ФГБОУ ВО «Воронежский государственный технический университет»

СПРАВОЧНИК ЭЛЕКТРОННОГО ИЗДАНИЯ

Строительно-политехнический колледж

107-2023

АВТОМАТИЗИРОВАННОЕ ПРОИЗВОДСТВО

МЕТОДИЧЕСКИЕ УКАЗАНИЯ

к практическим занятиям и самостоятельной работе
по дисциплине «Иностранный язык в профессиональной деятельности (английский)»
для студентов 4 курса специальности
15.02.10 Мехатроника и мобильная робототехника (по отраслям)

Часть 2

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Федеральное государственное бюджетное образовательное
учреждение высшего образования
«Воронежский государственный технический университет»

Строительно-политехнический колледж

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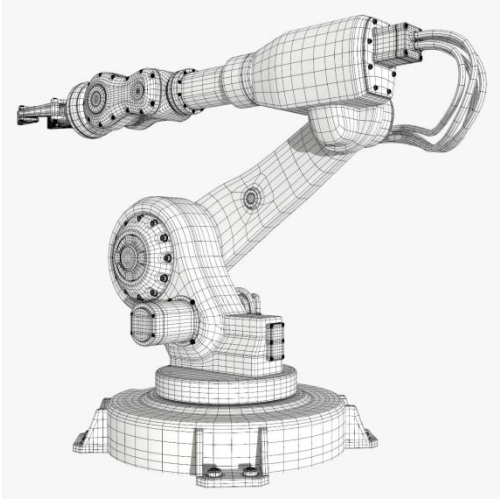

Воронеж 2023

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Составители: преп. Н. В. Аленькова,
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Автоматизированное производство: методические указания к практическим занятиям и самостоятельной работе по дисциплине «Иностранный язык в профессиональной деятельности (английский язык)» для студентов 4 курса специальности 15.02.10 Мехатроника и мобильная робототехника (по отраслям). Часть 2 / ФГБОУ ВО «Воронежский государственный технический университет»; сост.: Н. В. Аленькова, И. В. Полухина, О. В. Прибыткова, Ю. В. Малютина. Воронеж: Изд-во ВГТУ: 2023. 35 с.

Методические указания содержат учебные тексты и задания для аудиторной и внеаудиторной работы студентов. Они предназначены для развития навыков чтения, реферирования и аннотирования литературы по специальности, а также для развития навыков говорения и расширения терминологической лексики. Задания содержат упражнения на усвоение лексических единиц по специальности и развитие навыков говорения.

Методические указания предназначены для студентов 4 курса специальности 15.02.10 Мехатроника и мобильная робототехника (по отраслям) строительно-политехнического колледжа продолжающих изучение английского языка для профессиональных целей в соответствии с ФГОС СПО.

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UNIT 1

КОМПЬЮТЕРНО-ИНТЕГРИРОВАННОЕ ПРОИЗВОДСТВО

1. **Изучите следующие слова и выражения:**

1. activity – деятельность
2. circuit – схема, цепь
3. comprehensive – обширный; всесторонний
4. computer-aided design (CAD) – система автоматизированного проектирования (САПР)
5. computer-aided manufacturing (CAM) – автоматизированная система управления производством, технологическими процессами (АСУП, АСУТП)
6. computer-integrated manufacturing (CIM) – производство с комплексным управлением от ЭВМ
7. customer – заказчик; клиент
8. to draft – делать чертёж; проектировать
drafting board – чертёжная доска
9. to draw – чертить; рисовать
drawing – чертёж; рисунок
10.to entail – влечь за собой; вызывать
11.to extend – простирать(ся)
12.to invoke – вызывать; активизировать(процедуру)
13.numerical control (NC) – числовое программное управление (ЧПУ)
14.order – заказ
15.to schedule – назначать, намечать; планировать; составлять график (расписание)
scheduling – оперативное управление; планирование
16.scope – размах, охват
17.shipment – погрузка; отправка
18.to support – поддерживать; способствовать, содействовать
19.trend – общее направление, тенденция

2. Выберите подходящий ответ:

1. The technology of CAD/CAM was introduced into manufacturing firms in
   a) the 1970.
   b) the 1980.

2. CAD/CAM technology is associated with the use of computers to perform many functions related to
   a) production lines.
   b) design and production.

3. Computer's assisting in the creation, modification, analysis, and optimization of a design is the purpose of

a) computer-aided manufacturing.

b) computer-aided design.

4. Computer-aided manufacturing is the use of computers to control production processes by means of

a) numerically controlled (NC) machines.

b) simple mechanical devices.

5. Computer-integrated manufacturing includes all the engineering functions of CAD/CAM and

a) the production functions of the firm.

b) the business functions of the firm.

3. Переведите словосочетания на русский язык:

1. design and production functions, 2. computer applications scope, 3. part and product specifications, 4. electronics products, 5. equipment design and fabrication, 6. computer database, 7. design-and-manufacturing procedure, 8. heat transfer calculations, 9. final object design, 10. computer-aided design system, 11. computer process monitoring, 12. process-performance results, 13. planning and management functions, 14. step-by-step process, 15. information-processing function.

1. **Прочитайте текст и переведите:**

TEXT 1

COMPUTER-INTEGRATED MANUFACTURING

Since about 1970, there has been a growing trend in manufacturing firms toward the use of computers to perform many functions related to design and production. The technology associated with this trend is called CAD/CAM, for computer-aided design and computer-aided manufacturing. Today it is widely recognized that the scope of computer applications must extend beyond design and production to include the business functions of the firm. The name given to this more comprehensive use of computers is computer-integrated manufacturing (CIM).

CAD/CAM is based on the capability of a computer system to process, store, and display large amounts of data representing part and product specifications. For mechanical products, the data represent graphic models of the components; for electrical products, they represent circuit information; and so forth. CAD/CAM technology has been applied in many industries, including machined components,

electronics products, and equipment design and fabrication for chemical processing. CAD/CAM involves not only the automation of the manufacturing operations but also the automation of elements in the entire design-and-manufacturing procedure.

Computer-aided design (CAD) makes use of computer systems to assist in the creation, modification, analysis, and optimization of a design. The designer, working with the CAD system rather than the traditional drafting board, creates the lines and surfaces that form the object (product, part, structure, etc.) and stores this model in the computer database. By invoking the appropriate CAD software, the designer can perform various analyses on the object, such as heat transfer calculations. The final object design is developed as adjustments made on the basis of these analyses. Once the design procedure has been completed, the computer -aided design system can generate the detailed drawings required to make the object.

Computer-aided manufacturing (CAM) involves the use of computer systems to assist in the planning, control, and management of production operations. This is accomplished by either direct or indirect connections between the computer and production operations. In the case of the direct connection, the computer is used to monitor or control the processes in the factory. Computer process monitoring involves the collection of data from the factory, the analysis of the data, and the communication of process-performance results to the plant management. These measures increase the efficiency of the plant.

Computer process control entails the use of the computer system to execute control actions to operate the plant automatically, as described above. Indirect connections between the computer system and the process involve applications in which the computer supports the production operations without actually monitoring or controlling them. These applications include planning and management functions that can be performed by the computer (or by humans working with the computer) more efficiently than by humans alone. Examples of these functions are planning the step-by-step processes for the product, part programming in numerical control (NC), and scheduling the production operations in the factory.

Computer-integrated manufacturing includes all the engineering functions of CAD/CAM and the business functions of the firm as well. In an ideal CIM system, computer technology is applied to all the operational and information-processing functions of the company, from customer orders through design and production (CAD/CAM) to product shipment and customer service. The scope of the computer system includes all activities that are concerned with manufacturing. In many ways, CIM represents the highest level of automation in manufacturing.

2. **Выберите подходящее слово и переведите предложение:**

1. Manufacturing (a equipment, b. firms, c. elements) use computers for design and production.
2. CAD/CAM technology includes the business (a. functions, b. automation, c. collection) of the firm as well.

3. CIM means computer-integrated (a. management, b. modification, c. manufacturing).

4. CAD/CAM technology is applied in many (a. industries, b. laboratories, c. specifications).

5. CAD/CAM involves (a. models, b. processing, c. automation) of manufacturing operations.

6. The designer stores the model of the object in the computer (a. input unit, b. database, c. output unit).

3. **Ответьте на следующие вопросы:**

1. What is CAD/CAM technology based on?
2. What industries has it been applied in?
3. What is its main function?
4. How does the CAD system operate?
5. What is the purpose of the CAM system? How does it operate?
6. What functions does the CIM system perform?
7. What does the CIM system represent?

4. **Переведите текст 1А без словаря:**

TEXT 1A

ПРОИЗВОДСТВО С КОМПЛЕКСНЫМ УПРАВЛЕНИЕМ ОТ ЭВМ

Начиная с 1970 г., производственные организации стали широко применять компьютеры. Такая технология получила название САПР/АСУП. Она включает в себя автоматизацию проектирования отдельных компонентов и конечного продукта, производственных операций, а также предпринимательских функций фирмы.

Производство с комплексным управлением от ЭВМ включает в себя все инженерные функции САПР/АСУП, а также все предпринимательские функции управления предприятием. Вся информация компании обрабатывается компьютером и хранится в его базе данных, начиная с приёма заказов клиента и кончая погрузкой и доставкой продукта. Такая система представляет собой высший уровень автоматизации производства.

5. Подготовьте небольшое сообщение по теме:

1. The technology of CAD/CAM in manufacturing firms.
2. The characteristics of CAD/CAM technology.
3. The functions of the CAD system.
4. The functions of the CAM system.
5. The functions of the CIM system.

UNIT 2

КОМПОНЕНТЫ РОБОТИЗИРОВАННЫХ СИСТЕМ

1. **Рассмотрите устройство промышленных роботов, назовите из каких компонентов они состоят. С какой частью тела человека ассоциируются устройства данных роботов, какие слова помогают нам это понять?**

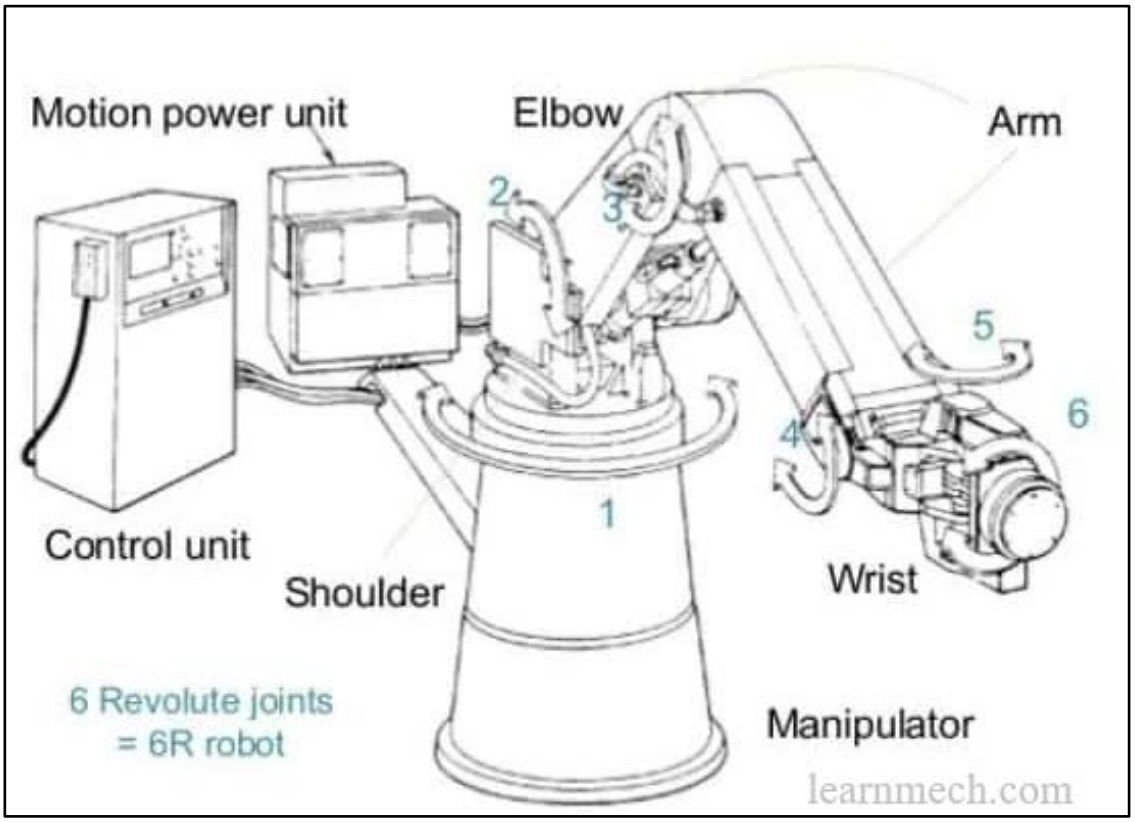


Рис. 1.1. Базовые составляющие робота-манипулятора

2. **Прочитайте текст и расскажите какие общие черты есть у роботов всех типов:**

TEXT 2

BASIC COMPONENTS OF ROBOTS

There are many types of robots; they are used in many different environments and for many different uses. Although being very diverse in application and form, they all share three basic similarities when it comes to their construction:

Robots have some kind of *mechanical construction*, a frame, form or shape designed to achieve a particular task. For example, a robot designed to travel across

heavy dirt or mud, might use caterpillar tracks. The mechanical aspect is mostly the creator's solution to completing the assigned task and dealing with the physics of the environment around it. Form follows function.

Robots have *electrical components* that power and control the machinery. For example, the robot with caterpillar tracks would need some kind of power to move the tracker treads. That power comes in the form of electricity, which will have to travel through a wire and originate from a battery, a basic electrical circuit. Even petrol powered machines that get their power mainly from petrol still require an electric current to start the combustion process which is why most petrol powered machines like cars, have batteries.

The electrical aspect of robots is used for movement (through motors), sensing (where electrical signals are used to measure things like heat, sound, position, and energy status) and operation (robots need some level of electrical energy supplied to their motors and sensors in order to activate and perform basic operations).

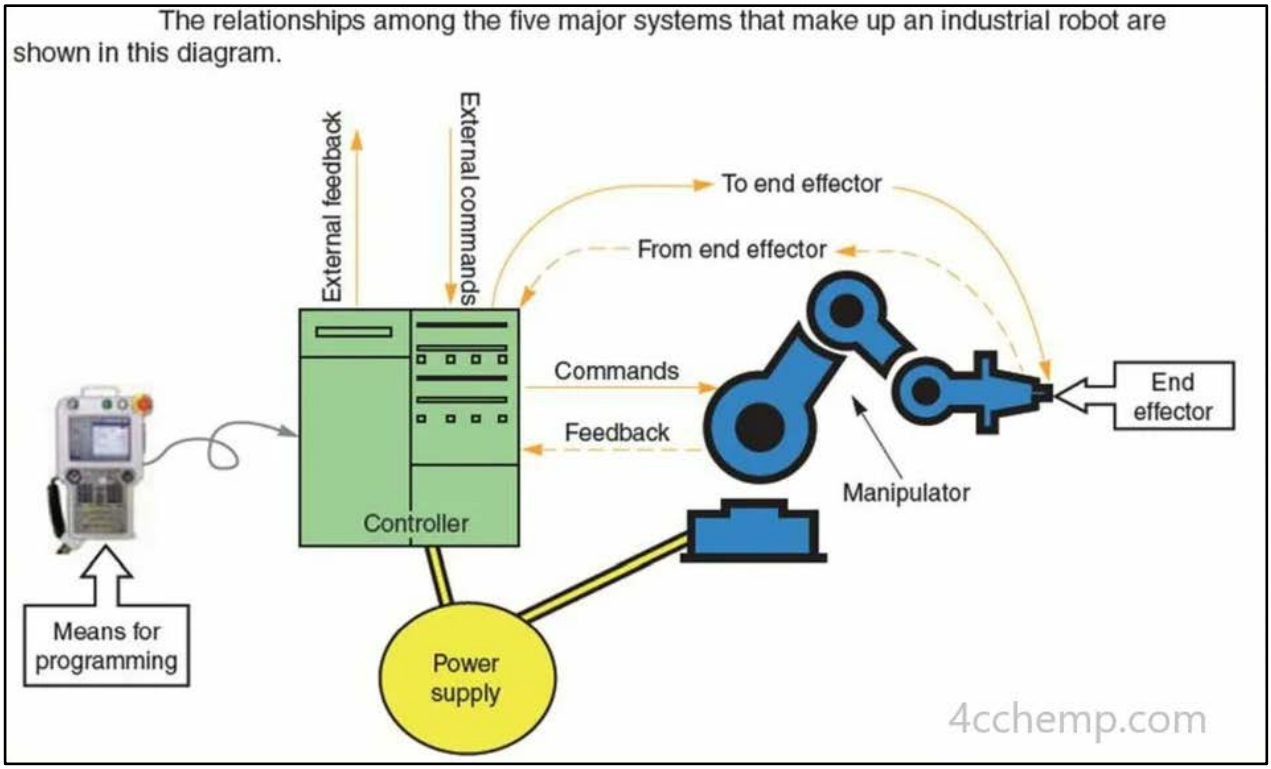


Рис. 1.2. Связь между пятью основными системами промышленного робота

All robots contain some level of *computer programming code*. A program is how a robot decides when or how to do something. In the caterpillar track example, a robot that needs to move across a muddy road may have the correct mechanical construction and receive the correct amount of power from its battery, but would not go anywhere without a program telling it to move. Programs are the core essence of a

robot, it could have excellent mechanical and electrical construction, but if its program is poorly constructed its performance will be very poor (or it may not perform at all).

There are three different types of robotic programs: remote control, artificial intelligence and hybrid. A robot with remote control programming has a preexisting set of commands that it will only perform if and when it receives a signal from a control source, typically a human being with a remote control. It is perhaps more appropriate to view devices controlled primarily by human commands as falling in the discipline of automation rather than robotics. Robots that use artificial intelligence interact with their environment on their own without a control source, and can determine reactions to objects and problems they encounter using their preexisting programming. Hybrid is a form of programming that incorporates both AI and RC functions in them.

4. Рассмотрите устройство промышленного робота-манипулятора (рис.1.3.). Опишите его (размер, внешний вид, из чего состоит, какую работу может выполнять):

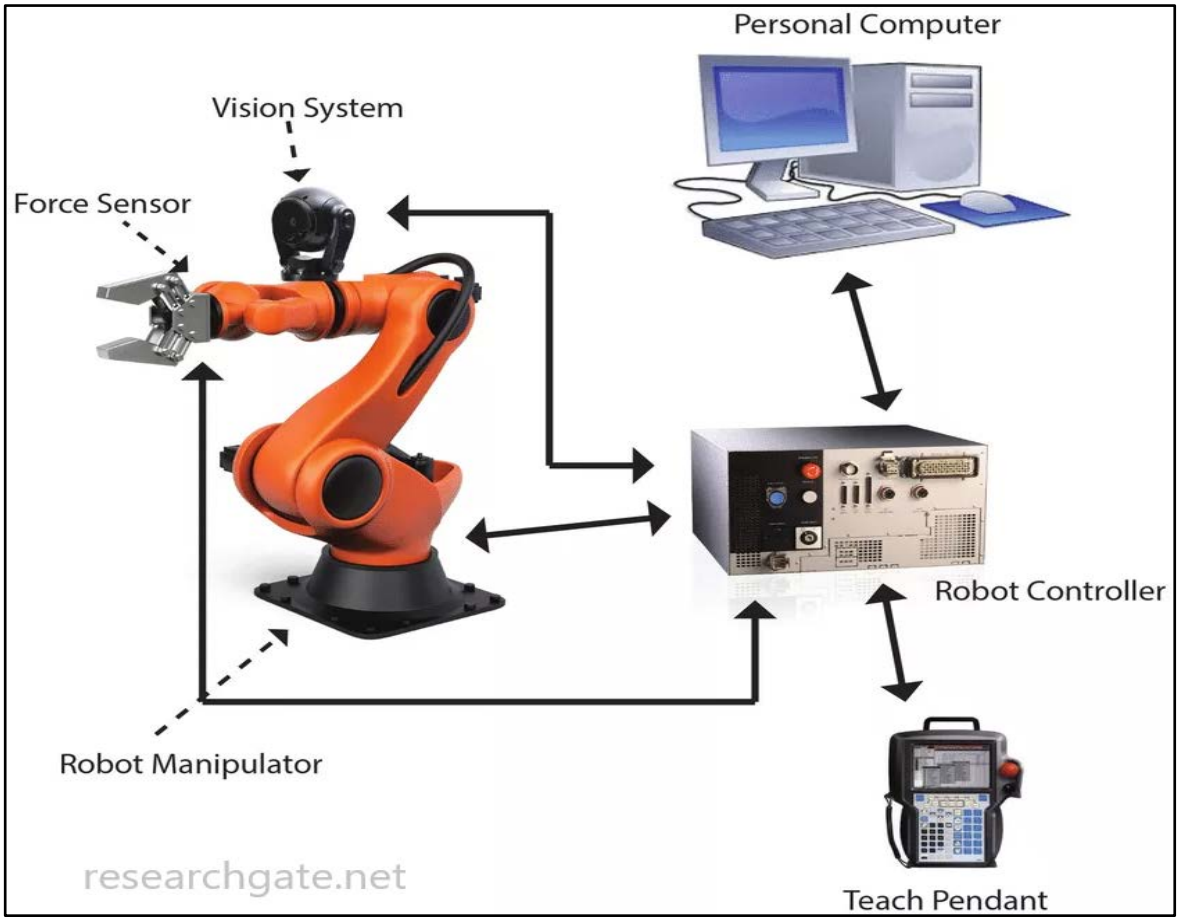


Рис. 1.3. Устройство промышленного робота-манипулятора

UNIT 3

РОБОТИЗИРОВАННЫЕ СИСТЕМЫ И КОМПЛЕКСЫ

1. Прочитайте текст, выпишите слова, выделенные курсивом и запишите их перевод; письменно переведите 1 и 2 абзацы:

TEXT 3

ROBOTIC CONTROL SYSTEMS

The mechanical structure of a robot must be controlled to perform tasks. The control of a robot involves three *distinct phases – perception*, *processing*, and action (robotic paradigms). Sensors give information about the environment or the robot itself (e.g. the position of its *joints* or its *end effector*). This information is then processed to be stored or transmitted and to calculate the *appropriate signals* to the *actuators* (motors), which move the mechanical structure to achieve the required coordinated motion or force actions.

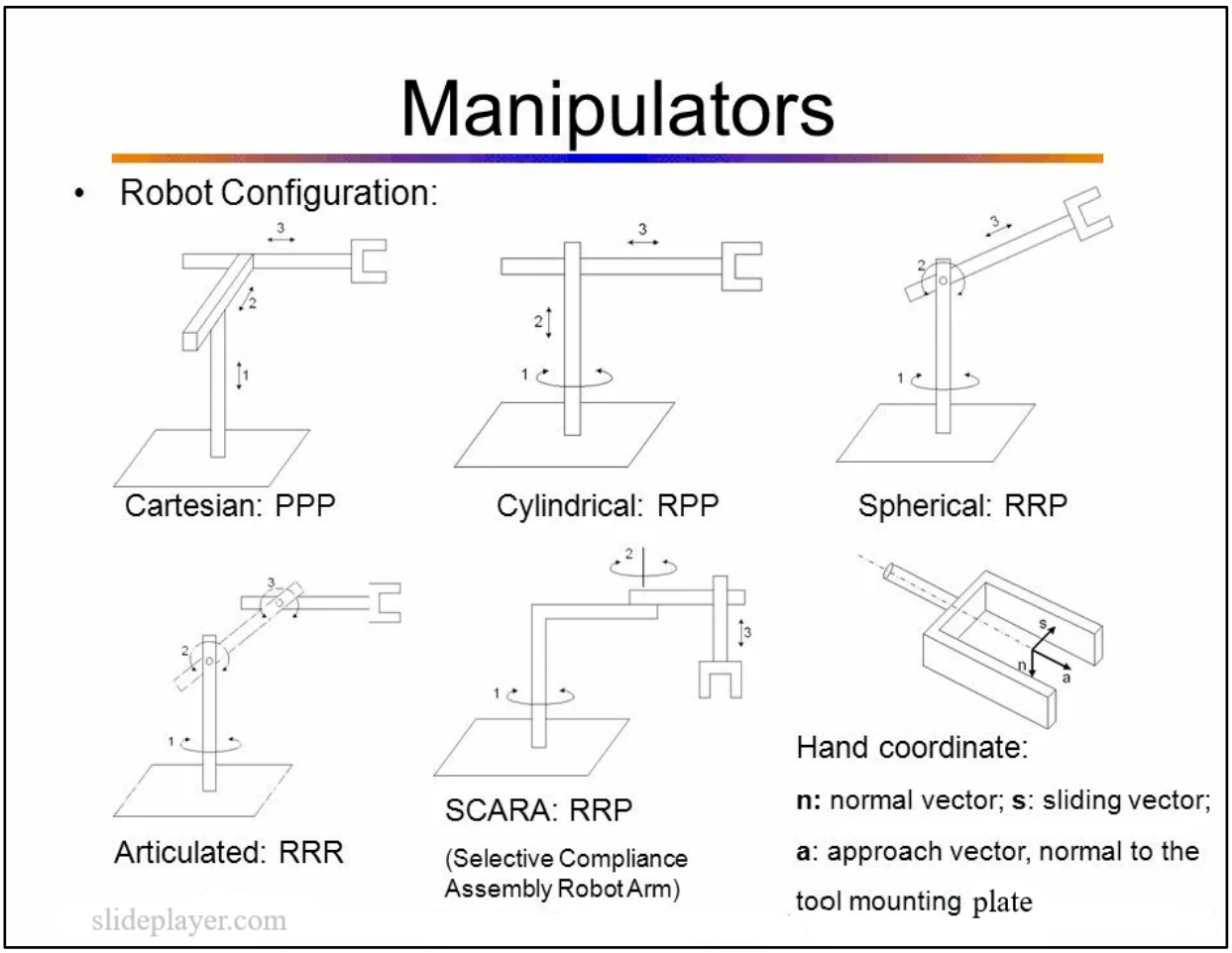


Рис. 1.4. Манипуляторы и их виды

The processing phase can range in *complexity*. At a reactive level, it may translate raw sensor information directly into actuator commands (e.g. firing motor power electronic gates based directly upon *encoder feedback signals* to achieve the required *torque/velocity* of the shaft). Sensor fusion and internal models may first be used to estimate parameters of interest (e.g. the position of the robot's *gripper*) from noisy sensor data. An immediate task (such as moving the gripper in a certain direction until an object is detected with a proximity sensor) is sometimes inferred from these estimates. Techniques from control theory are generally used to convert the higher-level tasks into individual commands that drive the actuators, most often using kinematic and dynamic models of the mechanical structure.

At longer time scales or with more sophisticated tasks, the robot may need to build and reason with a "cognitive" model. *Cognitive models* try to represent the robot, the world, and how the two interact. *Pattern recognition* and computer vision can be used to track objects. Mapping techniques can be used to build maps of the world. Finally, motion planning and other *artificial intelligence* techniques may be used to figure out how to act. For example, a planner may figure out how to achieve a task without hitting obstacles, falling over, etc.

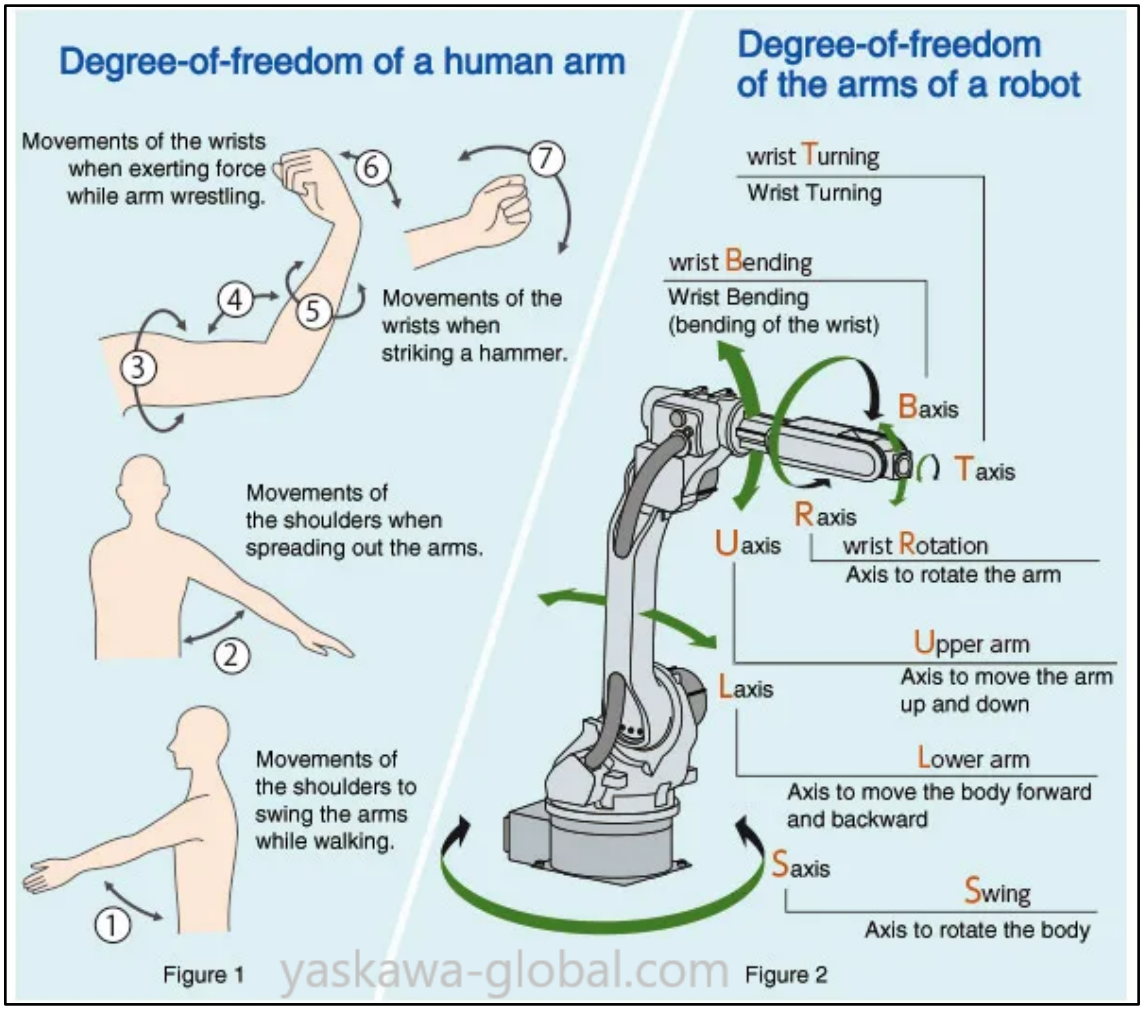


Рис. 1.5. Степени свободы (подвижности) робота-манипулятора

Modern commercial robotic control systems are highly complex, integrate multiple sensors and effectors, have many interacting degrees-of-freedom (DOF) and *require operator interfaces*, programming tools and real-time capabilities. They are oftentimes interconnected to wider communication networks and in many cases are now both IoT-enabled and mobile. Progress towards open architecture, layered, user-friendly and ‘intelligent’ sensor-based interconnected robots has emerged from earlier concepts related to Flexible Manufacturing Systems (FMS), and several 'open or 'hybrid' *reference architectures* exist which assist developers of robot control software and hardware to move beyond traditional, earlier notions of 'closed' robot control systems have been proposed.

2. **Расскажите, что нового вы узнали о системах управления роботами.**

UNIT 4

КОНТРОЛЛЕРЫ

1. **Прочитайте текст 4; устно переведите; расскажите про типы контроллеров, используя информацию из текста:**

TEXT 4

CONTROLLERS

A controller is basically a unit present in a control system that generates control signals to reduce the deviation of the actual value from the desired value to almost zero or lowest possible value. It is responsible for the control action of the system so as to get accurate output.

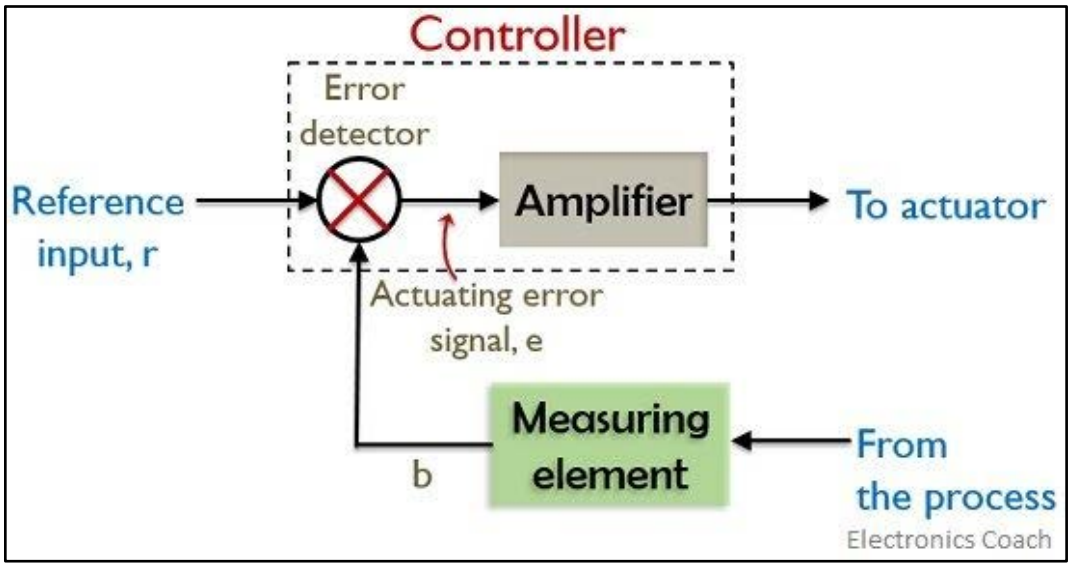


Рис. 1.6. Структурная схема промышленного контроллера

The method of producing a control signal by the controller is known as control action. Basically the deviation of the achieved output from the reference input is the error signal which is needed to be compensated by the controller so that the system generates required output.

In a control system, the controller provides the desired controlling to the system so as to get the necessary output. A discontinuous mode of controller operation permits a discrete output value. In this mode, the output does not show smooth variation according to the signal generated by the controller rather shows fluctuation from one value to another. According to this mode of operation, controllers are of two types: On-Off / Two-position controllers and Multiposition controllers.

A continuous mode permits smooth variation of the controlled output over the entire range of operation. The output of the control system shows continuous variation in proportion to the entire error signal or some form of it. So, on the basis of the input applied, controllers are majorly classified as: Proportional controller; Integral controller; Derivative controller.

Two-position controllers are also known as on/off controllers. Here the output of the controller fluctuates between two specific values, generally the maximum and minimum value. The maximum value is generally considered 100% while the minimum as 0%. It is the easiest and most common type of control action of a controller. Here the output shows variation between maximum and minimum values according to the actuating error signal. Basically the output gets changed from minimum value to maximum value when the value of actuating error signal increases above a critical value. Similarly, the output gets reduced to its minimum value from the maximum value when the value of the error signal falls below the critical value.

2. **Прочитайте текст 4A; выпишите слова, выделенные курсивом и найдите в словаре их перевод; письменно переведите 3 абзац:**

TEXT 4A

OPEN ARCHITECTURE CONTROLLERS

Open *architecture controllers* are said to be better able to meet the growing *requirements* of a wide range of robot users, including *system developers*, end users and research scientists, and are better positioned to deliver the advanced robotic concepts related to Industry 4.0.

In addition to utilizing many established features of robot controllers, such as position, *velocity* and force control of end effectors, they also enable IoT interconnection and the implementation of more advanced sensor *fusion* and control techniques, including adaptive control, *Fuzzy control* and Artificial Neural Network (ANN)-based control.

When implemented in real-time, such techniques can potentially improve the stability and performance of robots operating in unknown or uncertain environments by enabling the control systems to learn and adapt to environmental changes. There are several examples of *reference architectures* for robot controllers, and also examples of successful implementations of actual robot controllers developed from them.

One example of a generic reference architecture and associated interconnected, open-architecture robot and controller implementation was developed by Michael Short and colleagues at the University of Sunderland in the UK in 2000. The robot was used in a number of research and development studies, including prototype implementation of novel advanced and intelligent control and *environment mapping methods* in real-time.

ЗАДАНИЕ ДЛЯ САМОСТОЯТЕЛЬНОЙ РАБОТЫ

1. Прочитайте текст, переведите и объясните, как вы представляете современного робота (его внешний вид, основные блоки, какие функции выполняет):

WHAT IS A ROBOT?

Robotics is the intersection of science, engineering and technology that produces machines, called robots, that substitute for (or replicate) human actions. Pop culture has always been fascinated with robots. R2-D2. Optimus Prime. WALL-E. These over-exaggerated, humanoid concepts of robots usually seem like a caricature of the real thing...or are they more forward thinking than we realize? Robots are gaining intellectual and mechanical capabilities that don’t put the possibility of a R2-D2-like machine out of reach in the future.

A robot is the product of the robotics field, where programmable machines are built that can assist humans or mimic human actions. Robots were originally built to handle monotonous tasks (like building cars on an assembly line), but have since expanded well beyond their initial uses to perform tasks like fighting fires, cleaning homes and assisting with incredibly intricate surgeries. Each robot has a differing level of autonomy, ranging from human-controlled bots that carry out tasks that a human has full control over to fully-autonomous bots that perform tasks without any external influences.

As technology progresses, so too does the scope of what is considered robotics. In 2005, 90% of all robots could be found assembling cars in automotive factories. These robots consist mainly of mechanical arms tasked with welding or screwing on certain parts of a car. Today, we’re seeing an evolved and expanded definition of robotics that includes the development, creation and use of bots that explore Earth’s harshest conditions, robots that assist law-enforcement and even robots that assist in almost every facet of healthcare.

While the overall world of robotics is expanding, a robot has some consistent characteristics:

Robots all consist of some sort of mechanical construction. The mechanical aspect of a robot helps it complete tasks in the environment for which it's designed. For example, the Mars 2020 Rover's wheels are individually motorized and made of titanium tubing that help it firmly grip the harsh terrain of the red planet.

Robots need electrical components that control and power the machinery. Essentially, an electric current (a battery, for example) is needed to power a large majority of robots.

Robots contain at least some level of computer programming. Without a set of code telling it what to do, a robot would just be another piece of simple machinery. Inserting a program into a robot gives it the ability to know when and how to carry out a task.

We're really bound to see the promise of the robotics industry sooner, rather than later, as artificial intelligence and software also continue to progress. In the near future, thanks to advances in these technologies, robots will continue getting smarter, more flexible and more energy efficient. They'll also continue to be a main focal point in smart factories, where they'll take on more difficult challenges and help to secure global supply chains.

Though relatively young, the robotics industry is filled with an admirable promise of progress that science fiction could once only dream about. From the deepest depths of our oceans to thousands of miles in outer space, robots will be found performing tasks that humans couldn't dream of achieving alone.

2. **Напишите письмо другу, опираясь на следующую инструкцию:**

Write your pen-friend Jane a letter (100-120 words), using the following hints:

1. Начните письмо следующим образом:

Dear Jane,

I've just watched a TV series about robots, their past and future. Robots are so cool! They are able to replace humans in many kinds of jobs. If only they could do my homework…

2. Напишите что вы думаете о роботах и узнайте что думает по этому поводу ваш собеседник:

What job would you like a robot to do at your home? What else can robots be useful for? What films about robots have you watched? Do you like them?

3. Завершите свое письмо.

3. Прочитайте текст, переведите и расскажите о двух технологиях, на которых основывается роботехника.

INDUSTRIAL ROBOTICS

Industrial robotics is an automation technology that has received considerable attention since about 1960. This section will discuss the development of industrial robotics, the design of the robot manipulator, and the methods of programming robots. Robotics is based on two related technologies: numerical control and teleoperators.

Numerical control (NC) is a method of controlling machine tool axes by means of numbers that have been coded on a punched paper tape or other media. It was developed during the late 1940s and early 1950s. The first numerical control machine tool was demonstrated in 1952 in the United States at the Massachusetts Institute of Technology (MIT[1]). The subsequent research at MIT led to the development of the APT (Automatically Programmed Tools) language for programming machine tools.

A teleoperator is a mechanical manipulator that is controlled by a human from a remote location. The initial work on the design of teleoperators can be traced to the handling of radioactive materials in the early 1940s. In a typical implementation, a human moves a mechanical arm and hand at one location, and these motions are duplicated by the manipulator at another location.

Industrial robotics can be considered a combination of numerical control and teleoperator technologies. Numerical control provides the concept of a programmable industrial machine, and teleoperator technology contributes the notion of a mechanical arm to perform useful work. The first industrial robot was installed in 1961 to unload parts from a die-casting operation. Its development was due largely to the efforts of the Americans George C. Devol, an inventor, and Joseph F. Engelberger, a businessman. Devol originated the design for a programmable manipulator, the U.S. patent for which was issued in 1961. Engelberger teamed with Devol to promote the use of robots in industry and to establish the first corporation in robotics – Unimation, Inc.

[1]*MIT – Massachusetts Institute of Technology – Массачусетский технологический институт*

UNIT 5

ИСПОЛЬЗОВАНИЕ РОБОТОТЕХНИКИ В АВТОМОБИЛЕСТРОЕНИИ

1. Изучите следующие слова и выражения:

1. handling — обращение
2. transfer — передача, перенос
3. pick up — брать, подбирать
4. arrangement — расположение
5. to utilize — утилизировать, находить при-менение
6. gripper — захват
7. to grasp— схватывать
8. spot welding — точечная сварка
9. arc welding — электродуговая сварка
10. spray painting — окраска распылением
11. frame — рама
12. spray-painting gun — распылитель краски
13. grinding — шлифование
14. polishing — полирование
15. spindle — шпиндель
16. hazardous — опасный
17. shift — смена

2. Прочитайте текст и переведите:

TEXT 5

ROBOTS IN AUTOMOBILE MANUFACTURING

Robots and robotic complexes nowadays are widely-used in manufacturing operations of the automobile industry. The applications of robots can be divided into three categories:

1. material handling
2. processing operations
3. assembly and inspection.

Material-handling is the transfer of material and loading and unloading of machines. Material-transfer applications require the robot to move materials or work parts from one to another. Many of these tasks are relatively simple: robots pick up parts from one conveyor and place them on another. Other transfer operations are

more complex, such as placing parts in an arrangement that can be calculated by the robot. Machine loading and unloading operations utilize a robot to load and unload parts. This requires the robot to be equipped with a gripper that can grasp parts. As a rule, the gripper must be designed specifically for the particular part geometry.

In robotic processing operations, the robot manipulates a tool to perform a process on the work part. Examples of such applications include spot welding, continuous arc welding and spray painting. Spot welding of automobile bodies is one of the most common applications of industrial robots. The robot positions a spot welder against the automobile panels and frames to join them. Arc welding is a continuous process in which a robot moves the welding rod along the welding seam. Spray painting is the manipulation of a spray-painting gun over the surface of the object to be coated. Other operations in this category include grinding and polishing in which a rotating spindle serves as the robot's tool.

The third application area of industrial robots is assembly and inspection. The use of robots in assembly is expected to increase because of the high cost of manual labour. But the design of the product is an important aspect of robotic assembly. Assembly methods that are satisfactory for humans are not always suitable for robots. Screws and nuts are widely used for fastening in manual assembly, but the same operations are extremely difficult for an one-armed robot.

Рис. 1.7. Робот-манипулятор выполняет сборку автомобиля

Inspection is another area of factory operations in which the utilization of robots is growing. In a typical inspection job, the robot positions a sensor with respect to the work part and determines whether the part answers the quality specifications.

In nearly all industrial robotic applications, the robot provides a substitute for human labour. There are certain characteristics of industrial jobs performed by humans that can be done by robots:

1. the operation is repetitive, involving the same basic work motions every cycle,

2. the operation is hazardous or uncomfortable for the human worker (for example: spray painting, spot welding, arc welding, and certain machine loading and unloading tasks),

3. the workpiece or tool is too heavy and difficult to handle,

4. the operation allows the robot to be used on two or three shifts.

3. Ответьте на следующие вопросы:

1. How are robots used in automobile manufacturing?

2. What is «material handling»?

3. What does a robot need to be equipped with to do loading and unloading operations?

4. What does a robot manipulate in a robotic processing operation?

5. What is the most common application of robots in automobile manufacturing?

6. What operations could be done by robot in the car manufacturing industry?

7. What are the main reasons to use robots in production?

8. How can robots inspect the quality of production?

9. What operations could be done by robots in hazardous or uncomfortable conditions for the human workers?

4. Переведите предложения на английский язык:

1. Роботизированные системы широко используются для выполнения трудных или опасных для человека задач в производстве.

2. Автоматизация широко используется в химической промышленности и автомобилестроении.

3. Станки с числовым программным управлением — хороший пример программируемой автоматизации.

4. Гибкая автоматизация делает возможным перепрограммирование оборудования.

5. Использование гибкой автоматизации делает возможным производство разнообразной продукции.

UNIT 6

ЭНЕРГОСБЕРЕГАЮЩЕЕ ПРОИЗВОДСТВО

1. **Прочитайте текст, выпишите новые/ незнакомые слова, найдите их перевод в словаре, устно переведите:**

ENERGY SAVING MANUFACTURING

Electricity is used to energize different kinds of equipment. We use electrical power for heating, cooling and lighting our houses, for cooking food, and for numerous devices and gadgets such TV-sets, computers and smartphones. Electrical power has become an essential necessity for modern society. Besides the obvious advantages that electrical power brings to our life there is a definite set of threats that this modern technology causes. The process of electricity generation on different kinds of power stations often is not so harmless to nature.

One of the most efficient but dangerous means of electricity generation is a nuclear power station. Though this is one of the most effective ways to generate electricity for the needs of society, the disastrous catastrophes in Chernobyl and Fukusima showed us how dangerous nuclear power is. The process of nature-friendly electricity generation has been developing greatly these days. Wind power, solar power and the power of the ocean are used to generate safe and cheap electricity that will be able to bring our life to the next level of evolution.

Рис. 1.8. Энергосберегающие технологии 21 века

Manufacturing processes need a great consumption of electricity and water. While some facilities are mitigating their energy costs by installing on-site renewable generation, there are some more basic energy saving steps that everyone should investigate first. Here they are:

1. *Lighting*. Switching off lights remains one of the easiest ways to save on energy but it's surprising how often lights are kept on, even when no one is in the lit area. This problem is compounded when employees go in and out of various buildings and work areas as they go about their duties. Incorporate automated lighting systems that make adjustments based on the room's occupancy or daylight availability. You can also install day/night switches to automatically control outdoor lighting. Additionally, install motion detector sensors that only switch lights on when the area is in use.

2. *Turn off and run equipment only when required.* Ensure you shut off machinery and equipment when not in use. Walking through your plant after-hours and ensuring equipment is powered down when not in use can result in significant savings over time. Specifically, reduce the operating pressure of your air compressor, check for leakages, and turn it off completely when not in use.

3. *Reduce closing door delay.* Automatic doors are a great way for manufacturing businesses, which require a cold room or refrigerated storage, to save on energy as they use sensors or a time delay to close the door. Energy savings can be made by reducing the close delay time frame on automatic doors, and limiting the frequency of cool room access as far as its practical.

4. *Clean and maintain equipment.* Regular cleaning and planned maintenance of your electrical and mechanical equipment will go a long way towards optimising its performance and lifespan, which can translate to energy efficiency savings. Performing regular maintenance on your equipment will prolong its lifespan.

5. *Air conditioning and heating.* According to Siemens, heating and cooling uses around 20 to 40 percent of a building's energy. Newer heating and cooling systems will be far more efficient than old ones, so it may be worth getting systems more than 10 years old replaced. Ensure your air conditioning and heating are set to the optimum points during the seasons. 'Setting the temperature to 25 degrees Celsius could cut your office's daily air-conditioning energy consumption by 18 per cent,' ABC reports.

6. *Insulation*. Insulation acts as a barrier against temperature shifts, making it much easier to keep the workplace warmer in winter and cooler in summer. By installing insulation in the roof, and walls of your workspace, you can reduce the amount of energy needed to maintain room temperature during heat loss and heat

gain. This is one of the most practical and cost effective ways to make your facility more energy efficient.

7. *Shade windows and walls*. Often, the primary source of heat entering a building is via unprotected windows. The sun's radiant energy can generate the same local heat as a single bar radiator. Save energy by using fixed or adjustable shading, planting trees and vegetation or installing sun filters on the windows and walls of the workplace - especially industrial sheds - to protect it from radiant energy.

8. *Replace existing lights with LEDs.* LED bulbs use about a quarter of the energy to produce the same light as halogens and can last five to ten times longer. This makes them the logical lighting choice for energy savings, particularly when manufacturing workspaces need adequate and plentiful lighting.

9. *Use natural airflow*. Opening a window, or building door is a simple energy saving technique that can help reduce air conditioning and heating costs by relying on natural ventilation for climate control.

10. *Check air conditioning lines*. Make sure that pipe lagging on all refrigerant lines are intact as insulation is absolutely crucial, especially if the air conditioner is an outdoor unit. If the air conditioner lines are not insulated, it's just absorbing heat from the environment and cooling the outside air instead of the building and vice versa in winter.

11. *Optimise appliances.* Depending on the appliances used in the workplace, you can optimise their settings to increase energy savings. For example, you can increase the drinks fridge temperature in the kitchen by one or two degrees to save energy without impacting employees or business.

12. *Make it collaborative, not top down.* Any energy savings initiative should be collaborative and involve all employees. If you want your employees to change their behaviour they need to do it when you're not in the room. So, communicate the real business costs. Let them know how it affects the bottom line, and regularly raise energy at toolbox meetings or monthly company meetups, to keep it top of mind. People will want to do their part if you let them.

By making small changes to your facility's lighting, air conditioning usage and switching off equipment when not in use, you can make a big difference to your yearly energy consumption. Once you've mastered the basics, you may consider energy efficiency measures such as power factor correction, or energy monitoring to gain a better understanding of which systems consume the most energy.

2. На основе прочитанного текста подготовьте небольшое выступление на тему “Какие энергосберегающие технологии я буду применять на своем производстве”

UNIT 7

РОБОТИЗИРОВАННАЯ СВАРКА

1. Изучите следующие слова и словосочетания:

1. an articulating robot - робот с шарнирными сочленениями, шарнирный робот
2. a rectilinear robot - робот с прямолинейной дорожкой
3. a rotating wrist - вращающийся запястный шарнир
4. axes (мн. ч. от axis) – оси перемещений; система координат
5. a linear movement - линейное перемещение
6. a rotating joint - шарнир, шарнирное соединение
7. irregularly shaped - неправильной формы, несимметричный
8. setting up – заправка, установка
9. a facility - устройство; установка; оборудование
10. a recalibration - повторная калибровка; повторная градуировка, переградуировка; повторная тарировка
11. to necessitate - делать необходимым; неизбежно влечь за собой
12. appropriate - подходящий, соответствующий; должный
13. a maintenance procedure - порядок технического обслуживания
14. interruption - задержка, приостановка, прерывание
15. production line - производственная линия; технологическая линия

2. Прочитайте интернациональные слова и переведите:

Robotic, mechanized, programmable, to automate, a robot, virtual, an electro-mechanical system, an agent, commercial, industrial, accuracy, a human, manufacturing, packing, transport, a laboratory, mass production, a process, gas, metal, equivalent, extensively, to command, a component, manipulator, controller, a design, a type, to be categorized, popular, to be engineered, monotony, a zone, to operate.

3. Составьте из предложенных слов предложения. Первое предложение послужит примером:

1. programmable/ welding/ the/ robotic/ tools/ mechanized/ is/ of/ use. *Robotic welding is the use of mechanized programmable tools.*
2. mechanical/ agent/ a/ is/ robot/ a/ artificial.
3. robotics/ welding/ new/ a/ application/ of/ robotic/ is.
4. in/ first/ into/ were/ US/ 1960/ introduced/ robots/ industry.

4. Прочитайте текст:

TEXT 7

ROBOTIC WELDING

Robotic welding is the use of mechanized programmable tools (robots), which completely automate a welding process by both performing the weld and handling the part. A robot is a virtual or mechanical artificial agent. In practice, it is usually an electro-mechanical system. *"A robot is a reprogrammable multifunctional manipulator designed to move materials, parts, tools, or specialized devices, through variable programmed motions for the performance of a variety of tasks"* (Fu, Gonzalez, Lee, MacGraw Hill).

Commercial and industrial robots are in widespread use performing jobs more cheaply or with greater accuracy and reliability than humans. They are also employed for jobs, which are too dirty, dangerous or dull to be suitable for humans. Robots are widely used in manufacturing, assembly and packing, transport, earth and space exploration, surgery, weaponry, laboratory research, and mass production of consumer and industrial goods. Robotic welding is commonly used for resistance spot welding and arc welding in high production applications, such as the automotive industry. Processes such as gas metal arc welding, while often automated, are not necessarily equivalent to robotic welding, since a human operator sometimes prepares the materials to be welded.

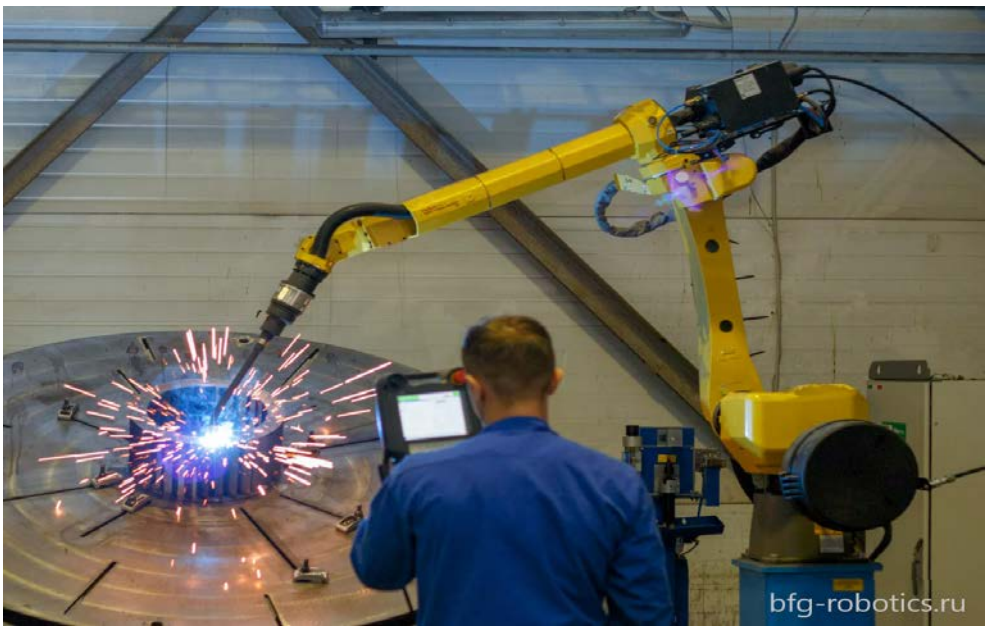


Рис. 1.9. Роботизированная сварка

Robotic welding is a relatively new application of robotics, even though robots were first introduced into US industry during the 1960s. The use of robots in welding did not take off until the 1980s, when the automotive industry began using robots

extensively for spot welding. Since then, both the number of robots used in industry and the number of their applications has grown greatly.

Robotic arc welding has begun growing quickly just recently, and already it commands about 20% of industrial robot applications. The major components of arc welding robots are the manipulator or the mechanical unit and the controller, which acts as the robot's "brain". The manipulator is what makes the robot move, and the design of these systems can be categorized into several common types, such as the SCARA robot and Cartesian coordinate robot, which use different coordinate systems to direct the arms of the machine.

There are two popular types of industrial welding robots. They are articulating robots and rectilinear robots. Robotics controls the movement of a rotating wrist in space. Rectilinear robots move in line in any of three axes (X, Y, Z). In addition to linear movement of the robot along axes there is a wrist attached to the robot to allow rotational movement. This creates a robotic working zone that is box shaped.

Articulating robots employ arms and rotating joints. These robots move like a human arm with a rotating wrist at the end. This creates an irregularly shaped robotic working zone. There are many factors that need to be considered when setting up a robotic welding facility. Robotic welding needs to be engineered differently than manual welding.

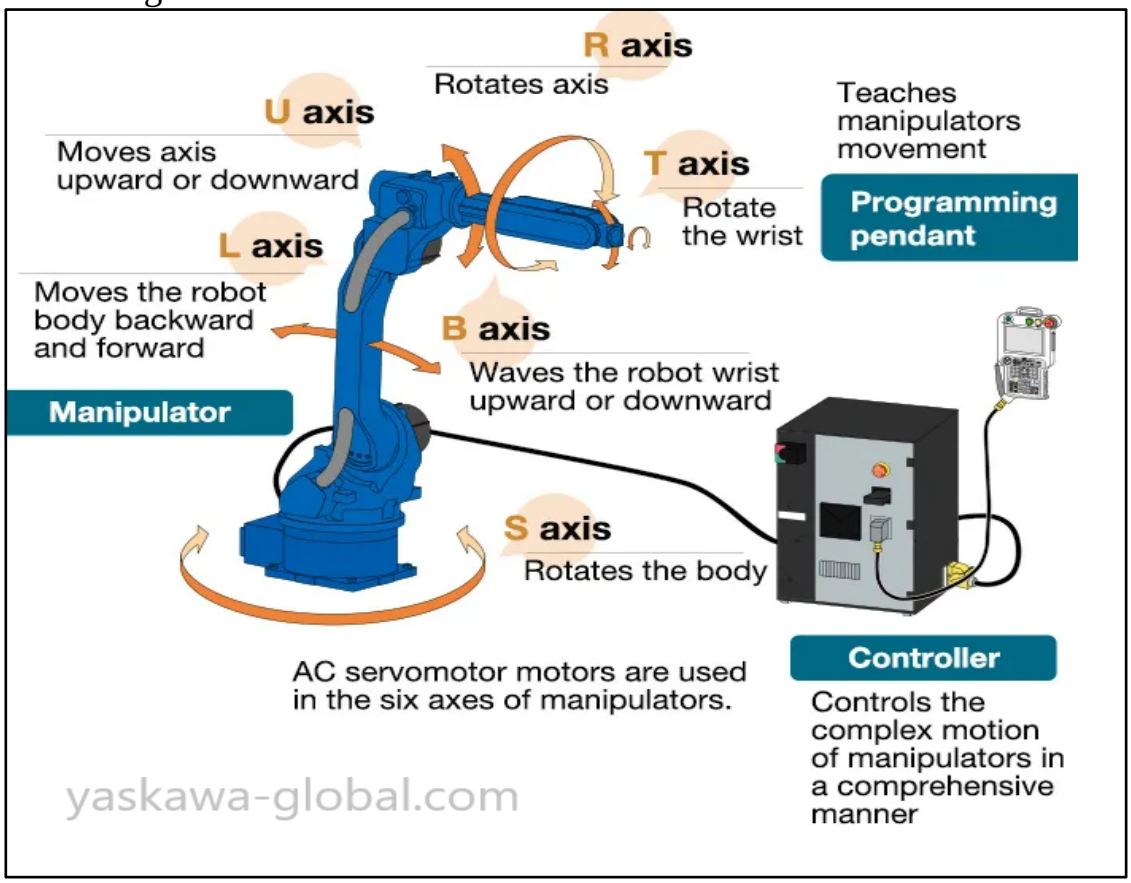


Рис. 1.10. Шесть осей манипуляторов

A robotic welding system may perform more repeatedly than a manual welder because of the monotony of the task. However, robots may necessitate a regular

recalibration or reprogramming. Robots should have the number of axes necessary to permit the proper range of motion. The robot arm should be able to approach the work from multiple angles. Robotic welding systems are able to operate continuously, provided appropriate maintenance procedures are adhered to. Continuous production line interruptions can be minimized with proper robotic system design.

5. Прочитайте предложения и поставьте T – если утверждение верное и F – если утверждение неверное:

1. Robotic welding is a manual process of welding.	
2. A robot is an electro-mechanical system.	
3. Robotic welding is commonly used for resistance spot welding and arc welding in high production applications.	
4. There are ten popular types of industrial welding robots.	
5. Rectilinear robots move in line in any of three axes.	
6. A wrist attached to the robot allows a linear movement.	
7. A robotic working zone is usually oval shaped.	
8. Articulating robots move like a human arm.	
9. Robotic welding is engineered as a manual welding.	
10.Robotic welding systems operate non continuously.	

6. Ответьте на вопросы:

1. Robotic welding is the use of mechanized programmable tools (robots), isn’t it?
2. What are the advantages of commercial and industrial robots? What is robotic welding commonly used for?
3. When and where were the first robots introduced and used?
4. What are the main parts of a robot?
5. The controller acts as the robot's "brain", doesn’t it?
6. What are two popular types of industrial welding robots?
7. Does robotics control the movement of a rotating wrist in space?
8. What robots move like a human arm with a rotating wrist at the end?
9. Why is a robotic welding system more preferable in some welding processes than a manual welder?
10. What are the advantages and disadvantages of using robotic welding systems?

UNIT 8

МИР РОБОТОТЕХНИЧЕСКИХ ИЗОБРЕТЕНИЙ

1. **Прочитайте текст, выпишите новые/ незнакомые слова, найдите их перевод в словаре; выберите текст про любое понравившееся изобретение в тексте и переведите этот абзац письменно:**

TEXT 8

THE WORLD OF ROBOTICS INVENTIONS

Robotics engineering has been developing since the beginning of the new millennium. The annual Consumer Electronics Show (CES) expo in Las Vegas has traditionally been a major showcase for robotics breakthroughs each year.

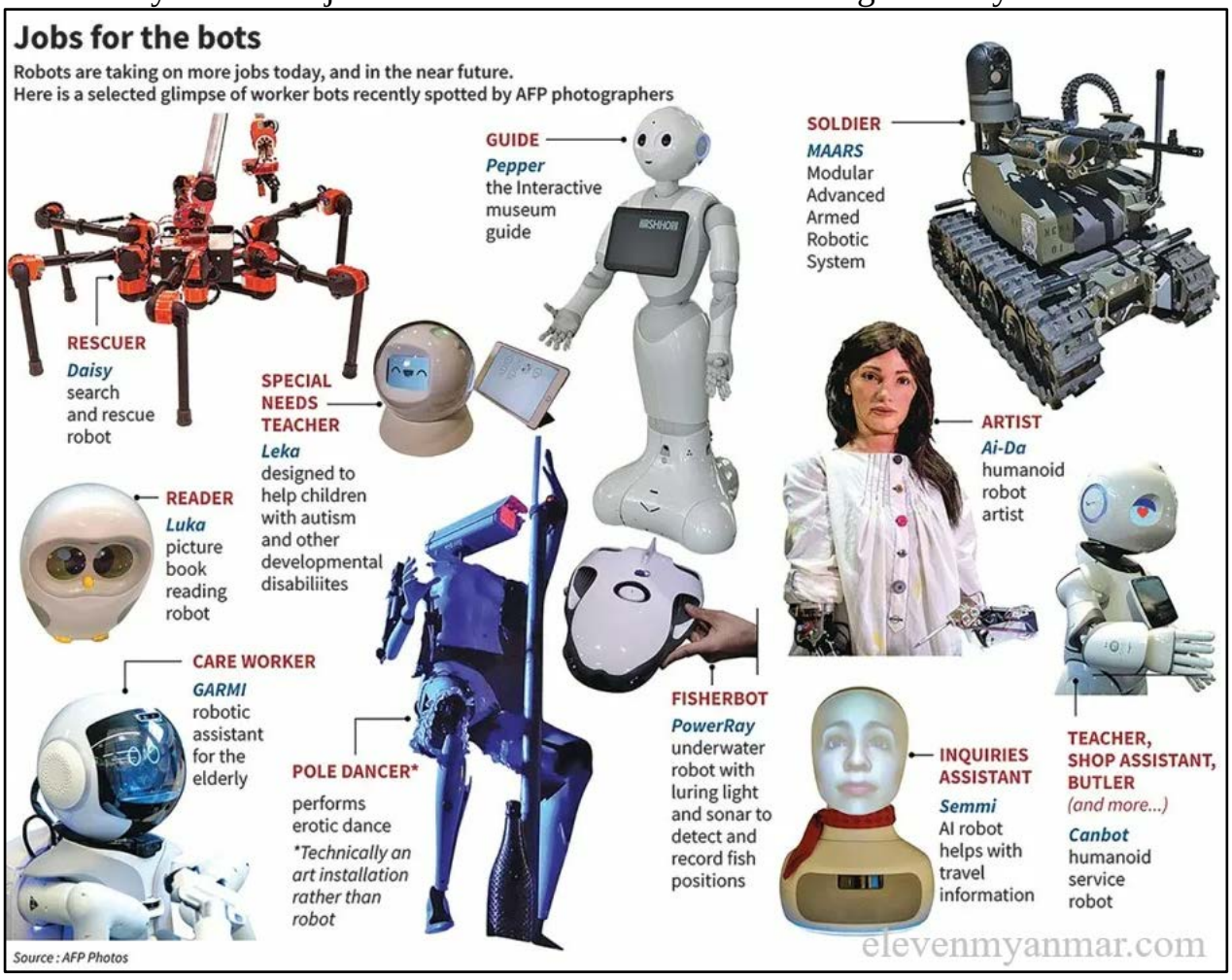


Рис. 1.11. Виды работ, с которыми успешно справляются боты

Throughout the year, some trends have been emerging that provide insight to the direction in which robotics development is heading, including:

1) Domestic cleaning robots.

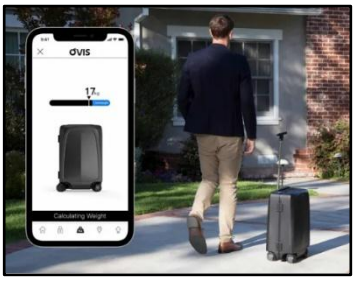
2) Companion robots.
3) Self-driving cars.
4) AI-powered health and wellbeing technology.

Let's look at ten of the most influential robotics inventions:

1. Ubtech Robotics Walker

The first bipedal robot to hit the commercial market, the Walker can be activated either by voice or by its touchscreen and serves as a robotic butler. This automated household helper can control your smart home, play music and dance, help schedule your calendar, patrol the home, and provide visual surveillance and motion detection. Although the Walker is currently armless, robotic arms that will further expand its usefulness are in development.

2. ForwardX CX-1 Robotics Suitcase



Frequent fliers among us will look on with envy at the hassle-saving potential of the CX-1. In essence it's a smart suitcase, packed full of features to take the effort out of carrying baggage. Powered wheels allow it to follow its owner autonomously, assisted by facial recognition so it can independently track users and sensors to detect and evade obstacles. There's even an anti-theft system in place where an alarm goes off on the user's smart wristband if the CX-1 goes beyond a certain distance.

3. Somnox Sleep Robot

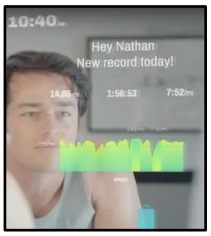
The body pillow gets a robotic upgrade with the Somnox sleep robot. This robotics device copies the feeling of sleeping next to another person by mimicking respiratory function to comfort the insomniacs amongst us. The idea is that the Somnox helps calm anxious sleepers by giving them a breathing pattern to mimic that helps them fall asleep faster. While the idea of clasping a "breathing" robot might be unsettling to some, the Somnox has already proven popular.

4. Boston Dynamics SpotMini

Boston Dynamics aren't known for deploying charm offensives. Much-viewed videos of their dog-like robots running and jumping have thrilled and terrified

viewers in equal measure. Perhaps the most infamous, and impressive, of all is the SpotMini. It's able to run, jump, and even open doors. A video published earlier this year saw it carrying out tasks even in the face of mild human interference. Whether you feel it's a harbinger of the Skynet-style technological dystopia that's awaiting us or not, there's no denying the potential applications of the technology are mind-boggling.

5. Care OS Smart Mirror



Magic mirrors that talk back to you look like they won't just be a feature of fairy tales anymore. The Care OF mirror uses gesture controls and facial recognition to give skincare advice, as well as playing music and taking selfies. It's similar to other smartphone apps in development that use the camera to analyse users' dermatological health and provide advice about hydration and UV exposure, albeit on a much larger, domestic scale.

6. Robomart

The Robomart aims to make trips to the grocery store a thing of the past, with an AI-assisted autonomous vehicle that can bring you foodstuffs to order. Food retailers would lease the technology, leading to a Robomart fleet that can autonomously fulfill online grocery orders at a speed of up to 25 miles per hour. A pilot launch is scheduled this summer for California's Bay Area.

7. Sophia

Although there have been iterations in previous years, it was at the 2018 CES that Sophia really made a splash. The ongoing brainchild of Hong Kong's Hanson Robotics, Sophia is one of the most impressive displays of smart, empathetic artificial intelligence around. A milestone in humanoid robotics, Sophia's software is powered by Google, helping her hold developed conversations with humans that include smart retorts, philosophizing, and even the occasional well-timed joke. While commercial applications aren't yet clear, Sophia remains a truly stunning example of the possibilities offered by smart AI.

8. Aeolus Bot

The Aeolus Bot is bringing the robotics market closer than ever before to serious domestic applications. This home assistant bot is capable of vacuuming the floor, cleaning and putting away objects, and guarding the home. Running on Alexa, it can also help with shopping and organizing your diary. It's still in the prototype stage, but manufacturer Aeolus Robotics is confident that a commercial model is just on the horizon.

9. Kuri

Of all domestic assistant robots, Kuri looks to be the first in line for widespread adoption with pre orders already starting to ship. It's packed full of features, with the ability to answer questions and monitor your home thanks to an array of sensors. Simple in design and fun and useful around the house, it seems likely that Kuri's the first robot that's going to become a reality in everyday life. These are just a handful of the innovations that 2018 has seen so far. With the year far from over, we're likely to see further eye-catching development in the robotics inventions industry still to come. Events such as the global heats of the worldwide VEX Robotics Competition, BestRoboFest by Max Polyakov, Robotworld, and the Automation Technology Expo promise to be hotspots for announcing more breakthroughs in robotics engineering. If we see more designs unveiled like the above inventions, it looks like 2018 will be a milestone in the field of robotics development.

(*by BOSS editorial team; from https://thebossmagazine.com*)

ПОДГОТОВКА К УЧЕТНО-ЗАЧЕТНОМУ ЗАНЯТИЮ

1. Рассмотрите устройство робота (рис. 1.12). Подберите английские эквиваленты к названиям частей робота.

2. Опишите его внешний вид, из чего состоит, какую работу может выполнять (рис. 1.12).

3. Рассмотрите устройство робота (рис. 1.13). Сравните роботов на рис. 1.12 и рис. 1.13, что у них общего и чем отличаются.

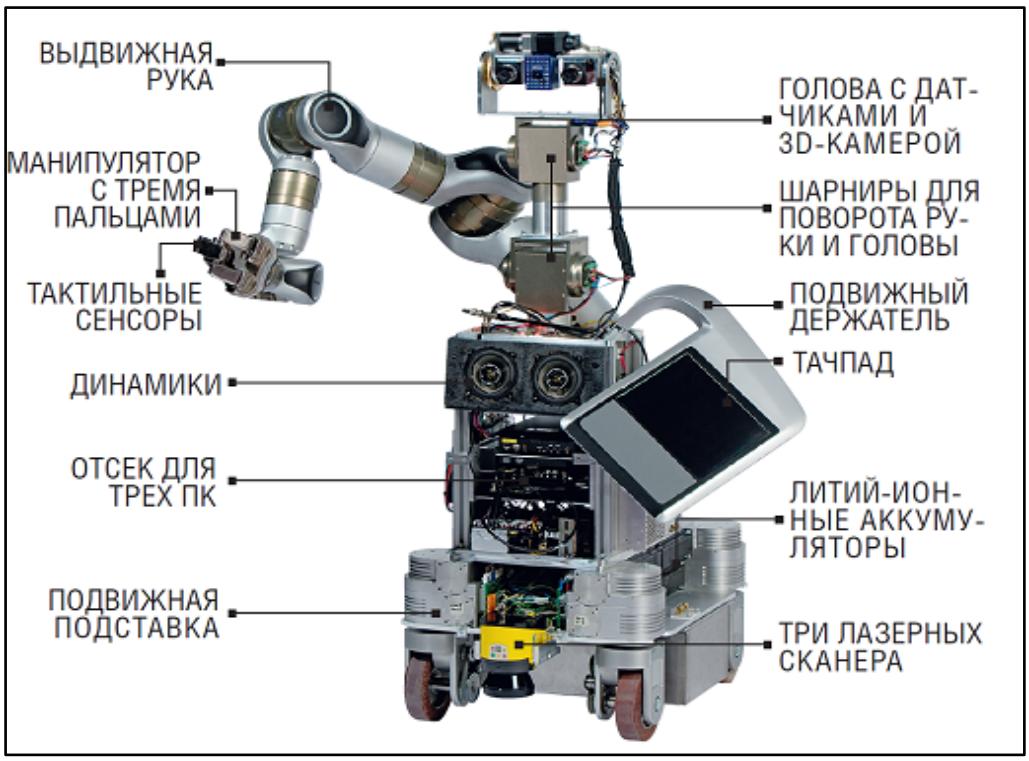


Рис. 1.12. Устройство мобильного робота

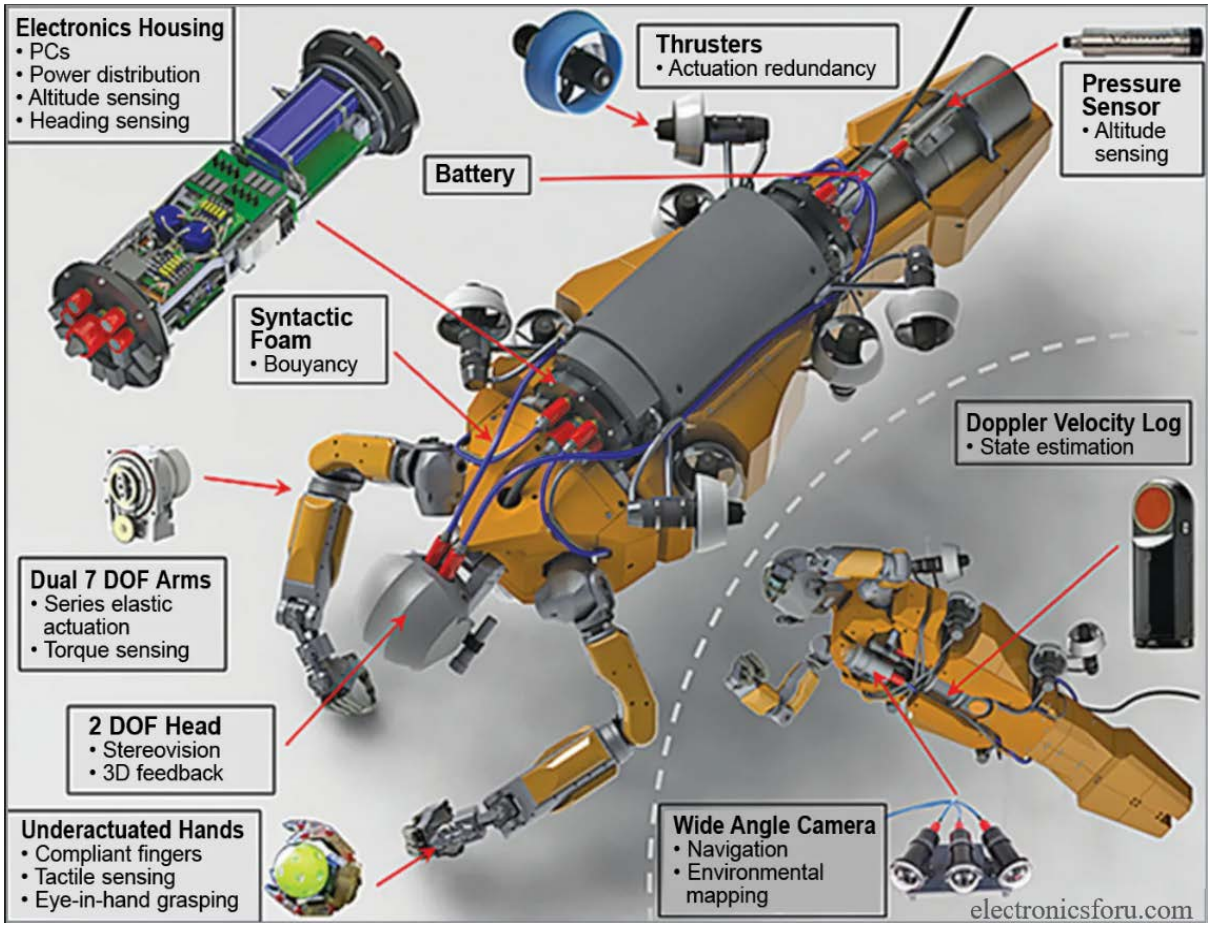


Рис. 1.13. Устройство подводного робота

4. Прочитайте текст, переведите его письменно и составьте реферат:

History of Mechatronics Engineering

Tetsura Mori was working for a Japanese company called Yaskawa Electric Corporation that was famous for building mechanical factory equipment.

At that time, Yaskawa Electric Corporation was using some electronic features for manufacturing mechanical equipment. Mori wanted to introduce a technical term for that new technology, so he combined the two technical words ‘mechanical’ and ‘electronics’ and created the new word “Mechatronics”.

In 1970, Yaskawa applied to make this word a registered brand and got the rights in 1973. But, at that time this term didn’t gain much popularity. After the 1980s, the term started gaining popularity because of its useful features.

Earlier, this term was based on only some electrical and electronic computers, but after the 1980s, the use of computer technology was integrated. The controlling and functioning of machines became much easier by use computer hardware and software. This allowed the start of manufacturing of a variety of products of any size with very high accuracy and comparatively low cost.

At the research and development level, mechatronics is classified into ten technical areas: Motion Control, Robotics, Automotive Systems, Intelligent Control, Actuators and Sensors, Modeling and Design, System Integration, Manufacturing, Micro Devices and Optoelectronics, and Vibration and Noise control.

Obviously, the design of future products will involve a combination of precision mechanical and electronic systems, and mechatronics will be the basis for all activities in products and production technology.

5. Прочитайте текст и расскажите о должностных обязанностях техника-мехатроника:

Some job responsibilities of a mechatronics engineer include:

1. Apply mechatronic or automated solutions to the transfer of material, components or finished goods.
2. Apply advanced control systems, which are usually computer-driven.
3. Apply electronic and mechanical processes and computers to tasks where the use of human labor may be dangerous (like underwater exploration, mining or forestry).
4. Build and test factory production lines introducing automation to improve existing processes.
5. Design and build completely new products by integrating various technologies, for example, developing robotic vehicles for underwater exploration.
6. Design, develop, maintain and manage high technology engineering systems for the automation of industrial tasks.

7. Develop new solutions to industrial problems using mechanical and electronic processes and computer technology.
8. Maintain and improve previous industrial and manufacturing processes and designs, for example, robotic lawn mowers and robot floor cleaners.

6. Напишите сочинение-рассуждение (150 слов) на тему:

«Robots are unable to replace a human in all jobs»

The problem of automation and robotization has always aroused debates. Some people are convinced that robots will soon replace humans in all jobs. However, the others believe that ...

Вопросы:

1. What functions are robots able to perform?
2. What kinds of jobs do you think robots will be doing in the future?
3. What jobs are impossible to complete by robots? Why?
4. What do robots lack compared to humans?

Фразы-подсказки: to do simple actions; to interact with the outer world; to create; to repair; to make other robots; to manage robots; to understand figurative speech; to build factories and houses in outer space; to mine minerals on Mars; to think like a human; to make decisions; to feel and produce emotional responses; people, who are involved in creative jobs.

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ОГЛАВЛЕНИЕ

АВТОМАТИЗИРОВАННОЕ ПРОИЗВОДСТВО

МЕТОДИЧЕСКИЕ УКАЗАНИЯ

к практическим занятиям и самостоятельной работе
по дисциплине «Иностранный язык в профессиональной деятельности (английский)»
для студентов 4 курса специальности
15.02.10 Мехатроника и мобильная робототехника (по отраслям)

Часть 2

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