Usenko Valery Grigorovich, Ph. D., assistant professor of descriptive geometry and graphics of Poltava Yuriy Kondratyuk National Technical University,

Vorontsov Oleg Victorovich, Ph. D., assistant professor of descriptive geometry and graphics of Poltava Yuriy Kondratyuk National Technical University,

Усенко Валерий Григорьевич, кандидат технических наук, доцент кафедры начертательной геометрии и графики Полтавского национального технического университета имени Юрия Кондратюка,

Воронцов Олег Викторович, кандидат технических наук, доцент кафедры начертательной геометрии и графики Полтавского национального технического университета имени Юрия Кондратюка.

General approach to the problem of technical control systems

Общий подход к задаче управления техническими системами

The processes of the various technical and information systems related to equipment failures. They are complex random processes because it's modeling results to the compilation and solving algebraic equations and differential equations of higher order. Small and visual modeling tools for the study of the functioning of the reliability of technical systems (TS).

The structure of the TS is a large number of interconnected components and subsystems. Set of elements that have common properties and also combined into subsystems. Complex technical system is not a common set of components and sub-systems, and complex algorithmic structure of their operation over a period of time. Interaction of elements in the system at any given time is determined by the presence and number of connections between them, different levels of hierarchy and order of importance of these relationships.

During the functioning technical systems are constantly changing their operation modes associated with the planned preventative and then restoration, occasional emergency, we interchangeable requirement on their various options. Urgent is the need for restoration of TC and timely regulation design decisions with taking into account the revised and new loads and other variables. The work of any technical system is associated with the process control necessary to ensure the established characteristics and address a number of tasks. The problem of control of the system is always appeared. The organization management process should not only be aimed at solving of a tasks, delivered to the system, but also enhance the effectiveness of its functioning by reducing operating costs.

Mathematical Model process of the system is based approximation it's unsteady on the functioning TC group of stationary processes. For creating the model of the system must use all main information about the structure, parameters and physical processes occurring in the TS. Allocation of certain objects of the system allows the decomposition of operation, identify controlled variables. Assume TS object control that function likely. Denote different influences acting on the system of vectors whose presence is essential for the optimal design of the TC and the planning of its modes during operation.

Input parameters of tags IMO at some time ***t*** components of the vector ***x (t)*** inlet system and the components of vectors ***y (t)*** and ***y * (t)*** — respectively the actual and desired output parameters of the system. The vector ***z (t)*** reflects a negative effect on the control item caused by failures of its elements and subsystems. Components of the vector ***x (t + d), y (t + d)*** denote the predicted values of the input parameters and required some time ***d. U (t)*** — a multidimensional vector control, ***u 1 (t), u 2 (t), …, u m (t)*** — management options; B — matrix of parameters; ***R (t, a, b)*** — the parameter vector output characteristic

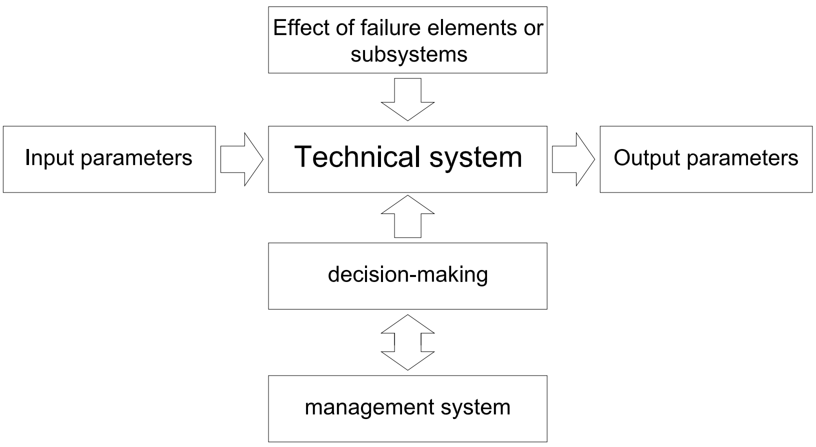

Figure. 1. General scheme of the functioning technical system.

Structure management process is a closed system (Fig. 2). It has an input vector ***x (t)***, the output vector ***y (t)***, display the system status, such as a matrix of parameters and feedback. In the most general formulation A Board of Management see algorithm: is expropriated study the behavior of the actual output vector of system parameters ***y (t)***. When you receive the initial response does not satisfy the required value, then the corresponding continuous using of model parameters of system managers actions aimed at changes in various parameters or method of control.

In the geometric interpretation of the process trajectory vector and the actual output parameters ***y (t)*** in space deviates from trajectory vector and planned outputs of the system ***y*(t).*** then s ystem management should take appropriate corrective action ***u (t)*** the object of control to bring the trajectory vector and y (t) to the trajectory vector ***y*(t).***

Deviation of output vector of actual parameters from ***y (t)*** the vector of actual outputs ***y * (t)*** can occur for the following reasons:

— Availability at certain limits of Resource Management and, consequently, the inability to various reasons apply for facility management fully corrective action that would ensure the required object behavior management;

— Untimely or distorted use of system contained in it, or one's ward to it about the parameters, the state of the object and the purpose of the control;

— Stochastic or control vector and negative actions ***z (t)***, that affect the control item and its actual output vector of system parameters ***y (t).***

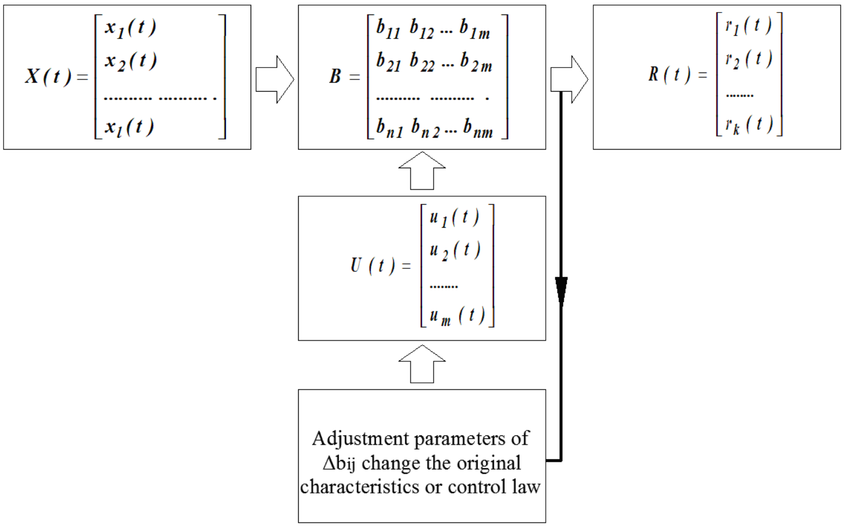

Figure. 2. Control circuitry technology systems.

Since the input parameters Hector ***x (t)*** depends on many factors, tons of worthwhile to consider the process ***x (t)*** Discrete what gets you random values. Powerful believe that at a certain range of control components of the input vector ***x (t)*** is a random variable s.

Consider the ***n*** — dimensional phase space (Fig. 3), in which the motion vector ***B (t)*** from the initial position $B_{(t\,0)}$ to position $B_{(t\,3)}$. If the system is in a state of complete or un complete performance, subspace ***w*** displays a set of required parameters for the output of the process and if the system is out of this condition in the control, the trajectory of a multidimensional vector ***B (t)*** is entirely in the subspace **w** (Fig. 3).

If in the process control in some time slots TS is in non-working condition, the trajectory of multidimensional vector ***B (t)*** get's out limit of multidimensional during space ***w***.

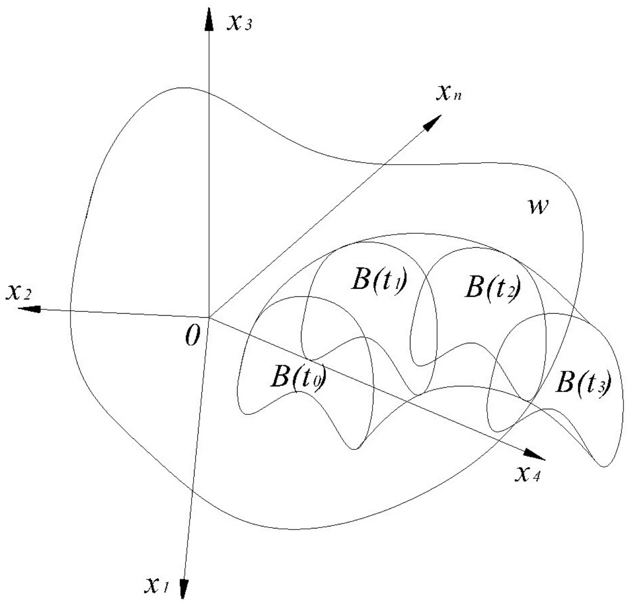

Figure. 3. The transformation in multidimensional phase space

To control object put forward a number of requirements including specified target control. In any case, the control objective can be interpreted as the achievement of an extremum of a functional ***F***, which is the criterion for optimality, which defines various technical and economic indices in operation of the facility management.

Assume optimality criterion F_{k1} functional $F_1\,[x\,(t), u\,(t)]$, which reflects the cost of funds for organizing process management in terms of value. Then ***F1 [-]*** will the performance of the system at time ***t***. If you select a different optimality criterion functional $F_2\,[y\,(t), y^*\,(t)]$, which reflects the extent of the discrepancy between actual and desired values of output processes, ***F2 [-]*** reflects the quality of the system at time t.

Functional taken by the optimality criterion reflects both the quality and efficiency of the system at time ***t***.

$$F\,(x\,(t), y\,(t), y^*\,(t), u\,(t))=G\,(F_1\,(x\,(t), u\,(t)), F_2\,(y\,(t), y^*\,(t)))$$

Let the time $t = t_0$ the initial value of the vector ***y (t) = y (0)***. If the dimension of the vector ***y (t)*** is equal to ***n-1***, then ***y (t)*** corresponding manifolds

$$y\,(0) = (y_1\,(0), y_2 \dots y_{n-1}\,(0))$$

in ***n***-dimensional space coordinate system $y_1, y_2, \dots, y_n$

The result of the control action ***u (t)*** on the system interprytuyetsya some trajectory of geometric transformations in n-dimensional space and in time ***t = T*** manifolds up a new position ***y (T).***

Let ***y (T)*** belongs to some subspace ***w*** phase ***n***-space. Subspace w displays a set of necessary parameters for the output vector ***x (t)*** process operation. Depending on the requirements posed to the original process subspace w can be modeled by geometric objects of different dimensions: points, lines, surfaces or manifolds in n-dimensional space.

Let the performance limitations imposed by the vector control action ***u(t)*** ∈ ***Ω***, where ***Ω*** - allowable space for control actions. Optimal control problem is to find the vector control actions ***u (t)*** and the trajectory corresponding transformation ***y (t)*** of the object to its trajectory in phase space, which moves from the initial position ***y (0)*** to the position ***y (t)*** and belongs to a subset of w give a minimum expectation functional in the time interval ***[t0, T]:***

$$M\left(\int_{t_0}^{t} G\left(F_1(x(t),u(t)),F_2(y(t),y^*(t))dt\right)\right)\to \min_{u(t)\in\Omega,\, y(t)\in w}$$

Problem simultaneous determination of extrema of functionals ***F1(x (t), u (t))*** and ***F2 (y (t), y * (t))*** of (1.1) in the general case is not resolved as the point of extrema of functions do not match. Therefore, argument values that correspond to an extremum of one or more functional ***F1 (x (t), u (t))*** and ***F2 (y (t), y * (t))*** in general does not exist. One approach puts the problem of determining a functional extremum of imposing conditions on the functional limitations of another. Another approach involves the use of a weighted consistency extrema of functions in multidimensional space. Then the functionals ***F1 (x (t), u (t))*** and ***F2 (y (t), y * (t))*** represent respectively the efficiency and quality of the system. Allowable space ***Ω*** and ω describes the system and inequalities, as well as various constraints that characterize the requirements for vector control and the values of input and output parameters. Thus, to solve complex problems process control system operation, it is necessary to formalize and detail in order to make the block diagram of the control and use the system handled the situation.

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Sharafutdinov Ulugbek Ziyatovich, Navoi Mining and Metallurgical Combinate,
Chief of the laboratory Mining Administration 5

Romashkin Petr Lavrentevich, Navoi State Mining Institute,
Magister of the second year education

Bekmuratov Sherkuzi Shermamatovich, Navoi State Mining Institute,
Magister of the second year education

Burkhanov Ahmad Kahramonovich, Navoi State Mining Institute,
Magister of the second year education

Gaffarov Jurabek Ikramovich, Navoi State Mining Institute,
Magister of the second year education

Influence of the various ion-dispersants on the uranium's sorption and desorption processes by "in-situ leaching" technology

Republic of Uzbekistan is reach by mineral resources. Uzbekistan interiors are especially rich by rare, noble and nonferrous metals. One of the most extracted metals in our country is uranium.

The uranium is extracted in our country by borehole underground leaching. The uranium takes a special place in modern. Development of the uranium extraction at the Kyzyl-Kum region on the basis of physicochemical technologies inseparably linked with general trend at the world mining industry and amid continuous changes of the economic conditions and in demand for raw material resources. Meanwhile there are many unsolved problems at uranium production technology. One such problem is the factor of negative influence of the various ion-dispersants on the uranium's sorption and desorption process.

Literature data reviews show that in-situ leaching (underground leaching) technology has found widespread use in the uranium leaching technology with subsequent sorption extraction on different marks of sorbents. The various types of sorbents are used in the process of uranium sorption technology currently. But these sorbents are selective against uranium, however in each specific case depending on the structure of the product solutions it is necessary to study depressants for suppression of the negative impact to the sorption and desorption process.

After-treatment conditions of the solution (residual acidity, total dissolved salts, presence of the depressive components by sorption process) are particularly considered in the leaching process. There at the sorption method of the uranium extraction from the solutions is used anionites. Related substances of the pregnant solutions are acting unequal. Cations of the alkaline, alkaline-earth element as well as copper, iron (Fe), cobalt, manganese ions are slightly sorbed. Sulfate-, nitrate-, chloride-, fluoride- and phosphate ions are depressors and fully sorbed. Also there are anions, which are able to accumulate at the anion exchangers and "to poison" them, as their affinity with lasts are exceedingly hard.

Therefore the pregnant solutions are that it being not permitted the concentration of the nitrate-ions more than 0,1 mg/l, chloride- and phosphate- ions more than 0,2 and 0,4 mg-eqv/l accordingly.

In the sulphuric-acid leaching process is accumulated up to 50–100 g/l sulphate-ions, which depressed ion-exchange sorption of uranium in fully. For prevention of the salts accumulation at cycling solution over permissible level and normal maintenance of the uranium ion-exchange extraction from pregnant solutions it is need to perform partial output for cleaning from main components with subsequent use in leach technology. The simplest way of the cleaning of the sulfic asid solution is liming, where concentrations of the sulphate ions are reduced to 5–8 g/l and Fe ions are precipitated almost fully. Cleaned solutions are reapplied for preparation of the working solution after sediments detachment. Sludges are buried. Henceforth sediments detachments are carried out on the exhausted stacks to achieve nonwaste technology.

Uranium sorption process from pregnant solutions by strong-base anion exchanger is described by ion-exchange and complex formation equations as shown below: