CURRENT TOPICS IN CYBERNETICS AND SYSTEMS

Y13—faulty resources partitioning (global goals overexposed)
Y14—fragmentation (confusion of means and ends, lack of goal continuity over time)
X1—faulty transmission
X2—faulty translation
X3—faulty transformation.

The paper discusses also notion of the satisfactory reliability of an organization and suggests certain measures of achieving it.

Conclusions arrived at can be summarized as follows: The reliability of an organization can be identified and analysed by means of qualitative and quantitative techniques. The useful tool for this kind of analysis seems to be the fault-free concept. The reliability theory of an organization should be considered as an interesting field for further research.

References

Some Theoretical Problems of the Layout and Connection Tasks in the Design of Technical Systems

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The paper contains proposals for a uniform way to formulate and solve the design tasks in which the designed object is a system consisting of a certain number of interconnected elements in a defined way. Two types of tasks are formulated: The designing of optimal interelemental connection nets and optimal layout of system's component elements in a given space. It was shown that both these tasks are brought to the transformation of graphs.

1. INTRODUCTION

Devices and engineering systems designed, lately manufactured and utilized, are characterized not only by their functional and constructional complexity which increases more and more, but also by their modular construction. Such a system consists of a certain number of constructional elements which depend on its functional properties and has congenial external features. They differ by function they realize. Depending on the function of the whole system, i.e. on the influence exerted by the environment on the system and vice-versa, particular constructional elements are interconnected in the strict sense of the word. The character of these connections, i.e. the type of the transferred medium between particular elements, will be insignificant in further considerations. A formal model of such technical systems was proposed by Leinemann(1).

In the manufacturing and utilization process of such systems, the way in which one may accomplish physically such interconnections of elements plays an essential part.
2. MODEL OF THE DESIGNED SYSTEM

It is further assumed that in a certain phase of the designing process the specification of component elements of the system is known and all the connections between them are defined. The internal structure of the system is then the graph

\[ G = (E, A) \]

where \( E \) is a finite, non-empty set of component elements

\[ E = \{e_1, e_2, \ldots, e_n\} \]

\( A \)—set of arcs corresponding to the connections between the pair of elements \( E \).

Let a certain function

\[ e_{ij} = f(a_{ij}) \]

be defined on the set \( A \). The measure of the quality for the structure \( G \) is the value

\[ Q(G) = \sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij} \gamma_{ij}. \]

3. FORMULATION OF CONNECTION AND LAYOUT TASKS

One of more often solved tasks is how to define an optimal structure of connections. They may be formulated as follows: There is a given set \( E \) of component elements of the system. There is also a complete graph \( X_n \)

\[ X_n = (E, \tilde{A}). \]

On the set \( \tilde{A} \) the function \( f \) is defined. There is a given subset \( R \)

\[ R \subset \tilde{A} \]

containing pairs \((e_i, e_j)\) of elements \( E \), which cannot be connected directly. The partial graph \( G_1 \) of \( X_n \) generated by \( \tilde{A}_1 = \tilde{A} \setminus R^{(3)} \)

\[ G_1 = (E, \tilde{A}_1) \]

is defined.

The task of designing the connections between elements may be formulated as follows: To find connected partial graph \( G_0 \) of graph \( G_1 \)

\[ G_0 = (E, \tilde{A}_0) \]

such that

\[ Q(G_0) = \min_{\gamma} Q(\gamma) \]

where \( \gamma^* \)—set of all the connected partial graphs.

Now it is easy to show that the graph \( G_0 \) is a tree. The algorithms for construction of such trees are known\(^{(4,5)}\).

The solution of the task is only possible when the set \( \gamma^* \) is not empty. In practice, it is often necessary to design the connection nets i.e. of trees \( G_0 \) of defined topological properties. These are the following modifications of the task (1):

(i) Construction of the tree \( G_{0}^{(\omega)} \), where for \( \omega > 1 \) there is

\[ \forall \deg(e_i) \leq \omega \]

then it is easy to show that

\[ \forall_{\omega > 1} Q(G_{0}^{(\omega)}) \geq Q(G_0) \]

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