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АНГЛИЙСКИЙ ЯЗЫК

Учебно-методическое пособие по чтению и переводу английской научно-технической литературы

Санкт-Петербург
2012

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ
ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ
ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ
ВЫСШЕГО ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ

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РАСТИТЕЛЬНЫХ ПОЛИМЕРОВ»

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Цель настоящего пособия – способствовать выработке умения правильно читать и переводить с английского языка на русский литературу по специальности.

Пособие содержит 24 урока, каждый из которых включает упражнения, тексты и вопросы к ним, а также коррективный фонетико-орфоэпический курс, таблицы грамматических трудностей и словарь. Предназначено для студентов I и II курсов факультета АСУТП.

Рецензенты: зав. кафедрой английского языка №3
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растительных полимеров, 2012

Введение

Предлагаемое учебно-методическое пособие предназначено для студентов факультета «Автоматические системы управления технологическими процессами» и имеет целью развитие навыков чтения и перевода специальной научно-технической литературы. Тексты посвящены общим вопросам автоматизированного управления производственными процессами.

Работа состоит из 24 уроков, приложений и словаря. Каждый урок включает два текста: для устного изучения и для письменного перевода. Предшествующие текстам упражнения помогают снять фонетические, лексические и грамматические трудности и определить словарный минимум, который студенты должны заучить. Послетекстовые упражнения предназначены для активизации лексико-грамматических знаний студентов по данной теме и повторения словарного минимума урока. Тексты для письменного перевода служат углублению навыков изучающего чтения по специальности.

Раздел «Приложения» содержит:

1. Коррективный фонетико-орфоэпический курс на лексике специальности.
2. Таблицы основных грамматических трудностей перевода технических текстов и упражнения к ним также на специальной лексике.

Все методические материалы «Приложения» используются преподавателем по своему усмотрению.

Словарь, прилагаемый в конце пособия, включает необходимые для перевода слова в их контекстуальном значении.

Урок 1

1. Вспомните основные правила чтения согласных букв в английском языке (Приложение 1, П 1.1). Прочитайте следующие слова и объясните их чтение.

supervision, manufacturing, stochastic, machine, require, ensure, beginning, increase, essential

2. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

supervise (v), supervision (n), recognize (v), involve (v), relieve (v), drive (v), obtain (v), require (v), reduce (v), increase (v), grow (v), monitor (v), on-line (a)

3. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

product [‘pr□d□kt], production [prə’d□k□n], automation [,□:tə’me□□n], manufacture [,mænj□’fæk□ə], parameter [pə’ræm□tə]

4. От данных глаголов с помощью суффиксов -tion (-ation, -ion, -sion) образуйте существительные со значением названия действия или его результата. Переведите их.

supervise, operate, optimize, apply, specify, produce, inform, concentrate, associate, decide

5. Переведите следующие существительные, образованные с помощью суффикса -ing и означающие название действия или его результат.

manufacturing, monitoring, beginning, meaning, increasing, checking, machining, functioning

6. Прочитайте и переведите словосочетания.

production system, production process, control system, end product, machine tool, research work, error signal, rule base, reagent flow requirement, on-line human activity

7. Переведите следующие предложения, учитывая разные значения слова “since”.

1) Since the atomic structure became known, many chemical processes were explained.
2) The need for automatic supervision has been recognized since the very beginning of industrial manufacture.
3) Since many factors can lead to many undesirable (нежелательный) effects, complete automatic monitoring is possible in exceptional (исключительный) cases.
4) Since the beginning of the 1940s, the computing technique has started to develop successfully.

8. Прочитайте и переведите предложения, учитывая разные значения слова “only”.

1) It was the only way to solve this problem.
2) In automatic supervision a monitoring system is only a part of an automatic supervision system.
3) The need for full automation of production is a very important impetus (импульс) for the research work, but not the only one.
4) Only a fully automated supervisory system enables (позволять) the manufacturing equipment to operate without human help.

9. Переведите предложения, обращая внимание на функции глагола “to have” (Приложение 2, табл. П 2.2).

1) The checking is done actively and this generally has a harmful effect on the process.
2) The machine tool with a driving system has relieved people from the physical effort.
3) The operators have always to supervise the state of machine tools and the performance of manufacturing process.
4) There are a great number of methods for the testing and observation, so the choice has to be made carefully.
5) Although the mental activity of the personnel has been reduced by the automatic control, it is always necessary to have some operators to monitor disturbances.

10. Переведите предложения, учитывая особенности перевода причастий (Приложение 2, табл. П 2.6).

1) A robot is a reprogrammable multifunctional manipulator designed to move different tools or specialized devices through variable programmed motions.
2) Positions and velocities are the usual state variables defining the state of a mechanical system.
3) The introduction of a reset action in the control system is achieved by parallel controllers using control laws based on triples instead of pairs of data.
4) The increase of the use of robots will have a favourable influence on working conditions, relieving the humans of heavy and/or repetitious tasks.
5) During normal operation, the controller will execute the point-to-point program, continuously monitoring the new values of the variables of motion of the end-effector.
6) The informal electronic net of a robot system has both analog and digital circuitry working in conjunction with sensory units, motor control and the main controller.

11. Прочитайте и переведите текст.

Role of automatic supervision in manufacturing

Automatic supervision in manufacturing is a relatively new term, but the need for such supervision has been recognized since the very beginning of industrial manufacture. Supervision of production involves the study of all stochastic events (that is disturbances) which might influence the production process and its end product. The operators have always to supervise such things as the state of machine tools, the performance of manufacturing processes etc. Their aim is to ensure that the end products were obtained as quickly and cheaply as possible.

However, with the increasing of automation of production processes, more and more supervisory tasks require automatic monitoring. Complete automation of a production system requires a complete automatic supervisory system that monitors all the vital parameters, which vary during the operation.

The machine tool with a driving system has relieved people from the physical effort, but not from the mental activity and stress, connected with the manual control of a manufacturing process. Although the mental activity has been reduced by development in automatic control, even with an automatic control system, which covers the whole manufacturing cycle, it is necessary to have some personnel to monitor disturbances. Only a fully automatic supervisory system would enable the manufacturing equipment to operate without on-line human activity.

The need for full automation of production is a very important impetus for the research work into the development and application of automatic supervision in manufacturing systems, but not the only one. With the growing complexity of manufacturing equipment as well as increasing parameters of production processes people might not be able to react as quickly as it is necessary. In many cases automatic supervisory systems are essential.

12. Ответьте на вопросы.

1) What is the aim of the supervision of manufacturing production?
2) What parameters have to be supervised during the manufacturing process?
3) Is it possible to monitor all the parameters of the manufacturing cycle by means of an automatic control system?
4) What kind of automatic control would ensure the operation of the equipment without on-line human activity?

13. Заполните пропуски нужным по смыслу предлогом: in, into – в; by + сущ. – творительный падеж (кем? чем?), с помощью; of + сущ. – родительный падеж (кого? чего?); to + сущ. – дательный падеж (кому? чему?), к; through – через; from – от.

1) Adaptability can be built …… the system …… the adaptive functions …… the control system.
2) …… the case of disturbances leading …… break-down (авария) the main supervisory function is to prevent failure (повреждение).
3) Break-downs are causes …… the class of disturbances that does not permit further operation …… the system.
4) The machine tool has relieved people …… physical effort but not …… mental activity.

14. Заполните пропуски нужной глагольной формой (was reduced, involves, requires, are obtained, is recognized).

1) Supervision of production ……….. the study of all the disturbances.
2) Complete automation of a production system ……….. a complete automatic supervisory system.

3) The end products ………… as quickly and cheaply as possible.
4) The necessity of automation of production processes ………… more and more.
5) The manufacturing equipment ………… by the automatic system.

15. Переведите текст письменно со словарем.

The traditional methodologies used in the analysis of the organizations consider them as highly structured closed systems. Nevertheless, it is now important, due to the complexity of the existing relationships, to consider the organization as being made by an external environment and an internal system of interdependent relationships. In this way an organization is considered as a formal system influenced by the internal social structure and subjected to the pressure of the external institutional environment.

Урок 2

1. Вспомните основные правила чтения гласных букв в английском языке. (Приложение 1, П 1.2). Прочитайте следующие слова и объясните их чтение.

related, produce, production, requirement, optimization, disturbance

2. Выпишите из словаря следующие слова с транскрипцией и переводом. Запомните их произношение и значение.

apply (v), batch (n), consider (v), demand (n), dimension (n), designate(v), level (n), mean (v), meaning (n), quality (n), property (n), tolerance (n)

3. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

result [r□'z□lt], associate [ə'sə□□□ət], accuracy ['ækj□rəs□], diameter [da□'æm□tə], calculate ['kælkj□le□t], efficiency [□'f□□əns□], uniformity [,ju:n□'f□:m□t□]

4. От данных глаголов с помощью суффикса -ment образуйте существительные со значением названия действия или его результата. Переведите их.

require, measure, equip, develop, improve

5. Переведите следующие существительные, образованные с помощью суффикса -ance (-ence) и означающие название действия или его результата.

disturbance, tolerance, conformance, performance, resistance

6. Прочитайте и переведите словосочетания.

tolerance range, quality level, signal level, error signature, safety point of view, break-down point of view, cost of production point of view, two-value quality index, multi-value quality index

7. Переведите предложения, учитывая значение сложных наречий (both… and… – и… и…; either… or… – или… или…; as well as – так же, как; as long as – пока; as soon as – как только).

1) Automatic error recovery is today possible to do both with simple and complex errors.
2) As long as known errors occur the system performs well.
3) Supervision system corrects the errors on-line with either manual or automatic operations.
4) Both with testing and observing, the results need to be compared.
5) The monitoring and the diagnosis can be done either manually or completely automatically.
6) The level of supervision is related to quality of products as well as quality of the production processes.
7) As soon as the monitoring system has detected a functional disturbance, it is the task of diagnosis system to determine its location, type and cause.

8. Переведите предложения, обращая внимание на сравнительную конструкцию “the… the…” – «чем… тем…».

1) The more heat a gas contains, the faster the molecules move. The faster they move, the more frequent and powerful are their collisions.
2) The longer and thinner a piece of wire, the greater will be its resistance.
3) The bigger the value of quality index, the higher the quality level.

9. Переведите предложения, учитывая разные функции глагола "to be" (Приложение 2, табл. П 2.1).

1) Diagnosis knowledge is a part of the automatic system.
2) During the production phase, permanent automatic monitoring and diagnosis are required.
3) The aim of automatic supervision is to ensure that the end product was obtained as quickly as possible.
4) During the phases of the operation, the diagnosis routines are not to be component of the system.
5) There are many kinds of disturbances.

10. Переведите предложения, учитывая особенности перевода причастий (Приложение 2, табл. П 2.6).

1) This type of control can be viewed as an intermediate class between discontinuous and linear control systems resulting in a compromise between advantages and drawbacks of both.
2) Self-organizing controllers are a possible solution to this problem.
3) Static measurements can only be performed using amplifiers having extremely high impedance (полное сопротивление).
4) Some experimental devices utilizing lasers for dimensional measurements have been tested recently.
5) Abnormalities in end-effect movements are first detected by the controller when the event trace observed does not confirm with the expected trace values.
6) An expert system, when asked, must have a short response time.

11. Переведите предложения, учитывая особенности перевода независимого причастного оборота (Приложение 2, табл. П 2.7).

1) Other things being equal, the efficiency is less in irreversible cyclic processes.
2) As the wavelength of such waves decreases they become more penetrating, gamma-rays being able to travel through as much as one foot of iron.
3) There being no atmosphere, the lunar surface is exposed to direct sunlight.
4) The main advantage of pieso-electric transducers is their sensitivity at high temperatures, the pieso-effect being lost at excessively high temperatures.

12. Прочитайте и переведите текст.

Quality of product and quality of production

The level of supervision is strongly related to quality in manufacturing – both quality of product and quality of production processes.

In industry, demands for a high level of quality must be translated into specific requirements based on features that can be measured. The results of the measurements of physical quantities are used to calculate a measure of quality which is called “quality index” and designated by **q**. The bigger the value of quality index, the higher the quality level.

In manufacturing departments the quality of a product is still frequently reduced to conformance of the properties of the end product to technical specifications. In specific cases of dimensional accuracy this means that all dimensions of the workpiece after machining should be kept within prescribed tolerance ranges. This then leads to the simplest binary assessment of workpiece quality, as “good” or “bad”. The quality index **q** may have one of two values: q=1 (“good”) when the diameter is inside the permitted range; q=0 (“bad”) when the diameter is outside. The modern trend, set first by Japanese industry, is to increase the uniformity of workpieces in a batch and to narrow the dimensional tolerances required.

When considering the quality level of manufacturing processes two aspects may be distinguished: 1) quality assessment from the safety or break-down point of view; 2) quality assessment from the efficiency or cost-of-production point of view. In the first case, quality level is associated with a two-value quality index (“good”, “bad”), in the second, with a multi-value quality index.

13. Ответьте на вопросы.

1) What is the level of supervision related to?
2) How is expressed the level of quality in industry?
3) What is the quality of product reduced to?
4) What is the modern trend in the assessment of quality index?
5) How many quality levels do you distinguish?

14. Заполните пропуски нужным по смыслу предлогом: for – для, к; to – к; after – после; from – от.

1) You may distinguish the quality assessment of manufacturing process … the safety or break-down point of view.
2) All the dimensions of the workpiece … machining should be kept within prescribed tolerance ranges.

3) The quality of product is reduced … conformance of the properties of the end product … technical specifications.
4) … this purpose you may use the results of measurements of physical quantities.

15. Заполните пропуски нужной глагольной формой (is applied; is designated; means; is considered).

1) The quality index ……….. by “q”.
2) The quality level ……….. from different points of view.
3) This ……….. that all the dimensions of the workpiece should be within tolerance range.
4) The term “quality index” ……….. not only to process, but also to products and manufacturing equipment.

16. Переведите текст письменно со словарем.

Disturbance

Disturbance means anything which was not planned and influences the quality index of the system of the manufacturing process. Disturbances do not necessarily have an adverse influence on the quality index. Sometimes disturbances make it possible to obtain better results than planned, e.g. a smaller than planned diameters of the shaft before turning allows an increase of feed and thus an increase in the output of machining.

Adaptive control of manufacturing processes is the control of a manufacturing process, which attempts, in spite of disturbances, either to keep the chosen features of the process (or features of the product) in the prescribed range or to obtain the highest quality index possible in the existing situation.

Урок 3

1. Вспомните основные правила чтения сочетаний гласных (Приложение 1, П 1.3). Прочитайте следующие слова и объясните их чтение.

feature, obtain, measure, tool

2. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

achieve (v), eliminate (v), enable (v), enter (v), expansion (n), feature (n), influence (n, v), lower (v), means (n), by means of, need (v), treat (v)

3. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

adaptation [,ædæp’te□□n], design [d□’za□n], demonstrate [‘demənstre□t], functioning [‘f□ŋk□ən□ŋ], diversified [da□’v□:s□fa□d], deformation [‘di:f□:’me□□n]

4. Прочитайте и переведите следующие пары слов.

feature – future; for – from; with – which;
since – science; change – charge; some – same

5. От данных прилагательных с помощью суффикса -ity (-ty) образуйте существительные со значением названия качества. Переведите их.

adaptable, sensitive (чувствительный), uniform, electric, similar (подобный), dense, rapid (быстрый), productive, possible, functional

6. Переведите следующие слова, учитывая отрицательное значение префиксов un-, im-, in-, de-, dis-.

unplanned, improper (proper – пригодный), deformation, inefficient, unacceptable (acceptable – приемлемый), unrealistic, dissimilar

7. Переведите следующие прилагательные, обращая внимание на их суффиксы: -al, -ry, -ive, -ic, -ous, -ent, -ar.

natural, different, supervisory, adaptive, unusual, serious, characteristic, environmental, particular, diagnostic

8. Прочитайте и переведите словосочетания.

energy input, information input, control system, execution time, tolerance margin, automatic error recovery, error type system, positioning device, time critical situation, sensing technique

9. Переведите предложения, учитывая значения слова "mean/means".

1) Automatic monitoring can check (проверять) the functionality of a module by means of specified tests.
2) The module to be checked is connected (соединять) to a testing function which means that the checking is done actively.
3) The term “diagnosis” is of Greek origin and means the detection and determination (определение) of an illness.
4) Rescheduling (перепланировка) cannot be considered as a means of error recovery (исправление).
5) Symptom in automatic manufacturing means a characteristic change of the manufacturing process.

10. Переведите предложения, учитывая значения слова "result".

1) Friction (трение) results in a loss of velocity when water flows through pipes.
2) Not all water that falls as rain or that results from the melting (таять) ice and snow runs off.
3) The flow of electrons in one direction results in an electric current.
4) An uncontrollable condition may result if no effective reactions are programmed.
5) The disturbances may be the result of an environmental influence, such as sunlight.

11. Переведите предложения, учитывая значения местоимения “it” (Приложение 2, табл. П 2.16).

1) When a circuit is switched on, current will flow through it. When it is switched off, it becomes an open circuit and the flow of current is stopped.
2) When the current flows through a conductor, it may heat the conductor. The temperature of the conductor rises. A practical use of it is in electric heaters.
3) Adaptability may be a natural feature of the manufacturing system, or it can be built into it.
4) It is necessary to enter these data into the memory.

12. Переведите предложения, учитывая особенности перевода независимого причастного оборота (Приложение 2, табл. П 2.7).

1) Personal computers being used for many purposes, scientists go on improving their characteristics.
2) Microprocessors being programmable logic devices, they can be adopted to serve a variety of job functions.
3) Robotic manipulators being relatively complex mechanical systems, their dynamics and control must be carefully studied.
4) It is necessary to study fuzzy control, this type of control appearing as a natural extension of multilevel discontinuous control.
5) The control schemes consist of two control loops, one of them including a basic position + velocity controller and the other one a model of the system.
6) The expert system conducts the diagnosis experiments in steps, each step refining the diagnosis information obtained in the previous step.

13. Переведите предложения, учитывая особенности перевода герундия (Приложение 2, табл. П 2.8).

1) Carrying out experiments is necessary for every scientist.
2) The two basic tasks of the control system are: following the desired trajectory on the one hand and reducing the effect of disturbances on the other hand.
3) These robot axes give the manipulator more flexibility in adapting its own configuration to a particular task.
4) In designing a well-developed supervision system, the desire to measure certain parameters is greater than the ability to do so.
5) The environmental sensitivity of those transducers sometimes diminishes the possibility of using them in machine tools.

14. Прочитайте и переведите текст.

Disturbances, adaptation and supervision

Any unplanned influence on the quality index should be treated as a disturbance. There are many kinds of disturbances. Some arise inside a manufacturing system (wear of tool, improper operation of a motor etc.). Others enter a manufacturing system by different material ways (energy input or information input). They may even be the result of an environmental influence, such as sunlight.

The influence of certain types of disturbances may be reduced or even eliminated by an appropriate design of the manufacturing system. This is achieved either by lowering its sensitivity to the particular types of disturbances or by building adaptability into the manufacturing system. Use of materials with a low coefficient of thermal expansion for machine tool elements demonstrates a good example where sensitivity to thermal deformations is lowered.

Another way of reducing disturbances is to use an adaptable manufacturing system. Adaptability is the characteristic feature of a manufacturing system that enables it to reduce the influence of disturbances on the quality index by means of changes in the functioning of the system. Adaptability may be a natural feature of the manufacturing system. Or it can be built into it through the adaptive functions of the control system.

Because of different characteristics of various types of possible disturbances and their diversified influences on manufacturing processes, there is a need for many different supervisory functions and systems.

15. Ответьте на вопросы.

1) What is a disturbance?
2) What kinds of disturbances are there?
3) How is it possible to reduce or eliminate a disturbance?
4) What is adaptability?
5) Why is it necessary to have many different supervisory systems?

16. Заполните пропуски нужной глагольной формой (is lowered, enter, enables, eliminates).

1) These disturbances ……… a manufacturing system by different material ways.
2) An appropriate design of the manufacturing system ……… the influence of certain disturbances.
3) Adaptability ……….. a manufacturing system to reduce the influence of disturbances.
4) Sensitivity to thermal deformation ……….. by the use of certain materials.

17. Переведите текст письменно со словарем.

Both processing and system conditions must be monitored to ensure optimum performance. There are three major strategies at present used for implementing process monitoring and control with the help of time-critical and non-time-critical situation sensing techniques. These are:

1) Open-loop monitoring systems that measure some condition of the machine tool or process and then display or activate an alarm to prompt human intervention;
2) Open-loop diagnostic systems that attempt to determine a functional or casual relationship between a machine failure and its cause;
3) Closed-loop adaptive control systems that automatically adapt machining conditions to changes in the process environment according to pre-determined strategies.

Урок 4

1. Вспомните основные правила ударения в английском языке (Приложение 1, П 1.4). Прочитайте следующие слова и объясните ударение в них.

to permit, disturbances, supervise, supervising, manufacturing, control, controller, the 'reject, to re'ject

2. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

include (v), lead (v), consequence (n), prevent (v), break-down (n), failure (n), loss (n), recovery (n), belong (v), perform (v), performance (n)

3. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

classify [‘klæs□fa□], exploit [□ks’pl□□t], procedure [prə’si:□ə], human [‘hju:mən], criteria [kra□’t□ər□ə], inefficient [,□n□’f□□ənt], integrate [‘□nt□gre□t]

4. Переведите следующие прилагательные, учитывая значение суффиксов -ful (наличие), -less (отсутствие, недостаточность).

helpful, useful, useless, powerful, powerless, colourless, successful, harmful, faultless

5. Переведите прилагательные, учитывая значение суффиксов -able, -ible, -uble (способный, подверженный, поддающийся).

valuable, understandable, unbelievable, reliable, unacceptable, adaptable, controllable, unavoidable, unsuitable, practicable, dependable

6. Прочитайте ряды однокоренных слов. Переведите их, исходя из значений словообразовательных элементов.

class (n), classify (v), classification (n)
supervise (v), supervisory (a), supervision (n)
'monitor (v), 'monitoring (n)
possible (a), impossible (a), possibility (n), impossibility (n)
manufacture (v), manufacturing (n)
product (n), production (n), productivity (n)
efficient (a), inefficient (a), efficiency (n)
accept (v), acceptable (a), unacceptable (a)

7. Прочитайте и переведите словосочетания.

recovery procedure, monitoring component, machine system, current supply, failure rates, surface roughness measurement, signature analysis, positioning accuracy, error recovery routine, industrial assembly environment

8. Переведите предложения, учитывая разные значения слова “case”.

1) In many cases a symptom is signaling that “something is wrong”, because conditions are different from normal.
2) The monitoring system measures the chosen features of the machining process and sends the signals in cases of malfunction.
3) In cases of disturbances leading to break-downs the main supervisory function is to prevent failure.
4) Automatic supervisory systems may differ from the elementary system. In one extreme case it may be a very simple hardware system. In another extreme case, it may be pure software.
5) There are many cases for packing the equipment.

9. Переведите предложения, учитывая значения подчёркнутых словосочетаний. Выпишите и запомните их значения.

1) An appropriate (соответствующий) command signal is formed according to the control strategy.
2) The device gathers (собрать) information in order to ensure the required value of the quality index.
3) The comparison (сравнение) has different criteria according to the task and diagnosis strategy.
4) In addition to monitoring, automatic supervision must have the capability to carry out (выполнять) a control action.
5) It is necessary to relate the faults (ошибки) according to the monitoring and diagnosis functions.
6) In order to increase output as well as to protect systems and operators, the monitoring and diagnosis functions of manufacturing are integrated into control system.
7) The control action influences the production process according to a chosen supervising strategy.

10. Переведите предложения, учитывая разные значения слова “one” (Приложение 2, табл. П 2.14).

1) One must record this new error signal.
2) When classifying an error, one usually utilized a rule base.
3) Adaptive control is a term that has been used for many years in control theory, but with a meaning not identical to the one it has in automatic supervisory system.
4) There are many ways of classifying disturbances. From the point of view of supervisory functions, the most important one is based on the consequence of disturbances.

11. Переведите предложения, учитывая особенности перевода герундия (Приложение 2, табл. П 2.8).

1) Measuring resistance is necessary in many experiments.
2) One cannot keep dividing matter without reaching the stage when further subdivision is impossible.
3) In actual machining, no standardized method of performing surface roughness (неровность) measurements has been established.

4) By measuring the potential, a measurement of the applied force can be made.
5) Because of the severe conditions in the cutting zone, there is no way of inspecting the tool wear optically during cutting.
6) Such a system is cheap to install when manufacturing the machine-tool and still cheap to fit into an already existing machine on the shopfloor (сборочная площадка).

12. Прочитайте и переведите текст.

Classification of disturbances and supervisory functions

There are many possible ways of classifying disturbances in manufacturing. From the point of view of supervisory functions the most important one is based on the consequences of the disturbances.

Disturbances may lead to break-down “production” of rejects or non-optimal production. Break-downs are caused by the class of disturbance that does not permit further operation of the manufacturing system. Another class includes disturbances that lead to the production of rejects – the manufacturing system may still work but its operation is inefficient because the results are unacceptable. Disturbances belonging to the third class lead to the least serious consequences: products are acceptable but production is suboptimal which means that all possibilities of improvement have not been exploited.

Different supervisory functions are needed in manufacturing. In the case of disturbances leading to break-downs, the main supervisory function is to prevent failure. However, if it is not possible, the supervisory system should attempt to reduce losses, probably by switching off the machine tool as quickly as possible, and then to perform a recovery procedure which brings manufacturing back to the successful state.

In cases of disturbances that lead to manufacturing products which cannot be accepted, the supervisory function is to prevent production of rejects. However, if it can only make corrections, it must change the manufacturing process in such a way that the parameters of the products are within the required tolerances. In case of successful production, the role of supervision is to optimize, that is to make success even greater by increasing the quality index.

Supervisory functions may be performed by humans, built into automatic control system of the working cycle or need a special supervisory system.

13. Ответьте на вопросы.

1) What are the three types of the consequences of the disturbances?
2) What is the main supervisory function in manufacturing?
3) What are the supervisory functions in manufacturing if the failure cannot be prevented?
4) What is the supervisory function if the disturbances lead to manufacturing unacceptable products?
5) What is the role of supervision in the cases of successful production?

14. Заполните пропуски нужной глагольной формой (prevents, performs, belong, lead, includes).

1) This class…………disturbances which…………to the production of rejects.
2) Disturbances which…………to this class…………to the least serious consequences.
3) The supervisory system…………failures.
4) The supervision…………the production process.

15. Переведите текст письменно со словарем.

Monitoring is on-line diagnosing of a system or of a process with the aim of recognizing malfunctioning or non-optimal functioning.

Supervision is control dealing with disturbances, in order to safeguard against a catastrophic failure, assure correct operation or achieve the best results of the supervised process.

Diagnose determines the situation from the point of view of the correct operation of the system (the machine) or the highest quality index of the process on the basis of observation of symptoms. Diagnosis may concern the present situation, the future situation or the cause of the breakdowns (or failures in operation which causes a stoppage of the process) which has already occurred.

Урок 5

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

ensure (v), send (v), carry out (v), establish (v), occur (v), determine (v), evaluate (v), record (n), (v), choose (v), chosen (a), gather (v), multifunction (n)

2. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

maximize [‘mæks□ma□z], diagnose (v) [‘da□əgnə□z], diagnosis [,da□əg’nə□s□s], diagnostic [,da□əg’nə□st□k], symptom [‘s□mptəm], scheme [ski:m], discrete [d□s’kri:t], reagent [r□’e□□ənt], confusion [kən’fju:□n], hypersensitive [‘ha□pə’sens□t□v], ultrasonic [‘□ltrə’s□n□k].

3. С помощью суффикса -er (-or) от данных глаголов образуйте существительные со значением деятеля. Переведите их.

operate, sense, actuate, control, manipulate, record, transduce

4. С помощью суффикса -ly от данных прилагательных образуйте наречия. Переведите их.

simple, experimental, general, common, similar, rapid, relative, quick, cheap, full, probable, manual

5. Переведите слова, образованные префиксами, означающими избыточность, чрезмерность.

overload, superheated, hypersensitive, ultrasonic, extraordinary, multilateral, polynomial

6. Переведите слова, образованные префиксами, означающими недостаточность.

underestimate, subroutine, suboptimal

7. Прочитайте ряды однокоренных слов. Переведите их, исходя из значений словообразовательных элементов.

observe (v), observation (n), observer (n)
perform (v), performance (n)
equip (v), equipment (n)
machine (n), machining (n)
capable (a), capability (n)
signify (v), significant (a), significantly (adv)
determine (v), determination (n), determinative (a)

8. Прочитайте и переведите словосочетания.

production equipment, control action, constraint comparison, operation scale, classification scheme, accuracy requirement, on-line diagnosis, time-length observation, machine tool operator, non-automatic cause detection, unit package level, finite element analysis

9. Переведите предложения, учитывая разные значения слова "cause".

1) Disturbances are caused by internal errors and external errors.
2) The detailed cause of a failure is frequently established later by a more complicated diagnosis process.
3) The diagnosis system detects the causes of the functional disturbance by means of some information.
4) For non-automatic cause detection, specialists are needed to carry out a manual diagnosis.
5) The terms “monitoring” and “diagnosing” are frequently used in automatic supervision, sometimes interchangeably, and may cause confusion.

10. Переведите предложения, обращая внимание на различные функции инфинитива (Приложение 2, табл. П 2.9).

1) The driving forces must be applied to the mechanical system to force the actual (существующий) positions to track (идти по) the desired ones.
2) A set of diagnostic test sequences are designed to check distinguishable segment in each path for correct operation.
3) To localize the faulty unit, the system will use test sequences and will identify the fault to a unit package level.
4) In an automatic supervision system, tool wear is an important parameter to monitor.
5) It is necessary to use modern calculating tools, i.e. finite element analysis to find the optimal placement of the transducer.
6) To compare the flow of electricity along a conductor with that of a liquid (жидкость) in a pipe has become familiar.

11. Прочитайте и переведите текст.

Monitoring, diagnosing, supervising

The terms “monitoring” and “diagnosing” are frequently used in automatic supervision, sometimes interchangeably, and hence may cause confusion. Monitoring may be considered as a special kind of diagnosing, but the terms are not synonymous.

In everyday “to monitor” means “to observe and record the activity or performance of an engine or other device”. Monitoring, in the context of automatic supervision in manufacturing is “inspecting the chosen features of the process, the product or the production equipment with the aim of gathering information in order to ensure the required value of the quality index or maximize the value of the quality index”.

Machine tool operators can themselves monitor the manufacturing process using their sensing organs and knowledge based on experience. They may be helped by a monitoring system that measures the chosen features of the machining process and/or production equipment and sends the signals in cases of malfunction.

In automatic supervision, a monitoring system is only a part of an automatic supervision system. In addition to monitoring, automatic supervision must have the capability to carry out a control action which influences the production process according to a chosen supervising strategy.

Diagnosing has a broader meaning than monitoring. Monitoring is a kind of on-line diagnosing with the capability of quick determination of what has happened – of what is the result of the disturbances. The detailed cause of a failure is frequently established later by a more complicated diagnostic process.

Symptom in automatic manufacturing means a characteristic change in the manufacturing process or equipment that indicates a failure, probability of failure or non-optimal condition of the process. Symptom is recognized by the monitoring system and signaled by its output. In many cases a symptom is just signaling that “something is wrong” because conditions are significantly different from normal. This change of conditions may be characteristic of a whole class of failure. Further diagnosing is needed to determine which specific kind of failure has occurred.

Identification of a failure can be made more accurately on the basis of a set of symptoms. A set of symptoms characteristic for the particular failure is called a syndrome. The measurement and evaluations of several features of the monitored system make possible a more specific determination of the failure.

12. Ответьте на вопросы.

1) What is the aim of monitoring?
2) How does a monitoring system help the operator?
3) What is the additional function of the automatic supervision system in comparison with the monitoring system?
4) What is the aim of diagnosing?
5) What is a symptom?
6) What system recognizes the symptoms?
7) What is a syndrome?

13. Заполните пропуски нужной глагольной формой (is established, are chosen, determines, has occurred, are determined, sends, is gathered, are recorded, is ensured).

1) The value of the quality index………..by gathering information.
2) Some features of the process………..by monitoring.
3) The information about the process………..by monitoring.
4) The monitoring system………..the signal in cases of malfunction.
5) The result of the disturbances………..by monitoring.
6) The diagnosis………..which specific kind of failures………..
7) Some features of the process………..for inspecting.
8) The detailed cause of a failure………..later by diagnosis.

14. Переведите текст письменно со словарем.

From the general point of view, measurement made for monitoring purposes can be classified on the basis of the timing of the measurement. Firstly, measurement may be continuous or interruptive. The discrete character of manufacturing production requires interruptive measurements and a classification which accords to timing relationships of the machining cycle. The choice of timing for the monitoring measurements depends on the character of the manufacturing process, the nature of expected disturbances and, of course, the practicality (точность осуществления) of measurements.

Урок 6

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

ratio (n), undergo (v), safety (n), change (n), (v), improve (v), variable (a), appropriate (a), follow (v), as follows, disturbance (n), actuator (n), deal with (v)

2. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

identical [a□'dent□kəl], type [ta□p], typical ['t□p□kəl], extreme [□ks'tri:m], sensor ['sensə], programming ['prə□græm□ŋ], process (n) ['prə□ses], process (v) [prə□'ses], structure['str□k□ə], signalize['s□gnəla□z]

3. Переведите следующие глаголы в инфинитиве, обращая внимание на их суффиксы.

to optimize, to facilitate, to qualify, to signalize

4. Переведите следующие слова с префиксом “pre-“, имеющим значение предварительного действия.

pre-processed, predetermine, predominate, prehistoric, prescribe, prevent

5. Переведите слова с префиксом “re-“ (значение повторного действия).

rearrange, rescheduling (schedule – план), reinstall (install – установить), renew

6. Переведите слова, учитывая значение префикса “inter-“: 1) меж-, между-, 2) взаимо- .

international, interaction, interchangeably, interrelated

7. Прочитайте ряды однокоренных слов. Переведите их, учитывая значение словообразовательных элементов.

process (n), process (v), processing (pres.p.), pre-processed (p.p.)
accurate (a), accuracy (n), accurately (adv)
fulfill (v), fulfillment (n)
complicate (a), complicated (p.p.), complication (n)
amplify (v), amplifier (n), amplification (n)
investigate (v), investigator (n), investigation (n)
signal (n), signalize (v), signalization (n)
actuate (v), actuator (n)
extreme (a), extremely (adv)

8. Прочитайте и переведите словосочетания.

safety control, control theory, measurement signal, command signal, control variable, automatic supervision manufacturing system, numerically controlled part programs, reasonable task execution, disturbance rejection capability

9. Переведите предложения, учитывая разные значения слова “set”.

1) A set of symptoms characteristic for the particular failure is called a syndrome.
2) The modern trend, set first by Japanese industry is to increase the uniformity of workpieces in a batch.
3) Identification of a failure can be made more accurately on the basis of a set of symptoms.
4) When using smart sensors, it is important to set tolerance margins for the error signal.
5) The conditional (условный) code is set as a result of all logical, comparing, connecting, testing and editing (редактировать) operations.

10. Переведите предложения, учитывая особенности перевода инфинитивных оборотов (Приложение 2, табл. П 2.10).

1) The importance of industrial robots is expected to increase very rapidly in the future.
2) Many robot related accidents have been reported to take place at different automated mills.
3) This task requires the worker to be near the robot.
4) The percentage of unrecorded robot accidents is presumed to be high.
5) The controller is assumed to store the trace of values corresponding to the most recent end-effector moves (движение). This trace is called event trace.
6) The experiments proved this system to be very efficient.

11. Прочитайте и переведите текст.

Automatic supervisory systems

According to the classification of supervisory functions, three types of automatic supervisory systems may be distinguished: safety control, geometrical adaptive control and technological adaptive control. Safety systems deal with disturbances that lead to break-downs. Geometrical adaptive control systems supervise the quality of technological processes.

The typical structure of an elementary system of automatic supervision is as follows.

The quantity being measured is transformed by a sensor into a measurement signal: this is nearly always an electrical quantity. The signal is then pre-processed in order to improve signal-to-noise ratio.

The pre-processed signal undergoes the main processing in order to present it in a form which best represents the feature of the manufacturing system investigated. The processed signal is then evaluated from the point of view of the symptom of non-optimal functioning of the manufacturing system.

The symptom is sent to the supervising system. There, an appropriate command signal is formed according to the control strategy. This command signal is sent to the actuator and changes the controlled variable of the manufacturing system.

In the elementary system, only one parameter is known to be measured, and as a result of supervision only one control variable can be changed. In practice, more complicated systems are reported to be in use. They employ several sensors for the measurement and several control variables to influence the operation of the manufacturing system.

12. Ответьте на вопросы.

1) What are three types of automatic supervisory systems?
2) What is the aim of each type of automatic control?
3) What is the role of the sensor?
4) What is the role of the pre-processing of the electric signal?
5) What is the aim of the main processing?
6) How does the supervisory system respond at the possible failure?
7) How many parameters can be measured in the elementary system?
8) What kind of supervisory systems can be used in manufacturing?

13. Замените пропуски нужной глагольной формой (undergoes, improves, changes, deal with, lead).

1) The pre-processing…………signal-to-noise ratio.
2) The safety systems…………disturbances that…………to break-downs.
3) The command signal is sent to actuator and…………the controlled variable.
4) The pre-processed signal…………the main processing.

14. Переведите текст письменно со словарем.

When the supervision system asks itself on whether the error is new or not, the answer may be “yes” or “no”. If the answer is “yes”, it means that the sensor/transducer has reported a signal which is not related to some known software and physical states of the system. One must therefore record this new error signal and its relative software physical conditions. We know where in the software the error occurred (where and when). We know what state the other

sensors showed at that time. All we need to record now is the transducer signal. When using simple sensors this is relatively easy as the signal is usually on or off. In this case it is usually position plus the signal itself which, together, make up the new error signature. When using smart sensors, it is very important to set an upper and lower tolerance margin for the error signal.

Урок 7

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

warn (v), reliable (a), installation (n), exist (v), purpose (n), choice (n), aim (n), represent (v), main (a), relate (v), concern (v), supply (v)

2. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

correction [kə'rek□n], monitoring ['m□n□tər□ŋ], immune [□'mju:n], function ['f□ŋk□n], general ['□enərəl], manufacturing [,mænj□'fæk□ər□ŋ], configuration [kən,f□gjə're□□n], intelligent [□n'tel□□ənt], detect [d□'tekt], technique [tek'ni:k], dynamic [da□'næm□k], static ['stæt□k]

3. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

correct (v), correct (a), correction (n), correctly (adv)
reliable (a), reliability (n)
measure (v), measurement (n), measurable (a), measuring (n)
require (v), required (p.p.), requiring (pres.p.), requirement(n)
integrate (v), integrated (p.p.), integrating (pres.p.), integration (n)
interrupt (v), interrupted (p.p.), interrupting (pres.p.), interruption (n)

4. Прочитайте и переведите словосочетания.

production equipment, monitoring purpose, task interruption, difficult workshop conditions, simple sensor value, process control system, simple sensor level

5. Переведите предложения, учитывая разные значения глагола “to have” (Приложение 2, табл. П 2.2).

1) The automatic supervision in manufacturing process system may have different structures.
2) The error recovery system always has to consult a database.
3) The process control system has found a successful means of recovering an error.
4) In most cases special sensors have to be employed.
5) The most common way to use adaptive error recovery is to have smart sensors.
6) We have already detected and classified an error. Now we have to start error recovery.

6. Переведите предложения, учитывая разные значения слова "for".

1) A battery is used for supplying electrical energy.

2) Electrical phenomena have been known to man for a very long time.
3) The materials with a low coefficient of thermal expansion used for machine tool elements lower their sensitivity to thermal deformations.
4) There are no perfect insulators for all insulators will allow some flow of electrons.

7. Переведите предложения, обращая внимание на инфинитив и инфинитивные обороты (Приложение 2, табл. П 2.9, П 2.10).

1) This is a long-term plan of various products to be assembled.
2) The choice of quantity to be measured depends on the characteristics of the manufacturing process to be supervised.
3) The types of sensors to be used in this case are very different.
4) Cutting force variations are reported to have been measured.
5) The automatic supervision of machining operations is considered to be in the first stage of development.
6) Several machining processes can only rely on numerical control to generate a desired workpiece shape.

8. Прочитайте и переведите текст.

Monitoring and measurements

Monitoring is the art of measuring change or condition of function signals as warning that possible corrections are required. In an automatic supervision system, monitoring is associated with measurements of the chosen features of the process and/or the production equipment. The general rule is to use a measuring installation that is as simple and reliable as possible. This installation should not interfere with the manufacturing functions and be immune to difficult workshop conditions. Whenever possible, the signal already existing in the manufacturing system should be used for monitoring purposes. But in most cases, special sensors have to be employed.

The choice of a quantity to be measured depends in most cases on the aim of the supervisory system (formulation of the quality index) and the characteristics of the manufacturing process to be supervised. The general rule is that the measured quantity should represent the quality index as closely as possible. In some specific cases the measured quantity should represent the value of the main disturbance and not the value of the quality index.

The choice of sensors for measurement of the selected quantity depends on the character of the manufacturing process and the configuration of the manufacturing system, as well as the static and dynamic requirements relating to the results of the measurements. The cost of the sensor and its measuring installation must of course be considered, but reliability is usually more important than cost where monitoring is concerned.

The rapidly developing integration techniques for electronic circuit make it possible to assemble, as one element, a sensor together with a large part of the measuring system. The term “intelligent sensor” is often used in such cases, but “integrated sensor” seems to be more appropriate.

9. Ответьте на вопросы.

1) What does monitoring measure?
2) What are the characteristics of a measuring installation?
3) What devices are employed for monitoring purposes?
4) What does the choice of quantity to be measured depend on?
5) What should the measured quantity represent?
6) What does the choice of sensor depend on?
7) What is the most important characteristic of a sensor?
8) What is an integrated sensor?

10. Подберите пары близких по значению слов из данного ряда.

aim (n), warn (v), main (a), different (a), concern (v), prevent (v), principal (a), relate (v) to, various (a), purpose (n)

11. Замените пропуски нужной глагольной формой (is supplied, exist, warns, is represented, relate to).

1) In an automatic system some signals…………for monitoring purposes.
2) The quality index…………by a measured quantity.
3) The static and dynamic requirements…………the results of measurements.
4) Monitoring…………that possible corrections are required.
5) New information…………by simple sensors.

12. Переведите текст письменно со словарем.

Simple sensors are usually used to detect where the task interruption has occurred. Often these sensors supply enough information for the system to draw its own conclusions. A particular sequence of simple sensor values can indicate a specific error if we have a process control system with some form of backing. Hence we can eliminate the need for several smart sensors: many small binary sensors are more reliable source of information than a few very complex sensors.

However, this is not enough in itself, because new errors occur and it is always best to have some form of analysis available. In practice one does not always use a secondary analysis with smart sensors, because classification of the error begins at the simple sensor level.

Урок 8

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

tool (n), condition (n), wear out (wore, worn) (v), replace (v), recovery (n), eliminate (v), loop (n), closed loop, open loop, solution (n), variety (n), debug (v)

2. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

control [kən'trə□l], collision [kə'l□□n], a posteriori [əpəs,ter□'□r□], magazine [,mægə'zi:n], compensate ['k□mpense□t]

3. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

low (a), lower (v)
influence (v), influence (n)
result (n), result (v) in, result (v) from
place (v), place (n), replace (v), replacement (n)
apply (v), application (n)
eliminate (v), eliminated (p.p.), eliminating (pres.p.), elimination (n)
recover (v), recovery (n)
see (v), foresee (v), foreseeable (a)

4. Прочитайте и переведите словосочетания.

process plan, tool condition, machining process parameters, technological adaptive control system, automatic recovery procedure, closed loop system, different control strategies, on-line manufacturing process, process monitoring, new error recovery routine, system downtime, steady state force level

5. Переведите предложения, обращая внимание на разные функции слов на -ing (Приложение 2, табл. П 2.6, 2.8).

1) Changing the machining process parameters is often used in technological adaptive system.
2) Knowing the influence of the disturbance, the automatic supervision compensates this influence by some changes in the work of the manufacturing system.
3) When designing an automatic supervision and recovery system, there are some factors to be considered.
4) Safety systems, sometimes also called monitoring systems in industry, are on-line diagnosing systems used to prevent break-downs or to minimize the damage caused by catastrophic tool failure.

6. Переведите предложения, обращая внимание на различные глагольные формы (Приложение 2, табл. П 2.6, 2.7, 2.8).

1) The disadvantage of this system, as many industrial installations will show, is the frequent number of false alarms often forcing the operator to disconnect the system.
2) Cutting forces for the safety systems are measured with pieso-electric force transducers placed in a measuring plate.
3) The typical indication of a total breakage is a fast increase of the force from the steady-state force level followed by a temporary drop to zero force.
4) Productivity increases from 20% to 75% have been reported, the highest values being for machining operations.
5) The methods of programming robots are presented in order of increasing complexity, the stages reflecting the development of robot system.

7. Прочитайте и переведите текст.

Supervisory actions

Apart from monitoring, a supervisory system should be capable of taking necessary action to influence operation of manufacturing system.

Changing the machining process parameters is the most common action taken in technological adaptive control systems (a change of tool, for example). When automatic changing of the tool condition in the machine tool is not possible the worn out tool may be automatically replaced by a new one. This is an easy operation for machining centers, because they are equipped with magazines for the automatic changing of tools.

In some cases of disturbances, such as collision between the tool and the production equipment, the automatic supervision in manufacturing system must interrupt the machining process as quickly as possible. An automatic recovery procedure may be applied later. This may involve changes to the process plans and certain types of machining operation may be eliminated.

In a typical system of automatic supervision the results of the manufacturing process are measured and necessary corrections are made to the process. In such a closed-loop system the influences of all disturbances on the measured result of manufacturing may be corrected, but a posteriori (that is, after they have already influenced the result). Another solution is to measure the value of the main disturbance and, knowing how it will influence the result, compensate this influence by appropriate changes in the work of the manufacturing systems. In such a supervisory system, only the influence of measured disturbances may be eliminated or reduced.

The automatic supervision in manufacturing systems may have different structures and work according to different control strategies. This is especially true for on-line manufacturing processes. Because of complicated processes and difficulties in process monitoring, a variety of techniques is often used.

8. Ответьте на вопросы.

1) What is the function of a supervisory system?
2) What is the most common action taken in technological adaptive control system?
3) When does the automatic system interrupt the machining process?
4) What may be the results of recovery procedures?
5) What may be corrected in a typical system of automatic supervision?
6) How are the influences of all disturbances corrected in a closed-loop system?
7) What characteristics can you measure in order to correct the process in a closed-loop system?
8) Does an on-line manufacturing process work only according to one control strategy?

9. Подберите пары близких по значению слов из данного ряда.

involve (v), act (v), manufacturing (n), include (v), changing (n), take an action, production (n), replacing (n), supervise (v), take care of.

10. Замените пропуски нужным глаголом (to debug, to wear out, to eliminate, to replace). Поставьте его в пассивной форме.

1) This tool………..; it must be………..by a new one.
2) Certain types of machining operation………..by means of some changes in the process plan.

3) The operation of the tool...........by automatic supervision.

11. Переведите текст письменно со словарем.

When designing an automatic supervision and recovery system, there are two factors to be considered:

1) The software must be easy to upgrade, debug and expand;

2) A good knowledge of types of errors that will be encountered must be available, as well as the sensors to be used.

Obviously, one cannot have full knowledge of all types of errors that will be encountered: hence the need to make the software as rich as possible, in order to enable an operator (not a programmer) to add new error which may be foreseeable. It is quite important to construct a software system in which robot and machine programs can be easily optimized, and, ideally, without creating any system downtime.

Урок 9

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

flexible (a), assemble (v), accept (v), size (n), sequence (n), solve (v), trust (v), hardware (n), software (n)

2. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

stage [ste□□], final ['fa□nl], balance (n, v) ['bæləns], stable ['ste□bl], principal ['pr□nsəpəl], variant ['v□ər□ənt], project ['pr□□ekt], produce [prə'dju:s]

3. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

vary (v), various (a), variant (n), variety (n)
accept (v), acceptable (a), acception (n), unacceptable (a)
assemble (v), assembly (n)
represent (v), representation (n), representative (a)
achieve (v), achieving (pres. p.), achieved (p.p.), achievement (n)
solve (v), solution (n), solvable (a)
procedure (n), procedural (a)
debug (v), debugging (n)

4. Прочитайте и переведите словосочетания.

price/performance plan, product assembly, product variant, software approach, database system, rule-based system, small batch size, object oriented environment, flexible automatic assembly system, intelligent error recovery system, expert system's inference engine

5. Переведите предложения, учитывая разные функции глагола "to be" (Приложение 2, табл. П 2.1).

1) The two methods are to be balanced.
2) There are two types of errors: external and internal.
3) The transfer of products is to be carried out as quickly as possible.
4) This error is corrected by cell calibration.
5) The reliability is usually more important than cost where monitoring is concerned.

6. Переведите предложения, обращая внимание на особенности перевода пассивных конструкций (Приложение 2, табл. П 2.4).

1) The students are shown a new laboratory.
2) Machine tool operators may be helped by a monitoring system.
3) Normally each 1/0 device is given address when it is installed in the system.
4) Read/write memory is usually referred to as random-access memory for historical reasons.
5) The storage locations can be immediately addressed by the program counter.

7. Переведите предложения, учитывая разные способы перевода глаголов "should", "would" (Приложение 2, табл. П 2.11, 2.12).

1) If the model fitted well, the observed data would be correct.
2) Unless computer techniques had been developed, space research would have never made such great progress.
3) Should it be desirable to divide the piece in two parts, several ways would be possible.
4) Care should always be taken in interpreting signals from accelerometers, since their dynamic characteristics may sometimes influence measuring results in an undesirable way.
5) In order to obtain complete information on tool wear, the transducers should present the possibility of looking at the tool from different angles.

8. Прочитайте и переведите текст.

Flexible automatic assembly system

A flexible automatic assembly system is a system in which different products or variants of a product are assembled automatically. Such a system should also be capable of accepting new products/product variants in as simple way as possible and of changing over automatically from one product assembly to another. A system should also be capable of accepting small batch sizes.

Assembly represents one of the final stages in the production sequence (зд. процесс). The product also represents the highest cost at this stage. Consequently, a high degree of reliability is very important in the assembly system.

There are two main ways to achieve this: 1) make the process 100% reliable or close to it 2) let the system analyse any problem that arises and correct the error automatically. The two methods are to be balanced. There is no single (единственный) “right” way to solve this problem. A combination of both methods based on a well-projected price/performance plan should be used. One cannot blindly trust on “intelligent error recovery system”.

Software and hardware within the system should be made as safe and economically as possible.

9. Ответьте на вопросы.

1) What is a flexible automatic assembly system?
2) What are the functions of such a system?
3) What is the main important feature of the assembly system?
4) How is it possible to achieve it?
5) Is it possible to use only one method to achieve the high degree of reliability?

10. Подберите пары противоположных по значению слов из данного ряда.

flexible (a), secondary (a), automatically (adv), main (a), stable (a), complicated (a), manually (adv), incapable (a), simple (a), capable (a)

11. Замените пропуски нужным глаголом (to accept, to assemble, to solve, to trust), поставьте его в пассивной форме.

1) Different tools…………automatically.
2) New products…………in small batch sizes.
3) The problem of reliability…………by combination of different methods.
4) Any intelligent error recovery system cannot…………blindly.

12. Переведите текст письменно со словарем.

One must consider carefully which software approach to use. Hard programming principles are to be avoided. Procedural languages can be used satisfactorily in combination with database system and some form of interface, which is known to the user. The best results are usually obtained with the rule-based systems or Expert Systems. Consider, however, that an Expert System's inference engine does not make debugging an easy task for a non-programmer, and that new error recovery routines are also not so easy to add to a backward/forward chaining system. Objects oriented environments are advisable.

Урок 10

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

suffer (v), source (n), link (v), except (prep.), generate (v), user (n), detect (v), amount (n), shutdown (n), database (n), check (v), error (n)

2. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

category ['kæt□gər□], stochastically [st□'kæst□kəl□], fatal ['fe□tl], controller [kən'trə□lə], hierarchically ['ha□əra:k□kəl□], vice versa ['va□s□'v□:sə], concentrate ['k□nsəntre□t]

3. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

relate (v), relation (n), interrelation (n), interrelated (p.p.)
follow (v), following (pres.p.), as follows
flexible (a), flexibility (n), inflexible (a), inflexibility (n)
mean (v), meaning (pres.p.), meaning (n), means (n)
generate (v), generator (n), generation (n)
control (v), control (n), controller (n), controllable(a)

4. Прочитайте и переведите словосочетания.

assembly process, lighting disturbances, vision system, hardware system, assembly rules, error recovery research, software control system, process control level, process control demand, automatic assembly system controller

5. Переведите предложения, учитывая разный перевод слов “it”, “that” (Приложение 2, табл. П 2.15, 2.14).

1) External errors are the errors that occur outside the assembly process.
2) These disturbances vary so quickly that the user might not detect their cause.
3) External errors often cause fatal errors that can only be recovered manually.
4) It is often at process control level that are used the assembly rules.
5) Active recovery signifies that the supervision system corrects the error on-line.
6) The system analyses every problem that arises and corrects the error automatically.
7) Expert Systems are designed to perform at a human level. However, in practice, they will perform more than that of an individual expert.

6. Переведите предложения, обращая внимание на придаточные предложения, вводимые союзом “whether” – ли.

1) The error recovery system consults a database to check whether the error is known (old) or whether it is a new one (new).
2) It is necessary to decide whether this statement is true or false.
3) From the disturbances detected it was possible to judge whether the errors were internal or external.
4) There was a discussion whether this loop was to be open or closed.
5) It is important to insert (включать) at this control level the means to check whether the tasks are being carried out satisfactorily.

7. Переведите предложения, учитывая разные способы перевода глаголов "should", "would" (Приложение 2, табл. П 2.11, 2.12).

1) If two sensory units indicated part missing, then it would be an operational error due to part missing. If only one sensory unit took an incorrect reading and the other sensory unit reads presence of the part, then the abnormality would be due to hardware failure in the first sensory unit of the controller.
2) Provided the fault were a recoverable error, the system would activate the built-in error recovery routines. Provided it were a hardware failure, then it would go through hardware diagnosis phase.
3) The placement of the transducer is very important and should be as close to the cutting zone as possible.
4) Feed rate should constantly be adapted to the rate of material removal.

8. Прочитайте и переведите текст.

Errors

Flexible automatic assembly systems are open systems. This means that the assembly process suffers disturbances not only from internal sources, but also from external ones. There are two types of errors.

1. External errors are all the errors that occur outside the assembly process.
2. Internal errors are all the errors linked to the assembly process itself.

These two categories of errors are interrelated: external errors cause internal errors and vice versa. External errors often occur stochastically and are not as common as internal ones. They usually cause fatal errors that can only be recovered manually. Errors recovery research has concentrated mainly on internal errors, except programming errors.

Certain disturbances can generate temporary external errors without showing their source. For example, lighting disturbances can give problems to vision systems, but vary so quickly that the user might not detect such a cause. These stochastic changes of product assembly must be planned into the automatic assembly system controller so that no large amount of re-scheduling and programming are required.

The most common classification of errors is as follows: fatal errors and non-fatal errors. This means that the recovery system must “know” what type of error is going to cause a system shutdown and what can be corrected on-line. This is the highest hierarchical subdivision of errors. The assembly system must be designed to be flexible at all levels of hardware and software in such a way that errors are not created by too strict operational constraints.

In practice the error recovery system will always have to consult a database to check whether the error is known (old) or whether it is a new one (new). Fatal errors require a system shutdown.

9. Ответьте на вопросы.

1) What is the open system?
2) Where do external and internal errors occur?
3) How are external and internal errors interrelated?
4) Where must the stochastic changes of product assembly be planned?
5) What is the most common classification of errors?
6) What must the recovery system know?
7) How does the recovery system recognize the type of errors?

10. Подберите слова, противоположные по значению, из данного ряда.

external, inside, static, internal, dynamic, outside, reliable, impossible, unreliable, possible

11. Подберите слова, близкие по значению, из данного ряда.

generate (v), check (v), produce (v), amount (n), correct (v), vary (v), quantity (n), change (v)

12. Замените пропуски нужным глаголом (to check, to link, to generate, to detect), поставьте его в пассивной форме.

1) Internal errors………..to the assembly process itself.
2) Temporary external errors………..by certain disturbances.
3) The cause of the errors of vision system………..by the automatic assembly system controller.
4) The type of the error………..by the error recovery system by means of the database.

13. Переведите текст письменно со словарем.

Consumers are now demanding products that are reasonably priced and reliable. As a result, manufacturers have to develop manufacturing systems that are flexible and can accommodate a variety of products promising high performance. Performance demands precision and complexity to different degrees and increased attention to monitoring devices during production.

The expense of automating manufacturing operations is high enough and demands to monitor the process. Thus there is also a great demand for monitoring systems to ensure the safe and efficient performance of these systems during operation.

Урок 11

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

task (n), handle (v), consist (v), dedicate (v), area (n), delivery (n), flow (n, v), in favour of, 'access (n), update (v), find (found, found) (v)

2. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

priority [pra□'□rət□], inform [□n'f□:m], inspection [□n'spek□ən], affect [ə'fekt], operate ['□pəre□t], operator ['□pəre□tə]

3. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

hand (n), handle (v), handling (n)
accurate (a), accuracy (n), inaccuracy (n)
care (n), take care of, careful (a), carefully (adv)
separate (a), separate (v), separation (n), inseparable (a)
stable (a), unstable (a), stability (n)
execute (v), execution (n), executant (n)
power (n), power (v), powerful (a), powerless (a)
schedule (n), scheduling (n), rescheduling (n)

4. Прочитайте и переведите словосочетания.

programming task, data handling, programming requirements, manipulation task, robot motion, assembly process, process control, product sequence,

product variant, delivery time, quality level, task scheduling, product priority, material flow, time-based scale, robot motion inaccuracy

5. Переведите предложения, учитывая значения слов “with” [w□ð] **и “which”** [w□□].

1) The machining centers are equipped with magazines for the automatic changing of tools.
2) It is not easy to define the parameter which may choose manual or automatic recovery.
3) The operator must analyse all the factors which can create a given error. He must also analyse which of the factors are common, which are stochastic and which occur very rarely.
4) The supervision system corrects the error on-line with either manual or automatic operations.
5) At the start of the project, one concentrates on the errors which may be foreseeable.
6) Procedural languages can be used in combination with database system and some form of interface which is known to the user.

6. Переведите предложения, учитывая особенности перевода слова "one" (Приложение 2, табл. П 2.14).

1) CAD software is divided into general system software and applied (special) software. The first one is used for organizing technical facility functioning.
2) In this type of circuit one transistor complements the other: when one is turned on, the other is turned off.
3) The personal computer market can be divided into 4 segments: business, home, science and education. The business segment is becoming the largest one.
4) Building circuits that are testable, as well as ones that are self-testing, are two solutions to the problem of testing of very large scale integration devices.
5) In some of robotic tasks one has to control contact forces between the robot-end-effector and the robot environment.
6) As one would expect, there has been a significant research effort to generate robot level programs for motion control.

7. Прочитайте и переведите текст.

Process control

In flexible automatic assembly, the programming tasks are made up of data handling. Up to 95% of the programming requirements consist of data handling and manipulation tasks. Only between 5% and 10% of the programming is dedicated to robot motion. This is a very important aspect of automatic assembly and it greatly affects the way in which the user corrects for robot motion inaccuracies.

One can therefore separate the assembly process into two main areas: process control and motion control. An assembly process is simple in its logic but requires the handling of large amount of complex data. Consider a flexible automatic assembly system which assembles two types of motors, of which there are 43 variants; we will have to monitor the assembly of 86 different products which can be assembled at varying time intervals, quantities and product sequences. Each product variant will have its own delivery time, quality levels etc.

Everything that has to be externally controlled within the assembly process should be carefully studied and planned before the programming.

By process control we mean task scheduling, product priority, materials flow etc. Product priority is a time-based scale that informs the system which product to start to assemble. A current product assembly can be stopped in favour of another product assembly, if it is required.

Task scheduling works hand-by-hand with the above. This is a more long-term plan of the various products to be assembled, material flow, which tools they will require, which programs they will need access to, etc.

The above process control tasks are only selected examples. An operator must be able to update and add new items to those control structures at any time. This type of flexibility is not often found in industry but it is now beginning to reach the market. A rule-based system, linked to several databases seems to be the best suited method for such applications.

It is very important to make the process control mechanism very stable. In other words, disturbances must not complicate the execution of the process. Strategic disturbances are easily incorporated into software control system and other, such as power fluctuations, are best handled by hardware systems.

8. Ответьте на вопросы.

1) What are the programming tasks in flexible automatic assembly?
2) How is it possible to separate the assembly process?
3) What is a process control?
4) What is a product priority?
5) What is a task-scheduling?
6) What is the best suited method for doing the process control?
7) What does the stability of the process control mean?
8) What disturbances are best handled by software systems?
9) What disturbances are best handled by hardware systems?

9. Замените пропуски нужным предлогом: up to (до), between, within, before, in favour of (в пользу, из-за).

1) A current product assembly may be stopped………another product assembly, if it is necessary.
2) Every element………the assembly process is studied………the programming.
3) A fixed arrangement………fault pattern and fault causes is necessary.
4) ………nineteen sixties the computer was considered only as a device for solving complicated mathematical problems more quickly than humans.

10. Замените пропуски нужным глаголом в соответствующей форме (to consist, to handle, to find, to dedicate, to update).

1) A large amount of complex data…………by the device.
2) This part of program…………to robot motion.
3) The control structures…………by the operator when it is necessary.
4) The disturbances can…………in the machine system and in the process itself.

5) A signal processing...........of a set of operations performed on the signal in order to derive the necessary information.

11. Переведите текст письменно со словарем.

It is often at process control level that are used the assembly rules which drive the robot, conveyors and system as a whole. Hence it is important to insert at this level the means to check on whether the tasks are being carried out satisfactorily.

Usually this is done by checking on whether certain digital inputs and outputs have been set. The important thing is to decide what you really need to know and when. A vision system can be a very flexible tool: it can give the robot precise positional information, it will respond to the process control demands only if the specific part required is found, it can carry out inspection tasks etc. but it is expensive and must be applied by experienced people – however it is a powerful tool.

Урок 12

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

cover (v), pick (v), repeat (v), transfer (v), reach (v), due to, maintain (v), routine (n), cell (n), success (n), motion (n)

2. Правильно прочитайте интернациональные слова и дайте их русский эквивалент. Посмотрите в словаре, выпишите с переводом и выучите подчёркнутые слова.

calibrated [,kæl□'bre□t□d], calibration [,kæl□'bre□□n], utilize ['ju:t□la□z], oriented ['□:r□ent□d], kinematics [,k□n□'mæt□ks], series ['s□əri:z], instruct [□ns'tr□kt], phenomenon [f□'n□m□nən], phase [fe□z]

3. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

move (v), movable (a), moveless (a), mover (n), movement (n), micromovement (n)
demand (v), demand (n), demanded (p.p.), demanding (pres.p.)
repeat (v), repeated (p.p.), repeatability (n), repeatedly(adv.)
transfer (v), transfer (n), transferable (a), transference (n)
line (n), on-line (a), linear (a), linearity (n), non-linearity (n)
resolve (v), resolver (n), resolution (n)
cause (v), cause (n), casual (a)

4. Прочитайте и переведите словосочетания.

programming error, robot movement, accuracy level, error recovery, automatic calibration routine, robot problem motion, robot calibration method, small robot positional error, object oriented programming environment, tool center point error

5. Переведите предложения, учитывая значение предлогов for, from.

1) The assembly process suffers disturbances not only from internal sources, but also from external ones.
2) For the better classification of the diagnosis strategies, it is reasonable to divide the faults into internal and external.
3) These conditions are significantly different from normal.
4) A set of symptoms characteristic for the particular failure is called a syndrome.
5) For the testing, there is a great number of procedures available.

6. Переведите предложения. Выпишите подчёркнутые наречия с переводом.

1) Hence, we can eliminate the need for several smart sensors.
2) However, this is not enough in itself.
3) The requirements of the assembly system must be worked out beforehand.
4) Consequently, a high degree of reliability is very important in the assembly symptom.
5) The diagnosis function is separately cooled and is therefore portable on to additional hardware.

7. Переведите предложения, учитывая особенности перевода слова "it" (Приложение 2, табл. П 2.16).

1) It is no exaggeration to say that the need for geometric adapting control systems is much more obvious than the number of available systems.
2) There are many ways of considering the cell of factory automation. It can be viewed in almost biological way as the smallest autonomous unit capable of sustained (усредненный) production.
3) The cell can also be viewed in terms of item that it usually contains. In this way we can see it as a small collection of machines which are closely cooperating with each other.
4) It seems unlively in the foreseeable future that the completely unmanned factory is practical, desirable or financially justifiable.
5) In factory automation it is usual to take account of the capability of manufacturing process.
6) It is not clear whether the cellular approach reduces the complexity of the overall system control problem.

8. Прочитайте и переведите текст.

Motion control

Let us consider some of major areas covered by motion control.

Parts picking: the manner in which we instruct the robots to pick the product parts. The operation requires high robot repeatability accuracy.

Assembly: programming strategies for the final assembly of parts. This operation requires very high repeatability level.

Transfer: programs, which move the robots from one operation to another. This series of movements is to be carried out as quickly as possible, without collisions, but has no high accuracy demands.

Tooling: programs, which drive the robots to different tools.

Recovery routines: special robot motions, which solve given problems. They include small micromovements and require high accuracy motion.

Cell calibration: automatic calibration routine, which corrects for small robot positional error.

The most common robot motion problem consists in the fact that the robots have difficulty in reaching the necessary position. Possible causes of this effect in the robot program are: 1) Tool center point error. 2) Programming error. 3) Error due to mechanical discrepancies. 4) Non-linearities in robots: inaccurate knowledge of different kinematic parameters. 5) Robot resolvers are uncalibrated – manual recovery.

Error cause 1 is a programming error. It should not really occur if the flexible assembly system has been programmed correctly. **Error 2** is easily corrected by recovery routines. **Error 4** is usually recovered by robot calibration methods. This error is a real problem in welding application where the robot movement must maintain very high repeatability and absolute accuracy levels. It does not affect assembly, because in this process it is only the final positions, which are of interest. Hence, we can correct this error by cell calibration methods.

Error 3 can also be corrected by cell calibration if one utilizes an object oriented programming environment. This type of error recovery requires robust sensors and object oriented programming environments.

9. Ответьте на вопросы.

1) What are the main areas covered by motion control?
2) What is the main robot motion problem?
3) What are possible causes of the difficulties in reaching the necessary position?
4) How can programming error be corrected?
5) How are non-linearities recovered?
6) How can error due to mechanical discrepancies be corrected?
7) What does the recovery of error due to mechanical discrepancies require?

10. Подберите слова, близкие по значению, из данного ряда.

movement, update, routine, constraint, motion, limitation, due to, program, because of, modernize.

11. Замените пропуски нужным глаголом (to affect, to transfer, to pick up, to reach, to maintain) в соответствующей форме.

1) The robots…………from one operation to another as quickly as possible.
2) The robot…………the necessary position getting over some difficult problems.
3) During this operation the robot movement…………very high repeatability and absolute accuracy level.
4) All the parts of the tool…………by the robot.
5) If the cause of the error is due to the hardware, then the same error…………the next product of the batch.

12. Переведите текст письменно со словарем.

Many error recoveries still require manual intervention. It is not always easy to define the parameters, which may guide the operation to choose manual rather than automatic recovery. Time is a major factor. If the operator is present when an error occurs, he or she might see what the problem is before the process control system has found a successful recovery for it. The assembly system will try to pick parts from it, fail, and try to reach a conclusion. An operator can act at once. But operators will rarely be present in the system; they may be called in if needed. The basic performance requirements of the assembly system and operator must be worked out beforehand. Most process control systems today are not able to ensure cost effective automatic recovery for all types of errors that could occur.

Урок 13

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

range (v), divide (v), try (v), constitute (v), execution (n), current (a), constraint (n), available (a)

2. Правильно прочитайте следующие слова и вспомните их перевод.

determine [d□'t□:m□n], important [□m'p□:tənt], require [r□'kwa□ə], requirement [r□'kwa□əment] industrial [□n'd□str□əl], industry ['□nd□str□], product ['pr□d□kt], production [prə'd□k□ən], result [r□'z□lt], the permit ['p□:m□t], to permit [pə'm□t], apply [ə'pla□]

3. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

sense (n), sense (v), senseless (a), sensibility (n), sensor (n)
define (v), definite (a), indefinite (a), definition (n), pre-defined (a)
range (v), range (n), arrange (v), rearrange (n), arrangement (n)
sure (a), ensure (v), make sure
organize (v), reorganize (v), organization (n)
structure (n), structure (v), structural (a)
divide (v), subdivide (v), division (n), subdivision (n)

4. Прочитайте и переведите словосочетания.

sensor level, monitoring task, supervision operation, execution time, classification phase, error detection level, signal data processing, sensor’s job sequence, flexible automatic system error detection, performance constraints

5. Переведите предложения, учитывая значения наречия “rather": 1) довольно, достаточно; 2) “rather than” – скорее чем..., а не... .

1) Most of the problems solved have been of the rather elementary nature.
2) In our work we stress quality rather than quantity.
3) Simple sensors produce analogue signals rather than simple binary levels.

6. Переведите предложения, учитывая особенности перевода бессоюзных придаточных предложений (Приложение 2, табл. П 2.13).

1) It is very important to analyse the operation one is going to monitor with a sensor.
2) It is known that a light year is the distance light will travel during one year.
3) The programmist is the connecting link between the computer and the problem it has to solve.
4) The main subject the scientists studied at that time was the structure of atom.
5) Sensors can be divided into categories in order to make clear the type of physical phenomenon one is trying to detect.
6) The number of degrees of freedom of robot axes depends on the tasks the robot is designed for.
7) We begin our discussion by indicating the properties we require in a computer for our control tasks.
8) Had this warning (предупреждение) been needed, the reaction would have taken quite a different turn.

7. Прочитайте и переведите текст.

Sensors

Sensors are used to detect disturbances or to determine conditions that are not pre-defined within the robots and the flexible automatic assembly system. They are used to optimize the automatic system's devices to complex systems capable of on-site signal analysis. Sensors can be subdivided into categories in order to make clear the type of physical phenomenon one is trying to detect.

Binary sensors are very common, very robust, reliable and very cheap. They usually constitute the backbone of most error detection.

There are also simple sensors that are neither binary, nor smart. Simple sensors are not numerous. They produce analogue signals rather than simple binary levels.

Smart sensors involve a given level of signal data processing at the sensor level, and a certain amount of monitoring tasks is also carried out at the sensor level. These sensors are expensive and not always suited to heavy industrial environment.

It is very important to analyse the operation one is going to monitor with a sensor in depth before doing anything else. Certain questions must be answered satisfactorily. The following points should be carefully considered:

- Make sure that the previous operation does not influence the correct execution of the current one.
- Analyse all the factors which can create the given error.
- Analyse which of these factors are common, which are stochastic and which occur very rarely.
- Study the details of how much time, money and space do you have to supervise.
- Plan the way in which this operation is included within the automatic supervision system.

In other words, one must plan the supervision operation before choosing a sensor. Many sensors are flexible enough to be used in several different supervision tasks, so there may be no need to add a new sensor, but only reorganize the sensor's job sequence.

Once the operation has been analysed, a careful appreciation of the sensor characteristics available as well as its performance constraints for the particular application must be made.

8. Ответьте на вопросы.

1) What are the sensors used for?
2) What kinds of sensors are there?
3) What are the characteristic features of binary sensors?
4) What are the characteristic features of simple sensors?
5) What are the possibilities of smart sensors?
6) What must you do before choosing a sensor?
7) What points should be considered?
8) What kind of sensors may be used in several different supervision tasks?
9) What is necessary to do after the analysis of operation?

9. Подберите слова, близкие по значению, из данного ряда.

determine, classify, solid, define, robust, smart, base, range, intelligent, consider, backbone, take place, analyse, occur

10. Подберите слова, противоположные по значению, из данного ряда.

cheap, future, stochastic, expensive, temporary, previous, common, permanent

11. Замените пропуски нужным глаголом (to try, to range, to constitute, to divide) в соответствующей форме.

1) The factors, which can create an error...........in some types: common, stochastic and rare.
2) The sensors...........in many categories: binary sensors, simple sensors, complex sensors (digital and analog) and smart sensors.
3) Performance constraints...........the object of a careful analysis.
4) The operators...........to minimize the use of smart sensors at the error detection level.

12. Переведите текст письменно со словарем.

It is advisable to use simple sensors for the detection phase. This decreases cost, software execution time, and the overall reliability of the supervision system is improved. Digital sensors are less sensitive to noise than analogue sensors are. Smart sensors can be brought into the scheme after an error or disturbance has been detected, in order to help the software in the classification phase. It is necessary to minimize the use of advanced sensors at the error detection level.

Very much depends on how one structures the software supervision system. A historical back of the errors is the vital ingredient here. If a simple sensor gives a signal at a very specific time and system condition, we can trace the error source from a historical specification of these existing conditions and use a known error recovery routine.

Урок 14

1. Выпишите из словаря транскрипцию и перевод следующих слов. Запомните их произношение и значения.

schedule (n), scheduling (n), add (v), recur (v), signify (v), attempt (v), salvage (n), become (v), conclusion (n), conventional (a)

2. Правильно прочитайте следующие слова и вспомните их перевод.

function ['f□ŋk□ən], should [□□d], success [sək'ses], to process [prə'ses], the process ['prə□ses], technique [tek'ni:k], supply [sə'pla□], machine [mə'□i:n], operate ['□pəre□t], operator ['□pəre□tə], consider [kən's□də]

3. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

schedule (n), schedule (v), scheduling (n), rescheduling (n)
signify (v), significant (a), signification (n)
possible (a), impossible (a), possibility (n), impossibility(n)
form (v), form (n), formal (a), informal (a), formation (n)
recur (v), recurring (n)

4. Прочитайте и переведите словосочетания.

machine system, control equipment, information processing, constraint values, diagnose routine, diagnose application, time-length observation, automatic cause detection, error recovery routine

5. Переведите предложения, учитывая значения союза "because" – потому что, "because of" – из-за.

1) Copper is widely used in cables because it is a good conductor.
2) The conductivity is never perfect because of resistance to the flow of current in metals.
3) The operation of the system is inefficient because the results are unacceptable.
4) Because of different characteristics of disturbances there is a need for many different supervisory functions and systems.
5) "Performance index" has a broader meaning than "quality index" because this term is applied not only to process, but also to product and manufacturing equipment.
6) The practical applications of superconductivity are limited because of the very low temperature required.
7) Some alloys have displaced iron and steel for many uses because of their more effective magnetic properties.

6. Переведите предложения, учитывая разные функции глагола "to do" (Приложение 2, табл. П 2.3).

1) This tactic does not improve the overall performance of the system.
2) How does recovery work?
3) Today, automatic recovery is possible to do at every error level.
4) The hard programming approach does not solve the main problem: complex data structures.

5) In practice, one does not always do a secondary analysis with smart sensors, because classification of the error begins at the simple sensor level.
6) In some cases of disturbances, the automatic supervision does interrupt the machining process instantaneously.

7. Переведите текст, учитывая значение глагольных форм.

Safety systems of the first generation usually consist of a monitoring device made up of transducer, an amplifier and electronic devices analyzing the measured signal. They also work with teaching techniques, meaning that information about the measured process quantity is recorded and memorized together with NC information. This in turn means that the system records the process parameter, for example, the cutting force, for each NC-block used for machining a component.

8. Прочитайте и переведите текст.

Error recovery

Let us say that we are at the point where we have detected and classified an error. Now we have to start error recovery routine. How do we do this? There are two main points of view: rescheduling and active recovery. Rescheduling tries to avoid the negative effect of an error by rearranging the system's sequence of actions. It temporarily or permanently disregards the error. This is acceptable to some degree if the error was of stochastic nature, but this tactics does not improve the overall performance of the system, it does not add to the knowledge of the process and it does not consider the effects of recurring errors. It cannot be considered as a means of error recovery.

How does "active recovery" work? Active recovery signifies that the supervision system attempts to correct the error on-line with either manual or automatic salvage operations. Automatic error recovery is today possible to do at both the simple and the complex error levels, but becomes impossible for fatal errors.

Adaptive error recovery is a form of active recovery, theoretically more true to its name than any other form of recovery.

The most common way to use adaptive error recovery is to have smart sensors linked directly to the software.

The main difference between conventional error recovery and adaptability is that the automatic error recovery system works in a closed loop. Smart sensors and existing programs permit to correct the error. The classification scheme is simplified and the execution time can be, at least in theory, greatly reduced.

9. Ответьте на вопросы.

1) When do you start error recovery routine?
2) What is a rescheduling? What are its disadvantages?
3) What is an active recovery?
4) What kind of error may be recovered by automatic error recovery?
5) What is it necessary to use in adaptive error recovery?

6) What is the main difference between conventional error recovery and adaptability?

10. Подберите слова, близкие по значению, из данного ряда.

signify, repeat, start, mean, common, link, recur, connect, conventional, put into operation

11. Заполните пропуски нужными глаголами (to become, to reschedule, to signify, to recur, to attempt, to add) в соответствующей форме.

1) The system's sequence of actions………..
2) This………..nothing to our knowledge of the process.
3) These errors………..at very short intervals, they must be studied apart.
4) The supervision system………..to correct the errors on-line.
5) The unmanned machining………..a machining in an autonomic manufacture system without an operator.
6) After a break-down, that manufacturing process………..impossible.

12. Подберите термин (error, disturbance, failure, sensor), эквивалентный данному определению.

1) Instrument, which reacts to a certain physical condition by sending a signal (usually electrical by nature), transmitting information of this condition.
2) State of manufacture described by the quality index equal to zero or negative.
3) Special kind of failure caused by the control system or the person.
4) Anything which was not planned and influences the quality index of the process.

13. Из данного ряда слов выберите две группы из трёх синонимичных слов. Что они означают?

actuator, disturbance, error, sensor, failure, fault, malfunction, break-down, tolerance

14. Переведите текст письменно со словарем.

Research in the field of automatic process supervision and error recovery has been carried out over several years by various researchers. Automatic supervision and error recovery systems are software based and they utilize all types of transducers. The simplest way to design these programs is by using "hard programming" techniques. This means that the supervision and recovery routines are included into the robot programs at the robot controller level. This design is very complicated. If such an approach is taken, 80% of the program code will consist of sensor signals error recovery routines and "if-then" statements. The hard programming approach is time and code intensive and it does not solve the main problem: complex data structures. It also makes any debugging work extremely complicated. It would be better not to use the robot-controller-based software and write common programs at the cell-controller level.

Урок 15

1. Правильно прочитайте и вспомните значение слов.

to affect, to correspond, to locate, to determine, to become, to behave, to depend

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

nullify (v), nullification (n), nullity (n)
apply (v), application (n)
lead (v), leader (n)
conclude (v), conclusion (n)
desire (n), desirable (a), undesirable (a)
know (v), known (a), unknown (a), knowledge (n)

3. Прочитайте и переведите словосочетания.

automatic diagnosis system location, non-automatic cause detection, computer-aided form, steady-state leading forces, fault diagnosis phase, adaptive control with constraints system

4. Выпишите из словаря значения слова "due" и переведите предложения, учитывая эти значения.

1) The control must be performed with due attention.
2) If both sensory units indicate the part missing, then it is an operational error due to part missing.
3) In control systems static errors due to steady-state leading forces cannot be avoided.
4) An expert system determines whether abnormality is due to a recoverable fault or fatal hardware failure.
5) The expert system must stop normal robot operation and activate fault diagnosis phase if the abnormality is due to hardware failures.
6) The incorrect reading may be due to a missing part and not due to sensory unit failing. In some rare cases, it may be due to both.

5. Выпишите из словаря значения глагола "to follow". Переведите предложения, учитывая эти значения.

1) He spoke so fast that nobody could follow him.
2) The nature of process will be discussed first and this will be followed by an interpretation of the actual system.
3) The typical indication of a tool breakage is a fast increase of the force from the steady-state force level followed by a temporary drop to zero force.
4) In the robot it is possible to distinguish the following major subsystems: a manipulator, sensors, a controller, actuators.
5) These schemes allow a separation of the two basic tasks of the control system: following the desired tracking on one hand and reducing the object of disturbances on the other hand.

6. Переведите предложения, учитывая разный перевод слова "it" (Приложение 2, табл. П 2.16).

1) It is apparent that a robot must be able to operate automatically.
2) It implies that data must be transmitted to the control system.

3) Although this diminishes the accuracy of the measurement, it also considerably increases protection against transducer failure.
4) It is understandable that adaptive control with constraints systems are mostly intended for rough cutting operations.
5) It is unlikely that this design will be duplicated in higher level controllers.

7. Переведите текст, учитывая значение глагольных форм.

Control systems that optimize turning (токарный) and boring (сверлильный) operations are still not to be found in industry. Nevertheless, much research and development effort is being spent worldwide in order to realize such systems. One important problem still to be solved in these control systems is the measurement of tool wear. Recent research findings involving advanced signal analysis present some hope that this problem will be solved.

Tool breakage is sensed by using advanced pattern of recognition of changes in the cutting force. This is done by simultaneously comparing the cutting force to stored cutting force patterns. Several different patterns are stored in the system, each signifying a different tool breakage. As soon as a pattern is recognized, an alarm indicating tool breakage is activated.

8. Прочитайте и переведите текст.

Automatic supervision of control systems.
Diagnosis (1)

In order to increase output as well as to protect systems and operators, it becomes standard practice to integrate the monitoring and diagnosis functions of manufacturing into the control systems. The term "diagnosis" is of Greek origin and means "the detection and determination of all illness". For technological processes the "illness" corresponds to "disturbances" which affect the process adversely. The disturbances can be located in the machine system, the process itself or the operator.

As soon as the monitoring system has detected a functional disturbance, it is the task of the diagnosis system to determine its location, type and cause. Following diagnosis, an adequate reaction which nullifies the influence of the disturbance of the process is necessary.

The monitoring and the diagnosis can be done either manually or completely automatically. Automatic diagnosis systems are based on an analysis of the system, module-by-module. To draw up conclusions, automatic diagnosis systems must also know the behaviour of these modules under normal conditions, automatic location of changes followed by observation and tests. The diagnosis knowledge is a part of the automatic system.

Since a great number of factors can lead to many undesirable kinds of behaviour, complete automatic monitoring and diagnosis are only possible in exceptional cases, depending on the application. For non-automatic cause detection, specialists are needed to carry out a manual diagnosis. This manual diagnosis can be done in a computer-aided form by so-called "Expert Systems", whereby the type of disturbance is determined via a dialogue of questions and answers with the help of structured knowledge.

9. Ответьте на вопросы.

1) What does the term "diagnosis" mean?
2) Where can disturbances be located?
3) What is the aim of monitoring and diagnosis in manufacturing?
4) What is the difference between the function of the monitoring system and the diagnosis system?
5) What are automatic diagnosis systems based on?
6) Why are complete automatic monitoring and diagnosis possible only in exceptional cases?
7) How can manual diagnosis be done?

10. Найдите в тексте синонимы следующих слов. Переведите их.

to abolish, to influence, the malfunction, equal, to conclude, many

11. Найдите в тексте слова того же корня, что и следующие. Переведите их.

to locate, the detection, the determination, the dependency, the correspondence, to behave

12. Переведите текст письменно со словарем.

The diagnosis of control-external faults covers all modules and components, which according to their inputs and outputs, can be assigned as actuators or signal transmitters. These include, for example, systems to execute numerically controlled movements, systems to execute protection functions, and other mechanical components.

As a monitoring is concerned, two different tasks are involved:

1) Monitoring of modules with logical functions by means of Boolean variables.

2) Monitoring of models with process behaviour by means of continuous variables.

Урок 16

1. Правильно прочитайте и вспомните значения слов.

the fault, the cause, to range, to switch off, to switch over, to result, to avoid, to damage, to include

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значений словообразовательных элементов.

action (n), activity (n), interaction (n), interactive (a), actively (adv.)
man (n), unmanned (a)
disturb (v), disturbance (n)
damage (n), damage (v), damageable (a)

3. Прочитайте и переведите словосочетания.

system condition, disturbance conditions, disturbance effect, monitoring indication, diagnosis knowledge

4. Переведите предложения, учитывая значения глагола "to provide" и союза "provided".

1) Provided they use the necessary instruments, the measurement will be always correct.
2) Automation provided the control of not only individual machines, but also of whole shops and factories.
3) Provided the motors and their servosystems are functioning properly, then it is possible to force the robot to make some programmed moves exclusively for diagnostic use.
4) Diagnosis is based on the diagnostic information provided by the event trace at the time of abnormal behaviour.
5) The recording of this tool wear is not so complicated or difficult provided there is sufficient illumination.
6) Automatic sensing devices with visual displays are often provided in order to help operators in monitoring the complex process.
7) Recommendations are provided on working methods for those who have to deal with robots.

5. Выпишите из словаря значения выделенных слов. Переведите предложения, учитывая эти значения.

1) **Since** the forces depend on several factors, estimation of tool wear may be difficult.
2) Cutting forces are the most common parameters measured in metal-cutting **science**.
3) Great wear of tool diminishes the cutting force **since** the effective rake angle (угол наклона) is increased.
4) The problem of detecting bad chip form is difficult **since** the space for chips is usually very small.
5) **Since** the classification of surface according to standards is a rather complex procedure, industrial applications of this method have been poor.
6) The **science** of automation had made great progress recently.
7) **Since** the mid-1970s, the systems have developed and one can even speak of different generations.

6. Переведите предложения, учитывая разное значение слов "that", "those" (Приложение 2, табл. П 2.15).

1) In task level programming, the task, that the robot is required to carry out, is described in a very abstract way.
2) The basic disadvantage of the call is that of the island (изолированный участок) of automation.
3) These tools are used to replace those that have been worn or broken.
4) The control hierarchy is often practically arranged according to organizational models similar to those outlined (описать) for the manufacturing facility.
5) This scheme of representing the control activity in hierarchical control is similar to that outlined for the single level control activity.

6) The constraints are generally those of timely and deterministic (детерминированный) operation.

7. Прочитайте и переведите текст.

Diagnosis (2)

If a fault is detected by the monitoring way, the system condition changes from the "regular" to the "disturbed" condition.

At this point, the diagnosis system comes into operation. It detects the causes of the functional disturbance by means of the following information:

- Location of the fault
- Type of the fault
- Cause of the fault

According to type and cause of the disturbance, a decision can be made about the best reaction to put into operation. This decision is graded according to the type of faults, and can range from an indication and a protocol, to automatically switching off the process or switching over to other units.

Since it cannot usually be guaranteed that all possible disturbance conditions can be detected automatically, the system might come to a point where disturbance effects bring it to an uncomfortable condition. This condition might also result if disturbances were detected, but no effective reactions were programmed. In such cases, an interaction by human operators is unavoidable. This shows that a completely unmanned factory is unrealistic for complex systems. A process disturbed into uncontrollable condition has too great a potential for damage.

Monitoring and diagnosis must be two separate processes. A monitoring indication depends on an information source that has a diagnosis information, i.e. monitoring always includes a certain diagnosis knowledge about the location of the disturbance.

8. Ответьте на вопросы.

1) When does the diagnosis system come into operation?
2) What information does it use to detect the causes of the disturbances?
3) What kind of reaction can be used in order to recover the manufacturing process?
4) When does a system come to an uncontrollable condition?
5) When is an interaction by human operators unavoidable?
6) Why is a completely unmanned factory unrealistic?

9. Найдите в тексте синонимы следующих слов и выражений. Переведите их.

automated factory, impossible, the error, the state, to come to, to begin to act, the power

10. Найдите в тексте слова того же корня, что и следующие. Переведите их.

the action, the man, the reality, to decide, the inclusion

11. Образуйте с помощью конверсии существительные от следующих глаголов. Переведите их.
to range, to switch, to cause, to result, to damage, to supply

12. Переведите текст письменно со словарем.

The pH (показатель концентрации водородных ионов) loop has been generally recognized as the most difficult loop in process control. Many, if not most, pH control loops are unsatisfactory, either limit-cycling or slow to response to upsets or both. Considerable effort has been done designing advanced control systems to solve these problems. Not enough has been done in designing the neutralization process to be controllable. If the process is designed to be controllable, the control system can be more effective and simpler, and, therefore easier to operate and maintain.

Урок 17

1. Правильно прочитайте и вспомните значение слов.
to process, available, to fail, to supply, to check

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значений словообразовательных элементов.
process (v), process (n), processing (n), microprocessor(n)
fail (v), failure (n)
control (n), controllable (a), uncontrollable (a), controller (n)
function (n), function (v), functional (a), functionality(n)
connect (v), connection (n)
mean (v), means (n), by means of
couple (v), couple (n), decouple (v)

3. Прочитайте и переведите словосочетания.
drive and measuring system, information processing, monitoring and diagnosis component, normal system behaviour

4. Переведите, учитывая значение союза “whether” – ли.
1) The problem which greatly interested the scientists was whether other elements besides uranium possessed the property of emitting radiation.
2) Following Roentgen's discovery, the x-rays were thoroughly investigated to determine whether they were waves or particles.
3) Usually a simple touch probe (зонд) is used to feel whether the tool is there.
4) The expert system must first decide whether the abnormality is due to an operational error or a hardware fault.

5) When a hardware failure is detected the controller first checks whether motors are operating correctly.

5. Переведите предложения, учитывая значение слов с элементом “-self”/”-selves”: (сам, само-).

1) Metal cutting power in itself is of great interest.
2) Most factors concerning machining supervision have to be related to the manufacturing processes themselves.
3) A skilled workforce in itself is difficult to find.
4) Self-organizing controllers are a possible solution to this problem.
5) The idea is to make the robot self-sufficient in diagnosis.

6. Переведите предложения, обращая внимание на различные глагольные формы.

1) After the information related to all the machining involved in making a complete component is stored, the actual monitoring phase can also take place for the next workpiece.
2) One big disadvantage of this system is that operator must calibrate it by using the first workpiece as a calibrating device, the time and memory for more complex workpieces using long NC programs.
3) When components of the system are machined after (согласно, по) the learning process, actual cutting forces are monitored and checked to ensure that they are within the established limits.
4) The stored values must be deducted from the measured values in order to obtain the true machining values.

7. Прочитайте и переведите текст.

Diagnosis (3)

The control equipment exists at all the electronic and electrical elements, including the connecting elements of the drive and measuring systems and all the equipment used in information processing. Modern diagnosis technology is based on electronics and such equipment is generally available today for most control systems in the form of microcomputers. Thus, the monitoring and diagnosis component is part of the machine system which itself can fail. However, as experience shows, when electronic controllers are used as a central part of the control system (processor, storage, bus, current supply) failure rates are very low in comparison to the system as a whole.

For a better classification of the diagnosis strategies, it is reasonable to divide the faults to be observed into internal and external control faults and thus to relate the faults according to the monitoring and diagnosis functions.

Disturbances are caused by internal faults and by external faults. The latter are differentiated into elements without information processing of their own and elements with information processing of their own.

There are two basic principles for automatic monitoring and diagnosis:

1) checking the functionality of a module by means of specified tests; and
2) checking the functionality by observation.

A testing procedure is characterized by the fact that the module to be checked is connected to a testing function, which means that the checking is done actively. Since this generally has a harmful effect on the process, it must be possible to decouple the checked module from the process itself while testing is in progress.

The characteristic of an observation is the passive checking of the normal system behaviour of a module by observing its input and/or output values.

8. Ответьте на вопросы.

1) What does the control equipment consist of?
2) What form does this equipment take in the machine system?
3) What is the role of the control equipment in the machine system?
4) How are the faults of the machine system classified?
5) What are these faults related to?
6) What are two basic principles for automatic monitoring and diagnosis?
7) How is the testing procedure realized?
8) How is observation procedure realized?

9. Найдите в тексте антонимы следующих слов. Переведите их.

passive, helpful, to succeed, unavailable, internal, to switch on

10. Найдите в тексте слова того же корня, что и следующие. Переведите их.

the checking, the processing, the availability, the failure, to compare, to observe, to classify, different, to function

11. Переведите текст письменно со словарем.

Creating a new signature for the error type is not difficult. One must read this signal and store the value with the other signal levels. Then tolerance level must be set for this signal if complex sensors (digital or analogue) are being used.

A mathematical model of the error signature is another way to compare the error signal to tolerance levels. It can be introduced as a confirmation; however mathematical models cannot be developed automatically. There are no known faultless automatic error learning modules yet available.

Once the error signal has been classified with its signature, tolerance levels and history, the system should ideally propose an error recovery routine. In some cases, depending on the type of error, it can be generated automatically. But this is a very difficult part of error recovery and usually it is done manually by the operator.

Урок 18

1. Правильно прочитайте и вспомните значение слов.

to need, the signature, to subject to, the constraint, the routine, to extend, to require, on-line, the component, the development, to load

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

compare (v), comparison (n), uncomparable (a)
'subject (n), sub'ject (v)
value (n), valuable (a), evaluation (n)
extend (v), extensibility (n)

3. Прочитайте и переведите словосочетания.

time-length observation, constraint comparison, test and observation routine, permanently loaded service routines, programmable logic controller, process course

4. Правильно прочитайте и переведите интернациональные слова.

focus ['fə□kəs], criteria [kra□'t□ər□ə], defective [d□'fekt□v], procedure [prə'si:□ə], permanently ['p□:mənəntl□], via [va□ə]

5. Переведите предложения, обращая внимание на выделенные слова (some – некоторый, несколько; the same – тот же самый).

1) The control system obeys **the same** basic principles as for control of motions of any mechanical system.
2) It may result in **some** deterioration of the dynamic performances of the system.
3) In **some** applications the base of the robot is carried by a vehicle which gives the possibility of large linear displacements.
4) The results are **the same** as those obtained in the previous experiments.
5) There are **some** restricted flow of control or sequencing commands available which depend on the input from simple sensors.

6. Выпишите из словаря значения выделенных слов и переведите предложения, учитывая эти значения.

1) The internal electronic net of a robot system will have **both** analog **and** digital circuitry.
2) This measure has **both** advantages **and** disadvantages.
3) **Both** velocity **and** displacement can be acquired by electric signal integration.
4) Information from the force transducers is used **both** for Automatic Data Control handling **and** for the safety system.
5) Fuzzy control can be viewed as an intermediate class between discontinuous and linear control systems, resulting in a compromise between advantages and drawbacks of **both**.

7. Переведите предложения, обращая внимание на пассивный залог (Приложение 2, табл. П 2.4).

1) This closed-loop phenomenon can be affected by the cutting data chosen.
2) All events will be permanently guarded by the safety system.
3) Nothing can be done to improve control performance when the control equipment does not perform adequately.
4) The cells are connected by means of a local network for information exchange.

5) The architecture is being implemented by us in the project at Wayne State University.
6) This definition of robots is often referred to by researchers.

8. Переведите предложения, обращая внимание на различные глагольные формы.

1) The supervision system has the ability of distinguishing between tool breakage and tool wear.
2) The lack of suitable sensors for tool-wear estimation is still one of the most serious obstacles to be overcome.
3) Automatic sensing devices with usual displays are often provided in order to help the operator in monitoring and controlling the complex processes.
4) An instruction in the task level program represents a description of a state transition, the discrete steps of robot changing from an initial state to the next state.

9. Прочитайте и переведите текст.

Diagnosis (4)

For the testing and observations, there is a great number of procedures available, so the choice has to be made carefully.

Both with testing and observing the results need to be compared. The comparison has different criteria according to the task and diagnosis strategy. The result of a signature analysis is compared with a given bit pattern, from which the decision "defective" or "in order" can be made. The result of time-length observation is typically subject to a constraint comparison that is obtained from tables. The comparison values can be stored before the operation, transmitted with the help of operators, or by self-learning during the test or in an operation phase built into the system itself.

Self-learning procedures are especially valuable for those variables and their combinations of which the constraint values are not known a priori. Test and observation routines serve for checking both individual components and systems. The routines can be used either by external diagnosis systems or by additional programs contained in the control system. There is a growing tendency to store such aids in the control system as permanently loaded service routines.

When following a system from its development phase to its use in production, various diagnosis applications can be differentiated.

During the phases of development and initial operation, the diagnosis routines do not have to be components of the system. Programmable logic controllers, for example, can be extended by using so-called external test systems.

During the production phase, however, permanent automatic monitoring and diagnosis are required. The corresponding routines therefore run on-line, parallel to the process course. If the diagnosis system is part of the control, and such is the usual case, one speaks of "integrated diagnosis".

10. Ответьте на вопросы.

1) How is the result of a signature analysis compared?
2) How is the result of time-length observation compared?
3) How are the comparison values treated?
4) What do the test and observation routines serve for?
5) Why diagnosis routines do not have to be included into the system during the phase of development and initial operation?
6) When do the diagnosis routines run on-line?
7) What is an integrated diagnosis?

11. Найдите в тексте синонимы следующих слов и выражений. Переведите их.

autonomous, automatic, to concentrate, to include, by means of, the program, the part of something

12. Найдите в тексте слова того же корня, что и следующие. Переведите их.

needless, the subject, the extension, the requirement, to develop, the loading, to constrain

13. Переведите текст письменно со словарем.

To use the operator manual assistance is contrary to the aim of an automatic supervision and error recovery system, but experience shows that an experienced operator can decide the best alternative to take when the error cause is difficult to locate and there is time constraint. One must not forget that there are many parameters to consider. For example, if such an error occurs when the last product in batch being assembled is urgently required, then the operator may decide to jump directly to the next product and assemble the last one manually to save time. This of course is very difficult to take, because this decision does not take into account the fact that the cause of error may be due to the hardware and so the same error will affect the next product. It is a question of how complex one should make the supervision and recovery system without increasing the occurrence of errors caused by the complexity of such system.

Урок 19

1. Правильно прочитайте и вспомните значение слов.

the supplement, the package, the measure, to initiate, appropriate, the reference, accessible, to separate, to receive, to recognize, to mention, to derive

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

measure (n), measure (v), measurement (n)
range (n), range (v), arrange (v), arrangement (n)
'access (n), ac'cess (v), accessible (a)
separate (v), separate (a), separately (adv), separation (n)
receive (v), reception (n)

3. Прочитайте и переведите словосочетания.

test program, statistical diagnosis procedures, known fault pattern, reference standards, control functional unit, control internal hardware fault sources, different function components

4. Переведите предложения, обращая внимание на выделенные слова.

1) Piezo-electric materials are usually ceramic, but crystals are also **available**.
2) Typical cutting force monitoring systems are **available** on the market. Most of the systems **available** at this time belong to the same category.
3) Statistics on robot related accidents are difficult to find. Those **available** have no statistically sound (надежный) information.
4) Of all the instruments **available** the Geiger counter (счетчик) is the most suitable for the purpose of counting particles.
5) Before the **availability** of rural electricity via transmission lines a wind generator system was a very clean and convenient source of electric power.
6) We are interested to know what fraction of the **available** energy we get in the form of useful work. This fraction we call efficiency.

5. Выпишите значения выделенных наречий и союзов. Переведите предложения, учитывая эти значения.

1) This method is not efficient. Tool wear must **therefore** be evaluated using other principles.
2) **Nevertheless**, the question of what to do with the measured values is of great importance.
3) **Although** this diminishes the accuracy of the measurement, it also **considerably** increases protection against transducer failure.
4) The time and memory used for this process is great. **Furthermore**, the number of workpieces is so small that even just one workpiece can be a **considerable** percentage of the whole batch.
5) A change can be activated. **Otherwise**, an alarm signal will attract the operator to a malfunction.
6) This system will work as an ADC system **whenever** possible.
7) Safety control may be based on adaptive control. **However**, the bandwidth of the safety control and optimizing control is quite different.

6. Переведите предложения, обращая внимание на различные глагольные формы.

1) We begin **by examining** the manufacturing cell which is regarded by many as the **building** block of larger systems.
2) **Off-line programming** is understood **to have** two elements: the development of the flow of control code and the development of the position instructions.
3) The robot usually follows a complex path from start point to end point, **this path being generated by all the robot joints together**.
4) **The robot controller** is assumed **to have** the necessary hardware and software **to allow** the high level instruction **to generate** the low level instructions **to perform** the actual state transition.

7. Прочитайте и переведите текст.

Diagnosis process (1)

Individual hardware components are supervised by small hardware supplements such as timer. Another usual method is to check all the hardware components, if possible, by test programs.

Since large software packages are not free of faults, it is necessary to take supervisory measures within the software. Various algorithms and procedures are available for these. Statical diagnosis procedures use known fault patterns to find the appropriate cause of any faults and to initiate appropriate reactions. In this case, statical diagnosis procedures mean that already existing fixed arrangement between fault pattern and fault cause is used. Dynamical diagnosis systems are capable of automatically recording processes with the reference standards.

Today automation systems are modularly structured, so that diagnosis is based on accessible signal components. There are several possibilities of realization. One method is the integration of the supervisory and diagnosis functions into the software already used during the development of the control functional units.

Another method is to keep the monitoring and diagnosis separate from the real functions. A monitoring and diagnosis unit made for a special function or for different functions can receive the data of one of several functions via adequate interfaces.

With the development of control functions, the diagnosis interface has to be considered as a separate phenomenon. The diagnosis function is separately coded and is therefore portable on to additional hardware.

So one can say that the method mentioned first does not cover control-internal hardware fault sources. If the second method is used, faults of the control hardware can also be recognized and a certain standardization of the diagnosis component is possible. Furthermore, diagnoses become possible which can only be derived from an analysis of variables of the different function components.

8. Ответьте на вопросы.

1) How are individual hardware components supervised?
2) How are software components supervised?
3) What is the principle of functioning of statistical diagnosis procedures?
4) What is the first method of modular structurization of automation systems?
5) What is another method of modular structurization of automation systems?
6) What is the difference between these two methods?

9. Найдите в тексте слова того же корня, что и следующие. Переведите их.

the supervision, to pack, the measurement, the separation, the derivation, recognizable, the reception, the accessibility, to realize, the addition, the module

10. Переведите текст письменно со словарем.

System engineering and the organization

A system is an organized whole, which means a plan according to which parts are interconnected to constitute a whole.

Defined in this way, the term system covers a large spectrum of our physical, biological and social reality. To analyse this reality a theory has been developed – System Theory – that tries to deal with dynamic systems and the interactions in its parts.

It is important to differentiate between open systems and closed systems.

The open systems consider the interaction among its components and with its environment. In these systems there is a dynamic relationship with the environment, from which they receive various inputs, transforming them and sending the outputs back to it. They adapt themselves to this environment through internal changes to their structure and in the process developed by their parts.

On the other hand, the closed systems consider the system under analysis as self-contained (самодостаточный).

Урок 20

1. Правильно прочитайте и вспомните значение слов.

occur (v), distinguish (v), location (n), specify (v), definitely (adv), diversity (n), search (n), program (n)

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

available (a), unavailable (a), availability (n)
definite (a), indefinite (a), definitely (adv.), define (v)
specify (v), specification (n)
locate (v), location (n)

3. Прочитайте и переведите словосочетания.

system software, operation software, pattern behaviour, function oriented diagnosis technology, typical fault pattern, fault search program, function result

4. Переведите предложения, обращая внимание на выделенные слова. Выпишите их значения.

1) Position and displacement control is not **the only** type of control which may be required in the performance of robotic tasks.
2) **The only** way to cope with such disturbances and reject their effect on the system is the introduction of a reset action in the control system.
3) In most countries where robots are used, no data or **only** vague (неточный) data about robot related accidents is available.
4) Human interference is minimized and is required **only** when the identified faulty unit is to be replaced.

5) Failures in motors are not very common. **The only** way to overcome this problem is first to repair the faulty motor and then to go through the diagnostic phase.
6) **The only** real link between programmable manufacturing and the balance of the computer-integrated manufacturing are those associated with CAD/CAM.
7) It is **only** the relevant modules that are modified rather than a very large single software system.

5. Переведите предложения, обращая внимание на выделенные слова. Выпишите их значения.

1) **Because of** the conditions in the cutting zone, there is no way of inspecting the tool wear.
2) Static measurements are always quasi-static. **Because of** this and the temperature drift problem, piezo-electric transducers have to be reset prior to measurement.
3) **Because of** the techniques employed, the diameter information can be used as a correction for the next workpiece.
4) **Because of** the nature of the measured values, safety systems of this type are used for medium cuts.
5) This system can be considered as belonging to the third generation of safety systems, **because** no teach-in is necessary.
6) The implementation of an optimizing system increased the economic benefit **because of** much heavier investment needed.
7) We shall study now the dynamics and control of robotic manipulators **because** they are relatively complex mechanical systems.

6. Переведите предложения, обращая внимание на различные глагольные формы.

1) **A parts family** is considered **to be** a set of parts that requires similar tooling and machine operations. A cell is usually used **to transfer** raw materials into finished products.
2) We must have supervisory control and sensors **to monitor** and **detect** the cell condition and to decide the new activity.
3) Any cell built must be capable of interfacing mechanically and electrically (power and control) with any further automation **that** is likely **to be installed**.
4) Depending on their relative importance, the incoming signals may require **the computer to interrupt** its current task to carry out one of higher priority. It must, therefore, be capable of interfacing with sensors **to permit** process monitoring.

7. Прочитайте и переведите текст.

Diagnosis process (2)

Normally faults occur only with components that can fail, so that software which has been tested once and which does not change can be looked on as fault free. Experience shows, however, that software faults can be uncovered even after it has been in operation for a very long time because the great number of combinations cannot be tested during the test phase by simply using the input parameter. Therefore, it is reasonable to supervise on-line both the system software and the operator software. If spare hardware is unavailable, hardware and software cannot be definitely distinguished. Software diagnosis is done either by test using pattern behaviour and input parameters or by specifying the time of operation. A further method compares results on software diversity. During this comparison various pieces of hardware should be used if possible.

With function oriented diagnosis technology, one can use the fact that functions need different hardware and software modules, so that faulty modules can be located by various tests. These tests lead to a typical fault pattern for every fault. A fault search program with a tree structure can be used to analyse the location of the fault.

8. Ответьте на вопросы.

1) What components can initiate a fault?
2) Why can the software faults be uncovered during the operation of the system?
3) What is it reasonable to supervise in order to minimize the number of faults?
4) How is software diagnosis realized?
5) How can faulty modules be located in function-oriented diagnosis technology?
6) What program is used to analyse the location of the fault?

9. Найдите в тексте лексические эквиваленты следующих выражений.

to consider the system, defective modules, to discover the fault, to supervise automatically

10. Переведите словосочетания.

безошибочный, программа обнаружения ошибки, обнаружить местоположение ошибки, ошибки происходят, обнаруженная ошибка, различать ошибки, разнообразие методов

11. Переведите текст письменно со словарем.

Motion control of Robot manipulation

The design of intelligent, autonomous machines to perform tasks that are dull and dangerous for humans is the ultimate goal of robotics research. Examples of such tasks include manufacturing, construction, space exploration, robotic-assisted medicine etc. The field of robotics is highly interdisciplinary and requires the integration of control theory with computer science, mechanics and electronics.

The term "robot" has been applied to a wide variety of mechanical devices, from children's toy to guided missiles. An important class of robots is the manipulator arms. These manipulators are used primarily in materials handling, assembly and other manufacturing applications.

Robot manipulators are basically multi-degree-of-freedom positioning devices. The robot, as "the plant to be controlled", is a multi-input/multi-output, nonlinear mechatronic system. The main task in the motion control of these robots is the complexity of the dynamics and uncertainties, both

parametric and dynamic. Parametric uncertainties arise from imprecise knowledge of kinematic parameters and inertia parameters while dynamic uncertainties arise from link flexibility, actuator dynamics, friction, sensor noise and unknown environment dynamics.

Урок 21

1. Правильно прочитайте и вспомните значение слов.

to carry out, the machine tool, to associate, to match, to search, to execute, the frame network, to find, the approach, to fulfill

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

capable (a), incapable (a), capability (n)
require (v), required (past p.), requiring (pres. p.), requirement (n)
fulfill (v), fulfillment (n)
describe (v), description (n)
structure (n), structure (v), structurize (v)

3. Прочитайте и переведите словосочетания.

computer-aided tool, structured knowledge memory, conclusion rule, short response time, larger knowledge bases, service technician

4. Переведите предложения, обращая внимание на выделенные слова. Выпишите их значения из словаря.

1) The careless **manner** of carrying out the experiment may induce the assistant to an error.
2) This device can be used in two different **ways**.
3) In this **way**, compensation for tool wear can be achieved.
4) In adaptive control the use of acoustic emission is a **way** of analyzing high frequency patterns.
5) The machine tool of tomorrow must be able to monitor the process and diagnose all events in almost intelligent **way**.
6) One common **way** to increase the sensitivity of the transducers is to make the structure more flexible. Another **way** is to use modern calculating tools to find the optimal placement of the transducer.
7) These dynamic characteristics may sometimes influence measuring results in an undesirable **way**.
8) Logical cell controllers are equal decision makers and perform all planning in a cooperative **manner**.

5. Переведите предложения, обращая внимание на различные глагольные формы.

1) For process control the computer must have the software capability **to direct** the hardware devices **to carry out** tasks. It must be able **to be interfaced** to actuators.
2) The control system software must be capable **of accepting** inputs from operators and outputs of commands **to trigger** (инициировать) operator activities.
3) Problems arise because there is a number of computers in contention (здесь – требующие связи) for the network, **each perhaps waiting to pass messages around the system**, **each needing to communicate message in an efficient way**.
4) If two or more stations decide to transmit (вести передачу) simultaneously, there will be a collision. Each will detect the collision, abort (прерывать) its transmission, wait a random (произвольный) period of time, and then try again, assuming that no other station has started **transmitting** in the meantime. **To minimize** delay, an adaptive randomization (перемещение) strategy has been advised.

6. Прочитайте и переведите текст.

Use of expert systems

Simple logical systems can generally be divided into modules in such a way that a completely automatic diagnosis can be carried out. A machine tool, however, is very complex, so that it becomes impossible to supervise all existing elementary modules. Because of their capability of thinking, and their capabilities also to learn, compare, recognize patterns and associate them, humans are extremely efficient diagnosis systems, which cannot be matched by computers. Computers are faster than people with their capabilities of searching and executing algorithmical processes. As the property of data processing is helpful in diagnosis, so-called "Expert Systems" can be described as structured knowledge memory with conclusion rules.

Today several methods, such as rules, frames, semantical networks, are used quite suitable for recording empirical knowledge. For generation of a knowledge base, facts and rules which relate to both functional and practical knowledge have to be recorded for every module of the machine.

By means of the conclusion components, the dialogue between the service technician and the expert system is controlled, whereby these components can be structured differently. An approach to faults is made by separating those modules in which the faults cannot be found. This is shown by the correct input and output values.

An expert system, when asked, must have a short response time. Experience shows that this requirement is not yet fulfilled for larger knowledge bases and medium databases. In the future, expert systems should be able to play an important role in fault diagnosis.

7. Ответьте на вопросы.

1) Why is it impossible to supervise all elementary modules of a machine tool?
2) Why do humans represent extremely efficient diagnosis systems?

3) What is the advantage of the computers in comparison to the humans?
4) What is an Expert System?
5) What methods are used to represent the knowledge?
6) Are these methods recorded for the whole machine tool?
7) How is the dialogue between the service technician and the Expert System controlled?
8) How is an approach to faults made?
9) Are Expert Systems used for large knowledge bases?

8. Подберите термины (downtime; expert system; adaptability of manufacturing system) к следующим определениям.

1) Ability of manufacturing system to eliminate or to diminish the influence of disturbances by appropriate changes in its operation.
2) Structured knowledge memory with conclusion rules.
3) Time of interruption in machining caused by a failure (break-down).

9. Найдите в тексте слова того же корня, что и следующие. Переведите их.

the association, the execution, the findings, to approach, the fulfillment, extreme, the existence, the representation, to know, to help

10. Переведите текст письменно со словарем.

The Integrated Service Digital Network operates quickly. It supplies the user at the basic telephone connection with two so-called B-channels and a D-channel. The two B-channels are line-connected and form useful channels which are independent of each other and can be used simultaneously: they transmit language, text, pictures and data. The D-channel transmits information for controlling and supervising purposes.

With the introduction of the ISDN an efficient new network became available, which, for functional as well as for financial reasons, is especially suitable for setting up teleservice systems.

Урок 22

1. Правильно прочитайте и вспомните значения слов.

to accomplish, to focus, to consider, to consist, to contain, major, inherent, the schedule

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

cell (n), cellular (a)
decide (v), decision (n)
depend (v), dependent (a), independent (a), independently (adv.)
address (n), address (v), addressable (a)
major (a), majority (n)
change (v), exchange (v)

3. Прочитайте и переведите словосочетания.

cellular flexible manufacturing system, factory operation function, information processing/decision making function, decision propagation, transportation subsystem, manufacturing planning, cell level scheduling

4. Переведите предложения, обращая внимание на выделенные предлоги.

1) This makes this method less reliable **for** industrial application.
2) **In** the supervision systems used in industrial applications, most factors are evaluated **by** indirect measurement methods.
3) **Among** the quantities which can be measured and detected **during** the process **in** a machining system **in order to** make performance (определить характеристику) of the system are tool wear, tool failure etc.
4) The reason **for** behaviour **of** the tool is that when the tool collapses (ломаться), no actual cutting takes place **for** a short period of time.
5) The tool starts to function **after** an interval of usually some hundred milliseconds.
6) The control system has to react fast enough **in order to** prevent further cutting **after** the force drop.
7) This state of the control may be reached during the program testing **prior to** production.

5. Переведите предложения, обращая внимание на выделенные слова. Выпишите их значения.

1) A wide variety of industrial processes are controlled **by means of** telemetry.
2) “Telemetry” is a combination of Greek and Latin words and **means** "measurements at a distance".
3) For this experiment you must take the **mean** value of several temperature measurements.
4) The computer's ability to do simple work by simple **means** explains its wide use.
5) For normal tool wear detection, the force F1 is evaluated **by means of** a sliding (скользящий) **mean** value F2.
6) Tool failure **means** that the tool has been completely worn out or broken.
7) The **main** disadvantage of piezo-electric transducers is their sensitivity at high temperatures, **meaning** that the piezo effect will be lost at excessively high temperatures.

6. Переведите предложения, обращая внимание на различные глагольные формы.

1) A readable language needs the programmer to write in a structured way. Typically a structured program is a hierarchy of modules, **each having a single entry point and a single exit point**.
2) The language must be flexible enough to allow the programmer to carry out whatever he wishes, **without having to use machine code inserts (включение) or other similar techniques**.

3) Real-time systems must often achieve high computational throughput (пропускная способность) in order to meet the constraints **imposed by the monitoring and control of the systems**.
4) Over the next few years **we** are likely **to see** many developments in manufacturing systems.

7. Прочитайте и переведите текст.

Decentralization of planning and control in a cellular flexible manufacturing system (1)

In an automated manufacturing system the objective is to accomplish two classes of manufacturing functions in a fully automated and flexible manner. These are: factory operation functions and information processing/decision making functions. Information processing functions are required to guide and support factory operations. Here, we focus primarily upon the automation of manufacturing planning and control functions.

Let us consider a manufacturing system consisting of units called flexible manufacturing cells. These cells are connected by means of a local area network for information exchange and decision propagation, and by a transportation subsystem. In the information processing, until recently, the major focus has been on integration of independently automated components such as Computer Aided Design (CAD) and Content Addressable Memory (CAM). Such orientation do not fully exploit the inherent advantages of cellular architectures. For example, models generated from CAD systems do not contain enough information to drive process planning. Planning is not linked to the shop floor, and thus cannot incorporate online information.

In addition to manufacturing equipment, each cell has computing and data storage units collectively referred to as a logical cell controller. Among others, an important function of a cell controller is to act as a link between the cell and the rest of the system. The cell controller of each cell is capable of exchanging information with the rest of the system through a communication subsystem.

In almost all cellular architectures presented by researchers so far (до сих пор) the cell controllers have limited functions which are cell NC programming, monitoring, cell level scheduling etc. All other functions such as process-planning, material requirements planning, coordination among cells etc. are performed externally at higher levels of control in the system.

8. Ответьте на вопросы.
1) What is the objective of an automated manufacturing system?
2) What is the aim of information processing functions?
3) What does a manufacturing system consist of?
4) How are manufacturing cells connected?
5) Give examples of the integration of independently automated components.
6) What is a logical cell controller?
7) What are the functions of the cell controller?
8) At what level are process-planning and coordination among cells performed?

9. Подберите термины (identification; cell; emergency stop) к следующим определениям.

1) Autonomic manufacturing system which may operate without human supervision.
2) Interruption in machining caused by the detection of a failure.
3) Process of model verification. On-line identification may be a part of a sophisticated monitoring system.

10. Найдите в тексте слова того же корня, что и следующие. Переведите их.

the accomplishment, considerable, the container, the inherence, the connection, to depend, the architect

11. Переведите текст письменно со словарем.

Tool wear in turning (токарная обработка) and boring (сверление) operations comprises estimations of flank wear (боковой износ) on the relief side (сторона сброса). The mechanisms deciding what wear type will occur in a specific operation depend on the tool and workpiece material combination and the cutting data used. In addition to these important wear types, plastic deformation of the tool tip and chipping of the cutting edge play important roles in tool wear.

In an automatic supervision system, tool wear is an important parameter to monitor. Unfortunately only flank wear can be measured using optical methods and in image processor system. Other types of wear are more complicated to measure.

Урок 23

1. Правильно прочитайте и вспомните значение слов.

responsible, the trigger, to exist, to send, to deal with, to distribute, to suggest, to issue, the domain, to approach

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

responsible (a), responsibility (n)
propose (v), proposal (n)
create (v), creation (n), creative (a)
distribute (v), distributed (past p.), distributing (pres. p.), distribution (n)
make (v), maker (n)

3. Прочитайте и переведите словосочетания.

essential high level global decision, shared (общий) CAD database logical cell controller, shop floor operation, entire factory level strategic and tactical planning, object oriented approach, adaptive resource sharing, fault tolerance

4. Переведите предложения, обращая внимание на выделенные предлоги.

1) This force in most materials shows a significant increase **with** the tool wear.

2) **For** application in productive machine tools, special sensors are usually used.
3) **Despite** all their drawbacks, piezo-electric transducers may prove to be very useful **provided** that their disadvantages are properly taken into account.
4) These measurements are truly static **over** a long period of time.
5) Several safety systems are built to operate **on** information **from** the feed motor power.
6) **In order to** obtain complete information on tool wear the transducer should have the possibility of looking at the tool **from** different angles.
7) **After** the information is stored, the actual monitoring phase can take place for the next workpiece.
8) This maximum force limit is determined **by** the operator **according to** the size of the machine tool.

5. Переведите предложения, обращая внимание на значение оборотов с глаголом "to take". Выпишите значения этих оборотов.

1) An accident **took place** at the factory.
2) This CPU **takes care** of the long-term control action.
3) The programmer must **take into consideration** the geometrical limitations of the workpiece.
4) The **action taken** is usually to shut the whole system off.
5) You must **take into account** all the disadvantages of this phenomenon.
6) The control action that **is taken** is a simple on/off signal.
7) An expert system **takes control of** the robot during abnormal situation.
8) When a sensor unit fails to **take a reading** indicating the presence of a part, the controller recognizes an abnormality and passes the control to the expert system.

6. Переведите предложения, обращая внимание на различные глагольные формы.

1) The basic part of CAD software is a data bank **representing** the set of facilities for centralized **accumulating** and **using** the data.
2) The time required for a read and write operation is independent of the physical location within the storage array of the cell **being accessed**.
3) A database implies (подразумевать) central control of data of consistency (наполняемость) and accuracy, **with users having authorized access to them**.
4) In the next century **computerization** is expected **to find** more applications than nowadays.
5) In a typical process, **the designer having to describe** (выразить**) the design from a graphical draft into data cards**, errors are often made.

7. Прочитайте и переведите текст.

Decentralization of planning and control in a cellular flexible manufacturing system (2)

In our model, the complete manufacturing system is viewed as composed of three autonomous components. These are:

Management/Business subsystem. This subsystem is responsible for carrying out entire business operations of the factory and for making out essential high level global decisions to trigger the activity in other subsystems.

Computer-Aided-Design (CAD) subsystem. In this subsystem design activity is performed and the finished design is made accessible to other subsystems by creation a shared CAD database.

Planning and Control subsystem. All shop floor operations lie within the domain of this subsystem. Besides operational control, entire factory level strategic and tactical planning are also the responsibility of these subsystems.

The three subsystems above are linked to an interconnection subsystem; in contrast to some existing proposals for CAD/CAM integration, in our architecture; there is no integrated data or knowledge base in the system. The local data and knowledge bases are organized using object oriented approach.

Most of the previous researches follow either centralized or hierarchical approach for the design of planning and control subsystems. In the hierarchical approach a computer at a higher level of control sends commands to and receives information from computers at lower levels of control. This creates a master/slave relationship among different levels of control. Consequently, it is not possible adequately to deal with the issues of fault tolerance, extensibility and dynamic control.

In the fully distributed architecture suggested by us, there are no multiple levels of control. Logical cell controllers are equal decision makers and perform all planning in a cooperative manner. For each cell there is a closely coupled cell controller. The information of a cell is readily accessible to the cell controller. The cell controllers are interconnected via local area network with broadcast capability.

8. Ответьте на вопросы.

1) What is the function of the Management/Business subsystem?
2) What is the function of CAD subsystem?
3) What is the function of Planning and Control subsystem?
4) What are the three subsystems linked to?
5) How are local data and knowledge bases organized?
6) What is a master/slave relationship among different levels of control?
7) What disadvantages does this principle have?
8) What is the principle of the functioning of the fully distributed architecture?

9. Переведите предложения, учитывая значения латинских выражений:
via – путем, через;
a posteriori – на основании опыта, потом;
a priori – заранее;
vice versa – наоборот.

1) In a closed-loop system the influence of all disturbances on the measured quantity may be corrected, but a posteriori.
2) External errors cause internal errors and vice versa.
3) A monitoring unit can receive the data of one of the several functions via adequate interface.

4) We know a priori the advantage of this system.

10. Подберите термины (break-down; signal processing; intelligent monitoring system) к следующим определениям.

1) A failure in operation which causes a stoppage of the process.
2) Self-improving monitoring system with some ability to learn on the basis of monitoring experience.
3) Set of operations performed on the signal in order to derive the desired information.

11. Переведите текст письменно со словарем.

Tool failure means that the tool has been completely worn out or broken. This state is usually easier to record than the slower tool-wear progress. If the tool fails during a cutting operation it is possible to detect breakage using the signal analysis of cutting forces. Usually, when a tool breaks, the cutting force will temporary disappear or be drastically (сильно) reduced. The reason of it is that when the tool collapses no actual cutting takes place for a short period of time. If the power is not turned off, the remaining part of the tool will start to cut with very bad performance after an interval of usually some hundred milliseconds. This conduct is used in some systems as an in-process indication of a broken tool. Needless to say that the control system has to react fast enough to prevent further cutting after the force drop. If it does not do so, severe damages to the tool holder (держатель), the workpiece and the machine tool may occur.

Урок 24

1. Правильно прочитайте и вспомните значения слов.

to request, the status, to maintain, to acquire, the cooperation, the allocation, to report, the implementation, to distribute

2. Прочитайте ряды однокоренных слов. Переведите их, исходя из значения словообразовательных элементов.

compose (v), decompose (v)
allocate (v), allocation (n)
report (v), report (n)
complete (a), complete (v), completion (n)
essential (a), essentially (adv.)

3. Прочитайте и переведите словосочетания.

factory level planning function, real time control, processing steps, distributed object oriental programming language, global maximum force limit

4. Переведите предложения, обращая внимание на выделенные слова и выражения. Выпишите их значения.

1) Touch probes (зонды) can be used between cuts **as** a tool failure sensor.
2) This type of sensor is sometimes used **as** a broken tool detector between passes.

3) The cutting force is frequently used **as** an indicator of tool wear.
4) **As for** tolerances, the ability to measure the diameter is the limiting factor.
5) Very often the positioning tolerances of NC systems are **as good as** the measuring device itself.
6) These emissions are caused by the microcracking (мельчайшее расщепление) of the surface **as well as** by friction phenomena.
7) **As soon as** the force exceeds a pre-set limit, machining will be stopped.
8) The operator uses the first workpiece **as** a calibrating device.
9) The number of degrees of freedom may be **as small as** four or even two in a few robots.

5. Переведите предложения, обращая внимание на различные глагольные формы.

1) The quantitative relationships of the process being controlled are described by mathematical equations some of which are known and others are to be found.
2) Automation has stepped up (выдвинуть) the machining of the most sophisticated items improving precision and quality of output, but it has demanded that auxiliary operations be precise and quick too.
3) A digital computer is an electronic assembly consisting of thousands of electronic components each of which, when connected in combination with one another, can perform certain basic functions necessary to data processing.
4) Being able to interface (связать) the command link to a microprocessor gives additional power and flexibility to the system.
5) Providing an easy-to-use interactive graphic processor to collect the design data graphically for the simulation system seems to be a good approach to solve some problems.

6. Прочитайте и переведите текст.

Decentralization of Planning and Control in a cellular flexible manufacturing system (3)

The functions of a cell controller are logically decomposed into three groups. These groups are: 1) factory level planning, 2) cell level planning, 3) cell level control.

Factory level planning. The interface modules in the cell controller request or accept input from CAD and business subsystem to trigger (запускать) functions in this group. It is noted that the functions in this group are not performed by an individual cell controller in isolation. This requires departing (отступление) from standard centralized formulation of the factory level planning functions.

Cell level planning. In this group a major task is to maintain status (состояние) information of the respective cell by acquiring real time information from cell interface modules (модуль всех ячеек). On the basis of strategic decision made by the previous level, the cell level planning functions are carried out. These functions require relatively less cooperation from other cell controllers.

Cell level control. This group of functions is for real time control of activities of machines within the cell. The various tasks include preparing processing steps, allocation of resources, monitoring of activities and reporting of status information.

The model presented by us is essentially a distributed real-time processing system with heterogeneous components. Realization of the above system imposes (налагать) special requirements on the software technology: distributed programming, distributed data bases, real-time programming. We have designed a distributed object oriented programming language. Its basic implementation is nearing completion (близок к завершению).

7. Ответьте на вопросы.

1) How are the functions of the cell controller decomposed?
2) What does factory planning represent?
3) What does cell level planning represent?
4) What does cell level control represent?
5) What model is presented by the researchers of the center?
6) What are the characteristics of the software of the system presented?

8. Подберите термины (unmanned machining; recovery procedure; safety system) к следующим определениям.

1) System of automatic supervision which either prevents break-down or minimizes the damage caused by break-down.
2) Method of operation after break-down which allows manufacturing to recommence.
3) Machining in an automatic manufacturing system (cell), without an operator.

9. Переведите слова, обращая внимание на значение приставок.

misorientation, abnormalities, over-simple, decommission, non-stationary, in-process, disjoint, retract, misinterpretation, displacement, reset, disconnect, unstructured

10. Переведите текст письменно со словарем.

Tool chipping (истирание) means that the small parts of the active cutting edge are removed. This is usually a sign of unfavourable cutting condition or that the tool grade used was not the best choice. Tool chipping may sometimes be detected by signal analysis of dynamic component of the cutting force. The tool will usually continue to function for a while, but larger and larger chipping will ultimately lead to catastrophic failure. Some systems are able to analyse this phenomenon.

Tool collision is a state in which the numerical control programmer has omitted to take the geometrical limitations of the workpiece into consideration. A tool collision means that forces in the tool will increase drastically, very fast and permanently. The action taken is usually to shut the whole system off, since fast reaction is needed and the strategy to retract the tool is usually difficult to analyse.

ПРИЛОЖЕНИЯ

Приложение 1

Коррективный фонетико-орфоэпический курс

П 1.1. Чтение согласных букв

1. Прочитайте слова, учитывая особенности чтения буквы "g".

1) g = [□]   перед **e, i, y**:
generation, geometry, image, storage, strategy, language, register, algebra, digital, general purpose, logic, original, range, margin, engine, arrangement

2) g = [g]   перед **a, o, u**, согласными, на конце слова:
gap, gate, grid, debug, flag, gain, grade, conjugate, negative, regard, magnetic, regulate, plug, investigator, log

НО: есть слова, где g = [g] и перед i, e: begin, give, gear, target

2. Прочитайте слова с буквосочетанием "ng" – [ŋ]. Обратите внимание, что в конце слова в этом буквосочетании "g" не читается.

assembling, fitting, heading, listing, mapping, meaning, planning, updating, addressing, polling, spooling, burning, saving, housing

3. Прочитайте слова, учитывая особенности чтения буквы "c".

1) c = [s]   перед **e, i, y**:
access, advanced, cell, circle, processing, placement, voice, device, decimal, facility, latency time, antecedent, cancel, circuit, velocity, orifice, success

2) c = [k]   перед **a, o, u**, согласными:
current, accuracy, allocation, carrousel, card, command, component, compatible, continuity, copy, capacity, carry, cassette, comparator, constant, local, counter, cross, cursor, execute, acceptable, access

4. Прочитайте слова с буквосочетанием "ch", которое читается по-разному.

1) ch = [□]:
approach, chip, matching, batch, fetch, branch, chain, channel, search, mismatch, punch, chapter, interchange, challenge, punching

2) ch = [k] в словах греческого происхождения:
stochastic, synchronize, technique, technology, wild character card, architecture, archive, character, chemical, chlorine

3) ch = [□] в словах французского происхождения:
machinery, machine language

5. Прочитайте слова с буквосочетанием ci + гласная = [□].

commercially, coefficient, appreciate, special, efficient, sufficiently, specialist, efficiency, associate

6. Прочитайте слова, где звук [□] выражается по-разному.

1) ch = [□]:
change, branch

2) -ture = [□ə]:
manufacture, fixture, feature, picture, natural, temperature, structure, curveture, armature, lecture

7. Прочитайте слова со звуком [□], который выражается по-разному.

1) sh = [□]:
off-the-shelf, on-the-shelf, shaft, vanish, timesharing, accomplish, establish, shunt, shape, shifting, relationship, sheeting, in shifts

2) ci + гласн. = [□]:
especially, appreciation, associate

3) ti = [□] в заударном слоге перед гласной:
initiate, differential, ratio, rational, partial, exponential, potential, sequential, additional, proportional

4) -tion = [□n], суффикс существительного, (частный случай предыдущего правила):
animation, condition, conventional, friction, function, implementation, installation, interaction, motion, options, solution, station, addition

5) -sure = [□ə] после согласной:
pressure

8. Прочитайте слова со звуком [□], который выражается по-разному.

1) -sion = [□(ə)n] после ударной гласной:
vision, television, fusion, provision, collision, supervision, conclusion, decision

НО: -sion = [□(ə)n] после согласной:
conversion, impression, version, extension, dimension, expression, discussion, expansion, comprehension

2) s = [□] после ударной гласной перед -ual:
usual, usually, casual

3) -sure [□ə] после ударной гласной:
measure, measurement

4) -dure = [□]:
procedure

5) g = [□] в словах французского происхождения:
regime, camouflage

9. Прочитайте пары слов по горизонтали. Сравните произношение звуков [w] и [v].

switching – voltage
way – view
wear – value
wiring – virtual memory
workshop – vectored word
windowing – variable
wild – behaviour
warning – development
hardware – invoice
hardwired – level
waterway – movement
equipment – vent

10. Прочитайте пары слов по горизонтали. Сравните произношение звуков [θ] и [ð].

path – other
synthesis – though
throughout – therefore
length – together
algorithm – thus
arithmetic – nevertheless
cathode – whether
throughout – either … or…
growth – rather
thickness – that

11. Прочитайте слова, в которых буква "s", как правило, читается [z] между гласными и [s] между гласным и согласным и в начале слова.

result, dosage, to use, resolve, re’sidual, resemble, enterprise, erase, desired;
disk, discharge, supersede, some

НО: есть слова, где "s" = [s] и между гласными:
increase, decrease, the use, useful, disadvantage, close, case, base, basic, resource, isolate

П 1.2. Чтение гласных букв

Гласная буква	Без буквы "r" после гласной		С буквой "r" после гласной	
	закрытый слог	открытый слог	закрытый слог	открытый слог
a	man [æ]	name [e□]	car [a:]	care [□ə]
o	not [□]	note [ə□]	nor [□:]	more [□:]
e	met [e]	mete [i:]	her [□:]	here [□ə]
u	but [□]	mute [ju:]	burn [□:]	cure [j□ə]
i/y	pin [□] gyp [□]	nine [a□] type [a□]	fir [□:]	fire [a□ə] tyre [a□ə]

1. **Прочитайте слова, учитывая разное чтение буквы "a" в зависимости от типа слога.**

1) Закрытый слог – [æ]:
adder, allocation, bit map, crosshatch, expanded, gap, handle, interaction, language, mapping, matching, package, pattern, planning

НО: в некоторых словах под ударением a = [æ] и в открытом слоге:
manufacturer, compatible, informatics, management

2) Открытый слог – [e□]:
gate, base, displacement, equation, erase, interface, frame, label, relational, shape, behaviour, representation, framework

НО: в некоторых словах a = [e□] и в закрытом слоге:
enable

3) Закрытый слог с “r” – [a:]:
card, hard-copy, part, sharpness, smart, state-of-the-art, archives, start, mark, artifact

4) Открытый слог с “r” – [□ə]:
care, courseware, software, hardware, antiglare face, sharing, variable, area

2. **Прочитайте слова, учитывая разное чтение буквы "e" в зависимости от типа слога.**

1) Закрытый слог – [e]:
cell, effort, assembling, conventional, crossection, deflection, edge, extension, fetch, intelligence, prevent, sense, event, density

НО: в некоторых словах e = [e] и в открытом слоге:
development, level, especially, reference, edit, execute, general, fidelity, decimal

2) Открытый слог – [i:]:
sequence, frequency, medium, immediately, completion, discrete, antecedent

3) Закрытый слог с “r” – [□:]:
certain, conversion, determine, emergency, external, interpretation, transfer line, service, terminal, version, term, internal, desperse, external

4) Открытый слог с “r” – [□ə]:
here, experience, material, period, coherent

3. Прочитайте слова, учитывая разное чтение буквы "i" в зависимости от типа слога.

1) Закрытый слог – [□]:
chip, criss-cross, equipment, existence, fitting, grid, joystick, link, picture

НО: в некоторых словах i = [□] и в отрытом слоге:
figure, facility, initiate, primitive, recognition, sensitiveness, particular, digital, elicit, peripheral, attribute

2) Открытый слог – [a□]:
device, cybernetics, decide, drive, file, identification, item, life-time, primary, isolate, type-writer, priority, volatile, filename

3) Закрытый слог с “r” – [□:]:
circle, circuit, first, circulate

4) Открытый слог с “r” – [a□ə]:
wire, wireframe, hard-wired, inquiry, environment, requirement

4. Прочитайте слова, учитывая разное чтение буквы "o" в зависимости от типа слога.

1) Закрытый слог – [□]:
dot, font, contour, accomplish, response, plot, job, project, floppy-disk, block, option, plotter

2) Открытый слог – [ə□]:
expose, motion, component, mode, photocell, photocopier, stand-alone, total, code, console, remote, global, overline, process

НО: o = [□] в конце слова и перед "m", "n", "v", "w", "th":
front-ends, cover, govern

НО: o = [u:] после "r", "l", "m":
remove, removable

3) Закрытый слог с “r” – [□:]:
support, port, forced, order, absorb, performance, shortage, recording, sorting, reinforcement, organize

НО: o = [□:]: work, word, worth

4) Открытый слог с “r” – [□:]:
core, ore, restore, more

5. Прочитайте слова, учитывая разное чтение буквы "u" в зависимости от типа слога.

1) Закрытый слог – [□]:
dump, conductor, current, debugging, function, instruction, interruption, malfunction, multiple, multiaddress, plug-in, run, up-to-date, instruction, production, punch, drum

2) Открытый слог – [ju:]:
unit, accuracy, accumulator, alfanumeric, computer, distribution, execute, menu, scheduling, user, value, tube, fuel, manually

НО: в некоторых словах u = [u:]:
resolution, rule, include

3) Закрытый слог с “r” – [□:]:
curve, curvature, cursor, purpose, further, burning, turn, in turn

НО: current [□]

4) Открытый слог с “r” – [ju:ə]:
pure, durable

П 1.3. Чтение буквосочетаний двух гласных

Первая гласная буква	Вторая гласная буква				
	a	o	e	u / w	i / y
a				pause [□:] law [□:]	main [e□] may [e□] pair [□ə]
o	road [ə□] roar [□:]	book [□] pool [u:] poor [□ə]	toe [ə□] goes [ə□]	loud [a□] sour [a□ə] show [ə□] town [a□]	voice [□□] joy [□□]
e	teach [i:] hear [□ə]		meet [i:] cheer [□ə]	few [ju:] crew [u:]	vein [e□] grey [e□]
u			due [ju:] cues [ju:] true [u:] blue [u:]		suit [ju:] fruit [u:]
i			pie ties } [a□] tied		

1. **Прочитайте слова, учитывая особенности чтения под ударением буквосочетаний.**

1) ai (ay) = [ei]:
aid, array, available, constraint, display, domain, fail, failure, strain, way, contain, laid, main, delay, layer, maintenance, playback, retain

2) air [□ə]: pair, fair

3) al + согласная = [□:]: alternator

НО: al + согл. = [æ]: altitude, malfunction

4) au (aw) = [□:]:
cause, because, auxiliary, draw, drawing, fault, default, augment, law, overhaul

2. **Прочитайте слова, учитывая особенности чтения под ударением буквосочетаний.**

1) ea = [e] перед d, th, lth:
head, ready, lead (НО: to lead [i:]), breadboard, instead, header

2) ea = [i:] не перед d, th:

heat, feature, meaning, reasoning, each, by means of, read-only memory, read-write memory, treat, leave, bleaching, cheap, reason, reveal, reach
3) ear = [□:]:
research, learn, search, earth

4) ear = [□ə]:
rear, appear, gear, clearance

5) ei (ey) = [i:]:
key, turnkey

6) ee = [i:]:
exceed, screen, keep, degree, feed, speed, need, succeeding, between

7) eu (ew) = [ju:]:
few, queue

8) ew = [u:]:
flew, screw

3. Прочитайте слова, учитывая особенности чтения под ударением буквосочетаний:

1) oa = [ə□]:
approach, floating, load, coated

НО: oa = [□:]: board, broad

2) oi = [□□]:
join, joistick, point, destroy, coil, oil

3) oo = [u:]:
loop, bootstrap, spooling, proofreading, room, root

НО: oo = [□]: flood

4) ou (ow) = [a□]:
amount, boundary, know-how, mouse, power, background, found, noun, counter, output, encounter, allow, mount, however, account, soundly

5) ou (ow) = [ə□] в некоторых словах:
follow, blow, growth, flow, slow, show, grow, row, overflow

6) ou = [□] в некоторых словах:
double, touchscreen, trouble, enough

7) ou = [u:] в некоторых словах:
route, throughout, group

8) our = [□:] в некоторых словах:
source, resource, course ware

П 1.4. Ударение

1. **Прочитайте двусложные слова, в которых ударение, как правило, падает на первый слог.**

engine, balance, instance, level, console, product, content, access, axis, contour, digit, edit, module, volume, channel

2. **Прочитайте двусложные глаголы, в которых ударение падает на второй слог.**

to prefer, to reduce, to relay, to correct, to produce, to include, to convert, to command

3. **Прочитайте двусложные слова-омонимы с разными ударениями: в существительных – на первом слоге, в глаголах – на втором.**

the 'transfer	to trans'fer
the 'augment	to aug'ment
the 'transport	to tran'sport
the 'conduct	to con'duct

4. **Прочитайте многосложные слова, в которых ударение, как правило, падает на третий слог от конца.**

in'vestigate, in'itiate, 'maintenance, 'management, 'measurement, 'primitive, 'scheduling, ne'cessitate, 'separate, 'standartize, 'volatile

5. **Прочитайте многосложные слова с двойным ударением: главное на втором или третьем слоге от конца, второстепенное – на первом или втором от начала.**

cybernetics, incompatibility, reinforcement, reliability, instantaneous

6. **Прочитайте производные слова, в которых, как правило, сохраняется ударение исходного слова.**

digit – digiter, model – modelling, process – processor – processing, program – programming, window – windowing, operate – operator, separate – separator – separated

7. **Запомните ударение в следующих трехсложных словах, которые часто встречаются.**

economy, molecule, modify, digital, operate, dedicate, competent, execute, industry, utilize, organize, justify, analogue

НО: component, electron, assembly, elicit, robotics, retrieval

Приложение 2

Грамматические таблицы и упражнения

Таблица П 2.1

Глагол "to be"

Функция в предложении и значение	Примеры	Перевод
1. Смысловой глагол «быть», «являться», «находиться».	1. A bit is the smallest part of information. 2. Many memorizing elements are on one chip.	1. Бит является самой малой частью информации. 2. Много запоминающих элементов находится на одном чипе.
2. Вспомогательный глагол для образования сложных глагольных времён (группа Continuous и Passive Voice). Самостоятельно не переводится.	1. Computer is storing information. 2. Bits are grouped in units that are called bytes.	1. Компьютер хранит информацию. 2. Биты объединяются в единицы, которые называются байты.
3. Модальный глагол (в сочетании с инфинитивом другого глагола с частицей "to"). «Должен», «нужно».	The results of the experiment are to be checked.	Результаты эксперимента должны быть проверены.
4. В конструкции "there is (are)" – «существует», «имеется», «есть».	There are two methods of solving this problem.	Существует два метода решения этой задачи.

Таблица П 2.2

Глагол "to have"

Функция в предложении и значение	Примеры	Перевод
1. Смысловой глагол «иметь».	Each memory location has its own unique address	Каждая ячейка памяти имеет свой единственный адрес. (У каждой ячейки памяти есть свой единственный адрес.)
2. Вспомогательный глагол для образования сложных глагольных времён (группа времён Perfect). Самостоятельно не переводится.	The invention has made people's work easier.	Изобретение облегчило труд людей.
3. Модальный глагол (в сочетании с инфинитивом другого глагола с частицей "to"). «Должен», «вынужден».	For digital computer the information has to be in the form of digits or numbers.	Для цифрового компьютера информация должна быть в виде цифр или чисел.

Таблица П 2.3

Глагол "to do"

Функция в предложении и значение	Примеры	Перевод
1. Смысловой глагол. «Делать».	He did his work well.	Он сделал свою работу хорошо.
2. Вспомогательный глагол: а) для создания отрицательной и вопросительной форм Present и Past Indefinite Active Voice. Самостоятельно не переводится; б) для усиления значения сказуемого. Переводится «действительно», «все-таки», «ведь», «же».	The system does not detect all the disturbances. The computer memory does store different information.	Система не обнаруживает все нарушения. Память компьютера действительно хранит различную информацию.

Таблица П 2.4

Страдательный (пассивный) залог: глагол to be + Participle II

Способы перевода	Примеры	Перевод
1. Сочетание глагола "быть" с кратким страдательным причастием прошедшего времени с суффиксом -н или -т. Глагол "быть" в настоящем времени не употребляется.	The device is made by us. was made has been made had been made will be made	Прибор делается нами. был сделан был сделан был сделан будет сделан
2. Глагол на -ся в соответствующем времени, лице и числе.	The machine-tool is operated by the new electronic system.	Станок приводится в действие новой электронной системой.
3. Глагол действительного залога в 3 лице множественного числа в неопределенно-личном предложении.	The experiment was made last year.	Эксперимент провели в прошлом году.
4. Глаголы с относящимися к ним предлогам, которые переводятся также глаголами с предлогом: to depend on – зависеть от; to insist on – настаивать на; to look at – смотреть на; to refer to – ссылаться на; to rely on – полагаться на; to speak of (about) – говорить о; to send for – послать за; to deal with – иметь дело с и другие. Переводятся глаголами в неопределенно-личной форме, причем соответствующий предлог ставится перед английским подлежащим.	This discovery is often referred to. This system is much spoken of.	**На** это открытие часто ссылаются. **Об** этой системе много говорят.
5. Глаголы без предлогов, которые переводятся глаголами с предлогами: to affect – влиять на; to act – действовать на; to answer – отвечать на; to attend – присутствовать на; to follow – следовать за; to influence – влиять на и другие.	The work of this device is affected by electricity.	**На** работу этого прибора влияет электричество.

Переводятся глаголами в действительном (активном) залоге, причем перевод надо начинать с предлога, поставив его **перед** английским подлежащим.		

Страдательный залог: упражнения

A

1. When two or more cells are joined, they form a primary battery.
2. The electric current reaches its maximum value, when magnetic lines are being cut most rapidly by the conductors.
3. Some circuits are affected by changes in line voltage.
4. In this type of receiver a crystal detector is followed by an audio amplifier.
5. The automatic machine had been much worked at before it was put into operation.
6. The first scientific researches were followed by experimental work.
7. This ammeter cannot be much relied upon because it is not accurate enough.
8. Difficulties are often met with in solving scientific problems.
9. From their nature, charged particles are influenced by electric fields.
10. The electrons were described as very small charged bodies which generated the field in free space and conversely (обратно) were acted upon by forces due to the field.

B

11. While mainframes are often located in a correct data processing facility, microcomputers are typically placed near the engineering department.
12. The coordinate points called nodes (узел) are locations in the model where output data are taken.
13. Artificial intelligence is sometimes referred to as machine intelligence.
14. The use of ultra-violet lighterasable (стираемый светом) memory has been well accepted for several years in microcomputers but in exchange for that technology, most users were forced to give up (отказаться) any program security.
15. As the term Read-Only-Memory (ROM) (постоянная память) implies, this type of memory can only be read from and not written into by the user.
16. The chip capacity increase has been achieved by increasing chip size or bit density.
17. Metal-oxyde-semiconductor (MOS) technology is found in some pocket calculators that hold their data or their program even when the power switch is in the "off" position.
18. Normally each 1/0 device is given address when it is installed in the system.
19. There are some methods by which interrupts may be controlled. The interrupting devices are given weight of importance or priority over other devices.
20. Minute charges stored of Programmable-Read-Only-Memory are erasable through exposure (подвержение воздействию) to ultra-violet light and are referred to as PROM.

Таблица П 2.5

Модальные глаголы

Модальный глагол и его эквивалент	Значение	Времена		
		Present	Past	Future
must to have to	должен, надо, нужно, вынужден, приходится	must work have (has) to work	– had to work	– shall /will have to work
can to be able to	могу, умею	can work am (is, are) able to work	could work was (were) able to work	– shall /will be able to work
may to be allowed to	могу, можно, разрешено	may work am (is, are) allowed to work	might work was (were) allowed to work	– shall /will be allowed to work
to be to	должен, предстоит (обусловлено заранее намеченным планом)	am (is, are) to work	was (were) to work	–
should + инфинитив без "to"	должен, должен бы, следует, следовало бы (рекомендация)	This device should be handled carefully. – С этим прибором следует обращаться осторожно.		
ought to	должен, следует (совет, моральный долг)	The result of this experiment ought to be checked. – Результат этого эксперимента следует		

		проверить		

Таблица П 2.6

Причастия

Вид причастия, примеры	Функция в предложении и перевод		
	Часть сказуемого	Определение	Обстоятельство
1	2	3	4
1. Participle I, active voice. **solving, writing**	He is solving a problem. Он решает задачу. (Для образования времен группы Continuous. Самостоятельно не переводится).	The engineer solving this problem works hard. Инженер, решающий эту задачу, работает много. The operator examined the device showing the disturbances. Оператор осмотрел прибор, показавший нарушения в работе. (Причастия на -щий, -вший).	(When, while) solving the problem he read many books. Решая задачу, он прочитал много книг. (Деепричастие на -а, -я).
2. Participle I, passive voice. **being solved, being written**	The problem is being solved. Задача решается. (Для образования времен группы Continuous пассивного залога. Самостоятельно не переводится).	The problem being solved was difficult. Решаемая задача была трудная. (Причастия на -емый и -имый).	(While) being solved, the problem offered some unexpected aspects. Когда ее решали (во время решения), задача представила некоторые неожиданные стороны. (Придаточное обстоятельственное предложение или

			обстоятельство, выраженное существительным с предлогом).

Окончание табл. П 2.6

1	2	3	4
3. Participle II, passive voice. **solved, written**	1) He has solved the problem. Он решил задачу. (Для образования времен Perfect. Самостоятельно не переводится). 2) The problem is solved. Задача решена. (Для образования пассивного залога. Самостоятельно не переводится).	1) The problem solved turned out to be fundamental. Решенная задача оказалась фундаментальной. 2) The problem discussed there yesterday is very important. Проблема, обсуждённая (обсуждавшаяся) вчера, очень важна. (Причастие на -щийся, -мый, -ный, -тый, -вшийся).	If solved, the problem will offer numerous consequences. Если ее решить, задача будет иметь многочисленные последствия. (Обстоятельственное придаточное предложение).
4. Perfect Participle, active voice. **having solved, having written**	–	–	Having solved the problem he left the classroom. Решив задачу, он ушел из класса. (Деепричастие на -ив, -ав).
5. Perfect Participle, passive voice.	–	–	Having been solved, the problem offered some unexpected consequences.

having been solved, having been written			После того, как задача была решена, обнаружились некоторые ее неожиданные следствия. (Придаточное обстоятельственное предложение).

Таблица П 2.7

Независимый причастный оборот

Примеры	Перевод
1) The problem ***being*** difficult, they worked hard.	***Так как*** задача ***была*** трудная, они работали много.
2) The experiment ***being carried out***, he cannot leave the laboratory.	***Когда (т.к.)*** эксперимент ***идёт***, он не может уйти из лаборатории.
3) *With* the results *being* different, scientists had to repeat their experiment.	***Поскольку*** результаты ***были*** разными, учёным пришлось повторить свой эксперимент.
4) He read two articles on this subject, the latter ***being*** more interesting.	Он прочитал две статьи на эту тему, ***причём*** последняя ***была*** более интересной.

Причастия и независимый причастный оборот: упражнения

A

1. Designers and drafters (чертежник) are using the computer as a tool.
2. The computer system shopping (to shop – брать данные) from function menu, specifies points, constructs the lines and figures.
3. Interactive graphic is an important component of CAD/CAM providing a "window" through which the computer can be reached and observed.
4. The signal is sent to the computer, which determines the screen location being illuminated at the time the signal is generated.
5. Computers designed to serve one limited specific purpose are called special-purpose computers.
6. The screen glows (светиться) to produce a visible trace when excited by impinging (сталкиваться) electrons.
7. Color adds to the amount of information stored in memory.
8. The compatibility (совместимость) of chips and chip families made by different manufacturers varies widely.
9. At the first level of hierarchy are the microprocessors chips representing the large-scale integration of individual electronic devices: transistors, diodes, resistors and capacitors.
10. Microprocessors being programmable logic systems, they can be adapted to serve various job functions each of which previously required individually designed circuit.
11. The PROM is supplied by integrated circuit manufacturer, all cells assuming to logic 1 state.

B

12. Technically, a database is an electronic organization of data and information organized and maintained by a database management system.
13. Since much of the organization data are placed into the database, the processing time required to access the database must be carefully evaluated.
14. Only when combined with a production system, intelligent robots will be fully used as helpers for economic and productivity increase.
15. During the last years integrated circuit technology is especially impressive (значительный) when viewed in terms of cost decrease.
16. The time-response history (временная характеристика) being known, complete detection and stress information can be obtained for specific times.
17. Integration techniques being improved, higher transistor became possible with faster speed and more reliability.
18. An analysis of the microprocessor logic behaviour in the presence of these faults allows determining test algorithms, each algorithm being designed for detecting particular class of faults.

Таблица П 2.8

Герундий

Функция в предложении	Примеры	Перевод
1. Подлежащее	Supervising the production is very important.	Наблюдение (наблюдать) за производством очень важно. (Существительное, инфинитив).
2. Часть сказуемого	The main task is switching off the system in time.	Главная задача – выключение (выключить) систему вовремя. (Существительное, инфинитив).
3. Прямое дополнение	The production requires utilizing supervisory system.	Производство требует использования (использовать) системы наблюдения. (Существительное, инфинитив).
4. Определение (обычно с предлогами of, for после существительного)	The property of influencing the production run is studied carefully.	Свойство влиять на ход производства тщательно изучается. (Инфинитив).
5. Обстоятельство (обычно с предлогами in – при, в то время как; on (upon) – по, после; after – после; before – перед; by – творительный падеж; instead of – вместо того, чтобы; for – для и т.д.)	The operator examined the machine without diminishing its speed.	Оператор осмотрел машину, не уменьшая (без уменьшения) ее скорости. (Существительное, деепричастие).

Герундий: упражнения

1. Computer Aided Design (CAD) and Drafting involves using the computer as a tool in making, checking, correcting and revising original drawings.
2. The computer can be used for converting a rough sketch into a finished working drafting, for producing numerical control, process control.
3. Selecting one type over the other is almost always a trade-off (выбор) between the cost of the machine and computational speed it can handle.
4. Real picture can be "photographed" into the computer system by being scanned by a digital camera.
5. Determining the best output device for a particular CAD/CAM application is a three-step process: 1) specifying how hardcopies (копии на твердой основе) will be used; 2) identifying quality and cost criteria and 3) selecting equipment most suited for the application.
6. In order to communicate with such a minimal system the user needs also a simple device capable of displaying or recording the computer output.
7. A common method of transferring large blocks of data between a computer and a peripheral device is called a direct memory access.
8. The problem of converting analog electrical signals into precise digital equipment is most often solved by using an analog-to-digital converter.
9. Personal computers with their standard 16-bit processors have an advantage of being able to run (обслуживать) a substantial amount of software such as programs for word processing.

Таблица П 2.9

Инфинитив

Функция в предложении	Примеры	Перевод
1. Подлежащее.	To design a good control system is not easy	Спроектировать хорошую систему (проектирование хорошей системы) управления непросто. (Инфинитив, существительное).
2. Часть сказуемого: а) после глагола-связки; б) после модального глагола.	а) Their aim is to improve the control system. б) You have to improve the control system.	а) Их цель – (состоит в том, чтобы) усовершенствовать систему управления. (Инфинитив). б) Вы должны усовершенствовать систему управления. (Инфинитив).
3. Дополнение.	The operator prefers to use the new device.	Оператор предпочитает использовать новое устройство (использование нового устройства). (Инфинитив, существительное).
4. Определение.	1) They have the possibility to use this system. 2) The new equipment to be used at our laboratory has just arrived. 3) He was the first to begin this experiment.	1) У них есть возможность использовать эту систему. (Инфинитив, существительное). 2) Новое оборудование, которое будет (должно быть) использовано в нашей лаборатории, только что прибыло. (Определительное придаточное предложение со сказуемым, выражающим действие, которое должно быть или будет совершено). 3) Он первым начал этот эксперимент.
5. Обстоятельство	To design a good control system, you	Чтобы спроектировать хорошую систему управления,

цели.	must have good knowledge of electronics.	вы должны иметь хорошие знания электроники. (Инфинитив с союзами чтобы, для того, чтобы).

Инфинитив: упражнения

A

1. To find the mass of the electron was then of prime importance.
2. To be fully effective control must start with the production of raw materials.
3. To improve the automatic system the engineers had to make numerous experiments.
4. To improve the accuracy of automatic supervision means to expand its usefulness.
5. To supervise manufacturing process is of great importance for every industry.
6. To supervise manufacturing process the engineers have to study all kinds of disturbances influencing the production run.
7. To pick (брать) the product parts requires high robot repeatability accuracy.
8. To transfer the product parts the movements of the robot must be as quick as possible.
9. The problem to consider next is concerned with classification of supervisory systems.
10. It was the first significant factor to be studied.
11. The method to be followed is based upon some peculiar properties of these rays.
12. There was only one signal to be detected.
13. There is only finite number of waves to characterize electronic states.
14. Attractive forces make molecules collide.

B

15. The central processing unit carries out program instructions to perform operations on data.
16. The task is to set up (установить) robotized complexes and flexible productions capable of transferring easily and quickly to an output of new goods (изделия).
17. Artificial intelligence and robotics are actually in their infancy, but they promise a lot of useful things to do.
18. Lasers work with program interactively to synthesize logic functions and produce functional designs.
19. The technology to support the development of microprocessor has grown significantly and has made possible to include larger number of devices on a single piece of silicon.
20. The first option (вариант) to be selected by the system designer is the use of the type of processor technology.
21. A practical aspect to be considered is power plant production control.
22. The user specifies the protocol to be used in a program in a microprocessor unit.
23. The choice of methods depends on the peripheral, the access time of the memory involved and the size of the data block to be transferred.

24. There is a choice to be made between hardware designed especially for the particular application and general purpose microcomputer card which requires the minimum of special logic.
25. There were many additional problems to be overcome to implement the smaller bubble films (магнитная лента) for 1-Mbit devices.
26. To create the model the interactive terminal screen is usually divided into sections showing various views of the model.
27. An expert system is a computer program which deals with a specialized field requiring some expertise to provide solutions to problems and/or to give advice.
28. One purpose of processing the image may be to count all the objects in an area, another may be to describe them, the third may be to determine their exact location, the fourth – to find all kinds of irregularities that can put different problems.

Таблица П 2.10

Инфинитивные обороты

Примеры			Перевод	
I. Сложное подлежащее				
1			2	
			Переводится двумя способами: **1.** Дополнительным придаточным предложением с союзами «что», «чтобы», «как». Инфинитив переводится личной глагольной формой.	
This device	is known is likely is certain is found is reported is assumed is considered is expected appears seems proved	to work very efficiently.	Известно Вероятно Несомненно Обнаружено Сообщают Допускается Считается Ожидается Оказывается Кажется Доказано	, что это устройство работает очень эффективно.
			2. Простым предложением с вводным словом, соответствующим сказуемому английского предложения.	
This device is known to work very efficiently.			Это устройство, как известно, работает очень эффективно.	

Окончание табл. П 2.10

II. Сложное дополнение	
1	2
1) They want (like) the plan to be fulfilled. **2)** * They see (hear) the engineer leave the room. **3)** * They order, allow (let), cause, force (make) these data to be processed immediately.	**1)** Они хотят, чтобы план был выполнен. **2)** Они видят (слышат), что инженер уходит из комнаты. **3)** Они приказывают (позволяют, заставляют), чтобы эти данные были обработаны немедленно. Переводится придаточным предложением с союзами «что», «чтобы», «как». Инфинитив переводится личной глагольной формой.
* После глаголов чувственного восприятия (see, hear, feel и т. д.), а также глаголов let, make, have используется инфинитив без частицы "to".	

Инфинитивные обороты: упражнения

A

1. We have thought this law to hold only for the voltage which is under normal conditions.
2. It is customary to consider the electric current to flow in the opposite direction to the motion of the electrons which constitute it.
3. The result was expected to agree with theoretical predictions.
4. The theory suggested by the researcher is reported to fit (соответствовать) the experimental data.
5. The light from a star only recently discovered is known to be coming to us during many years.
6. If a particle moves in a circle with constant speed, it is said to be in uniform motion.
7. New types of electronic tools are known to make a great contribution to industrial technology and scientific development.
8. They expect this new electronic equipment to improve automatic control in manufacturing process.
9. The break-downs are found to be caused by the disturbances which do not permit further operation of the manufacturing system.
10. They maintain these disturbances to be caused by the fact that all the possibilities of improvement have not been exploited.

B

11. PASCAL, ADA and C languages are considered to be the high level programmer (manufacturer) oriented languages.
12. FORTRAN language is relatively free of dependence of any particular computer, because of this FORTRAN is said to be a machine independent programming language.
13. Flexible manufacturing equipment is considered to be flexible manufacturing cells, flexible manufacturing systems and flexible transfer line.
14. The uses and application of minicomputer appear at present to fall somewhere between discrete logic, on the one hand, and minicomputer, on the other.
15. Semiconductor memories are expected to dominate the electronic memory market for at least another decade.
16. An analysis of the microprocessor logic behaviour in the presence of faults allows test algorithms to be determined.
17. The alternating current appears to flow through the capacitor but is being stored first on one plate of the capacitor and then on the other.
18. All control is implemented through a language called BIOS. This allows control functions to be specified in terms of data base only.
19. The ability to work with a computer is reported to be considered as a necessary basic skill.

Таблица П 2.11

Глагол “should”

Функция в предложении и значение	Примеры	Перевод
1. Вспомогательный глагол: 1) для образования времен Future in the Past 1 л. ед. и мн. числа; 2) в сложноподчиненном предложении с условным придаточным с 1 л. ед. и мн. числа; 3) в условных придаточных, действие которых не вполне реально и относится к будущему (со всеми лицами); 4) в бессоюзных условных придаточных предложениях (со всеми лицами); 5) в придаточных предложениях после безличных оборотов типа “it is necessary”.	1) We decided that we should finish the work in time. 2) If (provided, in case, unless) the task were difficult, I should help you. 3) If he should see her tomorrow, he would give her the book. 4) Should the machine be equipped with new rolls, its efficiency would be greater. 5) It is important that the machine-tool should be equipped with a new device.	1) Мы решили, что закончим работу вовремя (глагол в будущем времени). 2) Если бы (в случае если, если не) задача была бы трудной, я помог бы вам (глагол в прошедшем времени с «бы»). 3) Если бы он увидел её завтра, он дал бы ей книгу (глагол в прошедшем времени с «бы»). 4) Если бы машина была оснащена новыми валами, её производительность была бы больше (глагол в прошедшем времени с «бы»). 5) Необходимо, чтобы станок был оборудован новым устройством (глагол в прошедшем времени).
2. Модальный глагол со значением долженствования.	These experiments should be repeated.	Эти эксперименты следует (следовало бы, нужно) повторить.

Таблица П 2.12

Глагол “would”

Функция в предложении и значение	Примеры	Перевод
1. Вспомогательный глагол: 1) для образования времен Future in the Past 2 и 3 л. ед. и мн. числа; 2) в сложноподчиненном предложении с условным придаточным с 2 и 3 л. ед. и мн. числа; 3) для образования сослагательного наклонения в простом предложении, когда условие подразумевается.	1) They said that they would come tomorrow. 2) If (provided, in case) the task were difficult, they would help you. 3) It is a pity he is busy. He would help you.	1) Они сказали, что придут завтра (глагол в будущем времени). 2) Если бы (в случае если) задача была бы трудной, они помогли бы вам (глагол в прошедшем времени с «бы»). 3) Жаль, что он занят. Он помог бы вам (глагол в прошедшем времени с «бы»).
2. Модальный глагол: 1) для выражения повторного действия в прошлом; 2) для выражения желания или нежелания совершить действие; 3) как форма вежливости.	1) He would not listen to their advice. 2) He tried to start up the machine, but it would not. 3) Would you kindly help me.	1) Он обычно (часто, бывало) не слушал их советов. 2) Он попытался запустить машину, но ничего не получалось (она «не хотела»). 3) Будьте любезны, помогите мне.

Таблица П 2.13

Бессоюзные придаточные предложения

Вид предложения	Примеры	Перевод
1. Дополнительное придаточное предложение.	That means he can begin to control the operation.	Это означает, ***что*** он может начать управление процессом.
2. Определительное придаточное предложение.	Low consumption of energy is one of the advantages this device is known by.	Низкое потребление энергии – одно из преимуществ, ***которыми*** характеризуется это устройство.
3. Условное придаточное предложение с инверсией с глаголами were, had, could, should.	Were one electron removed, a positive charge would be left.	***Если бы*** один электрон был удалён, остался бы положительный заряд.

Таблица П 2.14

Многофункциональное слово “one”

Функция, значение	Примеры		Перевод	
1. Числительное «один», «одна», «одно».	This design is one of the oldest.		Эта конструкция — одна из самых старых.	
2. Формальное подлежащее в неопределенно-личных предложениях. Самостоятельно не переводится.	One knows One believes One can expect One must expect One may expect One should expect	that the machine will work well.	Известно Считают Можно ожидать Нужно ожидать Можно ожидать Следует ожидать	, что машина будет работать хорошо.
3. Словозаменитель. Переводится тем существительным, которое заменяет, или опускается в переводе.	The new way of processing data differs from the old one.		Новый способ обработки данных отличается от старого (способа).	
4. Местоимения в форме притяжательного падежа one's - свой,	No one likes when somebody reads one’s letters.		Никому не нравится, когда кто-либо читает его письма.	

собственный, чей-то.		

Многофункциональное слово "one": упражнения

1. The high cost of programming has become one of the obstacles to the efficient use of large scale computers.
2. Sometimes in technical literature one may come across the abbreviation CADD which means Computer-Aided Design and Drafting.
3. Flexible manufacturing equipment includes flexible manufacturing cells, flexible manufacturing systems and flexible transfer lines. The first one consists of computerized numerical control machine tool, automated control and supervision systems.
4. One can divide memories into two major types: static memories and dynamic memories.
5. The work of artificial intelligence means to investigate and simulate the sensitive possibilities of linguistic understanding the solving of problems and finally the ability to plan one's own actions.
6. One constructs algorithms for evaluating such algorithms and replacing algorithms, which have proved unsuitable or can no longer be adapted to a changed environment, by better ones.
7. Perhaps you have seen a simple flyball governor (паровой регулятор) like the one invented by James Watt in 1788.
8. One should remember that convection current cannot be set up (создать) in solids.

Таблица П 2.15

Многофункциональные слова

Функция и значение	Примеры	Перевод
"that" – "those"		
1. Указательное местоимение "тот" – "те", "этот" – "эти".	**Those** computers are used in manufacturing process.	**Эти (те)** компьютеры используются в производственном процессе.
2. Слово-заменитель, переводится тем существительным, которое оно заменяет. Иногда опускается.	The efficiency of the old apparatus is low compared with **that** of the new device.	Производительность старого прибора низкая по сравнению с **производительностью** нового устройства (с новым устройством).
3. "that" – союзное слово "который".	The device **that** was installed in our laboratory is efficient.	Устройство, **которое** было установлено в нашей лаборатории, эффективно.
4. "that" – союз "что", "чтобы".	One can say **that** this apparatus is the most useful.	Можно сказать, **что** этот прибор самый нужный.
"this" – "these"		
1. Указательное местоимение "этот" – "эти".	**These** systems will be installed at our mill.	**Эти** системы будут установлены на нашем заводе.
2. These – "они", заменитель существительного.	The elements of the Periodic group IA are called "the alkali metals". **These** are alike in having a single electron on the outermost shell.	Элементы периодической системы группы IA называются "щелочными металлами". **Они** сходны тем, что имеют по одному электрону на внешней оболочке.

Многофункциональные слова “that – those”, “this – these”: упражнения

1. Internal word length is the number of bits that the CPU can handle while external word length is the number of bits that can pass at a time on the data bus (шина).
2. Supercomputers take advantage of the most recent advances in electronic circuits, processing techniques and memory organization to reach computing speed many times that of mainframes.
3. CAD software combines different data which are necessary for performing as automated design. These may be represented in the form of various documents on various storage media (накопители).
4. Programming languages are similar to ordinary spoken and written languages in that they gradually develop and change with time.
5. Expert systems are designed to perform at a human expert level. However, in practice, they will perform more than that of an individual expert.
6. Flexibility has become a key word used in manufacture and now the trend is towards flexible manufacturing systems. These are factories in which machine tools are tied together with material handling equipment and centralized computer control.
7. In our country the most widespread system of today are expert systems. Their task is to accumulate experience of those working in poorly formalized fields, such as medicine, biology, history, etc.
8. It is possible to assemble robots of all degrees of sophistication, including those with elements of artificial intellect out of a large number of such modules, as if out of children's cubes.
9. The function of logical operation that the device accomplishes may be altered by applying instructional "words" as its input.
10. A microprocessor is a number of the family of large-scale integrated circuits that reflect the present state of evolution of a miniaturization process that began with the development of the transistor in the late 1940s.
11. All the small computer systems have software capabilities that approach in sophistication those found in much larger conventional systems.
12. The microprocessor is recognized as the device which finally unites two previously separate areas: that of the hardware designer and that of the programmer.

Таблица П 2.16

Многофункциональное слово "it"

Функция и значение	Примеры	Перевод
1. Личное местоимение "он", "она", "оно" (неодушевленный предмет).	A new device is created in the laboratory. **It** will be very efficient.	Новый прибор создан в лаборатории. **Он** будет очень эффективным.
2. Указательное местоимение "это".	The temperature is rising slowly. **It** means that…	Температура медленно поднимается. **Это** означает, что…
3. Формальное подлежащее безличного предложения. Самостоятельно не переводится.	It is a common practice It is essential It is impossible It is important It is expected } to use this tool.	Обычно принято Важно Невозможно Важно Ожидается } использовать этот инструмент (использование этого инструмента)
4. Формальное дополнение после некоторых глаголов. Не переводится.	The method makes **it** possible to obtain good productivity.	Метод делает возможным получение хорошей производительности.
5. Часть эмфатической (выделительной) конструкции "**it is … that (which)**". Переводится "именно", "это", "только", и т. д.	**It is** in our laboratory **that** the new design was created. **It was** not until 1950 **that** the new technique entered into practice.	**Именно (это)** в нашей лаборатории был создан новый проект. **Только** в 1950 г. новый метод вошел в употребление.

Многофункциональное слово “it”: упражнения

1. The software provides for the performance (выполнение) of design tasks within specific (конкретный) design field. It also allows for (учитывать) specific tasks within each of these design fields.
2. There is a great deal of high-level programming languages but nowadays it is the FORTRAN language which is the most usable and widespread in CAD systems.
3. Special purpose software is not provided by manufacturer because it is developed by the user after the system is delivered (доставлять).
4. The processor is the brain of the CAD system. It has a control unit and arithmetic/logic unit (устройство) like all central processing units, but it also has special design features for handling the various types of graphic data associated with design.
5. A data bank is the basic part of CAD system software. It is simply an electronic depository (склад) data and consists of a database and database management system.
6. A large cost reduction is achieved and it is for this reason that all computer communication over distances greater than a few tens of meters is done serially (последовательно).
7. Artificial intelligence is a technology that has recently attracted considerably publicity (известность). Many applications of it are now under development.
8. It is a Multiple Operating System (составная рабочая система) that can manage more than one program almost simultaneously.
9. It is well known that knowledge is of two kinds: we know a subject ourselves, or we know where we can find information upon it.
10. The report from this program furnishes (давать) readings of all pressures and storage levels in the area, and it is this information that assists the operator in determining the nature of the problem such that connective measures can be quickly taken.
11. One simple view of artificial intelligence is that it is concerned with devising computer program to make computer smarter (умнее).
12. It is the hardware software trade that makes the impact (действие) of the microprocessor so great.
13. It is expected that the number of installations will double every two years until the end of this decade.
14. Japan holds the lead in the world for robot production. No wonder it is called "the land of robots". It was precisely robot that serves as the main task force of the Japanese automotive firms in their struggle against their rivals (соперник).
15. It was necessary to create computerizing planning to avoid a shortage of processor planners and the need for proper routing (маршрутизация).
16. "Smart" robots by themselves do not provide the full increase of productivity. It is essential to use them as a part of computer integrated manufacturing system.
17. It is well known in the semiconductor industry that larger chip sizes result in lower yields.
18. It must be pointed out that the use of a resistor of any type must be very carefully considered.
19. It may be stated that the modern electronic industry was born with the invention of the electron tube.

Dictionary Словарь

A		
abnormality, n	□æbn□:'mæl□t□	аномалия
abolish, v	ə'b□l□□	уничтожать
above, adv a	ə'b□v	выше, наверху упомянутый выше
accelerometer, n	ək□selə'r□m□tə	измеритель скорости
accept, v	ək'sept	принимать
acceptable, a	ək'septəbl	приемлемый
access, n	'ækses	доступ
accessible, a	ək'sesəbl	доступный
accident, n	'æks□dənt	авария
accommodate, v	ə'k□m□de□t	приспосабливать(ся)
accomplish, v	ə'k□mpl□□	выполнять
accord, v	ə'k□:d	согласовывать(ся)
according to, prep	ə'k□:d□ŋtə	согласно
account, n take into account	ə'ka□nt	счёт принимать в расчёт
accumulate, v	ə'kju:mj□le□t	накапливать
accuracy, n	'ækj□rəs□	точность
achieve, v	ə'□i:v	достигать
acquire, v	ə'kwa□ə	приобретать
action, n	'æk□n	действие
activate, v	'ækt□ve□t	активизировать, привести в действие
actual, a	'æk□□əl	фактически существующий, действительный
actuator, n	'æk□ə□e□tə	рабочий орган, исполнительный механизм
adapt, v	ə'dæpt	приспосабливать
adaptability, n	ə□dæptə'b□l□t□	адаптивность, совместимость
ADC (Automatic Data Control)		автоматическое управление данными
add, v	æd	добавлять
addition, n in addition to	ə'd□□ən	сложение кроме (того), к тому же
additional, a	ə'd□□ənəl	дополнительный

advanced, a	əd'v□:nst	передовой, опытный, расширенный
advantage, n	əd'v□:nt□□	преимущество
adversely, adv	'ædvəsl□	отрицательно, враждебно
advice, n	əd'va□s	совет
advisable, a	əd'va□zəbl	рекомендуемый
affect, v	ə'fekt	влиять на, воздействовать на (что-либо, кого-либо)
agree, v	ə'gri:	соответствовать
aid, v	e□d	помогать
aim, n	e□m	цель
alarm, n	ə'l□:m	сигнал тревоги
alert, v	ə'l□:t	привести в состояние готовности
allocation, n	□ælə'ke□□n	размещение
allow, v	ə'la□	разрешать
alloy, n	'æl□□	сплав
alter, v	'□:ltə	изменить
although, cj	□:l'ðə□	хотя
among, prep	ə'm□ŋ	среди
amount, n	ə'ma□nt	количество
amplification, n	□æmpl□f□'ke□□n	усиление
amplifier, n	'æmpl□fa□ə	усилитель
angle, n	'æŋgl	угол
apart, adv apart from	ə'p□:t	отдельно кроме
a posteriori, (лат.)	əpəs□ter□'□r□	из опыта, на основании опыта
apparent, a	ə'pærənt	очевидный
appear, v	ə'p□ə	выступать, проявляться
appearance, n	ə'p□ərəns	появление
application, n	□æpl□'ke□□n	применение
apply, v	ə'pla□	применять
appreciation, n	ə□pri:□□'e□□n	оценка
approach, n	ə'prə□□	подход, принцип
appropriate, a	ə'prə□pr□ət	соответствующий
area, n	'□ər□ə	область
arise, v	ə'ra□z	возникать, вставать
arm, n	□:m	рука (робота), захват

arrangement, n	ə're□n□mənt	расположение, согласование
as, cj, adv as… as… as for as small as as soon as as well as	æz	так как; как так(ой) же… как что касается до (о количестве) как только так же как, а также
assemble, v	ə'sembl	собирать
assembly, n	ə'sembl□	сборка, агрегат
assessment, n	ə'sesmənt	оценка
assign, v	ə'sa□n	определять
assist, v robotic assisted	ə's□st	помогать с применением роботов
assistance, n	ə's□stəns	помощь
associate, v	ə'sə□□□ət	связывать
assume, v	ə'sju:m	предполагать
assure, v	ə'□□ə	обеспечивать
attempt, v	ə'tempt	пытаться
attract, v	ə'trækt	привлекать
attribute, n	'ætr□bju:t	свойство, определение
auxiliary, a	□:g'z□l□ər□	вспомогательный
available, a	ə've□ləbl	имеющийся, доступный
avoid, v	ə'v□□d	избегать
axe, n	æks	ось
B		
back, n	bæk	опора, резерв
backbone, n	'bækbə□n	основа
backing, n a	'bæk□ŋ	резервирование дополнительный
backward, adv	'bækwəd	назад
band, n	bænd	полоса, лента
base, n rule base	be□s	база база правил
batch, n a	bæ□	партия групповой, пакетный, командный
because, cj because of	b□'k□z	потому что вследствие

become, v	b□'k□m	становиться
behaviour, n	b□'he□vjə	поведение, состояние
belong, v	b□'l□ŋ	принадлежать
benefit, n	'ben□f□t	выгода, прибыль
besides, adv	b□'sa□dz	кроме
beyond, prep	b□'j□:nd	за (пределами), вне
both… and…, adv, cj	bə□θ… ənd	и…, и…; как…, так и…
brain, n	bre□n	мозг
break, v n	bre□k	разбивать разрыв
breakage, n	'bre□k□□	поломка
break-down, n	'bre□kda□n	авария, выход из строя
broad, a	br□:d	широкий
broadcast, n a	'br□:dk□:st	1) теле- или радиовещание; 2) передача, покрывающая большую площадь широковещательный
bus, n	b□s	шина
C		
CAD (Computer Aided Design), n		система автоматизированного проектирования (САПР)
calculate, v	'kælkj□le□t	вычислять
calibrate, v	'kæl□bre□t	проверять, градуировать
CAM 1) Content Addressable Memory 2) Communication Access Module 3) Computer Aided Manufacturing 4) Common Access Method		1) ассоциативная память 2) модуль доступа к каналу связи 3) автоматическая система управления производством, технологическими процессами 4) стандартный метод доступа
capability, n	□ke□pə'b□lət□	способность
capable, a	'ke□pəbl	способный
capacitor, n	kə'pæs□tə	конденсатор
carefully, adv	'k□əfl□	осторожно
carry, v	'kær□	нести

carry out		выполнять, проводить
case, n	ke□s	1) случай 2) ящик
casual, a	'kæ□□əl	случайный
cause, n v	k□:z	причина вызывать
cell, n	sel	ячейка, элемент
chaining, n	'□e□n□ŋ	связывание, сцепление
change, n v	□e□n□	изменение изменять
charged, a	□□:□d	заряженный
cheap, a	□i:p	дешевый
check, v	□ek	проверять
chip, n	□□p	1) кристалл, чип 2) скол; осколок
choice, n	□□□s	выбор
choose, v	□u:z	выбирать
circuit, n	's□:k□t	схема; (физический) канал; канал, переносящий эл. ток между двумя устройствами
circuitry, n	's□:k□tr□	схема
circumstance, n	's□:kəmstəns	обстоятельство
clock time	'kl□kta□m	тактовое время
close, v a	klə□z klə□s	закрыть, закрывать близкий, закрытый
CNC (Computerized Numerical Control)		числовое программное управление (ЧПУ)
collapse, v	kə'læps	рушиться
collision, n	kə'l□□n	столкновение, конфликт
common, a	'k□mən	простой, общий, распространенный
communicate, v	kə'mju:n□ke□t	сообщать
compare, v	kəm'p□ə	сравнивать
comparison, n	kəm'pær□sən	сравнение
complement, v	'k□mpl□mənt	дополнять
complete, a	kəm'pli:t	полный
completely, adv	kəm'pli:tl□	полностью
complicated, a	'k□mpl□ke□t□d	сложный

component, n	kəm'pə□nənt	составная часть
compose, v	kəm'pə□z	образовать, составлять
comprise, v	kəmp'ra□z	включать
computation, n	□kəmpj□'te□□n	вычисление
compute, v	kəm'pju:t	считать
concern, v	kən's□:n	касаться
conclude, v	kən'klu:d	делать вывод
conclusion, n	kən'klu:□n	заключение, вывод
draw up conclusion		сделать вывод
condition, n	kən'd□□n	1) условие 2) состояние
conditioning, n	kən'd□□n□ŋ	формирование, приведение к требуемым техническим условиям
signal conditioning	's□gnəl kən'd□□n□ŋ	преобразование, формирование сигнала
conduct, v	kən'd□kt	вести, проводить
n	'k□nd□kt	поведение
confirm, v	kən'f□:m	подтверждать
confirmation, n	□kənfə'me□□n	подтверждение
conformance, n	kən'f□:məns	соответствие, согласование
confusion, n	kən'fju:□n	путаница
conjunction, n	kən'□□ŋk□n	связь, соединение
connect, v	kə'nekt	соединять(ся)
consequence, n	'k□ns□kwəns	(по)следствие
consequently, adv	'k□ns□kwəntl□	следовательно
consider, v	kən's□də	рассматривать
considerable, a	kən's□dərəbl	значительный
consist (of), v	kən's□st	состоять (из)
constitute, v	'k□nst□tju:t	составлять, образовывать
constraint, n	kən'stre□nt	ограничение, принуждение
consult, v	kən's□lt	консультировать(ся)
consumer, n	kən'sju:mə	потребитель
contain, v	kən'te□n	содержать
continuous, a	kən't□nj□əs	непрерывный
contribution, n	□kəntr□'bju:□n	вклад
control, n	kən'trə□l	управление, регулирование

controller, n	kən'trə□lə	контроллер, регулятор
convenient, a	kən'vi:njent	пригодный
conventional, a	kən'ven□ənəl	обычный
convert, v	kən'v□:t	превращать
cooperate, v	kə□'□pəre□t	взаимодействовать
cope (with), v	kə□p	справиться (с)
correct, v a	kə'rekt	исправлять правильный
correspond, v	□k□rə'sp□nd	соответствовать
cost, n	k□st	стоимость, затраты
counter, n	'ka□ntə	счётчик
course, n	k□:s	ход (событий, действий)
cover, v	'k□və	покрывать, охватить
CPU (Central Processing Unit)		центральный процессор
create, v	kr□'e□t	создавать
current, n a	'k□rənt	ток текущий, современный
customary, a	'k□stəmər□	обычный
cut, v	k□t	резать
cutting, n cutting force	'k□t□ŋ	резка, фрезерование режущая сила
cycling, n limit-cycling	'sa□kl□ŋ	режим ограниченный циклический режим
D		
damage, n	'dæm□□	вред
dangerous, a	'de□n□ərəs	опасный
database, n	'de□təbe□s	база данных
deal (with), v	di:l w□ð	рассматривать вопрос, иметь дело (с)
debug, v	d□'b□g	налаживать, отлаживать, исправлять ошибки (в программе)
debugging, n	d□'b□g□ŋ	1) отладка (поиск и исправление ошибок в программе) 2) наладка (оборудования), устранение

		неисправностей
decide, v	d□'sa□d	решить
decision, n	d□'s□□n	решение
decouple, v	d□'k□pl	разделить, развязать
decrease, v	d□'kri:s	уменьшать
dedicate, v	'ded□ke□t	предназначать
dedicated, a	'ded□ke□t□d	выделенный, специальный, назначенный
deduct, v	d□'d□kt	вычитать
define, v	d□'fa□n	определять
definite, a	'def□n□t	определённый
deflection, n	d□'flek□n	отклонение
degree, n	d□'gri:	степень; градус
delay, n	d□'le□	задержка
demand, n	d□'m□:nd	потребность, запрос, расход
density, n	'dens□t□	плотность
department, n	d□'p□:tmənt	отдел
depend (on), v	d□'pend	зависеть (от)
depth, n	depθ	глубина
derive, v	d□'ra□v	происходить
describe, v	d□s'kra□b	описывать
design, v n	d□'za□n	предназначать, составлять (план) проект, замысел, чертёж, конструкция
designate, v	'dez□gne□t	обозначать, называть
desire, v	d□'za□ə	желать
detect, v	d□'tekt	обнаружить
deterioration, n	d□□t□ər□ə're□□ən	износ, нарушение
determine, v	d□'t□:m□n	определять
develop, v	d□'veləp	разрабатывать
device, n positioning device	d□'va□s	устройство, прибор устройство указания позиций
devise, v n	d□'va□z	изобретать изобретение
diagnosing, n	'da□əgnə□z□ŋ	диагностирование

diagnosis, n	□da□ə'gnə□s□s	диагностирование
difference, n	'd□fərəns	различие
difficult, a	'd□f□kəlt	трудный
digital, a	'd□□□təl	цифровой
dimensional, a	d□'men□nəl	имеющий измерение, пространственный
dimensions, n, pl.	d□'men□ənz	размеры
diminish, v	d□'m□n□□	уменьшать
directly, adv	d□'rektl□	прямо, непосредственно
disadvantage, n	□d□səd'v□:nt□□	недостаток
disappear, v	□d□sə'p□ə	исчезать
discontinuous, a	□d□skən't□nj□əs	прерывистый, дискретный
discovery, n	d□s'k□vər□	открытие
discrepancy, n	d□s'krepəns□	расхождение, несходство
discrete, a	d□s'kri:t	разделимый, дискретный
displace, v	d□s'ple□s	замещать
display, v	d□s'ple□	показывать
disregard, n v	□d□sr□'g□:d	пренебрежение пренебрегать
distinct, a	d□s't□ŋkt	отдельный
distinguish, v	d□s't□ŋgw□□	различать
distribute, v distributed	d□s'tr□bju:t	распределять распределённый
disturbance, n	d□s't□:bəns	помеха; повреждение; неисправность; сбой
diversified, a	da□'v□:s□fa□d	разнообразный
divide, v	d□'va□d	делить
downtime, n	'da□nta□m	простой, перерыв в работе
draw, v	dr□:	тянуть, вытаскивать
drawback, n	'dr□:bæk	недостаток
drift, n	dr□ft	медленное течение
drive, v n	dra□v	приводить в движение привод
drop, n	dr□p	падение
due to, prep to be due to	'dju: tə	благодаря, по причине, из-за объясняться чем-либо
dull, a	d□l	скучный, монотонный

duplicate, v	'dju:pl□ke□t	дублировать
E		
education, n	□edju:'ke□□n	образование
efficiency, n	□'f□□əns□	оперативность, экономическая эффективность
effort, n	'efət	усилие
either… or…, cj.	'a□ðə… □:	или… или…
eliminate, v	□'l□m□ne□t	устранять
emergency, n a emergency stop	□'m□:□əns□	авария, крайняя необходимость запасной аварийная остановка
emission, n	□'m□□ən	распространение, выделение
emit, v	□'m□t	испускать
empty, a	'empt□	пустой
enable, v	□'ne□bl	дать возможность (что-либо сделать)
encounter, v	□n'ka□ntə	встречать, сталкиваться
end-effect, n	'end□□fekt	концевой (конечный) эффект
end-effector, n	'end□□fektə	концевой эффектор
engine, n inference engine	'en□□n	механизм механизм логического вывода
engineering, n	□en□□'n□ər□ŋ	техника, разработка, инженерное дело
enhance, v	□n'h□:ns	увеличить
enormous, a	□n'□:məs	огромный
ensure, v	□n'□□ə	обеспечить
enter, v	'entə	входить, вводить
entire, a	□n'ta□ə	целый, полный
entry, n	'entr□	ввод, вход
environment, n object oriented environment	□n'va□rənmənt	окружение, среда, режим работы объектно-ориентированная среда
equipment, n	□'kw□pmənt	оборудование

error, n	'erə	ошибка
especially, adv	□s'pe□əl□	особенно
essential, a	□'sen□əl	существенный, главный
establish, v	□s'tæbl□□	устанавливать
estimation, n	□est□'me□□n	оценка
evaluate, v	□'vælj□e□t	оценивать
evaluation, n	□□vælj□'e□□n	оценка
event, n	□'vent	событие, явление
exact, a	□g'zækt	точный
exaggeration, n	□g□zæ□ə're□□n	преувеличение
examine, v	□g'zæm□n	рассматривать, проверять
exceed, v	□k'si:d	превышать
exceptional, a	□k'sep□ənl	исключительный
excessively, adv	□k'ses□vl□	крайне, очень
exchange, n	□ks'□e□n□	обмен
exclusively, adv	□ks'klu:s□vl□	только
execute, v	'eks□kju:t	выполнять
execution, n	□eks□'kju:□ən	выполнение
exist, v	□g'z□st	существовать
exit, n	'eks□t	выход
expand, v	□ks'pænd	расширять(ся)
expect, v	□ks'pekt	ожидать
expense, n	□ks'pens	расход
expensive, a	□ks'pens□v	дорогой
explain, v	□ks'ple□n	объяснять
exploit, v	□ks'pl□□t	эксплуатировать
exploration, n	□ekspl ə're□□n	исследование
expose, v	□k'spə□z	подвергать действию
extend, v	□ks'tend	расширять(ся)
extensibility, n	□ks□tens□'b□l□t□	растяжимость
external, a	□ks't□:nl	внешний
extraction, n	□ks'træk□n	извлечение
F		
facility, n	fə's□l□t□	оборудование; средства
fail, v	fe□l	выходить из строя, отказывать
failure, n	'fe□lə	авария, повреждение, сбой, отказ (техники)
false, a	f□:ls	ложный

familiar, a	fə'm□ljə	знакомый
fashion, n	'fæ□n	образ, манера
fast, a	f□:st	быстрый
fatal, a	'fe□tl	неизбежный, неустранимый
fault, n	f□:lt	ошибка; дефект, неисправность
faultless, a	'f□:ltl□s	безошибочный
favour, n in favour of	'fe□və	польза, помощь в пользу
favourable, a	'fe□vərəbl	благоприятный
feature, n	'fi:□ə	черта, особенность
feed, n	fi:d	питание; подача
feedback, n	'fi:dbæk	обратная связь
field, n	fi:ld	область, сфера деятельности
final, a	'fa□nəl	конечный
find (found), v	fa□nd	находить
finding, n	'fa□nd□ŋ	результат, вывод; полученные данные
finite, a	'fa□na□t	ограниченный
fit, v	f□t	соответствовать; пригонять, подгонять
flexible, a	'fleksəbl	гибкий
flow, n v	flə□	поток течь
fluctuation, n	□fl□ktj□'e□□n	отклонение, колебание
follow, v as follows		следовать; следовать за (кем/чем-либо) следующие
for, cj prep	f□:	так как для; в течение
force, n v	f□:s	интенсивность, сила принуждать
foreseeable, a	f□:'si:bl	предсказуемый
forward, adv	'f□:wəd	вперед
frame, n	fre□m	кадр, блок данных
free, a	fri:	свободный
frequent, a	'fri:kwənt	частый
friction, n	'fr□k□n	трение
fulfill, v	f□l'f□l	выполнять

further, a	'f□:ðə	дальнейший
furthermore, adv	□f□:ðə'm□:	кроме того
fusion, n fusion memory	'fju:□n	слияние синтетическая память
fuzzy, a fuzzy control	'f□z□	неопределенный регулирование с нечетким алгоритмом
G		
gather, v	'gæðə	собирать
general, a	'□enərəl	общий
generate, v	'□enəre□t	производить
generation, n	□□enə're□□n	поколение
goal, n	gə□l	цель
grade, v	gre□d	располагать по степени трудности
grow (grew, grown), v	grə□	расти
guard, v	g□:d	охранять
guide, v	ga□d	вести, руководить
guided, a	'ga□d□d	управляемый
H		
handle, v	hændl	обрабатывать
handling, n	'hændl□ŋ	обработка, манипулирование
hard, a	h□:d	жесткий
hardware, n	'h□:dw□ə	аппаратные средства
harmful, a	'h□:mf□l	вредный
heavy, a	'hev□	тяжелый
help, v	help	помогать
helpful, a	'helpf□l	полезный
high, a	ha□	высокий
history, n	'h□stər□	история
hold (held), v	hə□ld	держать; иметь влияние
hostile, a	'h□sta□l	враждебный
however, cj	ha□'evə	однако
I		
identify, v	a□'dent□fa□	устанавливать
illness, n	'□lnəs	болезнь
illumination, n	□□lu:m□'ne□□n	освещение
immune, a	□'mju:n	невосприимчивый
impedance, n	□m'pi:dns	импеданс, полное

		сопротивление
impetus, n	'□mp□təs	импульс, стимул
implement, v	'□mpl□mənt	выполнять
imply, v	□m'pla□	подразумевать, включать
impose, v	□m'pə□z	навязать, налагать
imprecise, a	□□mpr□'sa□z	неточный
improper, a	□m'pr□pə	неправильный, неподходящий
improve, v	□m'pru:v	улучшать(ся)
inaccuracy, n	□n'ækjərəs□	неточность
include, v	□n'klu:d	включать, содержать
incorporate, v	□n'k□:pəre□t	включать, встраивать
increase, n v	'□nkri:s □n'kri:s	рост увеличивать(ся)
independent, a	□□nd□'pendənt	независимый
index performance index	'□ndeks	индекс, показатель эксплуатационный показатель
indicate, v	'□nd□ke□t	указывать
inference, n	'□nfərəns	вывод, заключение
influence, n v	'□nfl□əns	влияние влиять
inherent, a	□n'h□ərənt	присущий
initiate, v	□'n□□□ət	начать
input, n	'□np□t	ввод
insert, v	□n's□:t	вставить
inspect, v	□n'spekt	осмотреть
installation, n	□□nstə'le□□n	установка
intelligence, n artificial intelligence	□n'tel□□əns	ум искусственный ум, интеллект
intelligent, a	□n'tel□□ənt	умный
intend, v	□n'tend	предназначать
interaction, n	□□ntə'ræk□n	взаимодействие
interchangeably, adv	□□ntə'□e□n□əbl□	поочередно, попеременно
interconnection, n	□□ntəkə'nek□n	взаимная связь
interface, n v	□□ntə'fe□s	интерфейс; поверхность раздела соединять, связывать

interfere, v	□□ntə'f□ə	вмешиваться
intermediate, a	□□ntə'mi:d□ət	промежуточный
internal, a	□n't□:nl	внутренний
interpret, v	□n't□:pr□t	объяснять
interrelated, a	□□ntər□'le□tid	взаимосвязанный
interrupt, n v	□□ntə'r□pt	перерыв прерывать
interruptive, a	□□ntə'r□pt□v	прерывающийся
intervention, n	□□ntə'ven□n	вмешательство
introduction, n	□□ntrə'd□k□n	введение
investigate, v	□n'vest□ge□t	исследовать
involve, v	□n'v□lv	вызывать, включать
irreversible, a	□□r□'v□:səbl	необратимый
issue, n	'□sju: ('□□u:)	вопрос, проблема; исход, результат
item, n	'a□təm	элемент (набора), каждый отдельный предмет, пункт (списка)
J		
join, v	□□□n	соединять
jump, v	□□mp	прыгать; перейти к
justify, v	'□□st□fa□	оправдать
K		
keep, v	ki:p	держать, хранить
kind, n	ka□nd	вид, род
knowledge, n	'n□l□□	знание
L		
lack, v	læk	не хватать
latter, a	'lætə	последний
lead, v	li:d	вести
learn, n learning process	l□:n	учить, узнавать процесс обучения
length, n	leŋθ	длина
level, n	'levl	уровень
lighting, n	'la□t□ŋ	освещение
line, n off-line on-line	la□n	линия отключенный, автономный, независимый оперативный,

		работающий в системе, неавтономный
link, v	l□ŋk	соединять
load, v	lə□d	загружать
locate, v	lə□'ke□t	размещать; определять местонахождение
location, n	lə□'ke□□n	определение местонахождения
long-term, a	□l□ŋ't□:m	долгосрочный
loop, n closed loop	lu:p	контур, цикл замкнутый цикл
loss, n	l□s	потеря
lower, v	'lə□ə	опускать, понижать
M		
machining, n	mə'□i:n□ŋ	машинная обработка
magazine, n	□mægə'zi:n	магазин (в технике)
magnitude, n	'mægn□tju:d	величина
main, a	me□n	главный
mainframe, n	'me□nfre□m	универсальная ЭВМ
maintain, v	me□n'te□n	поддерживать, содержать
major, a	'me□□ə	главный
make (made), v make clear make up	me□k	делать, выпускать выяснять составлять
maker, n decision maker	'me□kə	изготовитель ответственный за принятие решения, лицо, принимающее решение
malfunction, n	mæl'f□ŋk□n	сбой, неправильное срабатывание
management, n	'mæn□□mənt	управление
manned, a	mænd	управляемый человеком, обслуживаемый
manner, n	'mænə	способ, образ действия
manual, a	'mænj□əl	ручной
manually, adv	'mænj□əl□	вручную
manufacture, v	□mænj□'fæk□ə	производить, обрабатывать
manufacturing, n	□mænj□'fæk□ər□ŋ	производство
margin, n	'm□:□□n	граница

match, v	mæ□	сопоставлять, соответствовать
maximize, v	'məks□ma□z	увеличить до предела
mean, v	mi:n	означать
meaning, n	'mi:n□ŋ	значение
means, n, pl by means of	mi:nz	средство, средства посредством, с помощью
measure, v	'me□ə	измерять
measurement, n	'me□əmənt	измерение
medium, a	'mi:d□əm	средний
memory, n random access memory (RAM) read/write memory	'memər□	память память с произвольной выборкой оперативная память
mention, v	'men□n	упоминать
miss, v	m□s	отсутствовать; опустить, пропустить
missile, n guided m.	'm□sa□l	снаряд, ракета управляемый снаряд
monitor, v	'm□n□tə	контролировать, отслеживать
monitoring, n	'm□n□t□r□ŋ	текущий контроль, мониторинг
motion, n	'mə□ □ən	движение
motor, n	'mə□tə	двигатель
move, v	mu:v	двигать, перемещать
movement, n	'mu:vmənt	движение, перемещение
multi-	'm□lt□	много- (в сложных словах)
multiple, a	'm□lt□pl	составной, многочисленный
N		
narrow, a v	'nærə□	узкий суживать(ся)
NC (Numerical Control)		числовое управление
necessity, n	n□'ses□t□	необходимость
need, n v	ni:d	потребность нуждаться
network, n	'netw□:k	сеть

nevertheless, adv	□nevəðə'les	тем не менее
noise, n	n□□z	шум
non-linearity, n	'n□nl□n□'ær□t□	нелинейность
nullify, v	'n□l□fa□	аннулировать
number, n a number of	'n□mbə	число, цифра ряд, несколько
numerical, a	nju:'mer□kəl	числовой
numerous, a	'nju:mərəs	многочисленный
O		
obey, v	ə'be□	подчиняться
object, n	'□b□□kt	предмет
objective, n	əb'□ekt□v	цель
observation, n	□□bzə've□□n	наблюдение
obstacle, n	'□bstəkl	препятствие
obtain, v	əb'te□n	получать, добиваться
obvious, a	'□bv□əs	очевидный
occur, v	ə'k□:	встречаться
occurrence, n	ə'k□rəns	случай, местонахождение
omit, v	ə□'m□t	пропускать, не сделать чего-либо
once, adv at once	w□ns	если, когда (служит для усиления союза) однажды сразу
only, adv the only	'ə□nl□	только единственный
on-site, a	ən'sa□t	местный
operation, n	□□pə're□□n	работа, операция
order, n in order in order to	'□:də	порядок; приказ в порядке чтобы
origin, n	'□r□□□n	происхождение
otherwise, adv	'□ðəva□z	иначе
output, n	'a□tp□t	выход, вывод
outside, adv	□a□t'sa□d	вне, снаружи
overall, a	□ə□vər'□:l	общий
overcome, v	□ə□və'k□m	преодолеть
own, a	ə□n	собственный
P		
pack, v	pæk	паковать
package, n	'pæk□□	контейнер, модуль, пакет

		программ
pallet, n parts p.	'pæl□t	панель панель инструментов
part, n	p□:t	деталь, часть
particle, n	'p□:t□kl	частица
particular, a	pə't□kj□lə	особенный, отдельный
pass, v n	p□:s	проходить, передавать прохождение
path, n	p□:θ	маршрут, путь, траектория
pattern, n	'pætn	образец, модель
penetrating, a	'penətre□t□ŋ	проникающий
percentage, n	pə'sent□□	процент, количество
perfect, a	'p□:f□kt	совершенный
perform, v	pə'f□:m	выполнять
performance, n	pə'f□:məns	эксплуатационные показатели, производительность
permanently, adv	'p□:mənəntl□	постоянно
permit, v	pə'm□t	позволять
pick, v	p□k	брать, подбирать
place, v n	ple□s	помещать место
placement, n	'ple□smənt	расположение
point, n point of view	p□□nt	точка точка зрения
portable, a	'p□:təbl	переносный
position, n v	pə'z□□n	позиция ставить, помещать
positioning, n	pə'z□□ən□ŋ	определение позиции
power, n	'pa□ə	мощность; энергия
precision, n	pr□'s□□n	точность
predict, v	pr□'d□kt	предсказывать
prescribe, v	pr□s'kra□b	предписывать
present, v	pr□'zent	представлять
pressure, n	'pre□ə	давление
presume, v	pr□'zju:m	предполагать
prevent, v	pr□'vent	предотвращать
previous, a	'pri:vjəs	предыдущий
principal, a	'pr□ns□pl	главный

prior to, prep	'pra□ətə	до
priority, n	pra□'□rət□	приоритет, очередность
probability, n	□pr□bə'b□l□t□	вероятность
procedure, n recovery procedure	prə'si:□ə	процедура процедура восстановления
process, n v	'prə□ses prə'ses	процесс обрабатывать
processing, n	prə'ses□ŋ	обработка
produce, v	prə'dju:s	производить
production, n	prə'd□k□n	производство
PROM (programmable read-only memory)		программное постоянно запоминающее устройство (ПЗУ)
prompt, v	pr□mt	торопить, побуждать
propagation, n	□pr□pə'ge□□n	распространение
properly, adv	'pr□pəl□	должным образом
property, n	'pr□pət□	свойство
propose, v	prə'pə□z	предлагать
protection, n	prə'tek□n	защита
protocol, n	'prə□təkəl	протокол (формат сообщений)
prove, v	pru:v	доказать
provide, v	prə'va□d	обеспечить
provided, cj	prə'va□d□d	если, при условии что
purpose, n	'p□:pəs	цель
Q		
quality, n	'kw□l□t□	качество
quantity, n	'kw□nt□t□	количество
R		
range, n v	re□n□	диапазон располагаться
rapidly, adv	'ræp□dl□	быстро
rare, a	r□ə	редкий
rate, n	re□t	скорость
raw, a raw material	r□:	сырой сырьё
ray, n	re□	луч
reach, v	ri:□	достигать
reading, n	'ri:d□ŋ	показание (прибора)

take readings		снимать показания
reagent, n	r□'e□□ənt	реагент
reality, n	r□'æl□t□	действительность
reason, n	'ri:zən	причина, основание
reasonable, a	'ri:zənəbl	разумный, обоснованный
receive, v	r□'si:v	получать
recently, adv	'ri:sntl□	недавно
recognition, n	□rekəg'n□□n	узнавание, признание
recognize, v	'rekəgna□z	признавать
record, n v	'rek□:d r□'k□:d	запись; рекорд записывать
recoverable, a	r□'k□vərəbl	устранимый
recovery, n error recovery	r□'k□vər□	восстановление, исправление устранение ошибки
recur, v	r□'k□:	повторяться
reduce, v	r□'dju:s	снижать, превращать
refer (to), v	r□'f□:	ссылаться (на)
reference, n	'refrəns	ссылка
refine, v	r□'fa□n	совершенствовать
reflect, v	r□'flekt	отражать
regime, n regime on-line	re□'□i:m	режим постоянный режим
reject, v rejects, n, pl	r□'□ekt 'ri:□ekts	отвергать отходы
rejection, n	r□'□ek□n	отклонение
relate, v	r□'le□t	связывать, иметь отношение к
related, a	r□'le□t□d	связанный
relation, n	r□'le□□n	связь
relative, a	'relət□v	относительный
relevant, a	'rel□vənt	уместный, нужный
reliability, n	r□□la□ə'b□l□t□	надежность
reliable, a	r□'la□əbl	надежный
relieve, v	r□'li:v	облегчать, освобождать
rely (on), v	r□'la□	опираться (на)
remain, v	r□'me□n	оставаться
removal, n	r□'mu:vəl	удаление
remove, v	r□'mu:v	удалять

repair, v	r□'p□ə	ремонтировать
repeat, v	r□'pi:t	повторять
replace, v	r□'ple□s	заменить
report, v	r□'p□:t	сообщать
represent, v	□repr□'zent	представлять
reproduce, v	□ri:prə'dju:s	воспроизводить
request, n	r□'kwest	требование
require, v	r□'kwa□ə	требовать
requirement, n	r□'kwa□əmənt	требование
rescheduling, n	r□'□edj□l□ŋ	перепланировка
reset, n v	r□'set	сброс, возврат в исходное положение, перезагрузка системы возвращать в исходное положение
reside, v	r□'za□d	находиться
resistance, n	r□'z□stəns	сопротивление
resolver, n	r□'z□lvə	решающее устройство
respective, a	r□s'pekt□v	соответствующий
respond, v	r□s'p□nd	отвечать
response, n	r□s'p□ns	ответ
rest, n	rest	остальное, оставшаяся часть
restrict, v	r□s'tr□kt	ограничивать
result, n v result from result in	r□'z□lt	результат происходить проистекать из иметь результатом
retain, v	r□'te□n	удерживать
retract, v	r□'trækt	брать назад
revise, v	r□'va□z	пересматривать, перерабатывать
robust, a	rə'b□st	крепкий
rough, a	r□f	грубый, приблизительный
routine, n recovery routine	r□'ti:n	программа программа восстановления
rule, n	ru:l	правило
run, v	r□n	работать; приводить в движение

n		работа; ход
rural, a	'r□ərəl	сельский
S		
safe, a	se□f	надежный
safeguard, v	'se□fg□:d	охранять
safety system	'se□ft□ 's□stəm	система безопасности
salvage, n	'sælv□□	спасение
satisfactorily, adv	□sæt□s'fæktər□l□	удовлетворительно
save, v	se□v	экономить
scale, n time-based scale large scale integrated circuit	ske□l	шкала шкала времени крупномасштабная интегральная схема
schedule, n	'□edju:l	график, план
scheduling, n task scheduling	'□edju:l□ŋ	планирование составление графика
screen, n	skri:n	экран
search, v n	s□:□	искать поиск
select, v	s□'lekt	отбирать, выбирать
self-contained, a	□selfkən'te□nd	замкнутый, самодостаточный
self-learning, n	□self'l□:n□ŋ	самообучение, самостоятельное узнавание
send (sent), v	send	посылать
sense, v	sens	обнаружить, воспринимать
sensing, n	'sens□ŋ	считывание, восприятие
sensitivity, n	□sensə't□vət□	чувствительность
sensor, n	'sensə	сенсорный датчик, сенсор
separate, a	'sepr□t	отдельный
sequence, n	'si:kwəns	последовательность
set, n v pre-set	set	набор, система, ряд, серия устанавливать, присваивать установить заранее

several, adv	'sevrəl	несколько
shaft, n	□□:ft	вал
shape, n	□e□p	форма
share, n v	□□ə	доля делить
shortage, n	'□□:t□□	нехватка
show, v	□ə□	показывать
shutdown, n	'□□t,da□n	выключение
signature, n	's□gn□□ə	сигнатура, обозначение, характерный признак
significant, a	s□g'n□f□kənt	значительный
signify, v	's□gn□fa□	означать
similar, a	's□m□lə	подобный
simplify, v	's□mpl□fa□	упрощать
simulation, n	□s□mj□'le□□n	моделирование
simultaneous, a	□s□məl'te□n□əs	одновременный
since, prep cj	s□ns	с с тех пор как, так как
single, a	's□ŋgl	единственный
skilled, a	sk□ld	квалифицированный
smart, a	sm□:t	умный
software, n	's□ftw□ə	программное обеспечение
solution, n	sə'lu:□n	решение
solve, v	s□l	решать
sophistication, n	sə□f□st□'ke□□n	сложность
source, n	s□:s	источник
space, n	spe□s	пространство
spare, a	sp□ə	запасной
specify, v	'spes□fa□	точно определять
spend (spent, spent), v	spend	тратить
spite: in spite of, prep, cj	spa□t	 несмотря на
stable, a	'ste□bl	устойчивый
stage, n	ste□□	стадия, ступень
standard, n reference standard	'stændəd	стандарт типовой стандарт
start, v	st□:t	начинать

state, n	ste□t	состояние
statement, n	'ste□tmənt	утверждение; оператор
status, n	'ste□təs	положение, состояние
steady, a steady-state	'sted□	устойчивый установившийся режим
stochastic, a	st□'kæst□k	стохастический, вероятностный
stop, v	st□p	останавливать
storage, n	'st□:r□□	хранение; память
store, v	st□:	хранить
subdivision, n	's□bd□□v□□n	подразделение
succeed, v	sək'si:d	следовать за, преуспеть
success, n	sək'ses	успех
suffer, v	's□fə	испытывать
sufficient, a	sə'f□□ənt	достаточный
suggest, v	sə'□est	предлагать
suit, v	sju:t	подходить, годиться
suited, a	'sju:t□d	пригодный, подходящий
supervise, v	'sju:pəva□z	контролировать, следить
supervision, n automatic supervision	'sju:pə’v□□n	управление, контроль, наблюдение автоматический контроль
supplement, n	's□pl□mənt	дополнение, приложение
supply, n v	sə'pla□	подача, снабжение подавать, снабжать
support, n	sə'p□:t	поддержка
sure, a make sure	□□ə	надежный убедиться
surface, n	's□:f□s	поверхность
switch, n v switch off switch on switch over	sw□□	выключатель выключать выключать включать переключать
switching, n	'sw□□□ŋ	переключение
symptom, n	's□mptəm	симптом, признак сбоя
system, n backward chaining system	's□stəm	система, цикл обратная цепная система

closed-loop system		замкнутый цикл
drive system		запускающая система
driving system		запускающая система
forward chaining system		прямая цепная система
recovery system		восстанавливаемая система
safety system		система защиты
T		
take, v	te□k	брать
take account of		учитывать
take action		предпринимать, совершать действие
take advantage		использовать
take care		заботиться
take into consideration		принять во внимание
take place		происходить
take turn		принять оборот
task, n	t□:sk	задача
temporary, a	'tempərər□	временный
term, n	t□:m	срок; термин
in terms of		с точки зрения
therefore, adv	'ð□əf□:	поэтому
thoroughly, adv	'θ□rəl□	тщательно
thus, adv	ð□s	таким образом
time, n	ta□m	время
delivery time		время доставки
timing, n	'ta□m□ŋ	синхронизация
a		временной
tolerance, n	't□lərəns	допуск
tool, n	tu:l	инструмент
computer-aided tool		автоматизированный инструмент
machine tool		станок
tooling, n	'tu:l□ŋ	механическая обработка
trace, v	tre□s	следить
track, n	træk	дорожка
v		отслеживать
transducer, n	træns'dju:sə	преобразователь, датчик

transfer, n v	'trænsf□: træns'f□:	перенос переносить, перемещать
transition, n	træn'z□□n	переход
transmit, v	trænz'm□t	передавать
transmitter, n	trænz'm□tə	передатчик
treat, v	tri:t	обрабатывать, рассматривать
trend, n	trend	направление, тенденция
trigger, n v	'tr□gə	триггер запускать
true, a true to	tru:	правильный близкий к
try, v	tra□	пытаться
turn, n in turn turn, v turn off turn on	t□:n	оборот, поворот в свою очередь 1) повернуть; 2) точить на токарном станке выключить включить
turning, n	't□:n□ŋ	токарная обработка
U		
ultimate, a	'□lt□m□t	высший
unavoidable, a	□□nə'v□□dəbl	неизбежный
uncertainty, n	□n's□:tnt□	неопределенность
undergo, v	□□ndə'gə□	подвергаться
uniformity, n	□ju:n□'f□:m□t□	единообразие, однородность
unit, n	'ju:n□t	единица, блок
unlikely, adv	□n'la□kl□	невероятно
unmanned, a	□n'mænd	необслуживаемый, автоматический
unsatisfactory, a	□n□sæt□s'fæktər□	неудовлетворительный
untended, a	□n'tend□d	автоматизированный
update, n v	□p'de□t	обновление, модификация модернизировать
upgrade, n	□p'gre□d	модернизация (проф. апгрейд), замена аппаратных средств

v		переводить на более сложную работу
upper, a	'□pə	верхний
upset, n	□p'set	нарушение
urgently, adv	'□:□əntl□	срочно
V		
value, n	'vælju:	значение; величина
variable, n	'v□ər□əbl	переменная величина
variety, n	və'ra□ət□	ряд, множество, разнообразие
vary, v	'v□ər□	меняться
vehicle, n	'vi:□kl	транспортное средство
velocity, n	v□'l□s□t□	скорость
via, prep	'va□ə	посредством, через
viable, a	'va□əbl	жизнеспособный
vice versa, adv	□va□s□'v□:sə	наоборот
view, n v	vju:	вид рассматривать
W		
warning, n	'w□:n□ŋ	предупреждение
wave, n wave length	we□v	волна длина волны
way, n	we□	способ; путь
wear (wore, worn), v n	w□ə	носить, изнашивать износ
welding, n	'weld□ŋ	сварка
whenever, cj	wen'evə	всякий раз когда
whereby, adv	w□ə'ba□	посредством чего
whole, n a	hə□l	целое целый, весь
widespread, a	'wa□dspred	широко распространенный
workpiece, n	'w□:kpi:s	обрабатываемое изделие
world-wide, a	□w□:ld'wa□d	всемирно известный
worn out, a	'w□:n'a□t	изношенный
wrong, adv	r□ŋ	неправильно
Y		
yield, v n	ji:ld	давать выход, выработка

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