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Mechatronization

Abstract

The article deals with the concept of mechatronization, the problems of mechatronization were formulated. In the article the concept of the philosophy of mechatronization is introduced and general characteristics of mechatronization directions are given.

Key words: **mechatronization, mechatronics, holism, emergence, zenith, nadir, automation, cybernetics, synergetics, bionics, bionisation, reductionism, ideal space, sensitization, intellectualized movement, self-optimizing, semantic memory, machines with parallel kinematics, 3D printer**

Introduction

The 20th century was the century of cybernetics and automation. **Cybernetics**, as a science, introduced the term "feedback" into society as well as the general patterns of getting, storage, transformation and transmission of information in complex control systems. The direction of scientific and technological progress appeared side by side with it - automation. We can't probably say that these are two sisters of progress, rather, it is the mother and daughter. The use of the mathematical methods for modeling and self-regulatory technical means allowed automation reduce the degree of human participation in the operations people performed and the laboriousness of operations as much as possible . The term "automation" was widely used after Ford had established the department of automation in 1947.

The 21st century is the century of mechanization. Cybernetics and automation is the basis of it. The science for the development of a new direction of scientific and technical progress is mechatronics at the current stage, but its interaction with other sciences will be accompanied by a mutual penetration of some properties in others, as a result of it they will change each other in the context of mechatronization. It is a science and engineering based on the synergetic integration of nodes in precision mechanics (also "fine mechanics") with an electronic, electrotechnical and computer components.

Electrotechnical. This includes mechanical links, gears, motors, working body, additional electrotechnical elements, sensors. All components are used to provide the necessary movements. Sensors have particular importance for the correct performance of targets. They collect the data on the status of the work object and external environment, directly mechatronic device and its components.

Electronic. This includes microelectronic devices, power transforms and measuring circuits.

Computer components. This includes microcontrollers and high-end electronic computers.

Formulation of the problem

This article is devoted to a new stage in the development of mankind, from automation to mechatronization.

The task of the article is to show the relevance of the topic of mechatronization as direction of scientific and technical progress.

The task of mechatronization is the liberation of mankind from dependence of its habitat and preservation of this habitat. It is one of the main tasks of evolution. **Description of the research**

Mechatronization is an intellectualized movement of matter of time and space in an innumerable set of forms, objects and systems.

Mechatronization is the tool by means of which the humanities solve, and will be solving its basic task.

A person receives the first stage of independence from the environment from birth. Now the question is in the transition to the second stage of independence on the habitat - the dependence on the Earth, then the third stage of independence from the habitat - dependence on the Sun, then the fourth stage of independence from the habitat - dependence from the Galaxy and the last stage of independence from the habitat - fusion with the universe. On the second stage of independence we already remark how the quantity grows into quality and the basic philosophical postulate of mechatronization - the priority of the whole in relation to its parts.

Philosophy of mechatronization is holism. Holism - the relation of a part and a whole, proceeding from qualitative identity and the priority of the whole in relation to its parts.

The commonly used concept of synergy emanates from the holistic notions. The practical embodiment of the idea of holism is emergence (the notion appeared

in synergetics) that means the appearance in the system of a new systemic quality, that irreducible to the sum of the qualities of the elements of the system.

A clear example of this is an anthill, where each insect is not particularly intelligent separately, but when there are a large number of ants, they can solve complex problems to find food and protect from predators. In essence, the whole is greater than the sum of its parts.

Mechatronization includes automation, robotization, mechatronics and at the initial stage - bionics and other sciences of the future. Mechatronization gives way to the next stage of scientific and technical progress - bionisation. In its essence both of the stages of scientific and technical progress can't exist without intelligence for their development.

It was the century, the millennium of mechatronization and bionisation, the era of the new industrial and social development of society.

The mastering of the universe is at the zenith of mechatronization and the development of the ocean, the earth's crust, the mantle, and the earth's core is at the nadir of mechatronization. The nadir of mechatronization is such a complex direction as the zenith and in many ways it will help to develop the Universe at lower costs.

I'll start from the last stage of independence from the environment - a merger with the Universe.

It doesn't mean to be arriving at the final theory. The idea of final theory in the world of the infinity of space, matter, motion and as a consequence of these components – time is full of contradictions. We don't know the time limitation in past and future. If time is boundless, space is boundless too. The limitation of one kind or another immediately leads to the question: "What is there, beyond the limitation?"

The reductionism could help in developing the final theory if the Universe did not develop and did not perfect itself. The presuming of Steven Weinberg that our Universe is not the only one really desired, but then there is the problem of an ideal space between Universes.

As we can suppose, in ideal space there is no matter (neither light nor dark), there is no movement, which means that there is no time. Is it possible?!

Humanity aspires to understand the laws that our Universe is governed by at all times.

The basis of the Universe or the World is matter. Universal forms of the existence of matter in an infinite change of properties and forms are movement, space and time.

Philosophy defines: matter is uncreatable and indestructible, eternal in time and infinite in space, matter is the substantial basis of all possible properties and forms of motion.

The last stage of mechatronization does not presuppose the control of the Universe by humanity. It includes the independence of man from the environment – the Universe, the ability of a man with the help of highly intellectual mechatronic systems to save themselves in the ever-evolving and self-perfected Universe.

A question may arise: "Why is it from the last stage of mechatronization?" And the answer will be: "To see what stratum of technical perfection mankind needs to overcome".

In particular, unidentified flying objects (UFOs) is nothing else than a holographic image in the terrestrial atmosphere and that's why they move so easily and they cannot be caught up. The UFO itself is located at a sufficiently great distance from the Earth. When the source of waves moves at a distance of some millimeters, UFO will move to tens of thousands kilometers per second. Besides the UFO itself is one of the greatest achievement of the mechatronization.

Use in the mechanization of holography as a method of recording, reproduction and transformation, wave fields based on interference of waves, on registration of an interference pattern, which is formed by waves, reflected by an object, illuminated by a light source (object wave) will allow to expand the possibilities of information technologies, both in space and in the ocean.

Humanity go to its own UFO deliberately: micro drones, unmanned aerial systems much the same as UFO, the use of solar energy in aircraft with a large wingspan, then macrodrons, in shape resembling traditional UFOs, on the upper surface of which will be installed solar converters, and in the form of a plate of UFO. In the future we will not move anywhere from flying objects. In addition, this form will help to avoid catastrophes of flying machines and as result - natural victims.

If you look at the composition of unmanned aircraft systems, it can be seen that this is another achievement of mechanization and it includes: the drone flying apparatus, control station (operator's console, facsimile transceiver, specialized computers based on digital signal processors or computers running operating

systems in the real time), communication system (this may be a direct radio or satellite connection).

The software is usually written in high-level languages, such as C, C++, Modula-2.

Just mechatronization is the basis of all these innovations. Specialized editions often refer to the term "Industry 4.0". As many specialists consider, the possibility of exchanging data of mechatronic systems between each other, the possibility of system manufacturer to monitor the Internet through the implementation of rules for the operation of systems consumers and to anticipate violations, will fundamentally change the traditional industrial production.

The mechatronization of production will radically change the traditional logic of production, as far as each working object will determine itself what kind of work is necessary to perform for production.

Mechatronic systems require their high degree of sensation that is creation of highly sensitive multifunctional sensors. Sensors of various types, such as pressure and temperature sensors, electro-optical and infrared sensors, will function together creating a general picture of what is happening and determining what is happening in their environment.

A large number of sensors will register its encirclement with incredible accuracy, and the built-in processors will integrate various personal data from sensors for identification of complex events and critical conditions and their interpretation on the basis of the current situation and they will take decisions independently, regardless of the central system of production control based on given results.

In mechatronization mechatronic modules based on MEMS technology are used widely. Typical measured parameters mechatronic modules of MEMS technology include movement, speed and acceleration (linear or angular), acting forces and moments. Examples of sensors based on MEMS technology can be accelerometers – acceleration sensors.

MEMS-are technologies that allowed creating intelligent sensors, where the measuring functions of the current parameters of the mechanical motion, their transformation and processing by the given algorithm were united in a single block.

The intellectualization of sensors makes it possible to achieve higher accuracy of measurement, providing filtering of noise, calibration, linearization of input/ output characteristics, compensation for hysteresis, cross links.

Devices for 3D printing by themselves are the achievement of mechatronization. Knowing of the general principles of how a 3D printer works, allows us to talk about the large consumer potential of these devices. Theoretically, with the help of such equipment we can adjust non-waste production. At this stage, its capabilities are evaluated mainly by specialists who use 3D printing in solving their professional tasks.

The program language in printers at this stage is the G-code, built on the commands of printing equipment management. At this stage, you can go to the program slicers, which provide translation of 3D-model for 3D printing in a clear code for controllers. The main tasks of the program slicers are to set the parameters in accordance with which the printing will be carried out. Program selection is determined by the type of printer.

The presence of the ability of mechatronic systems to interact with their environment, plan and adapt their own behavior according to surrounding conditions, learn new models and lines of conduct, and on the basis of active **semantic memory**, respectively, be self-optimizing will allow mechatronization to link the virtual space of the Internet with the real world. These capabilities will ensure the effective release of even the minimum lots with rapid application changes in the output and a large number of options, will contribute to the future environmentally safe production.

By and large, mechatronization is the best choice of the scientific, technical, technological, organizational and economic and informational solutions with the intellectualization of movements. Ensuring the work with obstacles, in reconfigurable systems, when you want to copy the configuration of the circuit in non-deterministic external environments – fires, floods, space, underwater, underground, radioactive and other using mostly non-linear bases of executive movements in the direction of mehatronization.

The intellectualization of movement of mechatronic systems, functioning in a changing and uncertain external environments, require automatic monitoring and diagnostics its state, adaptation and optimization of features in terms of the external environment changing, when there are significant perturbing influences, significant autonomy and flexibility in planning and the performance of movements with minimal human participation.

Only mechatronization can solve questions of the characteristic features of the nonlinearity of basic executive motions of systems of movement. Questions of anisotropy and heterogeneity of dynamic, elastic and speed properties, variability of parameters in nonlinear equations can lead to loss of system controllability in singular positions, complexity of assignments of manipulator movements in generalized coordinates, related to degrees of mobility, performance for spatial along the curvilinear trajectories of movement and realizations of complex laws in time.

Mechatronization allows to create universal machines for many degrees of freedom movement with parallel kinematics.

The modern tendency of constructing machines of a new generation, which consists of the transferring of the functional load from mechanical components to the intellectual (electronic, computer and information) components and can be reprogrammed easily for a new task comes from the holistic notions in mechatronization. Now mechanical devices are increasingly becoming bottleneck in complex machines. The mechatronic approach is not a complement, but a substitution of functions, traditionally performed by mechanical elements of the system in electronic and computer blocks.

The method of electronic reduction also provides with the redistribution of functional load in the direction of increasing the intellectual component, when the executive mechanism monitors the motion of the master device.

Taking into account the increase in the intellectual component, we should keep in mind that the objective functions, tasks of the upper and lower levels of management usually harmonize poorly. This forces us to introduce appropriate adjustments to objective functions of the lower level, without destroying the orderliness of distributed system.

Therefore, one of the functions of the upper-level system should exert an appropriate influence on the lower-level systems that would allow to provide a state in which the mutual interaction between them would be desirable.

The problem of describing of the motion of a multidimensional mechatronic system in mechatronization is divided into two interrelated subtasks: movement in space and time.

The laws of the spatial movement of all links in the mechatronic system are determined by the technological formulation of the problem of motion.

The laws of motion in time of actuators are determined, on the one hand, by desired law of displacement of the working organ, and, on the other hand, kinematics of the multidimensional system.

It does not matter that there is such a physical phenomenon in the Universe as “black holes ", it is important what task the Universe sets before the "black holes", one of its working bodies is in improving itself.

It does not matter that there is a UFO, it is important that if we go in the opposite direction of mechatronization philosophy - holism, then we come to a particular, namely, to a rational being and the question arises: "Where is he from?"

This digression was made in order to convince the readers of the need to study the basics of mechatronics, which will unite many sciences and technical achievements together.

The main principle of mechatronization is the concept of a device for configurable control (control configured vehicle-CCV) ACU-configuration, in which maneuverability is a priority function.

The inhomogeneity of the characteristics (kinematic, velocity, dynamic, elastic) of environment, anisotropy (application of the force vector in a given direction), in which the mechatronic systems work, requires solving of the control task in space and time.

In the case of the apparatus of configurable control, there is a mechanical instability that often turns out to be necessary to ensure the corresponding dynamic characteristics. Stability is achieved thanks to the presence of control loops.

What is being said about the "fourth industrial revolution", in reality is the development of mechanization. Research organizations and the industrial sector are working hard to make Industry 4.0 in a reality.

In The German Research Center for Artificial Intelligence (DFKI) in Kaiserslautern, the first smart production in world has been used for several years as a "live" laboratory. This production is the reference architecture for Industry 4.0 in mechatronization.

An important factor for success of mechanization is the intellectual interpretation of information about the environment. Accordingly, the software plays a main role here.

The feature of software lies in its large inefficiency. With the accumulation of information that needs to be processed, the difficulties associated with the creation of software arise. If a certain volume is exceeded, even unsuccessful circumstances can happen, for the solution of which in most cases it is desirable to use hierarchical structures of software.

But, nevertheless, the choice of decentralization allows to increase the intellectual component of mechatronic systems due to computer distribution, reduce the amount of information transmitted in the system, simplify physical schemes, and one communication channel can used repeatedly.

This provision is embodied in the fact that as languages programming languages began to use structural languages, unified descriptive languages and Internet as a communication platform in the enterprise. Another direction of development was the distribution of software in the functional blocks.

In fact, mechatronization cannot exist without the intellectualization of motion. Modules of motion, mechatronic modules - are a transitional stage of mechatronics, a stage where the new is still weak, and the old hard-relay control system did not want to give up. It is impossible to imagine mechatronization without intellectualization of movement. This is the future.

Conclusion

During the study, the necessity of the introduction of the definition “mechatronization” in the terminology of technical progress is proved.

Even if once the teleportation is confirmed, it will easily mastered in mechatronization as mechatronic technology of intellectual movement.

Why don’t we talk about the academic discipline "Fundamentals of Mechatronization" first, instead of "Fundamentals of Automation" and "Fundamentals of Mechatronics "

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