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The development of mechatronization - artificial intelligence, drives and power sources

Abstract

In the development of previously published articles on mechatronization, the article 2–2018 “Mechatronization” and the article 3–2018 “New Paradigm” in the journals "Electronnyi Innovatsionnyi Vestnik" №2 and "Electronnyi Innovatsionnyi Vestnik" №3, this article focuses on **the dual task of mechatronization**, the need for early understanding of the significance of mechatronization, the beauty of mechatronization. The issues of degree of mechatronization are considered, in conjunction with the level of development of artificial intelligence, the problems of development of mechatronization are specially noted, the concept of development of mechatronization is introduced.

Keywords: mechatronization, **the degree of mechatronization, mechatro-drives,** the development of mechatronization, artificial intelligence (AI), artificial intelligence system (AIS), artificial intelligence space, artificial superintelligence (ASI), super energy sources.

Introduction

In the absence of understanding the new direction of scientific and technical progress - mechatronization, in the absence of understanding the basic dual purpose of mechatronization - the liberation of humanity from dependence on its habitat and the preservation of this habitat, people have achieved tremendous "success" in the destruction of natural resources, in the pollution of environment of the planet, climate change and the devastation of non-renewable natural resources.

The Earth is a mechatronic system in the overall complex mechatronic Solar system and it has its own sophisticated super drives, which combine both the drive and the operating device, such as the ebb and flow of huge water masses when the position of the Moon changes.

The reprogramming of the Earth: the construction of high-rise buildings, the creation of new lakes, canals, water reservoirs, deforestation, controlled by a mechatronic Solar system that scans the surface and through its drives – the operating devices, trying to change the situation. And no matter how ridiculous and unreal it looks, the Earth responds with earthquakes, tsunamis and floods, abnormal heat and cold.

The Earth seems to be conducting a process of purifying and restoring its strength, natural reserves and solar energy. Negative thoughts, emotions, negative

energy of a person, hate, cruelty, violence are also reflected in nature and the planet reacts and responds to the actions. The process of updating is constantly being carried out by the planet. The planet warns and changes the consciousness of people through its information field.

A man and mankind, as highly advanced mechatronic systems as a whole and each separately, based on the philosophy of mechatronization, must urgently find a common language with the planet Earth in the performance of the dual task of mechatronization.

Formulation of the problem

This article is devoted to the development of mechatronization.

The objective of the article is to show, based on the study of concepts and the study of changes in constructive principles, that the degree of mechatronization will be determined by the level of development of artificial intelligence.

The rates of mechatronization, the development of mechatronization technologies and, as a consequence, the development of society are constantly increasing. Proceeding from the tasks of mechatronization - the liberation of humanity from dependence in relation to its habitat and the preservation of this habitat, artificial intelligence (AI) is of particular interest today. In 1956 John McCarthy introduced the term "artificial intelligence" and the first launch of an artificial intelligence program was made at Carnegie Mellon University.

Description of the research

Artificial intelligence is not magic or science fiction, but a fusion of methods of science, technology and mathematics.

Artificial intelligence with perfect drives and an operating device forms an artificial intelligence system (AIS). Autonomous actions of artificial intelligence systems, especially so-called counter autonomous actions (when an artificial intelligence system that has undergone testing learns, draws conclusions from what happened and chooses the solution itself how to withstand the tests) make the artificial intelligence system more intelligent and increase its capabilities. And each time artificial intelligence in the composition of these systems is being transformed into artificial superintelligence (ASI).

But it immediately raises the question of how AI-systems should behave today and in the future. They should help a person to make better decisions faster or to allow a person to be excluded from the sphere of decision making.

The experience of mastering cyberspace suggests that success is achieved due to the speed of information processing. In this regard, a person becomes a weak and slow link in the decision-making chain and, accordingly, there will always be a temptation to create a completely autonomous system and over time a fully

intellectualized system based on artificial intelligence community – an autonomous artificial intelligence space.

In conjunction with the perfect (advanced by himself) motion drives and the possibility in their artificial intelligence space to have their super source of energy, society will receive an element of development with the highest degree of mechatronization.

It is important that contact with the AI will not be lost. It is impossible to deprive it of drives, it is not in the interests of man, the AI must be improved, i.e. it needs to provide movement or move itself — the basis of mechatronization.

The study of concepts shows that the **degree of mechatronization** will depend not on **the level of functional microelectronics**, but on the level of development of artificial intelligence.

Presumably, there are the following main categories of artificial intelligence:

• **Limited artificial intelligence** (ANI, Artificial Narrow Intelligence). It is artificial intelligence specializing in one particular area.

So far artificial intelligence can solve only individual problems: for example, playing a game of chess, recognizing a speech, finding an image or drawing it. It can ensure the functioning of smart homes, analyzing the preferences of residents, adjusting environmental factors to the usual and comfortable (temperature, lighting, maintaining humidity level, noise reduction, etc.). Making changes to the program leads to a change in its structure. Modification is not quick and easy.

Systems of narrow artificial intelligence pose no threat to humans. In the worst case, a failure in such a system can cause local concern such as a power surge.

The transition from limited artificial intelligence to general artificial intelligence is very complex: skills that seem simple to humans, because they have developed over millions of years of evolution, are complex for artificial intelligence. When you kick with a foot to hit the ball, your muscles, ligaments, bones and eyes perform a whole series of operations that are consistent with the goal.

Computers should have the same thinking abilities as a person. One way to achieve this is to increase the number of operations per second.

• **General artificial intelligence** (AGI, Artificial General Intelligence). Such AI is a computer whose intellect resembles a human, that is, it can perform all the same tasks as a person: substantiate, plan, solve problems, think abstractly, compare complex ideas, learn quickly, use accumulated experience.

In mechatronization, artificial general intelligence technologies are widely used as a part of intelligent robots, which play an important role in the rehabilitation of patients with various injuries and diseases. Communicating with artificial

intelligence - voice assistant through gadgets, photo editing apps, we carry out its in-depth training.

The emergence of a double neuro-module, which has provided gadgets with new intelligent functions that control power consumption, connection to networks, security and other components of the operating system, allows them to understand for themselves what tasks they need to spend a large amount of power and in what cases to save energy and reduce the energy consumption of source. For example, the smart function of clock frequency adjustment allows you to instantly improve the performance of graphics module. The speed of image recognition has doubled, compared with the previous generation of processors - from 6 to 12 seconds.

A program with artificial intelligence can absorb new modifications, sorting highly independent pieces of information into one. Therefore, it is possible to change pieces of information from the program without affecting the structure of the program itself. The modification is quick and easy.

The improvement of general artificial intelligence and its transformation into artificial superintelligence goes in two directions:

- Scientists are working on the so-called reverse engineering of the human brain. This work will be completed by 2030, and we will learn all the secrets of our brain. An example of such a system is an artificial neural network.

- Imitation of human brain functions. In the course of this experiment, it is planned to divide the brain into many subtlest layers and scan each of them. Then using a special program, it will be necessary to create a 3D model, and then embed it in a powerful computer. After that, we will get a device that will officially have all the functions of the human brain. All that remains for us to do is to collect information and learn.

• **Artificial Superintelligence (ASI).** A superintelligence is a phenomenon that we can't even partially understand. In our view, an intelligent person has an IQ of 130, while a stupid person has less than 85, and an artificial intelligence will have, approximately, an IQ of 12952.

The development of artificial intelligence and the development of mechatronization will complement each other, the development of one will push the development of the other.

The development of mechatronization is understood as the improvement of drives and operating devices, energy sources and their synchronization with the development of artificial intelligence.

In the course of the development and improvement of mechatronization, and linking its development with the development of artificial intelligence, mechatronization problems arise through artificial intelligence, which as the development progresses it will be necessary for the community to solve. They are:

• control over artificial intelligence systems;

• protection against hacker attacks;

• decision making in an emergency;

• mistakes and responsibility for mistakes of artificial intelligence system;

• ways to synchronize artificial intelligence systems.

Based on the fact that mechatronization is an intellectualized movement, the movement of the operating device which takes many forms, people will be forced to improve **motion drives,** and taking into account the basic law of mechatronization (the most efficient movement with a minimum expenditure of energy), as well to improve **energy sources**.

It is possible to control the amount of energy and, if necessary, limit the amount of energy with a certain condition of obedience to AI up to a certain point in the development of artificial intelligence.

Energy sources

Modern li-ion batteries are very reliable and safe, capable of withstanding a large number of charge and discharge cycles. They have a minimal memory effect and a relatively low weight. Due to such properties, li-ion batteries are widely used in many devices.

They can be used as rechargeable batteries, in the form of batteries for household appliances, as well as a highly efficient traction source of electric power. Nowadays such devices have several disadvantages: high cost; do not like deep discharges; may refuse at low temperatures; lose capacity when they get overheated.

As more advanced analogs, you can use lithium polymer or lithium - titanate batteries with a large number of charge - discharge cycles. They have a minimal memory effect and a relatively low weight, a high capacity and a high voltage.

A powerful accelerator of mechatronization development is the successful development of the peaceful atom energy. People relatively recently managed to successfully direct it for themselves. The main quality of radiation technologies is universality, the possibility of application in almost all areas of development and areas of human existence.

Now, when a man faces the question of transition to the second stage of independence from the environment - dependence on the Earth, and then the third stage - independence from the environment - dependence on the Sun, the peaceful atom opens up unlimited possibilities. Radiation properties are incredible. With the help of radiation, you can create a space engine capable of carrying the space research apparatus to the planets and other celestial bodies of the Solar System, and,

in the future, to the distant stars in our Milky Way, solve the riddles of human civilization and even preserve the fragile life on planet Earth.

Inspection and control systems of airports, railway stations, subways, stadiums and, in general, places of mass gathering of people are based on the properties of X-rays (already known to us), capable of seeing hidden elements.

Contactless scanning systems, based on radiation technologies, are permitted by the World Health Organization as completely safe, including for children and animals.

MagRay baggage scanning technology, based on a combination of radiography and nuclear magnetic resonance, has been developed. The technique makes it possible to distinguish hazardous substances from safe ones and eliminates the need to remove a laptop or phone from baggage, St. Petersburg Scientific-Technical Center RATEC has developed a baggage screening system in which thermal neutrons help determine the chemical composition of an object. So you can detect explosives, poisons and drugs without opening the suitcase. The screen displays not a picture, but a table with information on the content of chemicals in the inspected object.

The energy of peaceful atom is the best helper in space.

Without the use of radiation technologies, it is impossible to imagine the existing and future world space programs. Back in Soviet times, the compact nuclear power installations “Buk” and “Topaz” provided power supply for the onboard space equipment of various spacecrafts.

The heat generated by radioactive decay has also been applied. The Soviet "Lunokhods" during their travel on the natural satellite of the Earth were heated precisely by a radioisotope heat source based on the isotope polonium-210.

NASA Curiosity Mars Rover is equipped with a nuclear battery that retains heat inside the device and provides it with energy for movement. A neutron generator is also installed on it, created by Rosatom specialists. This device confirmed the presence of water on Mars.

The principle of operation of the equipment is based on the irradiation of the surface with a stream of neutrons, emitted by a neutron generator. And the reflected (so-called secondary) radiation from the object is captured by the detector. The resulting data is then processed by a computer.

The heat released as a result of radioactive decay can also be converted into electrical energy. Thus, the famous RTGs (radioisotope thermoelectric generators) appeared – stable and durable sources of electric power, capable of operating in conditions of space cold and high radiation fields of giant planets.

American spacecraft Pioneer-10 and Pioneer-11, Voyager-1 and Voyager-2, Galileo, Ulysses, Cassini, as well as descendable probes of the first and second

"Vikings" were equipped with a radioisotope "heart"- RTG, based on plutonium-238 radionuclide. These unique devices have completed the most important tasks in the study of the Solar System. Some of them still work. For example, today Voyager-1 has reached the limits of the Solar System and continues to function reliably. This is the first spacecraft in the history of mankind, which transmitted signals from interstellar space.

The mastery of outer space is one of the main tasks of mechatronization. Obviously, in the study of deep space, those places where starlight can no longer be used to produce electricity with photocells, radioisotope energy sources will become indispensable.

The world community is working on the creation of a fusion power plant. Humanity will get a cheap, very reliable and almost endless **super source of energy.**

Nanotechnology charger

Nanotechology will play a significant role in the development of mechatronization.

Nanotechnology will allow to create a new source of energy – "nanogenerator". The technology is based on the use of a piezoelectric material that generates electricity while in a state of mechanical stress. The material is endowed with nanoscopic pores, which turn it into a flexible sponge.

Such a “nanogenerator” works like a sponge, it only absorbs kinetic energy from the environment and sends it directly to the smartphone, the dashboard of each car. In addition, the technology has the potential to be used on a larger scale, for example, in industrial equipment.

Mechatro-drives

At this stage of development of mechatronization, humanity cannot create drives of a cosmic level, which ensure the ebb and flow of the Earth, the rotation of the Earth around its axis and around the Sun. It could only provide flights of satellites, mechatronic systems, in a geocentric orbit and other orbits with orbit correction from time to time, but the pace of development of mechatronization allows us to conclude that space drives are not far away.

Nanotechnologies make a significant contribution to the improvement of mechatronics.

Nanobots – robots created from nanomaterials, which are comparable in size to the molecule, with the functions of movement, processing and transmission of information, execution of programs. Nanobots are replicators capable of making their own copies.

Currently, there are already electromechanical nanodevices capable of having a movement, which can be considered prototypes of nanorobots.

Molecular rotors are synthetic nanoscale engines capable of generating torque when a sufficient amount of energy is applied to them.

The use of mechatronic drives, multifunctional sensors with high static, dynamic and frequency characteristics, the values of input and output signals allowed mechatronic systems to significantly press traditional means of automation. The main advantages of mechatronic systems include: relatively low cost due to the high degree of integration, unification and standardization of all elements and interfaces; high quality of implementation of complex and accurate movements due to the application of intelligent control methods; high reliability, durability and noise immunity; constructive compactness of modules right up to miniaturization.

Specialists in the field of mechatronization are constantly working on the creation of a wide variety of actuators controlled by artificial intelligence based on effects and phenomena known in nature.

In recent years, actuators based on piezoelectric transducers (PET) have become widespread in mechatronization.

In this class of actuators, as an electromechanical transducer, piezoelectric ceramics are used, which are able to deform when the electric potential changes (the mode of reverse piezoelectric effect) and can also generate electric potential on their surfaces when deformed by an external force (the mode of direct piezoelectric effect).

Unlike traditional electromagnetic converters, which are based on the change of the electromagnetic field, an electric field is used in PET, which significantly increases the reliability and noise immunity of the actuators under external perturbing electromagnetic fields.

Conclusion

As a result of studies of the totality of new scientific and technical concepts, defining specific research and development, it can be concluded that the development of mechatronization, **the degree of mechatronization** will be comprehensively associated with the use of artificial intelligence.

The degree of mechanization is related to the level of development of artificial intelligence used in the mechatronic system.

Drives and energy sources will correspond to the intelligence of this degree of mechatronization.

Three degrees of mechatronization are proposed:

1) Limited – ANI - mechatronization;
2) General – AGI - mechatronization;

3) Super – ASI - mechatronization

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