



# Mechanism of welding system technology of automation processes based on artificial intelligence

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## ABSTRACT

In technological processes, welding systems are being changed by the emergence of modern information technologies such as the Internet and things, big data, artificial intelligence, cloud computing and intelligent manufacturing systems are developing widely. Smart welding systems using these technologies are attracting attention from the academic and industrial communities. Intelligent welding is the use of computers to imitate, augment and/or replace human operators in sensing, learning, decision-making, monitoring and control, etc. This is achieved by combining the advantages of human and physical systems into intelligent cyber systems. Smart welding finds and provides a systematic analysis of experimental applications in the industry, its components, applications and future directions, helping to provide a unified definition of smart welding systems. This article explores the key components and techniques needed to make welding systems intelligent, including sensing and signal processing mining and selection, modeling, decision making, and learning. Emerging technologies and their application to IWS capabilities are also explored, including Industry, cyber-physical systems, digital twins, and more. Typical applications such as welding design, task sequencing, robot path planning, robots are studied. programming, process monitoring and diagnostics, forecasting, process control, quality inspection and evaluation; human-robot collaboration and virtual welding. Finally, conclusions and suggestions for future development are offered. This review is designed to provide an up-to-date reference for those interested in implementing smart welding capabilities in traditional welding stations, looking at plant process modernization and systems studies.

## Keywords:

Technological processes, welding process, artificial intelligence, robotic welding system, technical monitoring, system control, welding control, computer system processes

## Introduction

Artificial intelligence can be defined as the ability of an automatic device or a network of neural-like elements to respond to inputs in a human-like manner. Automation and robotization in technological processes reacts to such information conditions. Adaptive control systems with artificial intelligence elements are based on optimization algorithms,

retrieval, classification and clustering. Expert systems and technical decision support systems are possible. It can be used as a smart component in such systems. They allow the management system to make decisions on the change of regulator parameters depending on disturbing factors and control effects error. The study of approaches to the intelligent control of welding processes is a comprehensive science

and an engineering challenge that combines the latest advances in technology and equipment for welding production, as well as the theory of automatic control. A successful solution to this the problem is especially related to arc welding processes in shielding gases, as well as arcing requires the development of science-based approaches to product manufacturing and construction intelligent welding systems with flexible control. In this regard, the purpose of this work was to improve the quality of welded joints and the process development and implementation of intelligent control algorithms and performance through artificial application intelligence on the processes of arc welding and direct arc growth under conditions of disturbing factors. The main task was to establish such control measures that would compensate for violations ensure the formation of the welded joint according to the process and existing requirements. Regarding the process of arc welding in shielding gases, the main conditions for obtaining high quality welded joints that comply with regulatory documents are a reliable protection of the welding zone. If we consider the welding process as an object of control, we consider the object as an object of control the effectiveness of gas protection depends on a large number of parameters. These are the parameters They are installed by the welder and can quickly and accurately react to accidental process disturbances change. Shielding gas flow is the primary control of gas efficiency to protect. The technological scheme and technical systems of welding process management based on automation systems in technological processes play an important role in the stages of modern development and serve to provide management of alternative technological processes based on modern artificial intelligence in the stages of continuous technological processes of industrial production lines. After the evolution that continued in the early years of development, many welding operations with the help of hand tools were replaced by automated systems, and welding systems using the technological scheme of industrial robot automation programs began to be used in the Republic of

Uzbekistan. Today's welding processes are complex, dependent on many parameters and limited understanding of the process. At the same time, users and customers have special requirements for welding, creating a dynamic work environment. Therefore, it is part of our goals and objectives to move towards more customized production using new generation welding systems that can intelligently adapt to changing welding tasks in order to maintain high quality. In the age of big data, it is important to have smart strategies to collect and share welding data as part of a comprehensive life cycle assessment in industrial supply chains to improve internal operations. Therefore, for example, in-process welding parameters and post-process welding monitoring help to improve the quality of welding processes, components. Ensuring the quality of work and subsequent service plays an important role in technological processes. Although there are many methods of welding, developments in information science and technology are helping to transform the traditional welding craft. and advances in many areas of technological processes are advancing computer science, control theory, robotics, and artificial intelligence, which allows the automation and replacement of manual labor with intelligent technology systems. These were concepts and related technologies explored in manufacturing research initiatives such as Smart Manufacturing, Internet of Things, Industrial Internet, Big Data, Artificial Intelligence, Next Generation Smart Manufacturing, and Human-Cyber-Physical Systems. a model for the industry of the future. These initiatives provide the necessary drivers, activators and boards. In addition, it is very important to study the geometry of the weld. When there are special technical requirements in the technological processes, such as coating processes, production line cost studies, input waste control and reduction, and specific characteristics of the component are welded. Next, welding together with indirect measurement techniques reduces production costs and increases their productivity, thus reducing the number and number of parts rejected in the final quality control, we can

observe that it is based on modern power sources and robotic systems. When controlling weld geometry, width, height and penetration are the main properties considered in various industries. In general, an important part of the systems is designed to control the geometric parameters during the welding process. In technological processes based on statistical and artificial intelligence models, we can usually consider linear regression networks and neural networks. In the application of such methodologies in the management and control of technological processes, the control variables of such proposed systems mainly rely on the variables of the control power source. For example, the typical control variables voltage and wire feed speed control is necessary to organize a power supply using the traditional technological process of constant voltage type. Other independent parameters of the source power can be additionally introduced, for example, the welding speed, the distance between the contact tip and the workpiece, and the variation of the shielding gas must be taken into account. Creating a scheme of a smart welding system in technological processes. An intelligent welding system of technological processes controls the operations and station, system and system levels, to achieve it, different system goals must be taken into account. An example of system configuration for station-level processes is given. Typical pre-welding tasks such as robot planning etc. are performed in the IWS and it is necessary to control, monitor and control the welding process. The integration of multiple station-level IWS through an industrial network improves the free flow of information on the breadth, precision and depth of resource allocation. System-level IWS can take the form of welding production lines, workshops, enterprises, etc. Several system-level IWSs are integrated into the SoS-level industrial Internet, and intelligent cloud platforms are installed. SoS-level IWS provides horizontal, vertical and end-to-end integration and platforms, building an industry ecosystem with potential is realized in processes of openness, synergy and sharing. The next section examines the technologies available to improve

task performance. Next, emerging platform technologies and manufacturing research initiatives are touched upon and the direction of smart welding is examined. Enabling Technologies for IWS Although there are many technologies that enable IWS, this section focuses on sensors and sensors, signal processing and feature extraction, modeling and simulation, decision making, and dedicated to general enabling technologies such as reasoning, machine learning sensors, and sensors. Techniques of analog, digital and image signal sensors are integrated in welding systems for the quantitative description of welding parameters data. Example parameters of the arc welding process depend on the current, voltage, speed of movement, electrode expansion and electrode diameter. The computer vision system is at the entry level, based on a single sensor, it allows segmentation of relevant objects on the scene and extracting the necessary information quickly and accurately, so it processes one frame per millisecond. Regarding the vibration frequency of the welding processes, the results show an adequate distribution and behavior of the frequency spectra as expected. Thus, it can be concluded that the methodology is suitable for the monitoring system. It depends on the application of adequate process in obtaining the frequency of vibration in the technological process. Accordingly, the modeling procedure developed in technological processes is considered as a methodical approach and it is important that any combination of parameters that support penetration is guaranteed. Thus, the model offers a good look and quality seams, creating many opportunities to achieve the desired characteristics. Regarding the uncertainty, the manager made a technical mistake and concluded that it is necessary to work according to the system diagram in order to immediately adapt to the changes in properties during the welding process. Until now, the laws of many technological processes in mechanical engineering have not been sufficiently revealed, the operating parameters have been regulated by empirical methods. Under the influence of the scale factor and other production conditions in factories,

insufficiently studied technology has to be redeveloped. These problems are becoming more and more relevant, because the creation of new technology is associated with the complexity of structures, the use of materials that are difficult to process, and increased requirements for quality, reliability and performance. The most effective continuous technological processes in the manufacturing industry, for example, continuous steel casting, rolling of blanks, bending of spatial blanks from a sheet and coiled line. Continuous processes best suited for automation provide the highest productivity and metal savings. To improve the automation and mechanization of assembly work, which is carried out mainly by hand in extremely laborious and mass production, to improve the construction of parts and the location of machines, to increase the accuracy of processing measurements, to optimize tolerances. and measuring circuits of machines. Automation of certain technological operations will certainly increase productivity and product quality. But the most effective is the complex automation of serially connected technological operations. At the same time, the inaccuracies of the previous operations that could disrupt the work of the machine in the next operation are eliminated, the synchronization of the flow of technological operations is ensured, which eliminates the downtime of the machine. In small production, preparation for production, design and manufacture of equipment, adjustment of equipment, installation, alignment of products, control, transportation and storage are associated with large labor and time costs. Therefore, integrated automation is the most effective in mechanical engineering: the main technological operations are automated together with auxiliary, control and transport operations

## Conclusions

Regarding the geometry of the external system environment of welds where the technological process is performed in welding, this study presents a computer vision system followed by a goal-based intelligent system agent. At the same time, this system allows to control the

width and height of the welding work for the technological process in the short-circuit transfer mode, without the need for a predetermined model in the special welding process. We concluded that the inference method used in the controller does not represent it and is a technological mathematical model of the process, but it can increase or decrease the values of the control variable by the appropriate percentage depending on the errors between the controlled signals. reference values for each geometric parameter. In addition, sensor fusion and real-time short-circuit transfer regularity index control help to correct instabilities in technological processes.

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