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GEODETIC WORKS FOR GAS TRANSMISSION SYSTEM INSPECTION IN UKRAINE

Abstract. The article deals with the results of experimental research that was carried out on gas pipelines. Research was provided at beam air passages of gas pipelines which are the most common in Ukraine. In order to improve the methodology of geodetic monitoring using reflectorless total stations the current research was carried out.

Key words: geodetic monitoring, reflectorless total station, thermal deformation, pipeline air passage.

Currently Ukraine is one of the world's largest natural gas transporters that’s why stable operation of gas pipeline system is to provide economic development and international authority of Ukraine. The transit gas pipeline system represents a certain potential risk for its surrounding due to very high gas pressure. A significant static damage of the equipment may result in the breakdown with catastrophic consequences on ecological safety of the environment and may also cause considerable losses due to interruption of gas transfer. Therefore some elements of pipeline system must be subjected to a regular safety geodetic monitoring. One of such elements is large-diameter pipelines air passage over the waterways (Fig. 1).

The development of geodetic tools allows to introduce new technologies and methods to control the geometric parameters of engineering structures. Coordinates of control targets on pipeline can be determined using total station. The latest technology improve the surveying industry is reflectorless measurement, electromagnetic distance measurement without using targets or prism [1, 2].

Fig.1. "Union" pipeline air passage (Ukraine)

Reflectorless total station enables surveyors to accurately measure remote or inaccessible points without first locating a physical target for each point. Reflectorless technology opens new possibilities for one-person surveying, increased productivity and improved personal safety while measuring unsafe points. It is a high importance factor during air passage pipeline inspection. According to conducted researches, the accuracy of the plane coordinates of control targets on the pipeline by total station Sokkia SET 530 in reflectorless mode does not exceed 6 mm; elevation coordinate does not exceed 2.5 mm [3].

The accuracy of geodetic works depends on the permissible vertical displacement of support pillar. The analysis shows that permissible values of pillars vertical displacements depend on: distance between pillars, operating pressure, pipe wall thickness, material strength. This requires differentiated approach to setting accuracy of geodetic survey for each pipeline air passage.

In order to calculate value of pipeline displacement with required level of accuracy the effect of several factors should be considered. One of them is pipe temperature, which is variable in length and time. Mainly it depends on transported gas temperature and environment temperature. Temperature changing within the day become a reason of cyclic thermal deformation. Attention should be paid to the process of determining the accuracy of observation [4].

The investigation of cyclic thermal deformation was performed on the operating pipeline. Thermal deformation was determined on the basis of displacement by five control targets mounted on pipe. Graphic results clearly show that pipeline displacement correlates with temperature changes (Fig. 2). Maximum thermal deformations occurred in period of maximum temperature increase to 37.5^0C. The amplitude of pipeline diurnal displacements in the transverse direction does not exceed 10 mm in the longitudinal - 14 mm. Vertical pipe settlements for the follow-up period does not exceed 2 mm, indicating stability in high-rise design position.

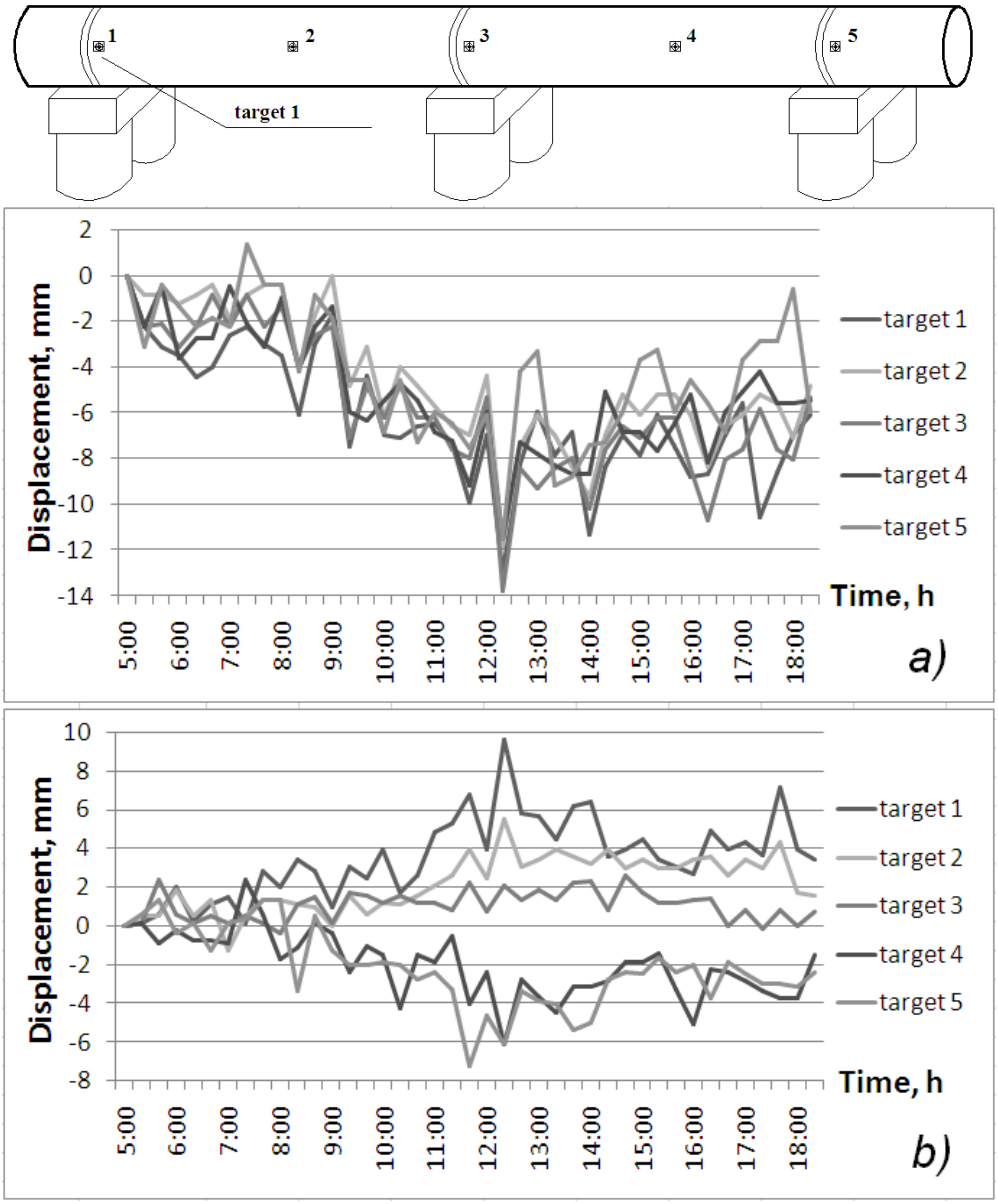

Fig.2. Pipeline thermal deformation: a) longitudinal direction; b) transverse direction

Since the whole material gets old and becomes deteriorated with time and external impacts, the geodetic control of pipelines is an important part of the maintenance and reconstruction works. Nearly 80% of gas pipelines on the territory of Ukraine has been in operation for the last 15-50 years. This is the only reason to perform a careful inspection of gas pipeline air passages. Geodetic methods together with using modern total station can detect the critical displacement of gas pipelines, reduce the time of surveying and provide the highest accuracy of measurement.

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STRUCTURAL MODELING OF INFORMATION SYSTEMS

Abstract: In the present work the main attention is paid to the structural modeling of information systems on the example of synthesis of UML class diagrams. Also, the article suggests an approach for improving the quality of design of information systems by automating the process of synthesis of structural models.

Key words: UML, class diagram, modeling, structural models.

The concept of modeling information systems is quite complex, it includes a huge variety of methods of modeling: from the creation of natural models to the derivation of mathematical formulas.

The process of modeling an information system is one of the most important stages of development, as the models allow us to consider the future system, its objects and their interaction even before investing significant resources into development, which reduces the risks of implementing the information system. Consequently, considerable attention is paid to the design and modeling of the future system. However, it can not be said about the problem of insufficient development of models at these stages of the project, which leads to a decrease in the quality of code and the effectiveness of the system.

One of the solutions to this problem can be the automation of the modeling process by synthesizing structural models of UML class diagrams.

Unified modeling language UML can be effectively used to build conceptual, logical and graphical models of complex systems for various purposes. Due to the fact that the basis of CASE-tools is the development of diagrams using UML, UML modeling, the development of the logical model of the system in the form of a class diagram occupies a central place in object-oriented analysis and program design. UML is not a programming language, but in the means of executing UML models as interpreted code, code generation is possible.

Therefore, based on the capabilities of the UML modeling language, an intellectual approach can be offered to solve the problem, which is an advanced technology for creating a software system and consists of the following stages:

1. The development of an expert ontology, a glossary of the subject area with the help of a user-friendly interface that automatically synthesizes the UML class diagram.

2. Automatic synthesis of the program diagrams of the class diagram in UML.