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EFFICIENCY OF USING GEOINFORMATION SYSTEMS IN THE DESIGN OF GAS DISTRIBUTION AND GAS CONSUMPTION NETWORKS

The scientific article is devoted to determining the effectiveness of the use of geoinformation systems (GIS) in the design of gas distribution and gas consumption networks. An experiment was carried out on a laboratory stand modeling ring, dead-end and mixed gas networks. The electronic model of a gas network identical to the laboratory stand in the ZuluGaz 10.0 software package, a module for expanding the GIS functionality for calculating gas supply networks designed to solve various industry. A comparative analysis of the results of an experiment and the results obtained during simulation in GIS is carried out. Based on the analysis, a conclusion is made about the accuracy of the GIS results and the feasibility of using GIS for the design of gas distribution and gas consumption systems.

Keywords: *gas supply, gas distribution and gas consumption networks, design, simulation, experiment, geoinformation systems, hydraulic calculation.*

Introduction

Currently, geoinformation systems (GIS) are widely used in all fields of activity and continue to improve, expanding their functionality and introducing new algorithms into the logic of calculations [1]. The use of geoinformation systems in the design of gas distribution and gas consumption networks under construction and improvement of existing ones is highly justified [2]. However, the characteristics of the electronic model cannot completely coincide with the current gas distribution and gas consumption network.

In the laboratory of the Department of Environmental Engineering of the Don State Technical University, a study was conducted to assess the effectiveness of using one of the most common geoinformation systems in the field of gas supply to settlements. Thus, the GIS ZuluGaz 10.0 was chosen as the object of the study.

Materials and Methods

The research method is based on a comparative analysis of the results of an experiment and an electronic model of the gas distribution and gas consumption system [3].

To solve this problem, a laboratory stand has been developed in the laboratory of the Department of Environmental Engineering of the Don State Technical University to perform scientific research. This stand models gas distribution and gas consumption systems with a gas supply source and consumers located at different distances from the gas supply source [4]. The same gas distribution and gas consumption system was simulation in ZuluGaz 10.0, a GIS functionality extension module for calculating gas supply networks designed to solve various industry tasks.

During the experiment, three types of gas networks were modeled on a laboratory stand: dead-end, ring and mixed (Figures 1, 2, 3) [5-8]. Then, in ZuluGaz 10.0, models of gas networks similar to the stand were modeled and calculated [8-10].

The simulation results in ZuluGaz 10.0 are shown in Figures 1, 2 and 3.

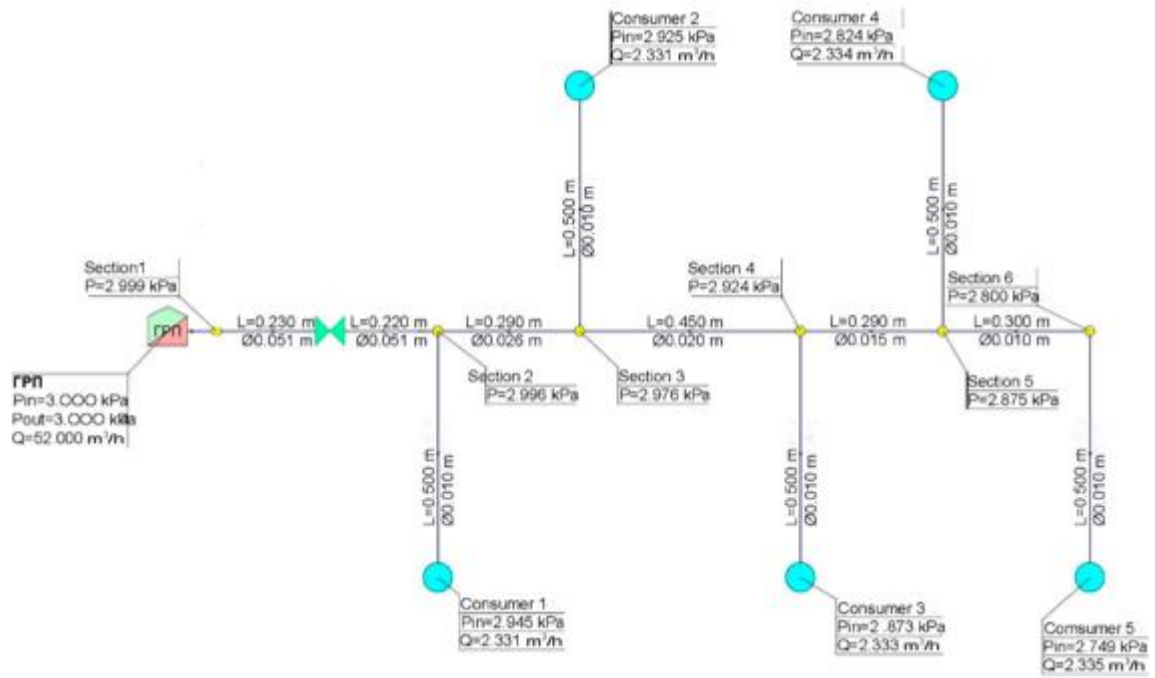

Fig. 1. *Model of the dead-end gas network*

ГРП - gas supply source; - consumer; - the valve is "open"; - the valve is "blocked"

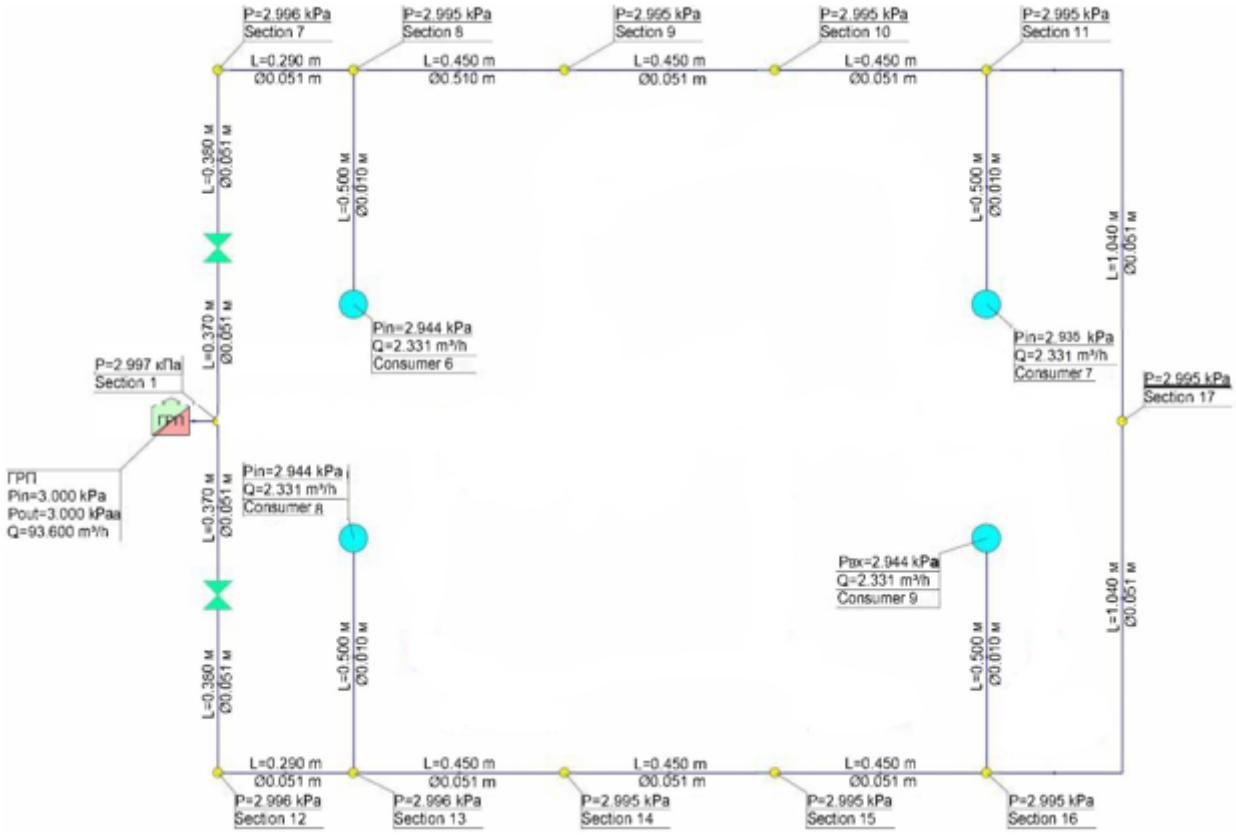

Fig. 2. Model of the ring gas network

ГРП - gas supply source; - consumer; - the valve is "open"; - the valve is "blocked"

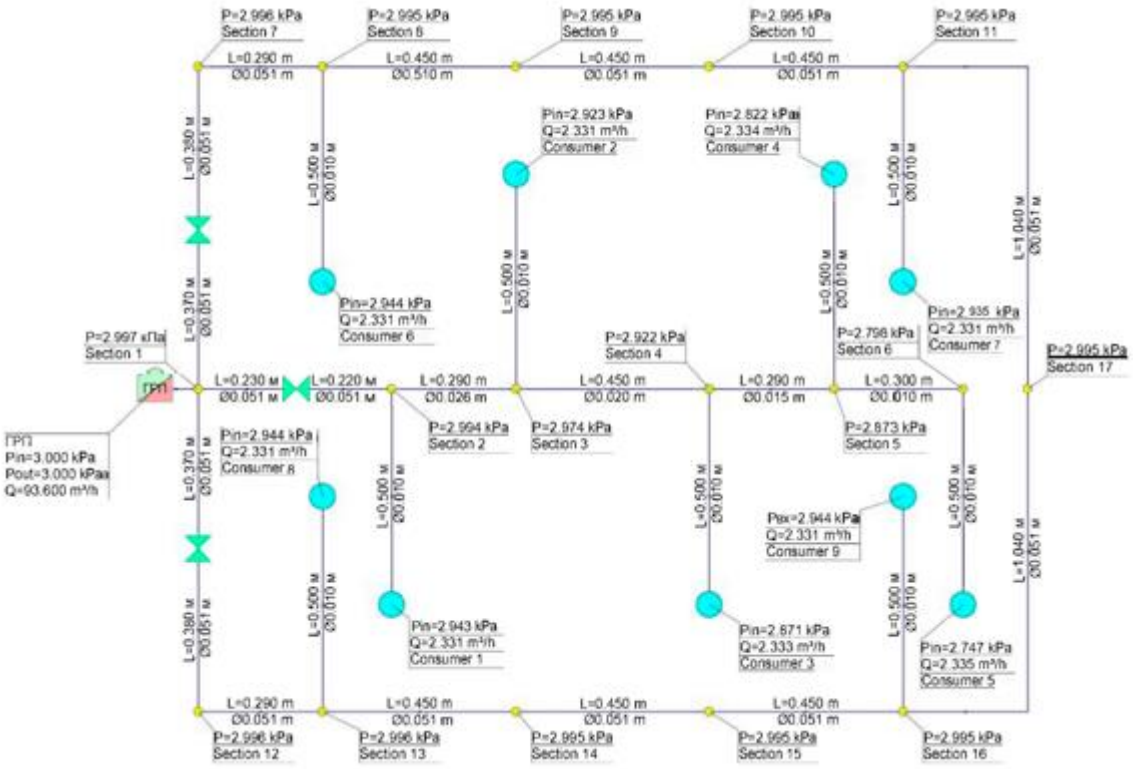

Fig. 3. Model of the mixed gas network

- gas supply source; - consumer; - the valve is "open"; - the valve is "blocked"

Results and Discussion

After completing a series of measurements at the laboratory stand and a series of calculations in ZuluGaz 10.0, piezometric graphs were constructed from the gas supply source to the most remote consumers for dead-end and ring gas networks (Figures 4, 5).

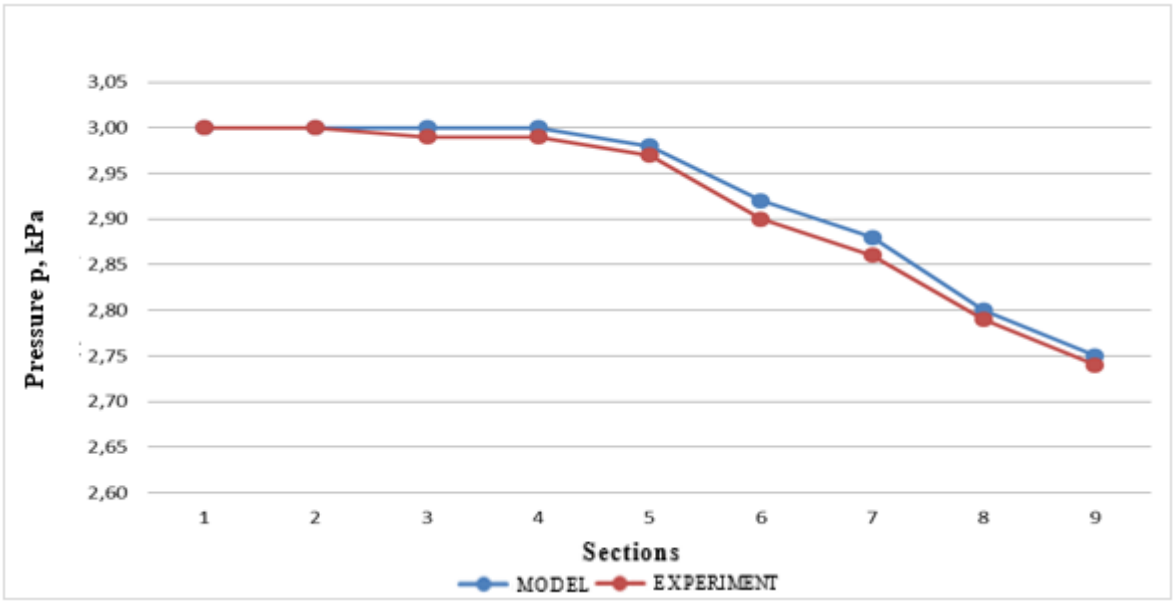

Fig. 4. *Piezometric graphs for the dead-end gas network*

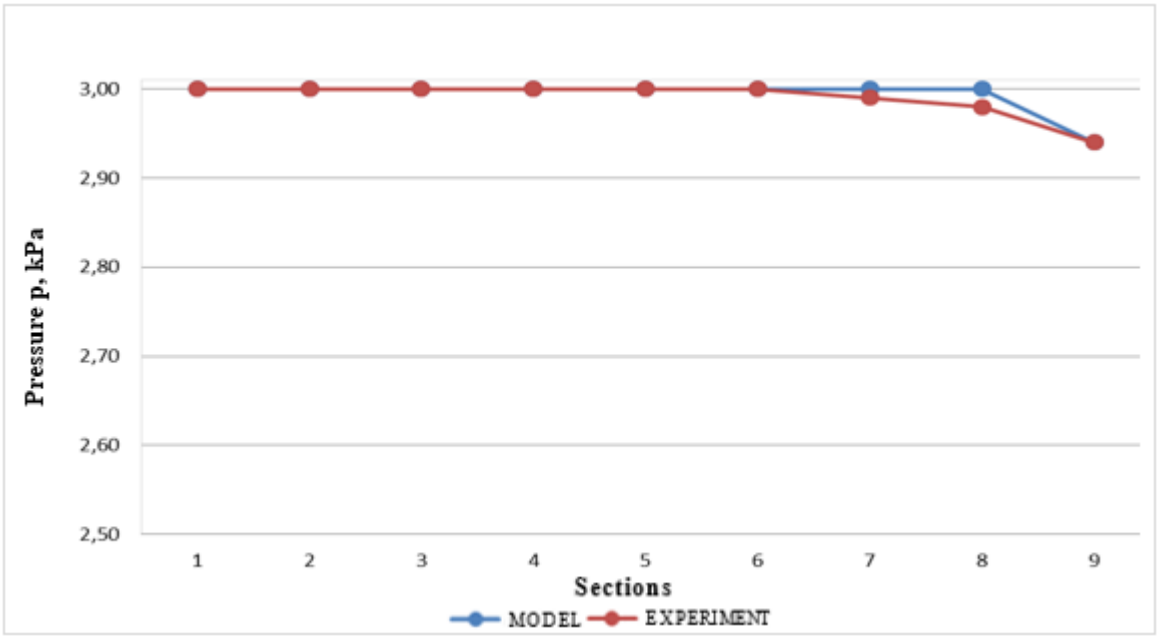

Fig. 5. *Piezometric graphs for the ring gas network*

The characteristics of the electronic model of gas networks showed almost complete identity with the results of the experiment. The results are shown on piezometric graphs (Figures 4,5).

According to the results of the study, it can be concluded that the calculation performed in ZuluGaz 10.0 creates a very accurate electronic model of the laboratory stand.

Conclusion

During the research, a comparative analysis of the electronic model of gas networks with an experiment was performed. The simulation results in ZuluGaz 10.0 almost completely coincided with the results of an experiment at the laboratory stand. Based on this, we can conclude about the high efficiency of the use of geoinformation systems for the design of gas distribution and gas consumption systems.

However, it is worth noting that this geoinformation system does not take into account the wear of gas pipelines and gas-using equipment installed on them. The solution of this problem can be the basis for further research.

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