

# Principles of building a system for automating the activities of a process engineer based on an ontological approach within the framework of the Industry 4.0 concept

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**Abstract**—In this article, an approach to the continuous development of automation of the processes of creating, developing and applying standards based on the OSTIS Technology is proposed. Examples of these processes due to the involvement of end-users of the system using the tools and mechanisms of the OSTIS Technology are considered. Examples of further formalization of standards within the framework of the proposed approach are given.

**Keywords**—automation of manufacturing processes, information service, ontological production model, Industry 4.0, ontology, knowledge base, OSTIS Technology

## I INTRODUCTION

The implementation of the Industry 4.0 concept at production facilities is accompanied by the development of a single ontological production model, which is the core of the complex information service of the enterprise. At the first stage of developing such an enterprise model, it is necessary to nest data on the lower level of production, namely on the manufacturing process and equipment. As the source of this data, PID-schemes of production can serve. Thus, the formalization of the ISA 5.1 [1] standard is necessary to work with PID-schemes, which are widely used in control systems together with the ISA 88 [2] standard and allow describing the lower level of production in full. At the same time, it is also necessary to consider the approach of formalization of the subject domain based on the ISO 15926 [3], [4] standard, which describes the integration of data on the life cycle of processing enterprises into a single ontological storage. New users will be added: an automation engineer and a master, who implement the new capability of the intelligent search together with the devel-

oped model. For the current user – the operator of the manufacturing process – the implementation of the mechanism for obtaining intelligent information that covers both particular and common issues of the manufacturing process, equipment,

## II BRIEFLY ABOUT ISA-5.1

This standard describes the rules for drawing up functional schemes for the automation of manufacturing processes. Such schemes allow the graphical representation of the production technology and equipment as well as define the rules for identifying equipment and measuring and automation tools for design and service purposes. Figure 1 shows an example of a functional scheme.

The functional scheme shows: the coagulator itself (the unit), the lines (the machine) and the valves (the control device). Different colors indicate the purpose of the lines (red – washing, blue – mixture, green – whey, black – product). This fragment allows getting an insight into which devices are used and how they are connected.

## III ONTOLOGIES IN PRODUCTION

The ISA-88 article described how to use the knowledge base on the basis of the OSTIS [7] ontologies to train the operator with complex concepts, search for objects according to ISA-88 and their interrelations. The need for knowledge bases for production is not restricted to the above. Among the most complex problems that can be solved using knowledge bases on the basis of ontologies, there are:

- decision support in unforeseen situations as well as start-ups and ends;