Features of the implementation of artificial intelligence and digital technologies in industrial production: promising directions and modern trends in automation

V N Malikov1,6, L V Kunigina2, V D Munister3, A L Zolkin4 and V R Varshavskij5

1 Department of General and Experimental Physics, Altai State University, Lenina Street 61, Barnaul, 656057, Russia
2 Department of Social and humanitarian, natural science and general professional disciplines, Voronezh branch of the Federal State Educational Institution of Higher Education "Rostov State Transport University", Uritskogo street 75a, Voronezh 394026, Russia
3 Department of Mathematical Methods and Computer-Aided Design, Private educational institution "Donetsk Academy of Transport", Dzerzhinsky Street 7, Donetsk 83086, Ukraine; Department of Enterprise Economics, State educational institution of higher professional education "Donetsk National Technical University", Shishbankova Street 2, Pokrovsk, Donetsk region 85300, Ukraine
4 Computer and Information Sciences Department, Povolzhskiy State University of Telecommunications and Informatics, L.Tolstogo Street 23, Samara 443010, Russia; Natural Sciences Department, Private institution of higher education "Medical University" Reaviz, Chapaevskaya Street 227, Samara 443001, Russia
5 Department of Economic Cybernetics, Federal State Budgetary Educational Institution of Higher Education “Kuban State Agrarian University named after I.T. Trubilin”, Kalinina Street 13, Krasnodar, Krasnodar Krai 350044, Russia
6 E-mail: mirotnas@gmail.com

Abstract. The article discusses the problems of optimizing the work of modern industrial production, promising areas of automation, the industrial Internet of things. The author's principle of optimizing the operation of automated systems through a number of promising technologies is described: a model of an improved abstract executor and distributed computing, modern machine learning tools. The application of information security methods in ensuring the search for the optimal connection between objects and subjects of an automated control system is given. The economic and technological significance and role of the potential described and considered implementations are formalized.

1. Rationale
The most important disadvantage of modern industrial production is their conservatism. Defined implementations and innovations often do not reflect the nature of the functional transformation of the existing infrastructure [1].
Optimization logic is based on rather trivial considerations and principles, mediated not so much by the depreciation essence of costs and profit-oriented component, but also by significant personal interest of counterparties. Undoubtedly, the principles of trust relatedness go back to the purely manufactory nature of industrial relations laid down in the Middle Ages. This character is inherent in the essence of man, determined by the peculiarities of subjectivization in control theory. This prevalence is reflected in the collective choice of the corporate management culture.

Indeed, it seems that the easiest way to solve the problem is through interaction with real categories - the quality of finished products, personnel, rather than methods and principles of management [2].

Often, a management role does not define a systems analysis to the strengths and weaknesses of the enterprise in relation to something. The qualitative and quantitative aspect of interaction is the most difficult to determine, since there is no feedback between the objects of the control system. The fact is that the principles of both automatic (technical) and classical management and control include a centralization module. It is expressed both by the principle of functioning and by the control scheme, and can determine the relationship of the object of interaction with the control system in various ways, but, unfortunately, not express the internal component of the issue [3].

2. Features of identifying optimization problems of modern industrial production

Cybernetics, as a science, forms the principle of systems thinking. In the system, all indivisible elements are interconnected. In the theory of automatic control, discrete mathematics, the theory of digital automata, a great variety of masked agents are allowed, which, in fact, are defined, but do not carry a relational essence. In addition, the dichotomous nature of the definition belongs to the peculiarities of the problem of identifying production problems. On the one hand, manufacturing can be viewed as a system in a dynamic environment. On the other hand, cybernetic control itself can be represented as a system [4]. Figure 1 shows a compilation of these two principles for considering a formal model determined by the stochasticity and equal probability of various risks, conditions, influences under the conditions of the Markov process - a mathematical model of almost all analog processes in the real world.

Moreover, the evolution of the process after any given value does not depend on evolution, the "predecessor", provided that the value of the process at this moment is fixed (the "future" of the process depends on the "past" only through the "present").

Assessment of the posterior maximum in cybernetic systems in Markov systems is reduced to the experience of those who already have ideas about the world and working conditions. This is the problem of identifying the problems of modernization, optimization of existing production.

Figure 1. An example of cybernetic reasoning.
This arises from the law enforcement practice, expressed in the form of a design approach to the design and maintenance of automated control systems, which has already become classical. Which is determined by the priority study of the dynamics of the enterprise from the factoring side. This is dictated by economic transparency and the simpler econometric side. The problems of an enterprise are determined in monetary terms, therefore, they must be solved by economists and financiers. However, specialists with such a training profile cannot study the entire enterprise in general.

They will certainly reduce everything to the accompanying algorithms for dividing into subsystems and systems, and, of course, will not be able to reflect the external side of the issue. In addition, the optimization component of such measures will be reduced to zero [5].

Thus, attention is focused on an important omission and on the non-application of a single non-complex method of analysis to the presented problematic. After all, the solution to a problem is "optimization" only in the case when the system is simplified in its fundamental form, while not changing in any way functionally. In other words, any implemented management methods are associated with an optimality criterion. Optimization methods are divided into direct and iterative. Optimization is about finding the best option. They are applied to find the calculation of the optimal technology, the optimal geometric design, the best time for technological processes and similar tasks. An example of this is Newton's iterative method.

Identification of problems that impede specific optimization shall be based both on the principles of economics and on the principles of information security of the enterprise. Modally, security is not directly associated with the process of updating and improving production, but it is it that can solve the problem of the optimal choice of means, methods and tools of cognitive influence on control devices and subordinate aggregates [6].

Thus, we will designate two groups of probable threats to the possibilities of updating, modernizing and optimizing the technological process in the industrial industry:

- The entropy of the "control device" is the assumed linearity in operation and general predictability (naive idealization). Linearization is possible, but not limited in its field.
- An economic approach to the policy of introducing innovations, based only on the financial side of the expected losses and profits, depreciation [7].

3. Final sampling principle in automated control systems

In connection with the described dilemma, it is necessary to determine the ways of solving the described stumbling blocks, defining a delimiting, discrete policy of influence of certain agents, subjects of the enterprise, expressed in the form of animate and inanimate objects.

For these purposes, the most promising technology is the creation of role-based or mandated delimitation policies used within the framework of the information security methodology of an enterprise and/or information system.

In its simplest unconditional form, it is sufficient to define equivalent AccessControlList models (ACLs) for all groups and types of devices, as well as program modules. The final discretization implies the definition of all possible relationships according to the principle of "human-machine", "machine-machine", "human-human", "machine-human" [7].

In the diagram shown in figure 2, the access control matrix determines the essence of the relationship of such relations: subjects (users) register rows, objects (resources, services) index columns.

The construction of such matrices will finally eliminate the information entropy of any considered economic system of this level. Moreover, it is understood that in the technological process, within the framework of the automated control system, each element that has more than one connection can express the form of a switch - a digital network device [8].
This is necessary to bring to a promising automation model Roboticprocessautomation (or RPA) - a process automation technology based on the metaphorical software of robots or bots, or artificial intelligence workers. A distinctive and main feature of RPA robots is the direct ability to use a human-machine interface (relationship protocol) to collect data and control technological applications.

4. An innovative approach to the implementation of support and control systems for cyber-physical and automated control systems

Having defined the problematic of the research topic, the possibilities of its correction, it is necessary to determine the promising automation technologies in the considered context [8].

Understanding of this approach consists of the possibilities of improving the principle of operation of a computing system and the principles of improving the performance of operating control devices - as the most significant element of the contour of the system of organizing and controlling technological processes. First of all, by changing or modifying the existing reference models, such as the Turing Machine and the Post Machine. Obviously, these models are not applied in practice in their pure form, to the extent of formalization restrictions, however, they still carry a great deal of importance on the way of organizing technical means working with data - determined by the discrete logic of work.

In many ways, the principles laid down in the thirties and forties of the last century that impede the introduction of true superscalar methods in computing. In addition, in relatively young, cyber-physical systems, the same architecture prevails. It is based on the consideration of one instruction, order, command, etc. in one step of the technical system. An increase in productivity is possible only by increasing the number of conveyor lines, microcontrollers. But on this basis, the idea of the optimum is distorted [9,10]. The most optimal technology (topology) in this direction is the Universal Memcomputing Machine (UMM). Its essence is that the calculations do not take place in a separate device (where it is needed to transfer data) but directly in the memory itself. The order is controlled by the control device. Figure 3 defines the principles (properties) of a control device with the UMM principle, which solve the previously described problems of finding the optimum in automation technologies.

Property 1. Intrinsic parallelism. Any function can be run on any set of processors at the same time. For this, in the Turing machine, additional tapes and heads must be introduced (and it is not optimal) [11].

Property 2. Functional polymorphism. It lies in the fact that, unlike a Turing machine, a UMM can have many different operators (it is optimal).
Considered system (Universal Memcomputing Machine) expresses the almost limitless possibilities of hardware use of algorithms and postulates of machine learning and artificial intelligence in telematics and digital control theory.

The cascade synthesis of enterprise management systems previously certainly encountered the constraints described by the Turing Machine, expressing their weak optimization component. Moreover, in modern control systems the role of software agents and modules is too expressed, which are high-level (from the point of view of programming) add-ons: macros, programs, scripts [12].

In the considered UMM system, it is already possible at the hardware level, without caching and delegation, to use artificial learning algorithms:

- Reinforcement learning is used to analyse the state of the control system.
- Bayesian systems of trust are used at the level of organization of production on the part of personnel, together with proposed implementations in the form of a mandatory security policy. The conditional probability is expressed based on the monitoring of the process considered in the memory of the UMM. Moreover, direct operations in the memory of the proposed model offer a more stable model of the control device, assuming the highest level of autonomy.
- Artificial neural networks are used to regulate the principle of operation of the proposed model of control devices with a lack of input data and regression.
- Principal component analysis (PCA) is a promising method for reducing the dimensionality of data obtained in larger quantities than data previously obtained with the proposed approach, having lost the least amount of information [13].

5. Findings

Thus, in this work, the key problem of all innovative activity in relation to industry has been identified, both from a technical and expert-economic point of view. The conflictology of value judgements based on econometrics is described. A variant of levelling of this aspectology is proposed. An innovative multi-loop approach to organization of an optimal automation strategy for a typical enterprise is defined and justified using the example of transformation of a control system. The role of
A combination of discrete logic control principles (Access Control List, Universal Memcomputing Machine, Role and Mandate Policies) with implementable fuzzy logic algorithms is described. It allows to improve functional map of technological production, significantly accelerating and increasing the productivity of control devices and arithmetic-logical systems. The role of artificial intelligence algorithms operating within the framework of the new concept of control devices is presented.

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