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Organization of Invariant Amplification-Conversion Systems

The current level of development of radio engineering systems is directly related to the problem of creating functionally and energetically efficient electronic equipment. This problem is especially important in recent years in connection with the development of microelectronics and semiconductor technology. This fully applies to the amplification and conversion systems (ACSs), which are part of a variety of info-communication equipment (ICE). The current level of the development of the hardware of the IKO, the constantly increasing requirements imposed on them, require the development of the ACS, which would combine the functions of forming a high-quality output signal and wide-range regulation (stabilization) of its parameters, thereby ensuring high energy and dynamic indicators. Necessity in such UTS is felt in the development and creation of various systems for the reproduction and strengthening of information of remote-controlled autonomous aerospace and deep-sea complexes, in particular, unmanned and spacecraft, automatic probes, robotic complexes, automated telecommunication systems, radio navigation and hydro acoustics used in the equipment of autonomous objects (AO). The work on creation of autonomous underwater vehicle is conducted at the Department Renewable Energy Sources, under the control of the c.t.s. Kirilova I. A.

The discrepancy that is regularly detected between the characteristics of the ACS and the continuously growing demands placed on them is a powerful and constantly acting stimulator for improving the UPS. At the same time, the growth of information throughput is accompanied, both by the expansion of the functionality of the ACS, and by the increase in energy costs. In addition, modern ACS works normally as part of complexes and, therefore, must satisfy the conditions imposed on the complex, for example, the condition of electromagnetic compatibility. Such ACS can have a large number of consumers, therefore the need for the ACS to work on a given schedule, the ability to rebuild the structure of the ACS, synchronize its operation significantly distinguish the ACS from known systems for which the sequence of change of operating modes and special requirements for characteristics is usually not regulated. Consequently, we are talking about self-adjusting multi-mode ACS.

An effective means of ensuring the specified characteristics of the ACS is to use the provisions of the theory of invariance, which is complicated by the nonlinearity of discrete automatic control systems in the construction of a modulation-type ACS, such as modern control systems. At the moment, many theoretical and practical issues related to the creation of structurally invariant ACS have not been solved. In

addition, the actual problem is the provision of specified characteristics with appriorial incompleteness or lack of information on the coordination-parametric effects on the system, which leads to the need for an adaptive approach.

The widespread use of robotic systems has created the problem of increasing the flexibility of the ACS and the reliability (fault tolerance and survivability) of this type of computer. As a result of the increase in these indicators and the quality of the decisions made, by improving only the hardware of the ACS structures, at a certain stage the level of automation of various kinds of technological parameters has significantly increased. Analysis of the results of the use of such complexes in systems with an increased degree of responsibility indicated the existence of limits of possible levels of attainability of these indicators for circuit implementation, for example, increasing the functionality of the ACS by increasing the complexity of hardware implementation leads to a decrease in fault tolerance and survivability of the system as a whole. Therefore, one of the possible ways to solve this problem is to reduce the level of complexity of the implementation of software and hardware used by the ACS by increasing their "intelligence".

At the same time, the requirements for the implementation of specified performance characteristics are presented to the ACS provided that the system's output coordinates are fully invariant to processes in the primary energy sources. The implementation of the specified performance characteristics provides for the invariance of the output coordinates of the ACS, not only to the disturbing effects, but also to the form of the converted electric power. This necessitates the expansion of the functional and dynamic capabilities of the systems.

The absence of a single methodological approach to the construction and analysis of invariant ACS with given characteristics of functioning significantly complicates the task of creating them and does not allow ensuring the implementation of the requirements that are imposed on such systems.

The main problem of the theory of invariance is the search for such conditions for the structural construction of an ACS, in which the motion of one or several coordinates of the system does not depend on one or more input influences applied to the system. Two cases are the most interesting.

Output effects are amenable to immediate measurement, but the laws of their change over time are unknown beforehand. In this case, the structure of the system must ensure the independence of the coordinate motion for any admissible change in the input influences.

Input effects cannot be directly measured. In this case, the structure of the system must ensure the independence of the coordinate motion for any admissible input action. At least, this independence must be fulfilled with a certain degree of accuracy.