например: оксистабильные растительные масла. Этот факт особенно актуализирует значимость исследовательских работ в области повышения разработки новых и совершенствования существующих технологий получения оксистабильных композиций растительных масел для функционального питания.

Целью работы являлось провести анализ выбора сырья для решения проблем по созданию конкурентоспособных технологий получения жировых продуктов, обладающих оксистабильными свойствами и функциональными свойствами, предназначенных для систематического употребления различными группами населения, путем комбинирования масличного сырья.

В представленной работе проведен сравнительный анализ жирнокислотного состава и оценка физико-химических показателей растительных масел подсолнечного, кукурузного, соевого, оливкового, рапсового и льняного.

Образцы растительных масел были оценены по органолептическим показателям в соотвествии с требованиями нормативных документов.

Вкус и запах растительных масел был свойственый данному виду. Цвет растительных масел от светло-желтого до насыщенного-золотистого-желтого. Внешний вид растительных масел – прозрачное без осадка.

Анализ органолептических показателей – растительных масел, используемых в исследованиях, показал соответствие их требованиям нормативных документов.

УДК 681
МРНТИ 621.865.8 ***DOI 10.56339/2305-9397-2022-2-2-207-214***

Silantieva M.A., Post-graduate student,**the main author,** https://orcid.org/0000-0001-5079-1400 .
St. Petersburg State Pediatric MedicalUniversity, 194100, st. Lithuanian 2, St. Petersburg, Russian Federation, msylantyeva@qmail.com.
Satybayeva N.A., Senior Lecturer, https://orcid.org/0000-0002-5566-9233**,**
NJSC «West Kazakhstan Agrarian and Technical University named after Zhangir khan», Uralsk, st. Zhangir khan 51, 090009, Kazakhstan, Satybaeva_nur@mail.ru
Kupeshova A.S., Senior Lecturer, https://orcid.org/0000-0002-6888-7619**,**
NJSC «West Kazakhstan Agrarian and Technical University named after Zhangir khan», Uralsk, st. Zhangir khan 51, 090009, Kazakhstan,kupeshova.altynay@mail.ru.

CHARACTERISTICS OF MECHATRONIC MODULES

ANNOTATION

The article gives a classification of mechatronic modules, presents a generalized structure of the mechatronic system, shows a block-modular system for constructing mechatronic modules.With a mechanism for modeling interdisciplinary ideas and methods, mechatronics provides ideal conditions for increasing synergy, thus providing a catalytic effect for new solutions to technically complex situations. an interdisciplinary field that synergistically combines classical knowledge in mechanical engineering, hydraulics, pneumatics, electronics, optics and computer science. The improvement of the functionality of technical systems and the creation of new concepts of machines and equipment with built-in «artificial intelligence» are presented.Emphasis is placed on the functional integration of mechanical drives with electronics and computer control. The article gives the formation in the engineering environment of automation and robotics, where the "mechanical" way of solving design problems did not meet the expectations and opportunities provided by other areas of technology, in particular electronics, optoelectronics, materials science, especially computer science. The concept of mechatronics engineering is given, which provides an opportunity not only to humanize machines, but also changes the way of thinking and approach to technological issues, and most importantly, teaches new technologies and ways of acquiring knowledge and skills.

Key words: *mechatronic module, control system, executive unit, technological equipment, gear motor.*

Introduction. The increasing demands on the performance of complex systems such as production machines and their ever-increasing technological importance will require the application of new methods in the product development process. The intelligent machine can make real-time process decisions with a variety of adaptive controls.

Mechatronics is a methodology used for the optimal design of electromechanical products. The term was coined almost 40 years ago, in 1969, when engineer Tetsuro Mori combined the words "mechanical" and "electronic" to describe the electronic control systems Yaskawa Electric Corporation built for mechanical plant equipment.

Mechatronics is a design philosophy that is an integrated approach to engineering design. The main factor in mechatronics is the involvement of these areas throughout the design process.

Materials and research methods. With a mechanism for modeling interdisciplinary ideas and methods, mechatronics provides ideal conditions for increasing synergy, thus providing a catalytic effect for new solutions to technically complex situations.

An important characteristic of mechatronic devices and systems is their built-in intelligence, which is achieved through a combination of precise mechanical and electrical engineering and real-time programming integrated into the design process. Synergy can be achieved through the right combination of parameters; that is, the end product can be better than just the sum of its parts.

Mechatronic products offer performance that was previously difficult to achieve without a synergistic combination. Recently, some mechatronic applications for micromotions, helicopters and robotic arms have been presented in various research papers.

Mechatronics was originally understood as a design and construction activity involving the incorporation of electronic components and systems into the functional structure of various precision mechanisms.

In 1982, Yaskawa Electric Co. has given up patent protection for its trademark, and from now on we can all use the term. Today, this means mechatronics engineering, which includes the design, testing and operation of machines and equipment that have a high level of functional integration of mechanical systems with electronics and computer control.

Mechatronics is an interdisciplinary field that synergistically combines classical knowledge in mechanical engineering, hydraulics, pneumatics, electronics, optics and computer science. The goal of mechatronics is to improve the functionality of technical systems and create new concepts for machines and equipment with built-in "artificial intelligence".

Several definitions of mechatronics can be found in various literary sources, almost all of them focus on the functional integration of mechanical drives with electronics and computer control. Mechatronics was formed in the engineering environment of automation and robotics, where the "mechanical" way of solving design problems did not meet the expectations and opportunities provided by other areas of technology, in particular electronics, optoelectronics, materials science, especially computer science [2].

Mechatronics engineering can be seen as a modern approach to automation methods for broadly defined engineering and educational needs. It can be assumed that mechatronics is an interdisciplinary field of science and technology dealing with general problems of mechanics, electronics and informatics.

However, it contains too many related areas of mechatronics, which form the basis of mechatronics and cover many well-known disciplines such as electrical engineering, power electronics, digital technology, microprocessor technology, and other methods.

Mechatronics engineering provides an opportunity not only to humanize machines, but also changes the way we think about and approach technology issues, and most importantly, teaches new technologies and ways to acquire knowledge and skills.

The most important feature of mechatronic devices is the ability to accurately process and transmit information in the form of various types of signals (mechanical, electrical, hydraulic, pneumatic, optical, chemical, biological) with a high level of automation of these devices.

Results and its discussion. At present, in the field of engineering and technology, the development of multi-coordinate mechatronic systems that perform the functions of power supply and control is of paramount importance. This is due to a number of important positive qualities of the systems, such as simplicity and compactness of the design, the possibility of obtaining significant forces, high accuracy and stability of establishing fixed positions, ease of control and high reliability.

The main assumption in the design of mechatronic devices is the acquisition by the device itself, which is responsible for lower levels of the process (task), in order to allow the user to focus on higher order functions.

The structure of a mechatronic device can be considered at two levels: an abstract one, consisting of a combination of partial functions of the main functional device, and a concrete plane, consisting of combined structural parts and nodes that are natural carriers of the various functions involved.

.

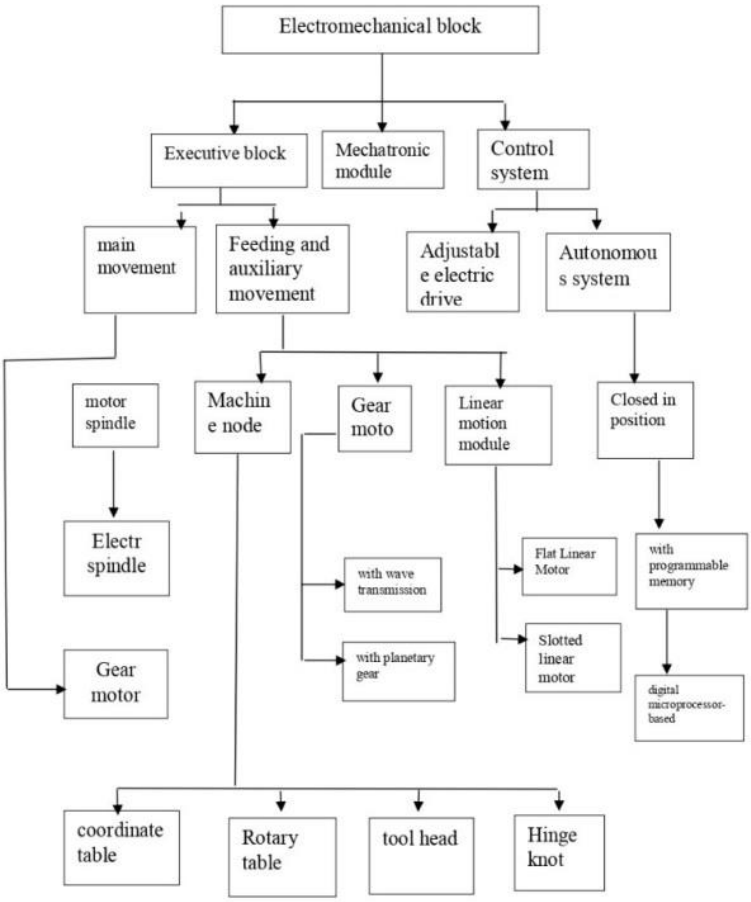

Figure 1 – Classification of mechatronic motion modules

The integration of the structure of a mechatronic device is the result of links between "smart" teams that communicate and collaborate. The connecting mechanical structure, sensors, actuators and information processing arise as a result of the mass flow of energy and information flows.

The input of the mechatronic module is information about the purpose of the movement, which is formed by the upper level, the output is the purposeful mechatronic movement of the final link, for example, the movement of the output shaft of the module.

Interface I4 at the input of the UCU in terms of the use of detectors with an analog output signal in the electromechanical mechatronic module is built on the foundation of analog digital converters (ADC).

The interfaces of the detectors I5, I6, I7, depending on the physical nature of the observed variables, are divided into electrical and mechanical.

Mechanical interfaces include connecting devices for feedback sensors of drives, force-torque and tactile sensors, as well as other means of sensing and information about the process of mechanical chain links, engines and external objects.

The transformation and transmission of signals about the variable states of the system, which have an electrical nature, is carried out by electrical interfaces. In addition to amplifying-converting boards, they also include connecting cables and switching equipment.

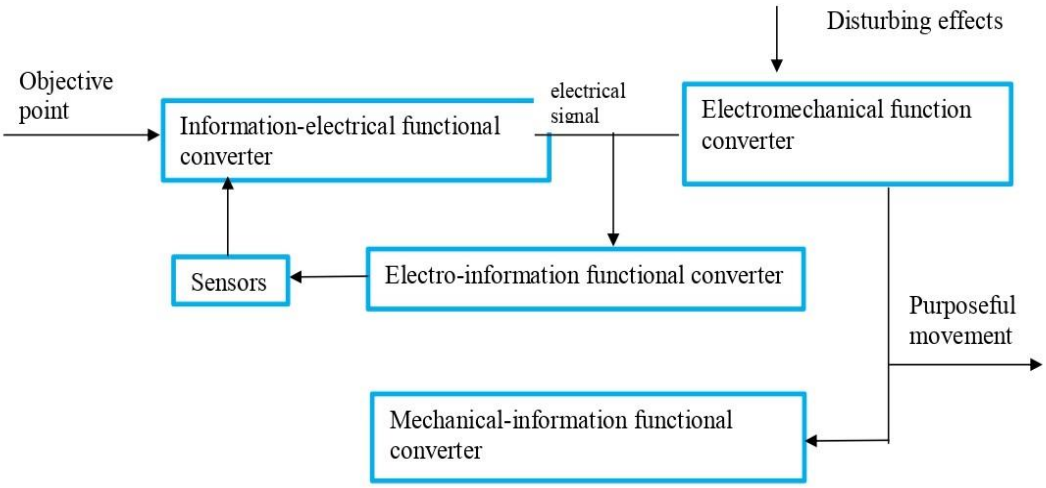

Figure 2 – Scheme of energy and information flows in the electromechanical mechatronic module

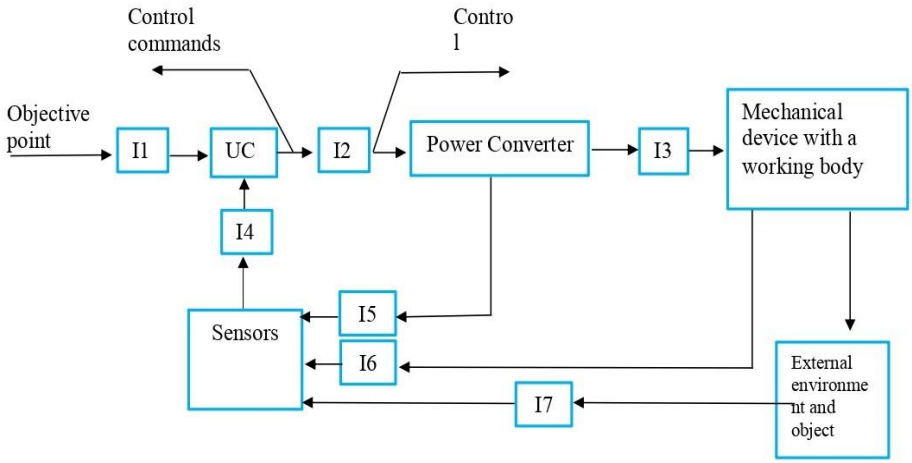

Figure 3 – Classical design of a computer-controlled electro-mechanical process module

The mechatronic approach aims the creator at integrating drive components into single units, minimizing transient transformations and eliminating interfaces as separate units To connect the elements into the system, specialized interface devices are included, which are designated as I1-I7.

I1 interface - a set of hardware and software tools for interfacing the UCU module with the upper level of the control system. Top-level control functions are performed by a high-performance computer or operator.

I2 interface includes:

• digital-to-analog converter;

• amplifying-converting device.

The purpose of the interface seems to be to ensure the establishment of control voltages for actuators.

I3 interfaces are mechanical transmissions that combine neat engines with links of a mechanical device. Transmission covers gearboxes, clutches, elastic links, brakes, etc.

The first level of integration is formed by mechatronic devices and their elements.

The second level of integration is formed by integrated mechatronic modules. The third level of integration is formed by integration mechatronic machines.

The fourth level of integration is formed by complexes of mechatronic machines.

The fifth level of integration is formed on a single integration platform by complexes of mechatronic machines and robots, which involve the formation of reconfigurable flexible production systems.

Figure 3 shows examples of single-coordinate motion modules in development: 4.

Today, mechatronic modules and systems are widely used in the following areas:

• machine tool building and equipment for automation, technological processes in mechanical engineering;

• industrial and special robotics;

• aviation and space technology;

• military equipment, vehicles for the police and special services;

• electronic engineering and equipment for rapid prototyping;

• automotive industry (motor-wheel drive modules, anti-lock brakes, automatic transmissions, automatic parking systems);

• non-traditional vehicles (electric cars, electric bicycles, wheelchairs);

• office equipment (eg copiers and facsimile machines);

• computer peripherals (eg printers, plotters, CD-ROM drives);

• medical and sports equipment (bioelectric and exoskeleton prostheses for the disabled, toning simulators, controlled diagnostic capsules, massagers, etc.);

• household appliances (washing machines, sewing machines, dishwashers, autonomous vacuum cleaners);

• micromachines (for medicine, biotechnology, communications and telecommunications);

• control and measuring devices and machines;

• elevator and warehouse equipment, automatic doors in hotels and airports; photo and video equipment (video disc players, video camera focusing devices);

• simulators for training operators of complex technical systems and pilots;

• railway transport (systems for control and stabilization of train traffic);

• intelligent machines for the food and meat and dairy industries;

• printing machines;

• smart devices for the show industry, attractions.

The module is a standardized functional half of the machine, structurally designed as an independent product.

Mechanical motion module (MMD) - the executive link of the mechatronic system, the mandatory inclusion of a mechanical control object (OR).The modules are divided according to the type of the execution unit and according to the variant of the control arrangement (Fig. 1).

The nodes that provide a range of mobility to the working bodies of the machine are represented by executive blocks.The executive structures are divided into feeds of auxiliary movements and blocks of the main movement.

According to the type of processes, they are divided into linear process modules and rotary motion modules.The main process units are produced in the form of a motor spindle and a gear motor. The motor-spindle is a spindle machine unit, on the shaft of which the rotor of the rotation drive motor is determined.

An electrospindle is an electric motor on which a workpiece or cutting tool is attached.Motor reducer - an electric motor with a wave or built-in planetary mechanism.

The mechatronic move in the construction of new generation machines is contained in the transfer of a multifunctional load from mechanical units to intelligent, electronic, computer information components.

Increasing demands on the productivity of machine tools and their growing technological complexity require improved methods in future product development processes.

Mechatronics is also influenced by smart devices for online and real-time monitoring, which includes diagnostics and process control.

The latest advances in mechatronics in the field of smart manufacturing are discussed, as well as modifications and improvements to traditional designs using a mechatronic approach.

Products will continue to evolve towards greater complexity and greater integration of mechanical and electronic functions, including the growing trend towards ubiquitous computing and embedded systems.

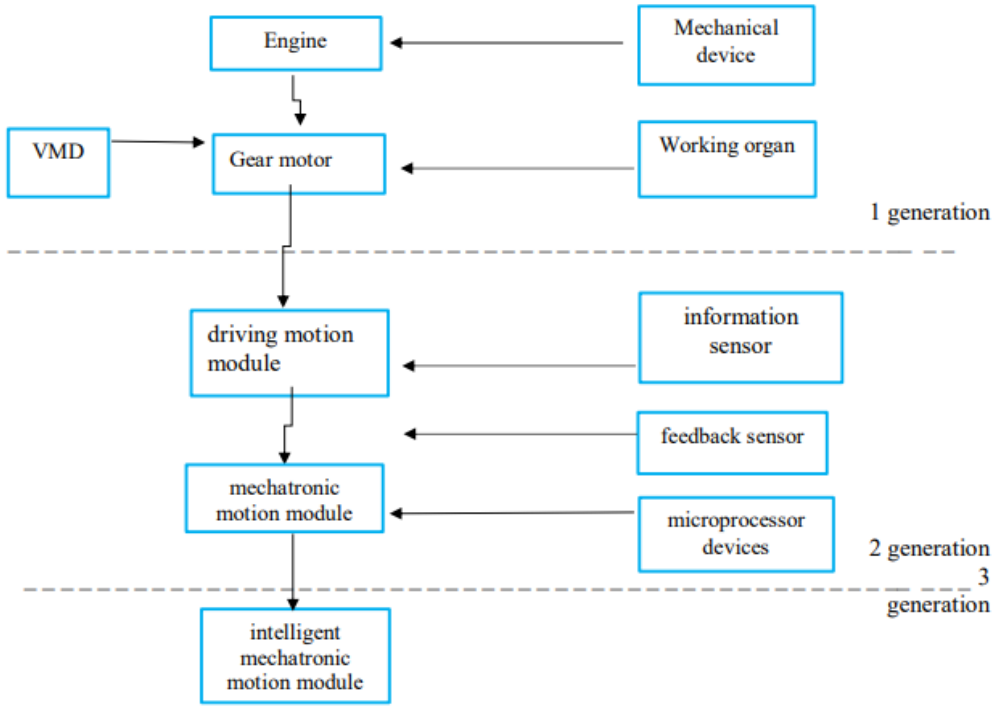

Figure 4 – Samples of single-coordinate process modules

Conclusion. The way companies design and manufacture products has rapidly evolved with the advent of global supply chains. Increasingly, components and subsystems will be sourced from global suppliers and will need to be easily combined in subassembly and final assembly.

As manufacturing sites are added and removed to meet contract requirements and import duties are reduced on new global contracts, many more challenges will arise. In addition, suppliers and components will increasingly be switched on and off the project to cope with global supply chain challenges and cost-cutting pressures.

Thus, in comparison with mechatronic motion modules, control and electronic devices are additionally built into the IMM design, which gives these modules intellectual properties.

Intelligent mechatronic modules, which contain all three defining subsystems, fully comply with the definition of mechatronics. But the study of modules of motion and mechatronic modules of motion seems to be methodically and logically justified, since without this it is impossible to understand the evolution of mechatronics.

Manufacturing will be much more flexible and will need to quickly adapt to new locations, component suppliers and design changes. For all these reasons, advanced mechatronic tools will be required to ensure high-quality production, from design to continuous monitoring and modification of production.

REFERENCES

1 Introduction to Mechatronics., Grabchenko A.I., Klepikov V.B., Dobroskok V.L., Kryzhny G.K., Anishchenko N.V., Kutovoy Yu.N., Pshenichnikov D.A., Garashchenko Ya.N Publisher: Kharkiv Polytechnic Institute Year: 2014 Pages : 264

2 Tauger V.M. Designing motion converters of mechatronic modules: Textbook. – Yekaterinburg: UrGUPS, 2006.

3 Fundamentals of Robotics, 2nd ed. revised and additional.-SPB PVC-Petersburg, – 2005, – P. 416.

4 Embedded robotic systems: design and application of mobile robots with embedded control systems.-M.-Izhevsk: Izhevsk Institute of Computer Research – 2012. – P.520.

5 Mechatronics: basics, methods, application: textbook for universities. - Mechanical engineering, – 2006. – P. 256.

6 Mason, M.T.Mechanics and Planning of Manipulator Pushing Operations.

7 Luo, S., Bimbo, J., Dahiya, R., Liu, H.Robotic tactile perception of object properties: A review

8 Hermans, T., Rehg, J.M., Bobick, A.F.Decoupling behavior, perception, and control for autonomous learning of affordances

9 Krivic, S., Piater, J.Pushing corridors for delivering unknown objects with a mobile robot

10 Yuan, W., Dong, S., Adelson, E.H.GelSight: High-resolution robot tactile sensors for estimating geometry and force

11 Behrens, M.J.(2013) *Robotic Manipulation By Pushing At A Single Point With Constant Velocity: Modeling And Techniques*

12 Faulkner S., Klein A., Hutter F.BOMBA: reliable and efficient optimization of hyperparameters at scale

13 Egorov O.D. Accuracy of robot manipulation mechanisms. - M.: MPI Publishing House, 1989.

14 Egorov O.D. Mechanics and design of robots. -M.: Stankin Publishing House, 1997

15 IlyukhinYu.V. Sinegorsky (mechatronic approach) to the design of control systems for technological robots.Mechatronics. – 2000. – No.2

16 Kazmirenko V.F. Electrohydraulic mechatronic motion modules. Moscow: Radio and Communications, 2001

17 Brodovsky V.N., Baranov M.V., IlyukhinYu.V. Mechatronic translational drive module for technological machines.Mechatronics. – 2000. – №. 5.

18 Vostrikov A.S., Bochenkov B.M. Experience in the development of mechatronic systems.Mechatronics, – 2000. – №. 5.

19 Ivanov, V. S. Structuralanalysisoftechnologicalmechatronic systems with parallel kinematics [Text] / V. S. Ivanov, G. N. Vasiliev // Mechatronika, avtomatizatsiya, upravlenie. – 2004. – № 5. – S. 37–42

20 Glebov, N. A. Elements of mechatronics [Text]/N. A. Glebov, A. G. Bulgakov, D. P. Geraskin. - Novocherkassk: YuRGTU, 2006.

ТҮЙІН

Мақалада мехатрондық модульдердің классификациясы, мехатрондық жүйенің жалпыланған құрылымы, мехатрондық модульдерді құрудың блоктық-модульдік жүйесі көрсетілген. Пәнаралық идеялар мен әдістерді модельдеу механизмімен мехатроника энергияны арттыру үшін тамаша жағдайларды қамтамасыз етеді, осылайша техникалық күрделі жағдайларға жаңа шешімдерге каталитикалық әсер береді. Машина жасау, гидравлика, пневматика, электроника, оптика және информатикадағы классикалық білімді синергетикалық біріктіретін пәнаралық сала. Техникалық жүйелердің функционалдығын жақсарту және біріктірілген «жасанды интеллект» бар машиналар мен жабдықтардың жаңа концепцияларын құру ұсынылған.

Механикалық жетектерді электроникамен және компьютерлік басқарумен функционалдық біріктіруге баса назар аударылады. Мақалада жобалау мәселелерін шешудің «механикалық» тәсілі технологияның басқа салалары, атап айтқанда электроника, оптоэлектроника, материалтану, әсіресе информатика ұсынатын күтулер мен мүмкіндіктерге сәйкес келмейтін автоматтандыру мен робототехниканың инженерлік ортасында қалыптасуы қарастырылған. . Машиналарды ізгілендіруге ғана емес, сонымен қатар ойлау тәсілі мен технологиялық мәселелерге көзқарасты өзгертуге мүмкіндік беретін, ең бастысы, жаңа технологиялар мен білім мен дағдыларды меңгерудің жолдарын үйретететін мехатроника инженериясы тұжырымдамасы берілген.

РЕЗЮМЕ

В статье дана классификация мехатронных модулей, представлена обобщенная структура мехатронной системы, показана блочно-модульная система построения мехатронных модулей. Благодаря механизму моделирования междисциплинарных идей и методов мехатроника обеспечивает идеальные условия для повышения синергии, тем самым обеспечивая каталитический эффект для новых решений технически сложных ситуаций.

Междисциплинарная область, синергетически объединяющая классические знания в области машиностроения, гидравлики, пневматики, электроники, оптики и информатики. Представляется улучшение функциональности технических систем и создание новых концепций машин и оборудования со встроенным "искусственным интеллектом". Делаются акцент на функциональной интеграции механических приводов с электроникой и компьютерным управлением. В статье дается формирование в инженерной среде автоматизации и робототехники, где "механический" способ решения задач проектирования не соответствовал ожиданиям и возможностям, которые предоставляют другие области технологий, в частности электроника, оптоэлектроника, материаловедение, особенно информатика. Дается понятии инженерии мехатроники предоставляющая возможность менять не только характеристики машины, но и меняет мышление и подход к технологическим вопросам, а самое главное - обучает новым технологиям и способам приобретения знаний и навыков

УДК 331.43
МРНТИ 86.25 ***DOI 10.56339/2305-9397-2022-2-2-214-222***

Павлов И.М., техника ғылымдарының докторы, профессор, **основной автор,** https://orcid.org/0000-0003-0907-0489
«Ю.А. Гагарин атындағы Саратов мемлекеттік техникалық университеті» ЖБ ФМББББК, 410054, Саратов қ. Политехническая көш., 77, 410054, Ресей, pim60@mail.ru
Сарсенов А.Е., Ph докторы, доцент https://orcid.org/0000-0002-0265-0141
НАО «Западно-Казахстанский аграрно-технический университет имени Жангир хана», г. Уральск, ул. Жангир хана, 51, 090009, Казахстан, sarsenov_1966@mail.ru
Утарова З.А., магистрант, https://orcid.org/0000-0002-8030-202X
НАО «Западно-Казахстанский аграрно-технический университет имени Жангир хана», г. Уральск, ул. Жангир хана, 51, 090009, Казахстан, zulfiyatastemirova98@gmail.com

Pavlov I.M., doctor of technical sciences, professor, **the main author,** https://orcid.org/ 0000-0003-0907-0489
«Saratov State Technical University named after Gagarin Yu. A.» Saratov, st. Polytechnic. 77, 410054, Russia, pim60@mail.ru
Sarsenov A.E., PhD, associate professor, https://orcid.org/0000-0002-0265-0141
NJSC «West Kazakhstan Agrarian and Technical University named after Zhangir khan», Uralsk, st. Zhangir khan 51, 090009, Kazakhstan, sarsenov_1966@mail.ru
Utarova Z.A., Master's student, https://orcid.org/0000-0002-8030-202X
NJSC «West Kazakhstan Agrarian and Technical University named after Zhangir khan», Uralsk, st. Zhangir khan 51, 090009, Kazakhstan, zulfiyatastemirova98@gmail.com

АНАЛИЗ ВЛИЯНИЯ ВРЕДНЫХ И ОПАСНЫХ ПРОИЗВОДСТВЕННЫХ ФАКТОРОВ НА ЗДОРОВЬЕ РАБОТНИКОВ ЖЕЛЕЗНОДОРОЖНОГО ТРАНСПОРТА
ANALYSIS OF THE INFLUENCE OF HARMFUL AND HAZARDOUS PRODUCTION FACTORS ON THE HEALTH OF RAILWAY TRANSPORT WORKERS

Аннотация

В статье отражены результаты исследований условий труда основных профессий железнодорожного транспорта: машинистов тепловоза, монтеров пути и проводников пассажирского вагона, на основе анализа статистических данных отчетов АО «Национальная Компания «Казахстан Темир Жолы» (АО «НК «КТЖ»). Изучены особенности их профессиональной деятельности в современных условиях. Около 41% от общего количества работников АО «НК «КТЖ» заняты во вредных, тяжелых и напряженных условиях труда. Выявлено, что большая часть рабочих мест связаны с тяжестью труда, шумом, напряженностью трудового процесса и электромагнитным излучением. Построен график