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HISTORY OF THE DEVELOPMENT OF ROBOTICS

Abstract. Robotics, as an interdisciplinary branch of science and technology, is associated with a variety of computer-controlled electromechanical structures designed for a variety of applications. A decade ago, robotics was a graduate-level research area in engineering and computer science offered by only a few major engineering institutes. It has now become an engineering discipline in its own right, with a small but growing number of universities offering an engineering bachelor's degree in robotics.

Keywords: robotics; mechanisms; programs; manipulators; android; nanorobots.

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ИСТОРИЯ РАЗВИТИЯ РОБОТОТЕХНИКИ

Аннотация. Робототехника как междисциплинарная отрасль науки и техники связана с множеством управляемых компьютером электромеханических конструкций, предназначенных для множества приложений. Десять лет назад робототехника была областью исследований в области инженерии и информатики, которую предлагали только несколько крупных инженерных институтов. Теперь это самостоятельная инженерная дисциплина, и небольшое, но постоянно растущее число университетов предлагает степень бакалавра инженерных наук в области робототехники.

Ключевые слова: робототехника; механизмы; программы; манипуляторы; андроид; нанороботы.

People have always sought to improve their lives and increase their opportunities. Therefore, people dreamed of inventing various tools, mechanisms, machines in order to facilitate their work, improve quality and productivity. Moreover, these dreams appeared long before society received the first ideas about the exact sciences.

Robotics is a natural logical continuation of technology as a phenomenon. Now robots are gradually displacing a person from many areas of his activity, providing in return all new opportunities for efforts: watching movies, underwater diving, computer games, etc. Part of the universal labor spent by humanity on the production of means of production, and not the final product of consumption, is gradually increasing from 0%, obviously striving for 100%.

Robotics today is an intensively developing scientific and technical discipline that studies both the theory, methods of calculation and design of robots, their systems and elements, and the problems of complex automation of production (Already now the efforts of most of the best modern robots are aimed at the production of other machines: machine tools, cars, computers) and scientific research using robots. The subject of robotics is the creation and application of robots, other means of robotics and technical systems and complexes based on them for various purposes.

Robotics is an area with already huge economic impact, which has produced and will continue to produce several new products and markets. These markets require an engineering workforce educated and qualified to contribute effectively to robotics. Robotics has evolved from several different engineering disciplines and sciences. This requires a systematic approach to integrating concepts from the fields of mechanics, electrical engineering, computer engineering, software development and computer science.

While robotic manipulators used in manufacturing still represent the largest population of robots in the modern world, an increasing number of applications require various types of robots, including unmanned aerial vehicles, commonly called drones, unmanned underwater vehicles, unmanned ground vehicles, several types of biomimetic robots, including humanoid robots, as well as micro-robots and nanorobots, which are expected to have several applications, including in the healthcare sector, and these are just some of them. The automotive industry is currently in the final stages of development for the upcoming commercialization of driverless cars, which creates an urgent need to expand knowledge in the field of automatic and autonomous mechanisms and processes.

Robot is an indefinite concept to which any kind of machine can be attributed; the term is usually used for artistic effect or means that certain manipulative mechanisms are used in the machine, allowing the machine to manipulate (control) objects. An important property of robots is a certain degree of autonomy.

An android is a humanoid robot, i.e. an anthropomorphic, human-imitating machine that seeks to replace a person in any of his activities. An android must look and behave like a human.

Robotics is an applied science engaged in the development of automated technical systems. Robotics relies on such disciplines as electronics, mechanics, programming. There are construction, industrial, household, aviation and extreme (military, space, underwater) robotics.

Automation and robotization of production in the capitalist world began in the 50s of the XX century. It was at that time that the appearance of the first industrial robots can be attributed. They carried out the assembly of equipment, and the simplest monotonous operations.

The first such robot was developed by self-taught inventor George Devol in 1954. The robot arm weighed two tons and was controlled by a program recorded on a magnetic drum. The system

was named Unimate, a patent was issued for a new device, and in 1961 the inventor founded the company Unimation.

The first robot was installed at the General Motors plant (at the foundry site) in 1961. Then the novelty was tested by Chrysler and Ford plants,

The Unimate system was used to work with cast metal parts that the manipulator extracted from the casting molds. The gripping device was controlled by a hydraulic drive. The robot had 5 degrees of freedom and a gripping device with two “fingers”. The accuracy of the work was very high up to 1.25 mm. And he was more efficient than a person - he worked faster and with less marriage.

In 1967, industrial manipulators came to Europe. They are already expanding their functionality, mastering the professions of welder, painter. The robot gets "technical vision" through video cameras and sensors, it learns to determine the dimensions of products and their location.

In 1982, IBM developed an official language for programming robotic systems. In 1984, Adept introduced the first Scara robot with an electric drive. The new design made the robots simpler and more reliable, while maintaining high speed.

In the 90s, a controller with an intuitive control interface appeared, which the operator could control, he could change parameters and adjust the operating mode. Since then, the control capabilities of robots and their functions have only developed, their complexity, speed, and number of axes have increased, various materials have been used, development and management capabilities have become wider, and several first confident steps towards artificial intelligence have been made.

At the same time, in the USSR, he was actually a leader in robotics. It all started back in the 30s. In 1936, a 16-year-old Soviet schoolboy Vadim Matskevich created a robot that could raise his right hand. To do this, he spent 2 years working in the lathes of the Novocherkassk Polytechnic. Earlier, at the age of 12, he created a small radio-controlled armored car that fired fireworks. The authorities paid attention to the “robot” Matskevich and in 1937 he represented him at the 1937 World Exhibition in Paris.

At the turn of the 30–40s of the XX century. automatic lines for processing bearing parts also appeared in the USSR, and at the end of the 40s of the XX century. for the first time in world practice, a complex production of pistons for tractor engines was created with automation of all processes – from loading raw materials to packaging finished products.

In 1966, a manipulator for laying metal sheets was invented in Voronezh, in 1968, an underwater robot “Manta” with a sensitive gripping device was developed in Leningrad – later it was improved.

In 1985, 40 thousand industrial robots were already used and several times exceeded the number used in the USA. Automated lines worked hard at AVTOVAZ in the 80s and were even attacked by “hacker” workers.

There were major military and space developments. A unique achievement at that time was the unmanned reconnaissance DBR-1, which was adopted by the USSR Air Force back in 1964. Such a device could perform reconnaissance missions over the entire territory of Western and Central Europe.

One of the most notable achievements of Soviet robotics and science was the creation of a design bureau named after Lavochkin's “Lunokhod-1”. It was the Soviet spacecraft that became the world's first planetary rover that successfully completed its mission on the surface of another celestial body.

“Humanoid robots” also developed: in 1962, the first robot guide Rex appeared - he conducted excursions for children at the Polytechnic Museum. They say he still “works” there.

More than 100 thousand units of industrial robotics were produced in the Soviet Union. They replaced more than one million workers, but in the 90s these robots disappeared.

In the future, the development of robotics is progressing at a rapid pace, because key industries are developing – physics, chemistry, electrical engineering and, most importantly, electronics. Vacuum tubes were replaced by power electronics, later microchips, then microcontrollers. There are new materials, new ways of automation and programming methods.

First of all, development is taking place in the USA, in Southeast Asia and Western Europe.

Controlled robotic lines are being introduced in production facilities, robotic manipulators are used in all industries, in agriculture, medicine, in space and, of course, in everyday life.

In some industries, up to 50% of the work is done by industrial robots, for example, in the automotive industry, they can weld, paint, and move parts to another assembly site, where other robots will take care of them.

There are even 100% automated factories. There is a factory in Japan where robots assemble robots themselves. And they even prepare food for 2,000 people – the office center that serves this plant.

In the 90s, there was some decline. The introduction of robots using existing technologies at that time did not bring the expected profit to production and the financing of some large-scale projects was suspended. For a number of reasons – both economic and social – the expected boom did not happen, they remained as niche products for car assembly and a number of other industries.

A sharp jump occurred only in the mid-noughties and this development continues. First of all, because the military became interested in robotics.

It is already impossible to stop development, and all countries wishing to be at the forefront of global industry have to accept and catch up.

Robot design and robotics tasks

There are six general tasks of robotics:

1. Moving – moving in any environment
2. Orientation – be aware of your location
3. Manipulation – freely manipulate objects of the environment
4. Interaction – contact with your own kind
5. Communication – communicate freely with a person
6. Artificial intelligence – a robot must independently decide how to execute a human command

The most optimal movement of the robot on wheels and a tracked platform. It is these methods that provide the greatest stability and patency.

It is more difficult for wheeled platforms with cross-country ability – the wheel cannot overcome an obstacle higher than its radius. Wheel schemes are constantly being improved, powerful servomotors are used, independent suspensions are being developed, tires with ground hooks are used.

Four-legged and insectomorphic robots are stable (this means in the form of insects, several “legs”, usually 6) Such devices are often used for military purposes.

The robot learned to walk on two legs for a very long time. Of all the existing ones, only the humanoid ASIMO from Honda copes well with this, he can not only walk steadily, but also climb the steps, the company has been developing it for more than 25 years.

Most of the humanoid robots are still moving on the platform.

In addition to walking on the ground, certain models can crawl, swim and fly.

The robot is oriented in space with the help of sensors, sensors, video cameras, has the ability to “see” in the infrared range, detect ultrasonic vibrations and perceive thermal radiation.

The operator can also control, he can be in the same room or several kilometers away.

The main tasks of robotics are being solved in one way or another. The robot becomes more perfect, it knows how to cooperate with other robots, learns to communicate with a person and understand him better.

An interesting training scheme for a space robot satellite, probably the same principle is used to configure other robotic systems. “Emotional learning”, as the developers call it. Its essence is that it lays the “apparatus of emotions”, which tells the satellite what is “good” for him and what is “bad”. Good - if it targets a specific specified object – it increases the score, bad –if it deviates from it – the score will be reduced. Well, so long as the device does not become a stable “good”.

For example, it can be useful for space telescopes. The training is conducted with the help of an operator and takes about 20 minutes, the result is displayed in the knowledge base.

Specifically, this described device can be thrown into outer space by an astronaut: the satellite will perform the rest of the actions itself.

Robotics of the future can independently collect new knowledge, analyze it and put it into practice.