UNIT 4

Text A. Interactive Graphics Hardware *(continued)*. Engineering Workstations. Text B. Hard copy Output. Text C

EXERCISES

1. Recognize the following international words:

contrast, act, form, special, front, documentation, popular, effective, to activate, complex, copy, thermal, presentation, particular, type, to select, criteria, intensity, pigment, electrode, electrostatic, tone, dielectric, problem, production, stationary, professional, intervention, personal, archive, electromechanical, film, electrophotographic, compact, cable, video, buffer

2. Practise the reading of the following words:

power - мощность, энергия; степень
appropriate соответствующий, подходящий
network - сеть
primary - первичный, исходный
approach - подход, приближение
rival *n, v* конкурент; конкурировать
setup *v*- устанавливаться, помещаться
run *v*- прогонять (программу); работать, выполнять
supply *v*- снабжать, обеспечивать
apply *v* применять; прилагать, прикладывать
relate (to) *v* связываться с; относиться к
driver - драйвер, привод, возбудитель
draw *v* (drew, drawn) чертить, рисовать
offer *v* предлагать
support *v* поддерживать, обеспечивать

3. Memorize the following word combinations:

computing power вычислительная мощность
low-end workstation автоматизированное рабочее место (АРМ) низшего класса high-end workstation АРМ высшего класса high-resolution graphic display графический дисплей с высокой разрешающей способностью
a main memory оперативное запоминающее устройство (ОЗУ) a computer network сеть вычислительных машин
basic components основные детали (компоненты)
a primary processor первичный (исходный) процессор basic approaches основные подходы
stand-alone processors автономные процессоры
a particular user особый (частный, индивидуальный) пользователь
a host computer главная вычислительная машина
a substantial amount значительное количество
custom processors процессоры, изготовленные по техническим условиям заказчика

4. Look through Text A. List the main ideas of it.

TEXT A. INTERACTIVE GRAPHICS HARDWARE (CONTINUED)

Engineering Worksfations

Engineering workstations are display terminals combined with computing power, most often in the form of 32-bit microprocessors. Workstations are typically divided into two broad categories: low and high end. Low-end workstations generally consist of personal computers, often incorporating a hard disk. Appropriate software is then added, along with [1] special hardware. High-end engineering workstations contain more powerful processors than personal computers. Hardware in these systems generally consists of a high-resolution graphic display (512x512 pixels of more), *a* processor capable of 0.5 to 2.0 million instructions per second, 1 Mbyte or more of main memory, mass storage[2] of 50 Mbytes; and the ability to operate in a computer network with other workstations or host computers.

Workstations consist of three basic components: a primary processor and associated memory, a graphics display system, and software. These elements are assembled in various manners, however. With low-end workstations standard personal computers as a base are used, often adding standard options

and proprietary software to the system as a turnkey work station. In high-end systems, there are two basic approaches. First, standard workstations that rival microcomputers in processing power and memory are used as a base with software being added to make the system an engineering workstation. Second, some computing plant build proprietary workstations on which to run their **software** (See a typical workstation in Fig. 3.)

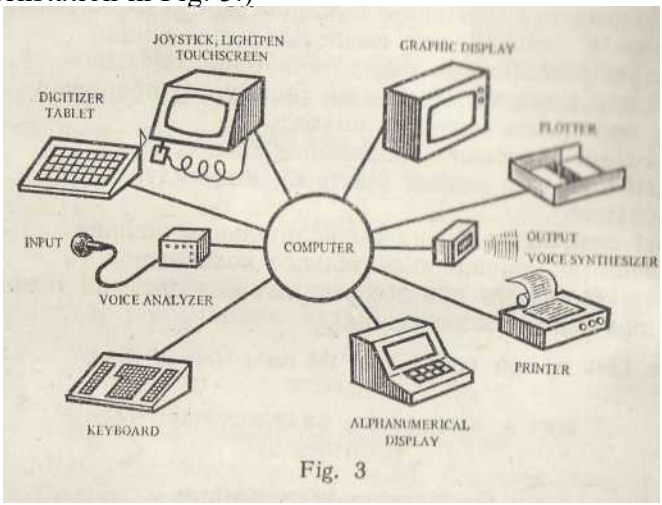

Fig. 3

Workstations can be used in a variety of ways. First, they can act-as dedicated, stand-alone processors for certain design or analysis tasks. They can be dedicated to a different task or for a particular user. Another large use of workstations is as front-ends[3] to larger host computers. Problems can be setup with the workstations, and up-loaded to the host for processing.

Processors for workstations are typically either 16-bit, as used in personal computers, or 32-bit, as used in high-end workstations. Personal computers, with their standard 16-bit processors, have an advantage of being able to run a substantial amount of software such as programs for word processing. In contrast, 32-bit workstations can provide processing power close to that of minicomputers. And some workstations manufacturers offer packages for other tasks such as word processing and documentation.

High-end workstations are generally based on 32-bit microprocessors, and take one of three forms: those found in newer personal computers, custom processors, and popular

microprocessors built-in architecture. High-end workstations are generally supplied with large, high-resolution displays of around 1,000x1,000 pixels. Main memory consists of at least[4] 1 Mbyte, and sometimes more. Network interfacing is built into the system. And all features can be found in a family of processors so that the appropriate processing power can be applied to a given task.

Workstations typically place an emphasis on graphics display and manipulation[5]- since this is an effective method of off-loading the host. The features of a display system are directly related to the processing power of a so-called display driver and not to the characteristics of the terminal screen itself. Functions such as colour fills,[6] line and arc generation, and rotating are controlled by the display processor and associated hardware. For example, to draw a line between two points on a raster system the display processor must calculate which pixels fall along that line and activate them.

Graphics calculations for a raster display may require large processing power. For example, 1 Mbyte of memory is required to support a screen with a resolution of 1.000X X 1,000 picture elements (pixels). A manipulation can be as simple as changing the colour of one line or as complex as rotating the entire image. Colour adds to the amount of information stored in memory.

NOTES

1. along with — вместе с
2. mass storage — массовое запоминающее устройство (ЗУ)
3. front-ends — связующие (компьютеры)
4. at (east — по крайней мере
5. place an emphasis on graphics display and manipulation — при дают особое значение графическому дисплею и управлению операциями
6. colour fills — цветовые наполнения

5. F.ind the Russian equivalents to the following English word combinations:

a) 1, in the form of 32-bit microprocessors; 2. in various manners; 3. as a base; 4. proprietary software; 5. a low-end workstation; 6. a turnkey workstation; 7. processing power; 8. computing power; 9. an engineering workstation; 10. front-end and large computers; 11. so-called; 12. host computers; 13. the basic approach; 14. a stand-alone processor; 15. an uploaded host computer; 16. dedicated processors; 17. custom processors; 18. an effective method of off-loading; 19. an entire image; 20. line and arc generation; 21. the proprietary workstations

9. Read Text A attentively. Divide it into logical parts. Write out the key words and the topic sentences from each paragraph.

10. Using the topic sentences from Text A, compose a plan (5-6 items) and recall the text according to your plan.

11. Check up yourself how much you have memorized from Text A.

a) Complete the following sentences:

1. Workstations are display terminals combined with computing (machine, power, numbers). 2. Low-end workstations generally consist of personal computers, often incorporating a hard (disk, ware, copy). 3. Workstations are dedicated to a different task or for a particular (computer, user, equipment). 4. Graphics calculations for a raster display may require large processing (device, capability, power). 5. High-end workstations are supplied with large high-resolution displays of around 1,000x1,000 (numbers, pixels, points). 6. In engineering workstations personal computers are used with their standard 16-bit (memory, input, processors).

b) Say which two classes the workstations consist of. c) Name in which ways workstations can be used, d) Recall which processors are used for workstations, e) Say what difference is between 16-bit and 32-bit microprocessors, f) Recall words and word combinations used for describing low-end and high-end workstations.

12. Write an abstract of Text A in Russian (see p. 126).

13. Look through Text B. List its main points.

TEXT B. HARDCOPY OUTPUT

A CAD/CAM system is not complete unless it can make hardcopies[1] of designs or analyses created on the terminal. Equipment for producing such copies includes pen plotters, photocopiers,[2] and graphics printers. Determining the best output device for a particular CAD/CAM application is a three-step process: (1) specifying how hardcopies will be used, (2) identifying quality and cost criteria, and (3) selecting equipment most suited for the application.

(1) Hardcopies are used for a variety of purposes. Design iterations can be reduced by making hardcopies at crucial (решающий) stages and distributing(распределять) them to the personnel for review. Hardcopy production equipment also permits drawings and documents to be made for archiving purposes.

(2) Another criteria is copy quality in terms of clarity and precision. Although resolution is often given in dots per inch or addressable points per inch,[4] the number of lines is important consideration in determining copy quality. Resolution of the hardcopy device must be important as it is in the display terminal.

(3) The first step in selecting an output system is to develop application requirements in terms of specific (конкретный) copy characteristics and production capabilities. The first of these is visual effect, primarily with regards to whether a hardcopy is black-and-white or colour. 5 Black-and-white is usually satisfactory for reproducing data, text, and line drawings. Colours can help emphasize areas of figures in data tables, highlight changes[6] on production drawings, and differentiate between components in system layouts. Moreover, colour is almost a requirement in complex or 3D designs.[7]

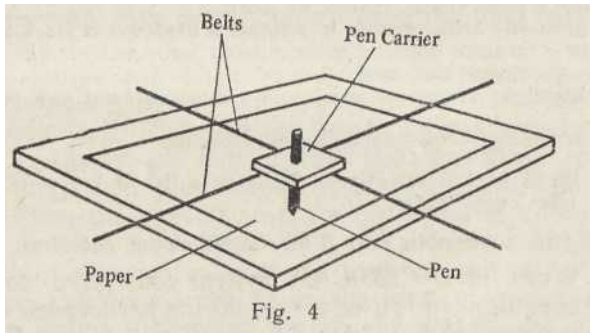

Fig. 4

Plotters. Two basic types of electromechanical pen plotters are used in CAD/CAM systems. In flatbed plotters, servo-controlled pens or styli are moved in two axis over flat, stationary sheets of paper. In drum or roll plotters, pens, styli, or ink jets remain stationary or move along one axis while the paper moves in another axis on a revolving drum.

Pen plotters are used to produce colour, professional drawings. They will produce large size hardcopies and have high line quality. Pen plotters can also work with almost any media, including paper, mylar (милар — искусственная пленка), and film. They are best suited for applications requiring high-line resolution. (See Fig. 4.)

Photocopiers. Copiers typically use the so-called electrophotographic method, in which a beam of light projects an image from a CRT onto light-sensitive (светочувствительный) paper. These units are most appropriate for applications that require high-speed, high-resolution copier. Copiers are com-

pact, inexpensive, and easy to operate. CRT copiers are most often used in preliminary (предварительный) work or for reference. Also in this class are video copiers, units that can copy an image appearing on a CAD/CAM terminal. Basically, a cable is run from the video output of a terminal to the copier. Pressing the button produces a copy of the images on the screen, commands and all. Some units have buffers so the terminal can be used during copying.

NOTES

1. unless it can make hardcopies —если она не может изготавливать печатные копии
2. photocopier — фотокопировальное устройство
3. in terms of clarity and precision — с точки зрения чистоты и точности
4. in dots per inch or addressable points per inch — в точках на дюйм или в адресуемых точках на дюйм
5. primarily with regards to whether a hardcopy is black-and-white or colour —главным образом относительно того, является ли печатная копия черно-белой или цветной
6. highlight changes—изменения в высвечивании информации на экране
7. 3D design — трехмерное проектирование

14. Read Text B attentively. Make up a list of key words. Divide Text B into logical parts.

15. Find answers in Text B for the following questions:

1. When is a CAD/CAM system considered complete?'[1] 2. What equipment is used for producing hardcopies? 3. What is it necessary to know for determining the best hardcopy device for a particular CAD/CAM system application?

Write down the answers into your exercise-book.

16. Speak on the process of selecting a hardcopy device best suited for a CAD/CAM application. Begin with the words:

"In order to select a hardcopy device best suited for a CAD/CAM application, it is quite necessary to develop application requirements ...."

17. **Write an abstract of Text B (see p. 126) in English.**

18. Look through Text C Guess the subject-matter of it. Find the topic sentences of Text C Write them down into your exercise-book.

TEXT C

In the past, CAD for electronic design was limited to automated drafting of printed circuit board (PCB) and integrated circuit (1C) production masks. More recently, however, CAD has been expanded to cover the entire range of tasks required to design and manufacture PCBs and ICs. These aids include analysis programs that help produce systems with a higher performance (характеристика) and reduce errors that have to be fixed after a product is manufactured.

Electronic design performed with CAD is typically done in a hierarchical process. This approach allows designers first to specify overall logic functions in terms of so-called behavioural models.[2] Software then helps generate architecture from these specifications. Such programs may also produce a physical layout based on design rules[2] of the selected IC or PCB design technology. Users work with the program interactively to synthesize logic functions and produce functional designs. With this process, several engineers can work on different parts of the logic simultaneously (одновременно) with coordination ensured by their high-level relationship.

Workstations—graphics terminals combined with appreciable computing power—are typically used for all types of electronic design. Software residing (постоянно находиться) on these systems can handle most tasks involved in electronic design, including design capture,[4] analysis, and simulation. Often, the workstations are connected in a local area network to allow many users to share (распределять) expensive peripherals such as plotters, printers, and large mass memories. Engineers working on the same project can communicate among themselves, share information, and off-load highly analytical tasks to mainframes.

PCB are getting smaller but must hold an increasing number of complex ICs. Boards with a high density (плотность) of components present two problems to designers. First, tolerances (допуск) are so tight (жесткий) that even dimensional variations of tapes used to manually construct board artwork' can lower manufacturing. The other problem caused by small, densely populated boards is the time required to manually layout circuits, which can be prohibitive (запретный) for multi-layer boards.[6] These boards common to some computer systems are so complex that they cannot be made by anything but computer-aided methods.

CAD for PCBs is generally divided into two different areas: drafting and photoplotting, and full-board design with automatic placement and routing' in addition to drafting and photoplotting.

All of them produce high-quality drawings and different documentation.

19. The digitizer tablet is used for converting graphic data into digital data so that the computer can accept and process it.

20. The processor is the "brain" of the computer-aided design system. It has a control unit and arithmetic/logic unit like all CPUs, but it also has special design features for handling the various types of graphic data associated with design.

SELF-TEST

1. Indicate whether each of the following statements is true or false:

a) The CRT workstation is the primary device in a CAD system, b) The processing unit is the "brain" of a CAD system, c) A hardcopy output is used primarily as an input device in a CAD system, d) The plotter converts digital data back into graphic form so that they can be used by human beings, e) Workstations cannot act as dedicated stand-alone processors for certain design or analysis tasks, f) Resolution, animation, colour and brightness are the characteristics of any CRT screen, g) Interactive graphics is not used for speeding the design process, on the contrary, the manual drafting speeds it.

2. Define the term "resolution". 3. Define the term "menu". 4. What are graphic input devices used for? 5. What types of graphic entry devices do CAD/CAM systems use? 6. What components does interactive graphic hardware con sist of? 7. Name two classes of engineering workstations. 8. List the basic components that make up a complete work station. 9. Define the term "hardcopy". 10. Explain how the plotter actually plots a line in a CAD system. 11. What is the purpose of the digitizer tablet? 12. How do operators enter the data into a computer?

UNIT 5

Text A. Geometric Modelling in CAD/CAM. Text B. Text C

EXERCISES 1.

Recognize the following international words:

geometry, geometric, structure, stress, location, to differentiate, object, physical, interpretation, section, to generate, parallel, perpendicular, tangent, critical, detail, tabulated, cylinder, sculptured, representation, contour, elementary, cube, sphere, primitive, nature, natural, moment, block, combination, family, axial, symmetry, specific, classical, characteristic, matrix, realistically, commercial, static, constant, material, elastic, plastic, deformation, vibration, dynamic, experimental, harmonic, sinusoidal, structural, history

2. Practise the reading of the words given below:

finite конечный
wi re-frame каркасный (скелетный)
precise точный
surface поверхность
discontinuity неоднородность
ambiguous неоднозначный
space пространство
comprise *и* включать тело
straight прямой
tangent касательная
curve кривая
circle окружность
circumference окружность
hyperbola гипербола
spline сплайн
arbitrary произвольный
boundary граница
envelope огибающая (линия)
sweep изогнутый
solid твердое (объемное)
expose *v* выявлять
successive последовательный
contour контур

3. Memorize the following word combinations:

finite-element analysis метод конечных элементов
wire-frame models каркасные (скелетные) модели
surface discontinuities неоднородности поверхности
straight lines прямые линии **curved lines** кривые линии
arbitrary points произвольные точки
surface menus меню поверхностей
solid models модели твердых (объемных) тел
part geometry геометрия детали
elementary shapes элементарные очертания
two (three)-dimensional surfaces двух (трех) мерные поверхности

4. Look through Text A. List its main points.

TEXT A. GEOMETRIC MODELLING IN CAD/CAM

The most important feature of CAD/CAM is the geometric model, representing part size and shape in the computer. These models are the starting point for virtually (фактически) every function in CAD/CAM. For example, the geometric model may be used to create a finite-element model of the

structure for stress (напряжение) analysis, or it may serve as input for automated drafting. In CAD/CAM, the geometric model can be used to create numerical control (NC) tapes[1] for making parts on automated machine tools (станок) or to produce process plans outlining steps required to make the part.

Wire Frames. Wire-frame models are generally part shapes with interconnected line elements. Wire frames represent the simplest models. Consequently, they expend relatively little computer time and memory, and they provide precise information about the location of surface discontinuities of the part. Wire frames, however, contain no information about the surface themselves nor do they differentiate between the inside and outside of objects. Thus, wire frames can be ambiguous in representing complex physical structures and often leave much interpretation to users.

Wire-frame models are created by specifying points and lines in space. To create the model, the interactive terminal screen is usually divided into sections showing various views of the model. Some systems use only a single view with a movable work place on which points and lines lie.

The designer uses the CRT in much the same manner as a drawing board to create top, bottom, side, isometric, and other views of the model. Unlike mechanical drafting systems, however, CAD systems provide many features to speed design. Essentially, the designer need not manually draw each line in a wire frame. Rather, the CAD system constructs the lines based on user-specified points and commands [2] chosen from an instruction menu.

Most lines comprising a wire-frame model are straight. To generate a line, the user may designate two end points and give the computer a LINE command. Or a line may be automatically produced parallel or perpendicular to another line or tangent to a curve. Some CAD systems produce straight-line elements with up to 40 such techniques.

Similar automatic features can also produce curved lines. Circles may be produced by specifying a point and a radius, three points on a circumference, or tangent points to two or three other curves. And conics—complex curves such as ellipses, hyperbolas, and parabolas—may be produced by specifying appropriate points. Most CAD systems can also generate splines—smooth, continuous curves fit through a series of arbitrary points specified by the user. **Surface Models.** Many ambiguities of wire-frame models are overcome with surface models, which define the outside

part geometries precisely and help produce NC machining instructions where the definition of structure boundaries is critical. However, surface models represent only an envelope of part geometry, even though features such as automatic hidden-line removal[3] make the model appear as a solid.

Surface models are created by connecting various types of surface elements to user-specified lines. The entire model may be comprised of different types of interconnected surfaces. With surface modelling, however, an entire structure may provide more detail than necessary for many applications, so some models combine surfaces for detailed faces, with wire frames representing the rest of the part.

CAD systems provide extensive surface menus from which to model. Typical surface menus include planes, ruled surfaces, surfaces of revolution, along with (вместе с) sweep, fillet (линейчатый), and sculptured surfaces.

Solid Modelling. Solid models are the highest level of models, completely defining the external and internal geometry of a part. This approach uses combinations of elementary cubes, spheres, and other so-called primitives to create complex models. Although (хотя) solid models may appear to be similar to wire-frame or surface models with hidden lines removed, solid models allow the solid nature of an object to be represented in the computer. As a result, computations of parameters such as weights (вес) and moments (крутящий момент) are possible. And cross-sections, which are usually crosshatched (заштриховывать), can be cut through the model to expose internal details with minimal user interaction.

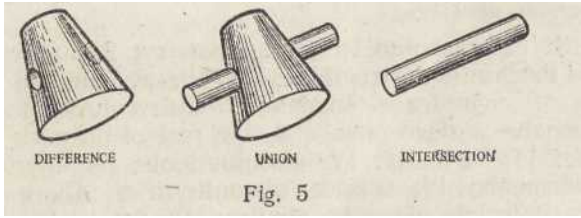

Fig. 5

Solid models are constructed in two ways: with primitives or with boundary definition.[4] Both of these methods develop complex geometries from successive combinations of simple geometric operations.

In the primitive approach, elementary shapes such as blocks and cylinders are combined in building-block fashion.[b] The user positions these primitives as required and then

creates a new shape with the proper Boolean logic command (union, difference, or intersection).[6] (Figure 5)

With boundary definition, two-dimensional surfaces are swept through space to trace out volumes.[7] A linear sweep translates the surface in a straight line to produce an extruded (путем выдавливания) volume, etc.

Most industrial parts, for example, consist of planar, cylindrical, or other simple shapes and are readily (просто) modeled with primitives. But components with complex contours, such as automobile body, or turbine blades, or shiphulls, which are 3D, are easily modeled by boundary definition. In this case, arbitrary curves can be fit to a mathematical function known as a cubic spline, or cubic (bicubic) basic spline (B-spline function).[8]

NOTES

1. lo create numerical control (NC) tapes — для создания перфолент числового программного управления (ЧПУ)
2. based on user-specified points and commands—основанные на точках и командах, конкретно указанных пользователем
3. hidden-line removal — удаление скрытых линий
4. with primitives or with boundary definition—с помощью базисных элементов или с помощью задания координат границ тела
5. in building-block fashion — блочным способом
6. with the proper Boolean logic command (union, difference, or intersection)—путем соответствующей команды Булевой логики (объединение, разность или пересечение)
7. to trace out volumes — для вычерчивания объемов
8. or cubic (bicubic) basic spline (B-spline function) —или кубический (бикубический) базисный сплайн (Б-сплайновая функция)

5. Find the Russian equivalents to the following English words and word combinations:

a) 1. external and internal geometry; 2. surface models; 3. NC machining instructions; 4. arbitrary points; 5. complex curves; 6. wire-frame models; 7. interconnected surfaces; 8. extensive surface menus; 9. the rest of the part; 10, solid models; 11. virtually; 12. machine tools; 13. interconnected line elements; 14. surface discontinuities; 15. ambiguity; 16. an isometric view; 17. similar; 18. several; 19. although; 20. even though; 21. along with; 22. a mathematical approach; 23. elementary cubes; 24. hidden lines; 25. cross-sections; 26. to Crosshatch; 27. to expose; 28. boundary definition; 29. the Boolean logic command; 30. volume; 31. shiphulls; 32. complex contours; 33. a cubic basic spline; 34. an envelope

b) 1. токарные станки; 2. в действительности; 3. взаимосвязанные поверхности; 4. расширенные меню поверхностей; 5. вместе с; 6. элементарные кубы; 7. команда Булевой логики; 8. кубический базисный сплайн; 9. огибающая кривая; 10. скрытые линии; 11. внешняя и внутренняя геометрия (детали); 12. контурная настройка; 13. математический подход; 14. оставшаяся часть детали; 15. машинные команды для ЧПУ; 16. поверхностные неоднородности; 17. модели поверхностей; 18. произвольные точки; 19. модели твердых (геометрических) тел; 20. взаимосвязанные элементы линий; 21. подобный; 22. поперечные сечения; 23. сложные контуры; 24. объем; 25. оставлять открытыми (экспонировать); 26. несколько; 27. даже если; 28. неопределенность; 29. корпуса кораблей; 30. заштриховывать; 31. хотя; 32. каркасные (скелетные) модели; 33. изометрический вид (проекция); 34. сложные кривые

6. Memorize the words the meanings of which are often mixed:

single—signal, some—same, then—than, also — always—almost, principle—principal, quite — quiet, since—science

single один, единый—a signal сигнал some некоторый, несколько—(the) same тот же самый then затем, тогда — than чем also также—always всегда—almost почти

principle принцип — principal главный quite -совершенно, полностью—quiet -тихий, бесшумный

since - так как, с, с тех пор — science –наука

7. **Translate the following definitions and memorize the terms which they describe:**

Display is a device for visual mapping (отображение) of output results for the operator or the user, which are received from a computer. Such devices are designed so that they are able to provide time visual mapping of graphical and/or alphanumeric (буквенно-цифровая) information. Examples of displays are cathode-ray tubes (CRT) or light-emitting diodes (LED) (светоизлучающий диод).

Model is mathematical representation of a device or process. Models which can be manipulated by computers are sets of equations which represent some condition or set of operations in the real world. Models are used for analysis and planning purposes.

Modelling is simulating a condition with the use of a model. Modelling simulates an activity by performing a set of equations on a set of data.

Geometry is science of properties and relations of lines, angles, surfaces and solids.

Process means to manipulate information. Processing is any action taken on information in a computer. Processing can mean: (1) any work done by the computer system, or (2) just the work done internally on the information by the computer.

8. Read Text A attentively. Divide it into logical parts.

9. List the key words and the topic sentences from Text A.

10. Choose the suitable title for each logical part from those given below:

A. 1. Outlining steps. 2. The most important feature of CAD/CAM. 3. Finite-element models. 4. Numerical control tapes.

B. 1. Computer's time and memory. 2. The simplest models. 3. Surface discontinuities. 4. Representation of wire frame models. ;

C. 1. Ambiguities of wire-frame models. 2. The structure boundaries definition. 3. Surface modelling. 4. An automatic hidden-line removal.

D. 1. The highest model level_solid mlodels. 2. Con. structing solid models with primitives. 3. Simple shapes in models. 4. Constructing solid models with boundary defi nition.

11. Check up yourself how much you have memorized from Text A.

a) Complete the following sentences:

1. The most important feature of CAD/CAM is (the starting point, the part size and shape, the geometric model). 2. Wire frames represent (computer time, the simplest model, precise information). 3. Wire-frames models are created by specifying points and lines (in space, in sections, in views). 4. Surface models are created (by modifying, by simplifying, by connecting) various types of surface elements. 5. Components of different machines with complex (conditions, descriptions, contours) are easily modeled by boundary (position, definition, construction).

b) Say what two approaches are used in constructing solid models, c) Compare wire-frame and solid models. d) Name components with complex contours of some in dustrial parts, e) Recall which models solid models resemble, f) Explain with your own words the notion (понятие) "hidden lines removed".

12. Write an abstract of Text A in English (see p. 126).

13. Look through Text B. List its main points.

TEXT B

Surface models are of different types. The plane is the most basic surface type. The system merely (просто) creates a flat plane between two user-specified straight lines. The tabulated cylinder is the projection of a free-form curve into the third dimension. Basically, this is a curved plane between two arbitrary parallel curves. A ruled surface is produced between two different edge curves. The effect is a surface generated by moving a straight line through space with the end-points resting on the edge curves. A surface of revolution is created by revolving an arbitrary curve in a circle about an axis. The sweep surface is an extension

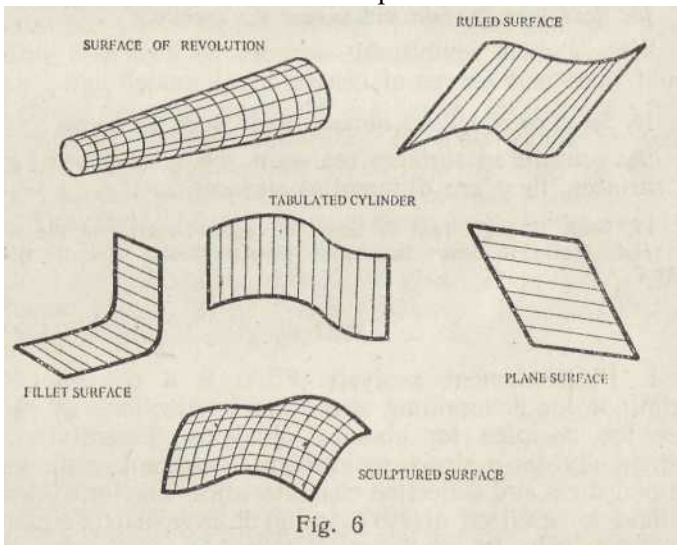

Fig. 6

(удлинение) of the surface of revolution. Sweep surfaces, however, sweep an arbitrary curve through another arbitrary curve instead of a circle. The fillet surface is a cylindrical surface connecting two other surfaces in a smooth transition. This is a tedious (утомительный) operation that has been done manually in industry for years. But CAD systems quickly solve the problem of blending surfaces (поверхность смещения) with the precise mathematical continuity required by many applications. Sculptured surfaces represent the most

general surface representation. A sculptured surface is a differential surface created from two families of curves. These families are not restricted (ограничивать) to being orthogonal, nor are the curve types fixed. Curves need not even be parallel. The two curve families intersect (пересекать) one another in cross-cross (крест-накрест) fashion. Sculptured surfaces are complex contours that cannot be described with the usual lines and curves of conventional modelling. Typical structures containing such contours range from helicopter blades and automobile bodies to camera cases and glass bottles. (Fig. 6)

14. Read Text B attentively. Divide it into the paragraphs and logical parts. Choose the title to Text B from those given below:

1. Sculptured surfaces. 2. Sweep and fillet surfaces. 3. Different surface model types. 4. Ruled surfaces.

15. Read Text B again and answer the question:

Why cannot sculptured surfaces be described with the usual lines and curves of conventional modelling?

16. Speak on sculptured surfaces. Begin with the words:

"As sculptured surfaces represent the most general group of surfaces, they are differential surfaces ... ."

17. -Look- through Text C Guess the subject-matter of the text to be read. Write it down into your exercise-book. Give the title to Text C

TEXT C

1. Finite-element analysis (FEA) is a computer-based technique for determining stresses and deflections[1] in a structure too complex for classical analysis. Essentially, the method divides a structure into small elements with easily defined stress and deflection characteristics. The finite-element method is based on arrays (массив) of large matrix equations that can only be realistically solved by computer. Most often, FEA is performed with business programs. In many cases, these programs require that the user only knows how to prepare a program input.

2. The finite-element method is applicable in several types of analyses. The most common is static analysis, which solves deflections, strains (деформация), and stresses in a structure under a constant set of applied loads. The material is generally assumed to be linearly elastic, but special cases such as plastic deformation, creep (ползучесть), large deflections, and stress stiffening can be handled in some moments.

3. Natural frequency (частота) analysis calculates the free vibration natural frequencies and associated mode shapes of a structure.[2] This analysis predicts critical operating conditions for machinery and is used in conjunction with experimental analysis.

4. Transient dynamic analysis[3] determines the time-response history* of a structure subjected to a forced displace ment function. The structure may behave linearly, or in some cases, friction (трение), plasticity, large deflections, or gaps (зазор) may produce nonlinear behaviour. Once the time-response history is known, complete deflection and stress information can be obtained for specific times. A similar method is forced under harmonic response analysis, which calculates the steady-state response of a structure to a continuous set of sinusoidal loadings. Complex displacements and phase angles are calculated. Deflections and stresses may again be calculated at specific times.

5. Heat transfer analysis[6] can solve steady-state and transient heat transfer problems. In most cases, thermal output data are applied as input to a structural analysis program to determine thermal deflections and stresses.

6. The first step in finite-element analysis is creation of a model that breaks a structure into simple standardized shapes or by a common coordinate grid (сетка) system. The coordinate points called nodes (узел) are locations in the model where output data are taken.

NOTES

1. for determining stresses and deflections —для определения напряжений и отклонений

2. the free vibration natural frequencies and associated mode shapes of a structure — собственные частоты при свободном вращении и связанные с ними наиболее вероятные очертания структуры

3. transient dynamic analysis — динамический анализ переходных процессов

4. the time-response history—описание временной характеристики

5. subjected to a forced displacement function — находящейся под воздействием функции смещения

6. heat transfer analysis — анализ процесса передачи тепла

18. Read Text C again. Find all international words in it, write them down into your exercise-book.

19. Translate the second, third and sixth paragraphs in writing.

UNIT 6

Text A. CAD Software. Text B. Database Management System, Text C Text D. Text E. Text F.

EXERCISES

1. Practise the reading of the following words:

reference справочный, эталонный
tutorial консультационный
tailor *v* рассчитывать; подгонять
jointly совместао
deliver *v* поставлять, доставлять
modifiable поддающийся изменению
available доступный
avoid *v* избегать
assignment предназначение
immediately немедленно, сразу
broaden *v* расширять
facilities средства
support обеспечение, поддержка
procedure процедура
decision решение
imply *v* означать
authorize *v* санкционировать
request запрос
access - доступ
maintain - *v* обслуживать
environment - (вычислительные) средства, окружающее оборудование

2. Memorize the following word combinations:

general-purpose programs универсальные (общесистемные) программы
special-purpose programs специализированные программы
reference manuals справочные руководства
off-the-shelf software готовое программное обеспечение
stock programs запасные (резервные) программы
base (kernel) software базовое программное обеспечение (ПО)
applied (special) software прикладное ПО
a mathematical support математическое обеспечение
application packages пакеты прикладных программ (ППП)
storage media накопители
reference information справочная информация
design decisions проектные решения
database management system система управления базой данных (СУБД)

3. Look through Text A. List the main ideas of it.

TEXT A. CAD SOFTWARE

CAD software provided by manufacturers includes all general-purpose programs and application programs needed to operate the system. The application programs consist of all operating, utility, and graphics programs. Several sets of reference manuals and other tutorial material on software are also often supplied. Generally, software is tailored to user's applications.

A set of off-the-shelf software is selected jointly by the user and manufacturer from a list of stock programs. This software generally is delivered in object (working) form and not in source (modifiable) form, although some manufacturers make both types available.

Special-purpose software is usually not provided by the manufacturer. These programs may depend on a user's application, and most manufacturers avoid such programming assignments. For example, special-purpose programs to create families of parts are normally developed by users, after the system is delivered. This type of software is not immediately essential but makes the system more convenient (удоб
ный) to use or broadens capabilities.

CAD software is divided into general system software, kernel software and applied (special) software. The first one is used for organizing technical facility functioning, i. e. for planning and computing process controlling, allocating resources available. It is represented by operating systems of computers, and is not used in CAD systems.

Kernel and applied (special) softwares are especially created for CAD. The kernel software contains all programs intended for correct functioning application programs. In the applied software, a mathematical support for direct performing design procedures is realized. It is usually given in the form of application packages, each of which provides service to a certain stage of the design process.

CAD software also combines different data which are necessary for performing an automated design. These may be represented in the form of various documents on various storage media, which contain reference information of materials, standard (типовой) design decisions, component parameters, current information about intermediate and final design decisions, structure and dimensions of designed objects, etc.

The basic part of CAD software is a data bank representing the set of facilities for centralized accumulating and using the data. The data bank is simply electronic depository (хранилище) of data. The data bank consists of a database and a database management system (DBMS).

Technically, a database is an electronic organization of data and information organized and maintained by a data-

base management system. A database implies integration of data across the entire environment that it serves. It also implies central control of data for consistency (согласованность) and accuracy, with users having authorized access to them.

The data/information stored in a database depends on the functions of its organization. The database structure into which the data are designed (hierarchical, network,[1] relational,[2] etc.) depends on the volume and frequency of the daily transactions and management's requirements[3] for information. Database design is often a compromise between operational requirements for efficient daily transaction processing and management's requirements for queries and reports.[4]

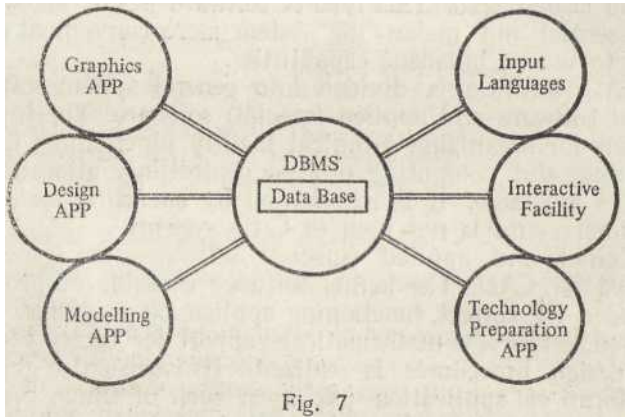

Fig. 7

The DBMS is the set of programming aids (средство) providing data banks functioning. By the DBMS data recording is performed to data banks; fetching (вызов) them according to users' requests; data protection from errors and from an unauthorized access is provided, etc. (See Fig. 7)

Programming languages used in CAD systems are the same languages used in computing systems intended for writing software. They are manufacturers' aids. There are 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. FORTRAN is used for numerical analysis object programs.[1'] However, for the most complex descriptions of logical character programs, such as monitors and language processors," either assembly language or PL/1, PASCAL, ADA, and C languages are used. The

latter four languages are considered to be the high-level programmer(manufacturer)-oriented languages.

Design languages are languages intended for describing information about designed objects and designed tasks. Most of them are related to users' aids of CAD/CAM systems. Among them there are input (source), object (target), debugging and correcting, control, intermediate, and internal languages. All of them are divided into object description languages and job description languages, which in turn are subdivided into circuit, graphics, modelling languages and at last universal intermediate languages. (See Fig. 8)

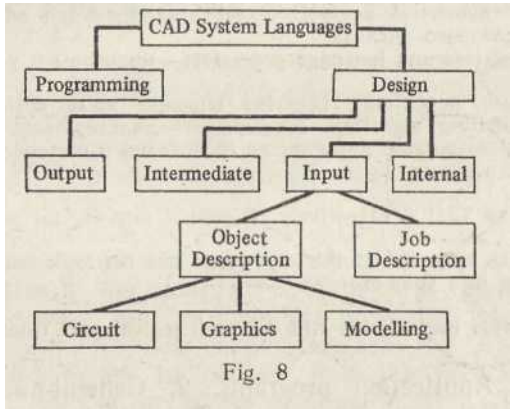

Fig. 8

There are also procedural and non-procedural languages in CAD systems. The first ones are intended for description of processes evolving during the course of time. The second ones are intended for description of designed object structures. As a rule, for CAD users non-procedural languages are more convenient, as by them an initial diagram or drawing is described, and a user needs only keep the language rules without worrying about modelling algorithm development.'

Conversational (interactive or dialogue) modes (режим) of the user/computer work are of great importance for CAD systems. They are named interactive languages and serve for an operative information exchange between man and computer. These languages may be used in passive and active modes. In the passive modes the dialogue initiative belongs to a computer. In the active one the dialogue initiative may be twofold — interruptions (прерывание) possibilities are at both a computer and a user. The active conversational languages are close to natural man languages, but with a limited

set of possible words and phrases. For the active dialogue a substantially complex software is required than for the passive one.

NOTES

1. network — сетевой
2. relational — родственный
3. of the daily transactions and management's requirements —по вседневных транзакций (групповых операций) и требований к управлению
4. queries and reports—запросы и сообщения
5. for numerical analysis object programs—для объектных про грамм численного анализа
6. monitors and language processors —мониторы и языковые процессоры
7. a user needs only keep the language rules without worrying about modelling algorithm development —пользователю нужно лишь соблюдать языковые правила, не беспокоясь о составлении алгоритмов моделирования

4. Read Text A attentively. Divide it into logical parts.

5. Make up a list of the key words and the topic sentences. Write them down into your exercise-book.

6. Choose the suitable title for each logical part from those given below:

A. 1. Application programs. 2. General-purpose programs. 3. Reference manuals. 4. Types of software programs.

B. 1. A user's application. 2. Programming assignments. 3. Special-purpose programs. 4. The more convenient system.

C. 1. General system software. 2. Software types. 3. Kernel software. 4. Applied (special) software.

D. 1. Different data for an automated design. 2. An auto mated design. 3. Standard design decisions. 4. Reference-' information.

E. 1. CAD facilities. 2. Electronic depository. 3. Centralized accumulation. 4. A data bank.

F. 1. An electronic organization. 2. Integration of data. 3. A database design. 4. The daily transactions.

G. 1. Programming aids. 2. Database management systems. 3. Data recording. 4. Data protection.

H. 1. Programming languages in CAD systems. 2. FORTRAN. 3. PL/1. 4. The high-level manufacturer-oriented 1anguages.

I. 1. Aids of CAD/CAM systems. 2. Debugging and correcting language. 3. Design languages in CAD/CAM systems. 4. An input language.

J. 1. Description of drawings. 2. Initial diagrams. 3. CAD user languages. 4. Procedural and non-procedural languages.

K. 1. The active and passive interactive languages. 2. An operative information exchange. 3. The dialogue initiative. 4. Interruption possibilities.

7. Write an abstract of Text A in Russian (see p. 126).

8. Look through Text B and say whether the subject-matter of it is "A description of the DBMS".

TEXT B. DATABASE MANAGEMENT SYSTEM (DBMS)

A database management system is software that organizes and retrieves data in a database. A DBMS makes it easier to access all varieties of data/information stored in a computer. It allows users to request data the way they see it rather than the way the computer sees it. The DBMS is a software package which acts as an interface between the user's programs and the physical database. The DBMS allows for the organization of non-redundant (незарезервированный) data in the database. It keeps track of all the data and allows each user to have an individual view of the data. The user's application program asks the DBMS to select that user's view and deliver it to the program (user). Only the DBMS knows where and how to get it. The DBMS acts as a buffer between the programs and the physical structure of the database. Selection of a DBMS can be critical. Since much of the organization's data will be placed into the database, the processing time required to access the database must be carefully (тщательно) evaluated. A data model is first developed which defines the data and their logical relationships with other data. Then the transaction activity that will be processed against this database is evaluated. The resulting selection is the DBMS that will manage (управлять). A portion of the DBMS resides in memory and is called upon (вызывать) by the application program each time data must be transferred to or from the database. Main features of a DBMS are the following: data independence. The application programs are not concerned with the location of any data they use. Advanced DBMSs[1] use data dictionaries and non-procedural languages, which may mean that no changes are required in the programs when a structural change to data is made. Security. The DBMS can test for user authorization at the application program level, subschema level, or field level, depending

on the DBMS. On-line query.[2] An interactive query capability allows users access to their data using a query lan.-guage. Application development language.[3] A high-level non-procedural language developed around the DBMS may allow programmers and users to develop application programs faster than with conventional (традиционный) programming languages.

NOTES

1. advanced DBMSs—СУБД с улучшенными свойствами
2. on-line query —неавтономный запрос (запрос от основного обо рудования вычислительной системы)
3. application development language —непроцедурный язык высо кого уровня, позволяющий программисту составлять прикладные про граммы

9. Read Text B attentively. Divide it into paragraphs.

10. List the main features of a DBMS in the following way:

"The main features of a DBMS are the following: (1) data independence, (2) . . . ."

Write them down into your exercise-book.

11. Analyse and translate the following sentences from Text B:

1. It allows users to request data the way they see it rather than the way the computer sees it. 2. A portion of the DBMS resides in memory and is called upon by the application program each time data must be transferred to or from the database.

Write down the translation of the sentences above into your exer-_cise.book.

12. Write a brief summary of Text B (see p.: 126)<

13. Analyse the text below and the translation given. Practise the oral back translation. Give the title to the text.

TEXT C

In 1956, an artificial language, FORTRAN, was created as a hybrid of English and mathematics and a program was written to translate statements in the FORTRAN language into instructions for a computer.

ТЕКСТ С

В 1956 г. появился искусственный язык ФОРТРАН, который можно рассматривать как некоторый гибрид английского языка и системы математических обозначений. Была разработана программа перевода предложений, записанных на языке ФОРТРАН, в команды для вычислительной машины.

Subsequently, similar programs have been made available for almost all computers.

В дальнейшем аналогичные программы были разработаны почти для всех типов вычислительных машин.

The word FORTRAN is contracted from FORmula TRANslator.

Слово «ФОРТРАН» образовано из начальных слогов двух английских слов "FORmula TRANslator" (переводчик формул).

A dictionary definition of FORTRAN might be as follows: FORTRAN. Of or pertaining to:

Если попытаться дать определение термина «ФОРТРАН», как это делается в словаре, то окажется, что с ним связаны:

1) any dialect of the English language; 2) a program called a source program for the solution of any problem which is written in the FORTRAN language; 3) a machine language program called a compiler, the input to which is a FORTRAN source program and the output of which is an equivalent machine language; 4) a machine language program produced by the FORTRAN compiler called an object program; 5) any special coding forms, special card designs, etc. intended to be used in the preparation of a FORTRAN program.

1) любой диалект английского языка; 2) программа, называемая исходной программой решения любой задачи, которая написана на языке ФОРТРАН; 3) программа на машинном языке, называемая компилятором, по отношению к которой входными данными является исходная программа на ФОРТРАНе, а выходными — эквивалентная программа на машинном языке; 4) программа на машинном языке, полученная после обработки исходной программы компилятором ФОРТРАНа и называемая объектной программой; 5) специальные бланки (или формы), специальные карты и т. п., употребляемые при подготовке программ на ФОРТРАНе.

As a noun FORTRAN is used to stand for the FOR-

Слово ФОРТРАН как существительное обозначает