



AUTOMATION OF OPERATING MODES OF POWER SUPPLY SYSTEMS OF OIL REFINING ENTERPRISES

Numonjonov Shakhzod Dilshodjon Ogli,

Senior teacher

Fergana Polytechnic Institute,

Uzbekistan, Fergana

sh.numonjonov@ferpi.uz

Article history:	Abstract:
Received: 10 th November 2022	this article covers the development of a specialized set of information and software for modeling the operating modes of power supply systems of oil refining enterprises, the development of the structure and algorithms of a flexible information and software complex for modeling power supply systems, automated control systems of production facilities in full
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An industrial enterprise is a complex dynamically developing system. Its stable and uninterrupted operation largely depends on the state of electrical networks, high-quality and reliable supply of electricity. In the network of any industrial enterprise, changes in the structure of electrical equipment, the configuration of power supply schemes often occur, and the external characteristics of the power system also change. Each such change in the power supply system of the enterprise leads to a change in current and voltage and a redistribution of the supplied electricity, depending on the variable power. Therefore, such changes should be accompanied in advance by the choice of types of electrical equipment, relay protection settings and confirmation of the correctness of automation devices, network configuration, etc.

These calculations are very time-consuming and responsible, especially considering that the power supply system is considered as a complex cybernetic object, all its elements are involved in a single production process, the main distinctive feature of which is the passage of events. It is also necessary to take into account the often low quality of the supplied electricity, which seriously affects the operation of emergency automation devices. However, advanced technologies introduced in a number of industries (for example, oil and gas processing) do not allow even short-term power loss.

So-called "manual" calculations require a large expenditure of working time of highly qualified employees, while there is a high probability of error. Usually, accounting documents for the calculations performed do not meet the requirements of accuracy and ease of use. At the same time, the slightest changes in the power supply scheme lead to the need to carry out calculations anew.

Currently, the most popular and universal tool for studying the behavior of the electric power system is electronic computers (computers). However, software products offer in the domestic market (ELSO, SAD, "PITM", "Diana", etc.) do not adequately meet modern requirements in terms of the completeness of coverage in the thematic sections of calculations, since they allow automating only certain stages (sections) of the design and calculation of electrical equipment of enterprises and often do not take into account the whole. power supply systems of enterprises are emergency automation control processes that occur during regular and non-standard switching times.

For these reasons, the task of developing a specialized set of information and software for modeling the operating modes of power supply systems is relevant, which allows complex, computational methods to check the possibility of using technical solutions for network formation during the design process and at the stages of comparing options in changing operating systems of the oil refining complex.

The algorithm for modeling the electrical regime, which is the basis of software electrical systems and expert system. to calculate and analyze the modes of their systems, standard programs must take into account a number of factors that are not usually taken into account. In particular, from the structural topology of the system, it is necessary to provide the user with operational changes, automatic calculation of emergency automation parameters for multivariate tasks, the possibility of reviewing protective selective algorithms. The information and software complex should be an integral part of the automated control system of the technological process and have connections with the automated system of control and accounting of electricity and high levels of the emergency automation hierarchy.

A qualitative prognostic assessment of the use of the developed complex includes:

- improving the reliability of the power supply system based on the strategy for the construction of tolerant systems.

- in the trend of minimizing the risk of interruption in an extreme situation, creating a system dramatically reduces the likelihood of interruptions that force an extreme situation; increasing the technical and economic performance of the power supply system by finding the optimal system option with minimal estimated costs.
- this becomes possible due to a sharp increase in the number of options under consideration and the use of mathematical programming methods; a sharp decrease in the dependence of the quality of decisions made to configure the system on personnel qualifications (system autonomy);
- accurate archiving of decisions made and their creation. operational information space providing control of technical and organizational responsibility; reducing risks associated with information loss;
- reduce the likelihood of emergencies occurring; reduce power losses associated with emergencies by optimizing management;
- increase the resources of electrical equipment and cable networks by reducing the likelihood of extreme situations.

Thus, the purpose of the article is to automate the selection of operating modes of power supply systems of oil refineries in the form of matrices of phenomena, conductivity and electromotor forces based on a universal generalized model of the power supply system.

To achieve the set goal, the following scientific tasks are set and solved:

- development of a methodology and algorithms for the rapid calculation of the stationary and quasi-stationary modes of power supply systems;
- formation of a base of typical mathematical models of elements of the power supply system characteristic of oil refineries;
- mathematical description of electrical systems in a complex structure;

The development of the structure and algorithms of a flexible information and software complex for modeling power supply systems of oil refining enterprises corresponds to automated control systems of production facilities, which makes it possible to analyze the state of their elements and the values of the parameters of operating modes during operational management and in design tasks.

When working on the article, fundamental and special theories were used. Fundamentals of electrical engineering, power supply, relay protection, modeling, digital methods, matrices. Software development Inprise Borland Delphi was carried out using a set of built-in software and tools for creating window applications. The reliability of the results obtained during modeling is achieved using rational mathematical models of the structural elements of the electric power system, as well as the correctness of subsequent analytical changes without additional assumptions.

The scientific novelty of the article consists in the formation of a new approach to the analysis and control of the modes of power supply systems based on a generalized formalization of the equations of nodular stresses in the form of phenomena, conductivity and EMF matrices representing the original aggregate model of the electric power system.

The practical value of the work is determined by: Depending on the expected operating modes, software has been developed to increase efficiency and select the best structure of the power grid and the composition of the equipment. For operating enterprises, analysis of modes is provided in order to optimize energy consumption. In addition, the software package allows you to calculate the parameters of the power supply system in rated and short-circuit modes, taking into account and without taking into account the engine load, assess the possibility of starting (self-starting) engines, check the correctness of the electrical equipment used, including thermal and dynamic stability, determine the main protection parameters, select Portable grounding sections; based on the use of the reference base of electrical equipment, which includes the parameters and characteristics of the main types of components of the elements of the power supply system of the oil refining complex, a system for providing information to the user is developed; the software package is also used as a simulator for dispatching personnel of the oil refining complex. Main energy office at Lukoil LLC enterprise; The study of the operating modes of the power supply system of Lukoil with an automatic calculation of the parameters and settings of emergency automation; the developed software environment is considered as an integral part of the automated power supply control system and a single software and technical complex of emergency automation.

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