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ORGANIZED DESIGN PRINCIPLES OF SYSTEMS ON THE BASE OF CONFLICT TYPE MODELS

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ABSTRACT

The necessity of analysis of conflicts (or contradiction) from the point of view of the optimization theoretical-game criteria is substantiated. The original models of optimization of the interaction of organization structures are presented.

Design of organization structures or functioning systems finds wide application, in modern technology. A distinguishing feature of such systems lies in the fact that their functioning and development occurs under contradictory interaction of different factors: unforcasting (man's right for a mistake), non-linearity, uncertainty of problems, goals, etc. This has resulted and continues to result in negative operational and social consequencies. Models of these systems are built to be centered upon machines, while a humanitarian factor being beyond the scope of designing and operating of complicated systems. Conflicts (contradictions) have been treated independently as negative factors to be eliminated or suppressed. Such one-sided approach fills up the approach of investigating a conflict which treats a conflict as a way of interaction of systems and ensuring their quality. In this case a conflict (as a state of clash of interests) can not only damage but also can be a useful factor (a system-forming factor). This is indeed true: functioning and development of systems is a conflict of opposites and their overcoming on a new level (a turn of a spiral) of evolution. The sides participating in such conflict take part in two conflicting processes, namely, degradation and organization characterized by such notions as organization and non-organization.

One of the main conceptions in the process of synthesis of complicated systems is contradiction. This is the characteristic of the opposites or differences in the goals of the sides which in the process of interaction cause negative consequences or positive effects for the sides or for the system as a whole (for instance, improvement of quality of functioning a system). It is quite obvious that such contradiction is necessary to control.

Now we consider some methods of the quantitative analysis of contradictions. An influence of contradictions on quality assurance of a functioning system is expressed in terms of the difference of goals, the degree of opposition of goals and the consequences of displayed contradictions: "Payment" for contradiction is the characteristic of negative consequences in a system caused either by conflicting relations or competition.

It should be noted that the reasons of the conflicting interaction lie in the goals of a system. Tension in relations between the sides in the system as the integral characteristic of contradiction depends on opposite goals, their importance and consequence. On analysing the tension of relations between the sides in the system, one must take into consideration its some critical value outside the limits of which the system's integrity or stability can fail. The tension of relations may be reduced to the lack of organization of a system [I] .

A characteristic of the released contradiction is a compromise determined in terms of a decrease of the contradiction, acuteness and negative consequencies of interaction of the sides in the system (by analogy with information which is represented as the released entropy by K. Shannon).

An account of contradiction in homeostatic models allows consideration of, along with a traditional aspect of reliability, i.e. a syntactic one, semantic and pragmatic aspects (analysis of unreliability and a degree to which the potential goals are not achieved).

A technique of the games theory, used in this work, treats a conflict as a condition in which decisions are to be made (optimized). In this case, a conflict is understood as non-indentity of interests of the sides or the state of competition when the sides tend to achieve the incompatible goals [2].

When working out the strategy of a behaviour (functioning) of systems, the principle of search for the optimum of an objective function at a permissible risk or a possible gain must be taken into consideration. Now let us examine some models of decisionmaking strategies of quality assurance of systems (organization structures) in terms of contradiction, organization, hierarchy of goals, types of relations between the interacting sides.

Model 1. If the center (the upper level) of the system does not "know" a decision of executors, i.e. gets no information F (x) on their behaviour at a given period T of functioning (planing, control or maintenance) of the system then a decision of the center for $y \in Y$ must be the best max J (x, y, T) of all the worst for $x \in X$ decisions $J(.) =$ $=$ min I (x, y, T) of executors for a quality functional of the type I_1 (x,y,T): $R_1^*(.) = \max_{y \in Y} \min_{x \in F_1(x)} I(x,y,T)$.

Such a decision of the center of the system is the guaranteeing maxmin decision with the gain R_1^* (.) (by analogy with the maxmin criterion). Here the function $y \in Y$ is the control of system components by its center. The function F_1 (x) is the set of points $x \in F_1$ (x) characterizing a priori state of the system or its components which allow the optimization problem of an organizational structure of the system at available feasibilities of control to be solved by using the function $y \in Y$. This variant of decision-making is implemented for an open loop without feedbacks (from the system components to its center).

Model 2. Provided that the center of the system can obtain the information $F_2(x)$ on decisions of its executors at a given period T of functioning, the decision $J_2(\cdot) = \max I_2(x,y,T)$ of the center must be taken with a minimum risk (losses) for the function i.e. in the form $\min J_2(\cdot)$ for the information $F_2(x)$, known from executors, in the form of the following functional:

$$R_2^*(\cdot) = \min_{y \in Y} \max_{x \in F_2(x)} I(x, y, T),$$

It should be borne in mind that choosing its strategy, i.e. the vector y, the center of the system cannot in any way influence a choice which has been made a priori by executors of the system and, hence, it needs only minimize its risk (losses). Here, $x \in F_2(x)$ is a priori information about the state of system's executors obtained from feedback channels (from executors to the center) in depenedence on the center's decisions in the form of the control function $y \in Y$. Such decision of the system's center is the guaranteeing minimax decision with a risk(losses) value of $R_2^*(\cdot)$ (by analogy with the minimax criterion). This variant of decision-making is accomplished for a closed loop at available feedbacks (from the system components to its center).

Model 3. In the case when the center informs executors about its decisions y at known decisions x of the executors, these decisions find a response of the executors in the manner as to do their best to promote fulfilment of the center's decision. Then the organization is interested in obtaining the best decision $J_3(\cdot) = \max I_3[x, y(x)]$.

Let $F_3[y(x)]$ be the set of decisions x, which a decision of the organization is based on when realizing the function $y \in Y$, i.e. a priori information of the system's center relatively the decisions of its executors, then the most guaranteed result of a decision for the organization as a whole will be equal to

$$R_3^*(n) = \max_{y(x)\in Y} \min_{x\in F_3[y(x)]} I_3 [x,y(x)].$$

Model 4. Here the center of the system requires from the organization of its executors to deliver information in the form of the function x(y) about its decision in response to their actions. The center makes its further decisions in the form of a maximum guaranteed result of a special kind.

Other combinations of co-ordination of the center's decisions and system components are also possible.

Consider more in detail single "elements" of an organizational structure, interacting "pairs" (along the horizontal or the vertical) such as the "executor-executor" or "center-executor".

As an effectiveness criterion of interaction of the system components a degree of organization (efficiency, reliability. readiness, workability, etc.) may be considered. As a formal effectiveness criterion of interaction, use may be made of the following functional

$$R^*(t) = \max_{u(t)} \min_{x(t)} I(x,u,t),$$

where $x(t) \in X$ is the parameter determining the quality of functioning or criterion of system components; $u(t) \in U$ is the parameter of control or assurance of a desired level of quality and effectiveness of the system.

Interaction of systems or componets in a system can change in dependence on external stimuli (a medium) or internal factors. One of the forms of interaction of systems is homeostasis allowing functioning and development of systems under controllable conflict or contradiction conditions. A contradiction is defined as reflection of the opposites and differences of the confronted sides giving rise to conflicting or completive relations.

Conflicts may be classified with respect to structural, functional and informative signs [I] .

The structural classification includes neutrality, unity, symbiosis, collaboration, coalition, antagonism, completition, asymetry, exploitation and other conflicts.

The functional classification comprises such conflicts as deterministic, stochastic, uncontrolled, controllable, inertia, inertia-free, latent, continuous, discrete, enchancing, going out slowly or periodic and so on.

The informative classification treats conflicts as open (bilateral, one-sided), with a feedback, without a feedback, so on.

A system study of different kinds of conflicts allows regularities of interaction (functioning, control, maintenance and development) of organization structures of different nature to be revealed.

Optimization models based on the maxmin (or minimax) effectiveness criterion of interaction of organization structures are realized on personal computers and make it possible to take rational decisions at stages of creating complicated systems of different nature, to reduce waste of capital, to prevent damage from a negative influence of conflicts on evolution of systems.

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