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FEATURES OF THE SYSTEM APPLICATION APPROACH TO CAD ENGINEERING NETWORKS

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Abstract. Based on a review and analysis of the basic methods of designing of engineering networks developed the principles of the system approach to engineering design automation utilities in developing. The practical implementation of the principles of the system approach to the creation of CAD of engineering networks makes it possible to increase the quality and technical and economic level of the designed objects during their creation and application, to increase labor productivity, to shorten the design time of engineering networks, and to reduce the cost and complexity of designing network systems.

Key words: engineering networks, automation systems design, systematic approach.

Introduction

The planned development of large cities leads not only to the complication of utility networks, but also requires colossal human labor and large capital investments even at the design stage. Specialists designing and operating such network systems are faced with the task of designing engineering networks taking into account the capacity reserve and the possibility of quickly changing the structure and parameters of trunk and distribution networks in conditions of growing demand for the target product. In connection with this, there is a need to effectively solve the tasks of finding resources for the intensification of the work of engineering networks within a limited time, to determine the optimal characteristics and parameters of communication lines, sources of the target product, regulators already at the design stage, to determine the possibility of eliminating emergency situations, to determine the functional algorithms of

networks under automatic control conditions. Therefore, solving the problem of automating engineering network design in terms of their projected development is important.

Main text

The use of mathematical methods in the design of national and economic objects allows to improve their technical level and quality, shorten the terms of their development and implementation in industry. The automation of design is especially effective, if from the automation of the execution of individual engineering calculations, they move to complex automation, and automated design systems (CAD) are created for this purpose.

One of the ways to solve the problem of overcoming the contradiction between the tasks and the possibilities of solving them in an acceptable time frame is the development and widespread use of CAD, based on modern computing equipment, application program packages and data banks.

Project solutions, in addition to satisfying functional, technological and other requirements, must be optimal in some sense, i.e. realize the possibility of economical use of almost always limited material and technical resources. As the analysis of existing design methods [1] shows, this is not always possible. Therefore, an effective, if not the only, method of solving existing problems is the development of design automation systems based on the wide use of mathematical methods and computer technology, which ultimately allows [2, 3]:

- solve multi-criteria problems of analysis and synthesis of engineering networks with minimal manual labor costs;
- to increase the efficiency of the work of designers due to a sharp reduction in the terms of execution of project works;
- dramatically increase the accuracy of calculations, improve the reliability of networks, which is especially important in the conditions of the growing shortage of the target product (gas, water, heat).

As a result of the conducted research, a systematic approach to the design of developing engineering networks was developed. The systemic approach, as a rule,

deals with the perspective of development. Therefore, any information about the future - situations, resources, discoveries and inventions - is of maximum interest.

Therefore, forecasting is the most important and most difficult part of the analysis. By analysis we understand the real or imaginary division of an object into its component parts.

System approach means [4, 5] that each system is an integrated whole even when it contains separate functional systems and subsystems. Each system has a number of targets and the balance between them can vary widely from one system to another. System engineering methods are aimed at finding the minimum target functions of the system by individual indicators and achieving the maximum interchangeability of the constituent parts of the system.

Subsystems must be implemented and function independently of other subsystems. The unity of system-wide requirements is ensured by the CAD project service.

A systematic approach to design considers the design process as a means of achieving the goal - the creation of systems that optimally satisfy the set requirements, for the selection of the most essential and general, which is inherent in design. It makes it possible to meaningfully imagine the stages of the decomposition of the design process and the design object, which allows you to formulate the main principles that underlie the design automation systems (including CAD of engineering networks), their components and support [6]:

- the principle of new tasks; system approach to design; the first manager; system unity; development; inclusion; invariance; complexity; and information unity; compatibility; standardization.

The principle of the system approach to design is that the object of design is considered as a single system to achieve the set goals, first of all, due to the controlled interaction of subsystems. A systematic approach to design defines design as a process of achieving goals, allocating resources, organizing information and ensuring coordination in such a way that all major aspects and problems are precisely defined and linked to sub-processes in accordance with a previously constructed scheme [7].

Implementation of the principle of a system approach to the design of engineering networks means:

- decompose the general design task at the level with target orientation and stages with procedural localization.
- build a scheme for exchanging project solutions between cells, stages and levels with iteration cycles.
- to determine the goals and criteria of design systems.
- to build a (multi-story) hierarchical system of evaluations of project solutions to build a multi-criteria optimization procedure according to the «cost-effectiveness» indicator.

Summary and conclusions

As a result of the work, the principles of a system approach to the creation of CAD of engineering networks were proposed. The main practical significance of the implementation of the principles of the system approach to the creation of CAD of engineering networks is to increase the quality and technical and economic level of objects designed during their creation and application, increase labor productivity, shorten the design time of engineering networks, reducing the cost and complexity of designing network systems.

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