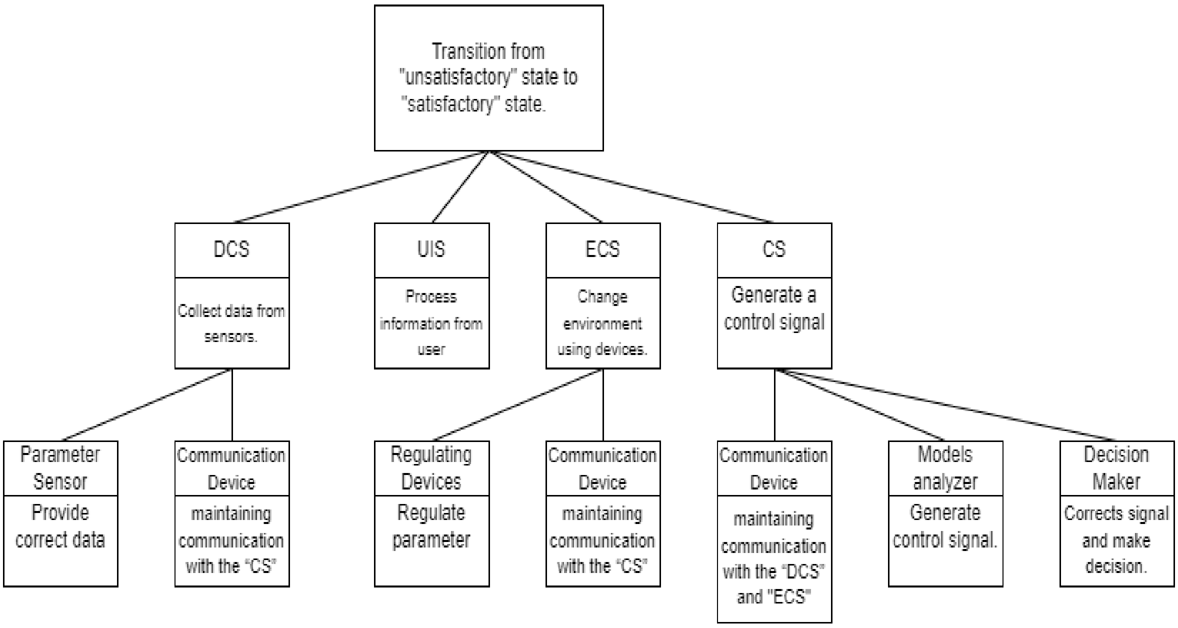

Figure 2 – Goal tree for three levels of decomposition

Clarification of the concept of a goal in relation to a greenhouse climate control system makes it possible to more accurately identify the goals of the system and subsystems, including using the goal tree method. The goal tree is used to obtain the structure of decision making within the system. Further research can be aimed at building computer and mathematical models that allow the control system to find the most effective combinations of control actions.

Conclusion. As a result of the study, a tree of goals was constructed, which makes it possible to simplify the mathematical and computer modeling of the system under consideration in further research.

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ON THE CHARACTERIZATION σ-LOCAL FITTING CLASS

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Keywords: Fitting class, class of groups, formation, radical, σ-local Fitting class.

The paper considers only finite groups. In terminology and notation, we follow [1, 2]. In the theory of classes of finite groups, the result of the Bryce-Cossey [3] is known that the local formation solvable groups are hereditary if and only if every value of the canonical formation function is hereditary. In connection with above, the following dual question of Bryce-Cossey Theorem naturally arises: is it true that a local Fitting class is hereditary if and only if every value of the canonical local function is hereditary? A positive solution of this question for generically local Fitting classes (in particular local Fitting classes) is the main goal of this paper.

Material and methods. The methods of the theory of groups and their classes are used in the paper. In particular case methods of the theory of formations of groups and Fitting classes of groups.

Findings and their discussions. *Class of groups* is a set of groups that, along with each group, contains an isomorphic a group. The class of groups $\mathfrak{F}$ is called *a formation* if $\mathfrak{F}$ closed under taking factor groups and subdirect products, $\mathfrak{F}$ is called *Fitting class* if $\mathfrak{F}$ closed under taking normal subgroups and products of normal $\mathfrak{F}$-subgroups. The Fitting class $\mathfrak{F}$ is called *hereditary* if it is closed under taking subgroups, i.e. from the conditions $G \in \mathfrak{F}$ and H $\leq$ G follows $H \in \mathfrak{F}$.

If $\mathfrak{F}$ is a nonempty Fitting class, then there is the largest normal $\mathfrak{F}$-subgroup in every group. It is denoted by $G_{\mathfrak{F}}$ and is called the $\mathfrak{F}$-radical G. Let $\mathfrak{F}$ and $\mathfrak{H}$ be Fitting classes. Then the class of groups $\mathfrak{F}\mathfrak{H} = (G : G/G_{\mathfrak{F}} \in \mathfrak{H})$ called *the product of Fitting classes* $\mathfrak{F}$ *and* $\mathfrak{H}$. It is well known that the product of Fitting classes is a Fitting class and the operation of multiplying Fitting classes is associative. (see [1, theorem X.1.12]).

For the characterization of the generalized local Fitting classes, we will use the Skiba σ-method of studying groups and formations proposed in paper [4], which was dualized in paper [2] and consists of the following. Let $\mathbb{P}$ be a set of all primes, $\pi \subseteq \mathbb{P}$ and $\pi' = \mathbb{P} \backslash \pi$. If n is a primes, then the symbols $\pi(n)$ denote the set of all prime