The basic theoretical principles of planning the distribution of gas flow low pressure

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Abstract. Currently there is a large amount of research devoted to modeling pipeline systems, which include distribution system. In this paper, the priority is the lighting applied problems of mathematical modeling, including in the field of operational management. Operational management of the operation of urban gas supply systems improves the quality, efficiency and service of technological equipment and engineering systems, ensures reliability of the control system, prevents accidents, reduces the search time for localization and liquidation of accidents, optimizes the consumption of energy, reducing energy consumption and resource consumption over.

Gas consumption is based in ensuring that two indicators of gas flows: a) level of pressure before the burners gas-consuming units, ensuring the quality of combustion and b) energetic aspects of consumption, i.e. the thermal power of gas-burning devices. These figures entail the need to regulate pressure and flow. This control system is able to function in the event of excess natural gas and needs to be adjusted in case of deficiency.

Key words: natural gas, pressure, flow, gas flow, operational management, mathematical modeling, energy resource consumption over the consumption of gas, pipeline system, gas-burning device.

1. Introduction
The implementation of automated systems of remote control technology of process of transportation and distribution of gas and its commercial accounting and consumption is established for cities with a population exceeding 100 thousand people and has a centralized structure, including two levels: lower control points upper – Central control, which is implemented in the form of workstations connected maximum network [1].

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pressure and flow. This control system is able to function in the event of excess natural gas and needs to be adjusted in case of deficiency [2].

The gas distribution network of settlements with a population exceeding 100 thousand people, according to safety Rules of gas distribution systems and gas consumption (section 2.6.1) and SNiP 42-01-2002 (paragraph 4.9) shall operate within the framework of an automatic control system of gas supply, which provides analysis and optimal control of process gas distribution [3].

It should be noted that traditionally the management system boils down to the seasonal adjustment of the working pressure after regulatory points, and the mode of consumption of energy is formed by the consumers themselves. The functioning of this system can be only in case of excess energy, and in case of deficit adjustment is required.

The main purpose of adjustments is to control ganapataye at the municipal level, with the priority interests of individual consumers (groups of consumers) [4].

Automated control system of technological processes naturally encompass as regulating structures, distribution centers and contain functional subsystems that implement the set of tasks of operational control of the distribution and the technical condition of the system.

It should be noted that the regulating and control system based on multiple distribution points, designed for direct control of pressure in the networks and only indirectly to regulate and control the gas flow via the working pressure [5].

In the result, it can be argued that the control system is centralized although working within the automatic gas distribution system in need of equipment elements, i.e. Executive bodies directly administering costs of gas, intended for consumption.

Such elements can be managed from the computer centre chokes, that is, the flow regulators, and the aforesaid system applies to the class of cybernetic systems, because the control signal produced in the computer center and is transmitted to the flow controllers. The creation of the control signal is performed by simulation based on mathematical model of operational management of the functioning of urban systems [6].

A new system of transportation and distribution of gas, which is built on the use, controlled from the computer center of the inductors, the amount of which can greatly exceed the number of functioning regulatory bodies and transportation of energy, which creates prerequisites for the formation is quite flexible with a high degree of identity management system [7].

In the theory of automatic control there are two control principle: a) the principle of regulation by the disturbance and b) the principle of regulation error [2].

This article presents the developed the principle of regulation by the disturbance in the application to urban supply systems in a number of advantages, nominating him in the category of competitive capacity in relation to the principle of regulation by mistake. One of these advantages is the relatively low order of the block-matrix structures in a model of operational management, which is important for operational execution of the job is generated and transmitted by the Executive unit, as parts of automatic control system [8].

For the first phase of the restructuring of subscriber subsystems is structural separation unmanaged and managed transit track components through the selection of the travel expenses to consumers, not by the length of pipelines, and nodes. At the same waypoints (nodes) selections pass through the system is controlled from the computer centre of the inductors.

It is known that the system variation of hydraulic resistance of a plurality of managed choke is a form of parametric perturbations introduced into the system, the model management operation should be based on the model of perturbed state [3]. The physical embodiment of a model of the disturbed condition is a binary structural graph illustrating the second stage of structural change, Fig. 1.
In the diagram, node selections passed through a short process pipelines with connected controllable inductors. To process line selections settle down a dead-end sham plots, uniting the subscriber subsystem and ending with hanging nodes associated with the United consumers written from nodes of a distribution network. The Association of pipes and lines and gas consumers shall be in accordance with private conditions of energy reduction [4].

After the second phase of structural transformation, we have the model a full-sized gas supply system includes a distribution system attached to the controllable choke, and equivalents. Distribution network within the model should be limited to nodes with defined and fixed forms of the boundary conditions. In other words, the nodal pressure, limiting the model needs to be determined and not depend on parametric perturbations introduced into the system through configuration (computer center) of a plurality of controlled throttles. After timing item operating pressures meet these conditions, the power automatically maintain this pressure. The pressure values in the leaf nodes, limiting the model to these conditions can satisfy the ambient pressure. This condition is achievable in case of full extension of gazobetona of the operating pressure in selected nodes.

This model of the disturbed state of heat supply of low pressure, the underlying model of operational management of the function and its linear analogue is a systematic relationship of the hydraulic parameters of the flow and hydraulic resistance of the throttle elements. It gives a principal possibility of the formation mechanism of gazobetona through its impact on the resistance of the throttle elements. Note that the flow distribution and gas consumption while interdependent, but this relationship exists in an implicit form, using a system of linear equations. But at the same time, for the operation of the control system required the explicit form of the interaction [5].

It should be remembered that one of the important aspects of the management systems is the mechanism of interaction of multiple inductors influence each other. Since the control task used the parametric form of the perturbation, i.e. the "force" effect on the flow behaviour of the throttle elements, modeling should be based on the model of a perturbed state. In this case, the flow distribution and gas consumption have a unique solution when the originally specified coefficient of hydraulic resistance of all the unregulated lines, including dummy [6].

However, the formulation of the problem management is not limited to one or more configuration modes controlled throttles, and to a greater extent is determined by the dependence of the hydraulic configuration of the managed chokes from set mode of consumption, in other words the throttle characteristics.
Built on a limited variety of reference points throttle characteristics of different local dispersion, which, however, does not lead to distortion of the configuration of the features. The manifestation of the specific characteristics of the local dispersion manifests itself in an unfavorable combination of the hydraulic settings of the other chokes and can lead to temporary reduction in accuracy of the performance modes of gas consumption [7].

Throttle characteristics play an important role in the formation of integrated operational disturbances without the necessary in such cases, solving systems of equations (nonlinear) in higher dimensions. Note that they must be determined in advance based on the forecast of consumption of gas and quickly be adjusted in monitoring mode, when you change the system configuration, for example in the case of connection of new consumers, sources, structural elements, etc.

The management task is largely determined by the dependence of the hydraulic configuration of the managed chokes from set mode of consumption, in other words the throttle characteristics.

Throttle characteristics, Fig. 2, built on a limited variety of calculated points differ local dispersion of pressure, however, does not lead to the execution of configuration features. Local variance the specific characteristics appears in an unfavorable combination of the hydraulic settings of the other chokes and can lead to temporary reduction in accuracy of the performance modes of gas consumption [8].

![Figure 2. Throttle characteristics of the distribution network of low pressure (Fig.1) 1 – (5-T)](image)

The definition of the shape of the disturbance introduced into the system gas low pressure stage can be divided into: primary – the deviation of the mode of gas consumption over time and the secondary is adequate deviation of the coefficient of hydraulic resistance controlled throttles. As a result, a principle of regulation in the perturbation, namely the new control scheme for the operation of urban gas supply systems low pressure, based on individual control of individual consumers or groups of consumers will allow to fulfill the specified forecast of gas consumption for homogeneous consumers or specific groups [9-10].
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