ТЕХНІЧНІ НАУКИ

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AUTOMATIC MANIPULATOR ROBOTIC ARM

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Robot is universal automatic machine that allows performing mechanical actions. Its principal feature is the rapid operational reorganization from one operation to another. There are several varieties of robots and for each of them there is a definition. Most often talk about three generations of robots: industrial robots, adaptive robots and robots with artificial intelligence or as they used to say – integral robots. The use of modern industrial robots increases the productivity of equipment and production, improves the quality of products, replace people in monotonous and hard work, help to save materials and energy. In addition, they have sufficient flexibility for their use for the production of medium and small lots, that is, in an area where traditional automation tools are not used. Small-scale production has a large market.
Keywords: robot, manipulation arm, automatic machine.

Introduction. Industrial robot – designed for performing motor and control functions in the production process, a manipulation robot, i.e., an automatic device consisting of a manipulator and a reprogrammable control device that generates control actions specifying the required movements of the manipulator's executive bodies. It is used for moving objects of production and performing various technological operations.

In the literature in Ukraine, the following definition of an industrial robot, taken from GOST 25686-85, was distributed: it is "an automatic machine, stationary or mobile, consisting of an actuator in the form of a manipulator having several degrees of mobility and a reprogrammable program control device to perform motor and control functions in the production process". In industry, however, along with manipulation robots that have received the greatest distribution, mobile (locomotive), information, information-control, complex and other types of industrial robots are also used.

It is economically advantageous to use industrial robots together with other means of production automation (automatic lines, sections and complexes).

Research objectives and methodology. Manipulators in factories have been used since the middle of the 20th century. These devices are an automated mechanism, equipped with a special distinctive tool – the so-called "arm" of the manipulator. This "hand" also serves as the main operating body for various purposes. If it is a robot for welding, the manipulator arm performs welding operations, if the robot-stacker, the hand serves for stacking and packaging products. Naturally, the principle of the manipulator depends on its programming and equipment.

The bases of manipulators are spatial mechanisms with many degrees of freedom. Manipulators perform work in environments that are inaccessible or dangerous to humans (underwater depths, vacuum, radioactive environments and other corrosive environments), auxiliary work in industrial production. Manipulators are used in medical technology (for example, in prosthetics). Manipulators study the theory of manipulators, which is a division of the theory of machines and mechanisms. In the narrow sense, a manipulator is a mechanical arm.

Manipulators are divided into human-controlled and automatic manipulators (robot manipulators as a kind of robots). The development of manipulators led to the creation of industrial robots. The design of mechanisms-manipulators requires the solution of such problems as the creation of maneuverability, stability in work, the choice of the correct ratio of useful and idle moves. Sometimes it is required to design such systems in which the operator feels the effort created on the working organ or on the load gripper.

The introduction of manipulation robot complexes into the educational process is also considered.

The main purpose of this study is to provide valuable information on the effective design of automatic manipulator robotic arm for automatic assembly. The study includes the **Solidworks 3D** program to create automatic manipulator robotic arm.

As shown by the economic studies, up to 25% of the total production time is spent on assembly operations. Assembly robots manipulators are basically 6-axis devices with 6 degrees of freedom, which are driven by a servo system.

Assembly robots are one of the best mechanisms for automated assembly. They are available in the industrial automation market at an average price of $ 2,000. Robots offer high-quality assembly of products, raising labor productivity by 10-20% and reducing the marriage by 30-40%. The greatest effect from the use of assembly robots is achieved with full automation of the entire production line.

Proposed automatic manipulator robotic arm

Carrying capacity: 5.0-16.0 kg

Working area: 1.5 m, 1.8 m

Mounting options: floor, ceiling

Instead of gripping devices, the manipulator can be equipped with a working tool. This can be a spray gun, a welding head, a screwdriver, etc.

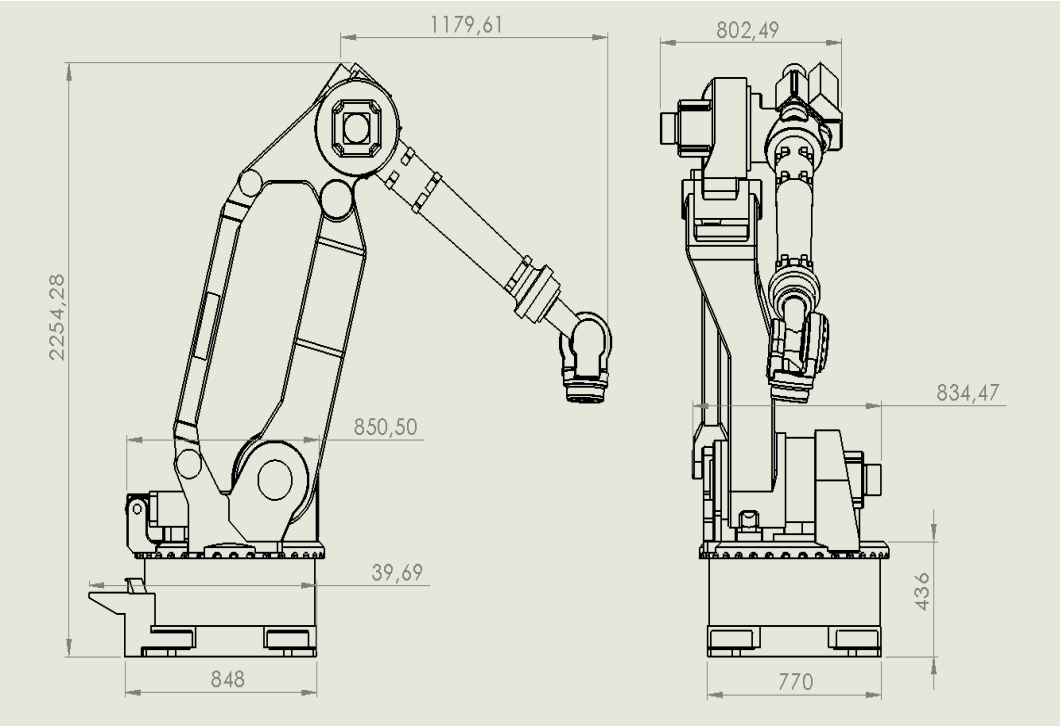

Figure 1. Automatic manipulator robotic arm

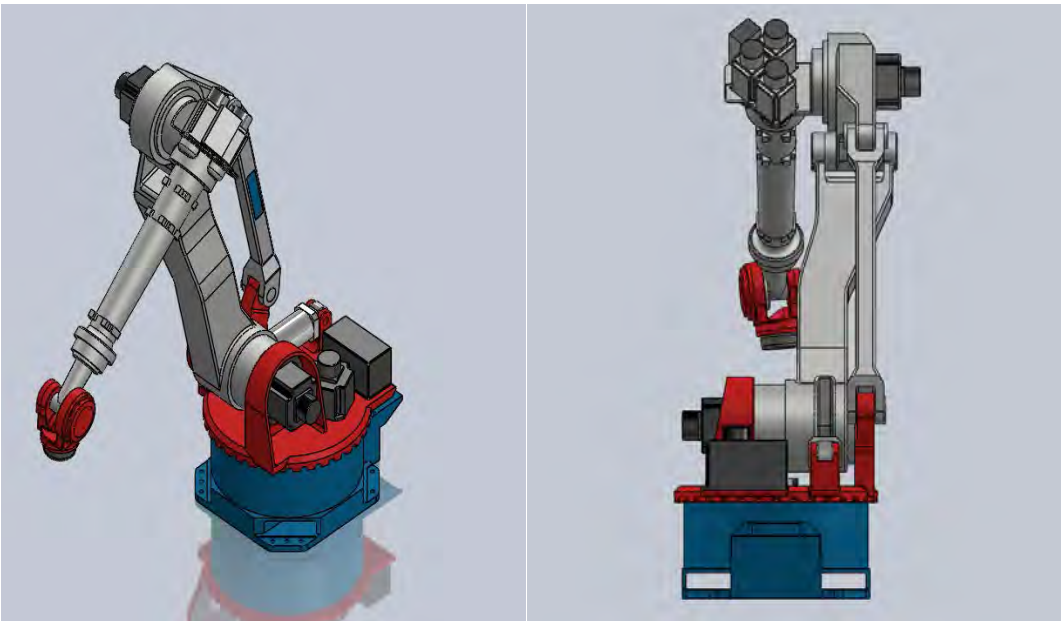

Figure 2. Automatic manipulator robotic arm (3D model)

Figure 2-3 shows proposed design as to create a transfer device design to compare to other devices.

Principle of operation

Industrial robots are a fully mechanized and automatic device consisting of a manipulator and a control system. This system reprograms. In addition, you can change the trajectory, set other necessary parameters.

What can such machines do? First, various technological operations, for example, welding, assembly or painting. Secondly, various auxiliary technological operations – unloading or loading of equipment and other working elements. To increase economic benefits, many firms use industrial robots along with other automatic devices.

Management of them can be of the following types:

1. Using the program. This method is the simplest. Industrial robots do not have a sensor part, its actions are completely fixed and constantly repeated.

2. Adaptive. In this case, there is a sensory device, and the transmitted signals are analyzed, and then some action is taken.

3. The method of a kind of artificial intelligence.

4. Acts at the expense of managing a person at a distance.

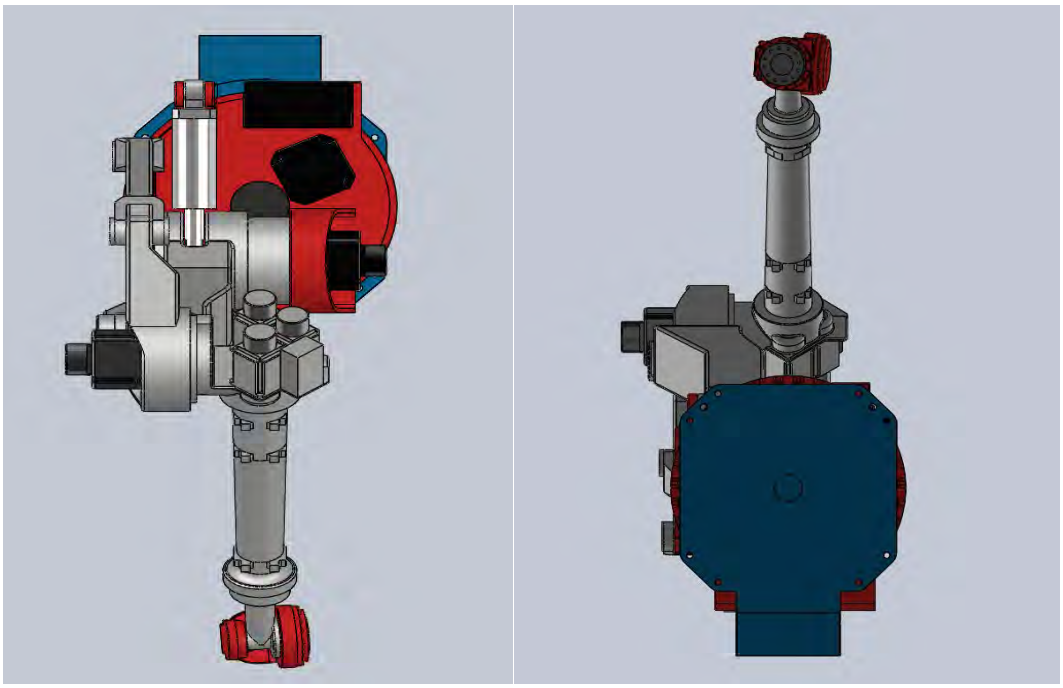

Figure 3. Automatic manipulator robotic arm (3D model)

Robots operate on the principle of subordinate control. The above-described machines are used in industry. They can perform major and secondary activities. But the most common actions for robots are unloading or loading, laying or sorting parts, transporting them, moving objects from one place to another, spot welding and welding seams, assembling mechanical or electrical parts, and electronic painting.

A huge positive point of industrial robots is that they completely exclude the human factor, besides the high accuracy of actions, rational use of the premises.

It is difficult to talk about the price of such cars. It varies from the functionality of the robot and from the manufacturer.

The use of industrial robots is characterized by the fact that:

– It does not require long terms of implementation;

– It does not take much money to transfer an industrial robot from one job to another;

– Provides a low cost of debugging the robot.

Conclusion. Various aspects of the application of industrial robots are considered, as a rule, within the framework of standard industrial projects: based on the available requirements, the optimal variant is selected, in which the type of robots necessary for the task, the number of robots, and the issues of food infrastructure (power lines, feed cooling liquid – in the case of using liquid cooling elements of the tooling) and integration into the production process (provision of preforms / semifinished products and return t of the finished product into an automatic line for the transfer of the next process operation).

Industrial robots in the production process are able to perform basic and auxiliary technological operations.

The main technological operations include operations of direct execution of shaping, changes in the linear dimensions of the billet, etc.

The auxiliary technological operations include transport operations, including operations for loading and unloading technological equipment.

Among the most common actions performed by industrial robots, we can name the following:

– Transfer of materials (transfer of parts and blanks from the machine to the machine or from the conveyor to the conveyor, stacking, working with pallets, packing parts in containers, etc.);

– Maintenance of machine tools and machines (loading and unloading of machines, retention of the workpiece);

– Arc and spot welding;

– Casting (especially injection molding);

– Forging and stamping;

– Spray coating;

– Other processing operations (drilling, milling, riveting, cutting with a water jet, stripping, cleaning, polishing, polishing);

– Assembly of mechanical, electrical and electronic components;

– Quality control of products, etc.

The use of robots in industrial production has a number of advantages, in particular:

– Increase in labor productivity (since it opens the possibility of using technological equipment in three or four shifts and 365 days a year);

– Reduction of production costs and increased competitiveness;

– Rational use of equipment and production facilities;

– Improving the quality of products associated with improving the accuracy of technological operations;

– The elimination of the human factor influence on conveyor production, as well as in the performance of monotonous works requiring high accuracy;

– The elimination of the impact on the personnel of harmful factors characteristic of industries with increased risk;

– Decrease in the payback period of investments.

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АВТОМАТИЧНА МАНІПУЛЯЦІЙНА РУКА

Анотація
Робот – це універсальний автомат, що дозволяє виконувати механічні дії. Його принциповою особливістю є швидка оперативна перебудова з одної виконуваної операції на іншу. Існує кілька різновидів роботів і для кожного з них є своє визначення. Найчастіше говорять про трьох поколіннях роботів: промислових роботів, адаптивних роботах і роботах зі штучним інтелектом або як говорили раніше – інтегральних роботах. Застосування сучасних промислових роботів збільшує продуктивність обладнання і випуск продукції, поліпшує якість продукції, замінює людини на монотонних і важких роботах, допомагає економити матеріали і енергію. Крім того, вони володіють достатньою гнучкістю, щоб використовувати їх при випуску продукції середніми і малими партіями, тобто в тій області, де традиційні засоби автоматизації незастосовні. Дрібносерійна продукція має великий ринок.
Ключові слова: робот, маніпуляційна рука, універсальний автомат.

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АВТОМАТИЧЕСКАЯ МАНИПУЛЯЦИОННАЯ РУКА

Аннотация
Робот – это универсальный автомат, позволяющий выполнять механические действия. Его принципиальной особенностью является быстрая оперативная перестройка с одной выполняемой операции на другую. Существует несколько разновидностей роботов и для каждого из них имеется своё определение. Чаще всего говорят о трёх поколениях роботов: промышленных роботах, адаптивных роботах и роботах с искусственным интеллектом или как говорили раньше – интегральных роботах. Применение современных промышленных роботов увеличивает производительность оборудования и выпуск продукции, улучшает качество продукции, заменяет человека на монотонных и тяжелых работах, помогает экономить материалы и энергию. Кроме того, они обладают достаточной гибкостью, чтобы использовать их при выпуске продукции средними и малыми партиями, т. е. в той области, где традиционные средства автоматизации неприменимы. Мелкосерийная продукция имеет большой рынок.
Ключевые слова: робот, манипуляционная рука, универсальный автомат.