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USSR: Computers

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63
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SCIENCE & TECHNOLOGY

USSR: COMPUTERS

CONTENTS

HARDWARE

SOFTWARE

APPLICATIONS

EDUCATION

/13046

SESSION OF DESIGNERS FROM SOCIALIST COUNTRIES

Kishinev SOVETSKAYA MOLDAVIYA in Russian 30 Nov 86 p 3

[Article by ATEM correspondent: "Session of Designers from Socialist Countries"]

[Text] A session of the Council of Head Designers for Small Computer Systems, part of the Intergovernmental Commission on Cooperation Between Socialist Countries in the Area of Computer Technology, took place November 25-27 in Kishinev. Representatives of the Bulgarian People's Republic, Hungarian People's Republic, German Democratic Republic, Cuba, Polish People's Republic, Socialist Republic of Rumania, USSR, and Czechoslovak Socialist Republic took part in the session.

N. L. Prokhorov, chief designer of the council, told the ATEM correspondent that "starting this year, the work of our council is being conducted within the framework of the Integrated Program for Scientific and Technical Progress of the Comecon member countries up to the year 2000. In our eleven years of cooperation, we have created three stages of small computers and microcomputers, which in the socialist countries have become the foundation for the automation of technological processes and design systems in the most varied branches of the national economy.

"We are now working on a program to create a fourth stage of small computers, which will be 2-3 times more reliable than their precursors, 2-4 times more energy- and materials-efficient, and more economical. The current session has examined the progress of work on the development and production of these computers. The first machines of this class should be created by 1988."

12713
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OPTIMIZATION OF MULTIPROCESSOR COMPUTER SYSTEM CONFIGURATION

[Article by V.M. Borisenko, Severodonetsk]

[Abstract] A method is suggested for selecting the configuration of a computer
system with fixed statistical characteristics for high productivity multi-
processor computer systems such as the PS-3000 system, which includes control
processor, vector processors, peripheral storage processors, I/O processors
and array processors. The method involves selection of the configuration based
on the type of tasks to be performed by the system to maximize speed. The
statistical parameters of the most important or most frequently encountered
types of tasks are used, rather than those of all tasks. Figures 3;
references 7: 6 Russian, 1 Western.

USE OF REED-MULLER CODES IN SELF-TESTING OF CIRCUITS

[Article by R.Kh. Latypov, Kazan]

[Abstract] Self-testing involves a built-in test generator and decision
circuit to determine the proper operation of the device tested. A previous
article suggested the method of increasing the reliability of the compact
method of counting the number of ones by modifying the output sequence Z of the
tested device before compression using another sequence S. However, the
algorithms suggested do not always allow construction of modifying sequences
for a fixed sequence Z. This article suggests utilization of a sequence in
Reed-Muller first order code closest to Z to modify Z before compression. In
the case of combination circuits, the method is reduced to approximate dupli-
cation of the assigned circuit with a certain multiple-input binary adder. A

method is indicated for synthesizing the additional equipment necessary for modification, containing $\log_2 N$ elements. It is shown that for certain lengths N, the mean probability of an undetected error is less than for signature analysis. In the method, the output sequence of the tested device is added in modulo 2 with the Reed-Muller code sequence. The method is most effective for near-linear circuits. References 9: 6 Russian, 3 Western.

6508/13046
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APPROXIMATION MULTICRITERION SCHEDULING IN COMPUTER SYSTEMS

[Article by V.I. Borzenko, E.A. Trakhtengerts and V.M. Shershakov, Moscow]

[Abstract] A special approximation method has been developed for automatic scheduling of queues of requests for computer resources based on the actual preferences of the decision maker, correctly aggregated in the general request-sorting system. Results are presented from application of the method to planning of batches of jobs to be run on computers. Information on the preferences of the system administrator is established in a dialogue conducted during generation of the supervisor programs, and can be adjusted later depending on the functioning quality of the system. The method can be used to sort either individual requests or sets of requests for computer resources. Figures 12; references 5: Russian.

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INTERACTIVE SYSTEM FOR LOGIC MODELING OF DIGITAL CIRCUITS

[Article by A.M. Vlasov, V.A. Dyboy, V.Ye. Mezhov, V.V. Plotnikov, V.N. Kharin and Yu.A. Chevychelov, Voronezh]

[Abstract] A study is made of an application software set for logic analysis of PRATSIS-2 logic modules, intended for use in "Kulon" interactive graphic systems and computer systems based on "Elektronika" microcomputers with at least 64K words memory. The software set includes logic modeling programs plus a module for express analysis of digital circuits for controllability, testablity and observability. The software allows logic analysis of large

digital modules at the gate and functional levels. Modules in the software perform processing and documentation of information on the circuit, rapid analysis of circuits for controllability, observability and testability, and fragmentation. Additional modules include a library, modulator, and logic analyzer for circuits with individual errors. The program uses the principle of fragmentation of a circuit allowing analysis of large circuits without expanding memory volume. A flow chart of the fragmentation algorithm is presented. The PRATSIS-2 modeling program was written in FORTRAN-IV and runs under the MDOS RV operating environment on computers with at least 64K RAM. The program has 20,000 lines of code and is used in the process of digital circuit design and testing. Figures 3; references 5: 4 Russian, 1 Western.

AUTOMATION OF DIGITAL PROCESSING AND RECORDING OF HOLOGRAPHIC INTERFEROGRAMS

[Article by A.N. Grishanov, S.T. De, Ye.N. Denezhkin and V.A. Khandogin, Novosibirsk]

[Abstract] A study is made of investigation of residual stresses in flat specimens to demonstrate on version of search for optimal parameters in a holographic measurement system. Optimization of the geometric system of the interferometer used for such measurements is discussed. The major optimality criterion used is minimum measurement error. Algorithms are developed for simultaneous processing of two interferograms obtained in studies of flat specimens in the holographic interferometer. Estimates are presented of errors in input and processing of interferograms using these algorithms. Methods are suggested for decreasing errors. The random distribution of residual stresses in a flat specimen is found to result not only from random measurement errors, but also from specific characteristics of the specimens. Figures 5; references 11: 10 Russian, 1 Western.

SYSTEM FOR DIGITAL ANALYSIS OF FIELDS OF HETEROGENEOUS DEFORMATIONS USING
APPLIED HOLOGRAPHIC INTERFEROMETERS

[Article by V.N. Sarnadskiy, Novosibirsk]

[Abstract] A study is made of automatic interferogram processing systems based
on microcomputers implementing a full cycle of automatic processing of inter-
ferograms with a high level of spatial noise and complex band picture. When
an applied holographic interferometer is used, the system can study fields of
heterogeneous deformations of flat products in standard test machines under
industrial conditions. The principles of design of the system include economy,
independence of interferogram type, interactive operation, functional automony
and program adaptability. A photograph of the system is presented. The soft-
ware used with the description was written in FORTRAN and macroassembler.
Results are presented from determination of the field of linear deformation of
a flat specimen by processing of two interferograms recorded symmetrically.
Figures 4; references 17: 13 Russian, 4 Western.

BIPOLAR INTEGRATED CIRCUIT COMPONENT MODELING SOFTWARE

[Article by A.I. Adamsone, V.S. Polskiy, L.S. Pokhvalina and Ya.S. Rimshans,
Riga]

[Abstract] A description is presented of the "Alfa" software developed at the
computer center of Leningrad State University for modeling of a broad class of
bipolar integrated circuit components. A specialized input language has been
developed for the "Alfa" software and is used to enter the difference grid,
location of metal-semiconductor contacts, voltages on the contacts and voltage
change modes, lifetime of charge carriers, Auger recombination coefficients,
model of strong doping effects, exchange mode with external files and other
input factors. This information is processed by special input and test pro-
grams which check the correctness of the data input and produce diagnostic
messages when errors are found. The input language facilitates work with the
software and allows calculations to be performed by a user minimally familiar
with the principles of numeric methods of solutions of equations in partial
derivatives. Calculation examples are noted. Figures 3; references 36:
16 Russian, 20 Western.

EFES SOFTWARE FOR MODELING STATISTICAL CHARACTERISTICS OF MOS STRUCTURES

[Article by N.I. Gorbenko, Novosibirsk]

[Abstract] A description is presented of the EFES software, used to model static modes in multiple-element MOS structures in a two-dimensional approximation. Charge-coupled devices are studied consisting of electrodes with various potentials interconnected periodically and including subareas with dielectrics and semiconductors with varying types of conductivity and degrees of doping. The software is designed for computation of fields in areas with arbitrary boundary shapes, represented by sectors of second order curves. The software includes the following components: a translator with a special input language; a set of modules implementing the numerical algorithms; a set of modules implementing processing and output of results; and a data base. An example of utilization of the software is described. Figures 2; references 3: 2 Russian, 1 Western.

ONE APPROACH TO DESIGNING THE PHYSICAL ORGANIZATION OF A RELATIONAL DATA BASE

[Article by V.A. Kurylev, Smolensk]

[Abstract] A model is suggested allowing analysis of the cost of accessing data considering interconnection of relations through the joint operation. A relational data base structure design algorithm based on this model allows selection of a specific file organization for storage of each relation and is founded on minimizing the time cost of accessing data during inquiries. The algorithm is implemented in the RELBAZ DBMS and allows utilization of a broad range of physical data structures for the storage of relations on disks. References 12: 4 Russian, 8 Western.

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INTERACTION OF PARALLEL CYCLICAL PROCESSES IN MULTIPROCESSOR COMPUTER SYSTEMS

[Article by Ye.L. Kulida, Moscow]

[Abstract] A class of parallel processes is suggested for which the character-istics of interactions can be determined before the processes start to execute. A method is developed for selecting the optimal synchronization mechanism for processes satisfying the assigned limitations, and a method of equivalent program conversion is developed, minimizing losses due to the interactions of parallel processes. The optimization method suggested, based on selection of the optimal synchronization mechanisms and equivalent transformation of programs, includes three stages: In the first stage, the program text is used to determine conflicting sets of processes; the second stage of optimization involves selection of one of four possible optimization modes for each conflicting process set revealed; the third stage is implemented in the process

of translation of the program. Based on information obtained in the first two stages, a program is generated which implements the selected optimization mode for all conflicting sets of processes. An example is presented. References 4: 2 Russian, 2 Western.

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CLASSIFICATION SYSTEMS AND DOCUMENTS

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 8, Aug 86 pp 1-25

1. DATA BASE ORGANIZATION OF AUTOMATED MANAGEMENT SYSTEMS [ASU]. GENERAL PROBLEMS OF CLASSIFICATION, CODING, AND UNIFIED SYSTEMS OF DOCUMENTATION [USD]

UDC 002:65.011.56:681.3

USING THE UNIFIED DOCUMENT PRINCIPLE IN AUTOMATED ORGANIZATIONAL MANAGEMENT SYSTEMS

[Article by Candidate of Technical Sciences L.P. Akimov from the All-Union Scientific Research Institute of Business Conditions (kon''yunkturniy institut)]

[Text] Creating document forms that provide for data input into data bases is one of the most important tasks in developing automated management systems [ASU].

In the future it will be possible to create ASU between which information can be exchanged on the basis of paperless technology. However, the document on a paper media will remain the main document for data in administrative activity for a long time. In ASU, documents are not only the means of preparing and sending data but also have a significant effect on such characteristics as data precision and accuracy.

Preparing data for input on paper media is also advisable during the transition of ASU users to work using automated workstations [ARM] [1] in cases where large volumes of information are input into a computer with the help of computer center operators.

As early as the 1920's it was proposed that the principle of a unified document be used for accomplishing a specific economic task, i.e., all data on a given task should be included in one document.

The use of such a principle in ASU is based on the fact that individual processes, for example, planning, reporting, etc., may be isolated in ASU.

The main economic indicators of each process are reduced to one document that is produced using the current data base. We will call this document the process report. To control the process the user must be able to enter correcting information into the data base. To prepare this information it is advisable to use the same process report.

Presenting the process report user with source information about it for subsequent entry of correcting information from the process report into the data base is an implementation of the unified document principle under conditions of ASU operation.

From the process report the user has the capability of entering any correcting data, for example, entering new lines, removing unnecessary and outdated information, or changing any data about the process. There is a special column entitled "Type of Operation" for managing work with the data in the process report. In ta column, for each line, the user notes exactly what is to be done with the data on that line. Instruction codes (for example, "K" to correct individual commands, "U" to delete an entire line, and "V" to enter new data) are placed in the column. The user distinguishes (underlines, for example) the lines from which data may be input from the summary and computation lines of the document. Incomplete (blank) underlined lines with the grid of the columns of the document are left at the end of the page for inputting new lines.

Using the process report, the user prepares all necessary changes for entry into the data base and, depending on the amount of changes, either sends the pages of the report with the corrections to an operator for entry or enters them from an automated workstation. After obtaining the corrected process report, the data of which correspond to reality, the user permits the external users to obtain the output reports or documents on magnetic media.

Using process reports makes it possible to increase access to data both within the ASU and for the external environment inasmuch as the specified process reports provide feedback in the control loop.

The ASU may contain several levels of control for one process (for example, planning in an enterprise, association, or branch as a whole).

The structure of the economic indicators of the process does not usually depend on the level of control, and the data are distinguished by degree of aggregation of individual indicators. Therefore, a process report for one process may be used for all levels of control, which makes it possible to unify the documents of the ASU. The process report for different levels has a level code in the header section. This makes it easier to check data about the process at different levels of control.

Using a process report makes it possible to eliminate different entry forms and, in many respects, makes the work close to the usual way of working -- working with a machine bureau. Moreover, the user's work involving coding information that is not inherent to him or her is reduced to a minimum inasmuch as he or she can write data in the process report in natural language (for example, the name of an article). Coding is done automatically in the

ASU. For individual cases where manual coding is necessary, the process report provides for "prompts" (for example, directions for the code for grouping goods, line number in which the article entering the group is specified, etc.).

The advantage of using a process report is a sharp reduction in the role of reporting about updating the data base, which usually complicates the user's work. In such cases, reports about updating the data base by and large play only an informative role and are stored at the computer center. Such a solution becomes possible in the case where the input data entered into the data base (under the condition that they are not damaged) are subject to automatic editing and are entered in the data base and the process report with appropriate editing flags, calling the user's attention to edited or "suspicious" information. In the process, it has become possible to eliminate computing manual check sums for the process reports inasmuch as practice has shown that the volume of entry errors from process reports for qualified operators is very small. Therefore, it is simplest for the user to correct them from the video data terminal of an automated workstation than to compute check sums manually or send data back to the computer center.

The aforementioned principles for using a unified document have been implemented in an automated system for planning exports at the Ministry of Foreign Trade.

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12794
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CLASSIFICATION FEATURES OF AUTOMATED DATA PROCESSING SYSTEMS

[Article by Candidate of Technical Sciences L.B. Venchkovskiy and Candidate of Economic Sciences I.T. Rudnik from the Moscow Institute of Management imeni S. Ordzhonikidze]

[Text] In recent years, the area of science and technology that is connected with the data processing industry has undergone significant changes that have been caused by success in the development of modern hardware, the creation of software and data base organization and management, and the introduction of effective technologies in the realm of data processing. The new direction that has appeared in this context, informatics, embraces a wide circle of topics on the automation of data processing. Informatics is defined as the field connected with the development, creation, use, and management of information processing systems.

However, until now, a marked confusion in terminology relating to this rapidly developing field of knowledge has continued to exist. The definitions connected with data processing systems, which form the basis of informatics, are especially diverse and contradictory. In this context, it seems advisable to begin work on ordering terminology in the given field in order to unify and standardize it. We will first examine the existing definitions of data processing systems and related features of classification that make it possible to consider the features and groups of systems completely and put the set of concepts relating to them in order.

At the present time, a significant confusion is evident in the concepts relating to the field of automated data processing. This is explained by the presence of a set of terminological obscurities and the difference in translations of one and the same terms from the foreign literature and different interpretations of identically translated terms, etc.

The terminology in the field of automated data processing systems must be put in order.

The concept of a system has been taken to mean a connected whole that is formed by mutual subordination and generally by the compatibility of its component parts and elements.

12

In the more special sense, a system is treated as a set of methods, procedures, or techniques that are unified by regulatable interrelationships for forming an organized whole or as an organized set of people, machines, and methods required to accomplish a specified set of functions.

In the field of automated data processing and informatics there are a large number of concepts that are connected among themselves in various ways, mutually subordinate, or simply close in meaning from the point of view of the system's purpose. Examples of such concepts include automated data processing systems, information systems and their variations, management information systems and automated data banks, etc.

The variety of automated data processing systems is in many respects determined by the presence of a large number of classification features whose unification makes it possible to put a variety of systems in order more effectively by using a multidimensional description of them based on the totality of the features under examination. It is advisable to isolate individual independent classification features by which different aspects of automated data processing systems [ASOD] are characterized.

Systems may be classified in the following manner:

1. By purpose

    1.1. Specialized
    1.2. Broad-purpose (universal)

2. By degree of automation of the execution of functions

    2.1. Mechanized
    2.2. Automated
    2.3. Electronic (automatic)

3. By goal orientation

    3.1. Procedure-oriented
    3.2. Data-oriented

4. By territorial location

    4.1. Centralized
    4.2. Decentralized

5. By organization of processing (by distribution of processing operations)

    5.1. Distributed (polycentral)
    5.2. Concentrated (monocentral)

6. By nature of data transmission

    6.1. Data teleprocessing
    6.2. Local data processing

7. By course of tasks

    7.1. Single-program
    7.2. Multiprogram

8. By number of processors

    8.1. Single-processor
    8.2. Multiprocessor

9. By technology for interaction with users and modes of computer operation

    9.1. Batch (local) processing
    9.2. On-line (interactive) processing

        9.2.1. Real-time processing
        9.2.2. Processing with time sharing

            9.2.2.1. Interactive processing
            9.2.2.2. Question-and-answer processing
            9.2.2.3. Distant (remote) batch processing

10. By nature of use

    10.1. Collective use
    10.2. Individual use

11. By direction of use

    11.1. Operational data processing
    11.2. Data processing based on user requests

12. By level of decision making provided

    12.1. Strategic
    12.2. Tactical
    12.3. Operational

13. By level of control hierarchy

    13.1. All-union
    13.2. Sectoral
    13.3. Enterprise

14. By subordination feature

    14.1. Sectoral
    14.2. Territorial

15. By functional directivity

15.1. Plant process control automation system (ASUTP)
15.2. Organizational-type ASU
15.3. Organizational and production-type ASU
15.4. Training systems
15.5. Computer-aided design systems
15.6. Scientific research automation systems
15.7. Automated systems to monitor and test objects

It is also probably possible to classify ASOD according to the data organization used in them (file systems, data bases, etc.), by areas of use (industry, agriculture, medicine, trade, architecture, etc.) and by throughput (small, medium, high), etc.

In practice, systems of one type or another do not exist in "pure" form. This is especially true for the production aspect where modes are usually combined. Therefore, it is advisable to classify them using the features presented.

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LINGUISTIC MEANS AND SOFTWARE FOR COLLECTIVE-USE TERMINAL REFERENCE SYSTEM [TSSKP] (LANGUAGE FOR INTERACTION OF END USERS WITH TSSKP)

[Article by A.S. Kovalev and G.I. Ksenda]

[Text] The main design principles and capabilities of a collective-use terminal reference system as well as the main characteristics of a specialized language of instructions that is intended for communication between a user and such a system has been examined in work [1].

This article presents a detailed description of the linguistic means (language of instructions) of this system.

The instructions for working with catalogs are intended for creating, updating, deleting, examiming, and printing catalogs.

The instruction PK makes it possible to print out the contents of a catalog on a printer furnished at a workstation. When necesssary, the catalog may be printed out on an alphanumeric printer (for PRINTER- or SPOOL-type terminals). The instruction has two operands, the name of the catalog and the name of the logical terminal for a printer.

The instruction UK makes it possible to delete a catalog from the "catalogs" data base, and the instruction has the operand "name of catalog."

The instruction IK makes it possible to change the name of the catalog. The instruction has two operands, the old and new names of the catalog.

The instruction KK makes it possible to create a new catalog with the characteristics of the existing catalog. The instruction has the operands "name of initial catalog" and "name of new catalog."

The instruction ChK makes it possible to examine the characteristics of catalogs. The instruction has the operand "name of catalog." After this instruction it is possible to send instructions having a deeper level:

    NMN makes it possible to read the name of the catalog,
    USL makes it possible to read the conditions for forming the catalog,

KAT makes it possible to read the characteristics of the catalog,
NACh makes it possible to read the names of the first 60 pieces of
    reference information in a given catalog,
ChTS makes it possible to read the names of the next 60 pieces of
    reference information in the given catalog, and
KONETs makes it possible to complete the examination of the
    characteristics of the catalog.

The instruction OK makes it possible to update the characteristics of the catalog and change the reference information in the catalog. The instruction has the operand "name of catalog." After this instruction it is possible to send the aforementioned deeper-level instructions, NMN, USL, KAT, NACh, ChTS, KONETs as well as the following added instructions:

TRD makes it possible to read conditions for demarcating access to a
    given catalog;
OBN makes it possible to update information obtained on the screen after
    the instructions USL, NMN, TRD;
VKL makes it possible to include the name of a piece of reference
    information in a catalog and hold it as an operand of the name of
    the piece of reference information;
UDL makes it possible to delete the name of a piece of reference
    information from a catalog and hold it as an operand of the name of
    a piece of reference information;
VK makes it possible to create a new catalog. The instruction has the
    operand "name of catalog." After this instruction it is possible to
    send the following deeper-level instructions:

    EKR makes it possible to include the names of pieces of reference
        information references in the catalog and has the operand "list
        of names of pieces of reference information";
    KAT makes it possible to include the names of all queries entering
        the existing catalog in the catalog being created. The
        instruction has the operand "name of existing catalog";
    SPR makes it possible to include the names of all pieces of
        reference information satisfying the conditions of the sampling
        in the catalog. The instruction has the operand "conditions of
        reference information sampling";
    KONETs makes it possible to conclude the formation of the catalog.

It is necessary to use the instruction OK to input names, formation conditions, and tables demarcating access to the catalog. This instruction makes it possible to to examine the catalogs' directories. After this instruction it is possible to send the following deeper-level instructions:

NACh makes it possible to read the names of the first 60 catalogs in the
    directory;
ChTS makes it possible to read the names of the next 60 catalogs in the
    directory;
IZM, PECh, and UDL make it possible to change the catalog's name, print
    it at the workstation, or delete it. These instructions have the
    previously described respective instruction formats IK, PK, AND UK;

KONETs makes it possible to complete the examination of the catalog's
directories.

The instructions for working with references are intended for creating,
deleting, updating, printing, and examining references.

The instruction PS makes it possible to print out the text of a piece of
reference information on printers with which workstations are equipped. When
necessary, the reference information may be printed out on an alphanumeric
printer (on PRINTER- or SPOOL-type terminals). The instruction has the
operands "name of reference information" and "name of logical terminal for
UPCh [not further defined]."

The instruction US makes it possible to delete a piece of reference
information from the "references" data base and "the archive"; the instruction
has the operand "name of reference information."

The instruction IS makes it possible to change the name of a piece of
reference information and has the operands "old name of reference information"
and "new name of reference information."

The instruction KS makes it possible to create a new piece of reference
information with the characteristics and text of an existing piece of
refernece information. The instruction has the operands "name of source
reference information" and "name of new reference information."

The instruction ChS makes it possible to examine the characteristics and text
of the pieces of reference information. After this instruction, the following
deeper-level instructions may be sent:

    NMN makes it possible to read the name of a piece of reference
        information;
    KRS makes it possible to read the conditions for retrieving (the result
        of indexing or key words) a piece of reference information;
    SPR makes it possible to read the attributes of a piece of reference
        information that is formulated automatically by the software
        components of a collective-use terminal reference system [TSSKP];
    NACh makes it possible to send the first page of a piece of reference
        information to the screen;
    ChTS makes it possible to send the next page of a piece of reference
        information to the screen;
    ChTP makes it possible to send the preceding page of a piece of reference
        information to the screen;
    SDV makes it possible to examine the text of a piece of reference
        information in a foward direction, shifting the text the specified
        number of lines. It has the operand "number of lines";
    SDN makes it possible to examine the text of a piece of reference
        information in a backward direction, shifting the text the specified
        number of lines. It has the operand "number of lines";
    PSK makes it possible to retrieve pieces of reference information having
        a specified context in the text and send the references to the
        screen, beginning with the line containing the sought-after text.

The context retrieval begins with the current line of the piece of
reference information under examination;

ChTk executes the retrieval and sends the last page of the piece of
reference information to the screen.

When working with pieces of reference information whose line length exceeds 79
characters, it is possible to use the following instructions:

SDL outputs the 79 left-most characters of the page of the piece of
reference information to the screen;

SDP outputs the right-most 79 characters of the page of the piece of
reference information to the screen;

UST sends the 79 characters of the current page of the piece of reference
information to the screen, beginning with a specified position in
the line. The instruction contains the operand "initial position in
line";

KONETs makes it possible to conclude the examination of the
characteristics and the text of the piece of reference information.

The instruction OS makes it possible to update the characteristics and text of
the piece of reference information. After this instruction, it is possible to
send deeper-level instructions. These include the instruction ChS as well as
the following instructions:

TRD makes it possible to to read the conditions demarcating access for
the given piece of reference information;

OBN makes it possible to update the information obtained on the screen
after the instructions USL, NMN, TRD, KRS, NACh, ChTS, ChTP, SDV,
SDN, SDL, SDP, UST, PSK, and ChTK;

VKL makes it possible to include pieces of reference information to
information after a specified line in the text. It has the operands
"line number for insertion" and "number of lines insertable." The
instruction may be sent after the instructions NACh, ChTS, ChTP,
SDV, SDN, SDL, SDP, UST, PSK, and ChTK;

ZAM makes it possible to replace an initial context with a specified
context throughout the entire text of a piece of reference
information. It contains the operands "intitial context" and
"context for replacement."

VNS makes it possible to insert information into the text of a piece of
reference information and form different masks. It contains the
operands "position number in the line for insertion of information"
and "text for insertion in all lines of the piece of reference
information."

The instruction VS makes it possible to include a new piece of reference
information. The instruction contains the operands "name of new piece of
reference information" and "flag of line length of piece of reference
information being created". After this instruction, it is possible to send
the following deeper-level instructions:

ChTN makes it possible to exit from examining the existing piece of
reference information and has the operand "name of existing piece of

19

reference information." The instructions NACh, ChTS, ChTS, SDV, SDN, SDL, SDP, UST, PSK, and ChTK may be used during the examination;

EKP forms a screen for inputting the text of a piece of reference information and does not have any operands;

FRM makes it possible to output special formats for making it easier to output pages of the pieces of reference information to the screen of an alphanumeric display [ATsD]. It has the operand "name of format." To use this instruction it is necessary to first describe the format by formatting the messages of the OKA [not further defined] system;

ZAP makes it possible to write the contents of a screen in the text of the piece of reference information being created and may be sent after the instructions EKR, FRM, or the instructions for examining a piece of reference information. It has the operand "number of lines writable";

KOP makes it possible to include the text of an existing piece of reference information in the text of the piece of reference information being created. It has the operands "name of existing piece of reference information," "number of initial line of text of existing piece of reference information for copying," and "number of copyable lines." The instructions KOP, ChTN, and ZAP make it possible to combine the test of several pieces of reference information.

KONETs makes it possible to finish including a new piece of reference information.

It is necessary to use the instruction OS to input a name, retrieval conditions, the brief contents, and tables demarcating access to a piece of reference information.

The instruction SS makes it possible to examine the directories of pieces of reference information.

After this instruction it is possible to send the following deeper-level instructions:

NACh makes it possible to read the names of the first 60 pieces of reference information of the directory;

ChTS makes it possible to read the names of the NEXT 60 pieces of reference information of the directory;

IZM, PECh, and UDL make it possible to change the name of a piece of reference information, print it at a workstation, or delete it. These instructions have the respective instruction formats IS, PS, and US, which were described previously;

KONETs makes it possible to conclude the examination of the pieces of reference information.

The instruction FM is intended to format the screen of an alphanumeric display. As a result of executing this instruction, it is possible to call up different decision tables on the screen of an alphanumeric display. The instruction FM is analogous to the instruction "/FORMAT Name" in the OKA

20

system, which may not be used when executing interactive programs and assumes preliminary design and generation of the required format by formatting the messages of the OKA system. The instruction has the operand "name of format." Using the instruction FM makes it possible to simplify algorithms for the interaction of different categories of users with the TSSKP. Subsequent use of FM instructions for different formats makes it possible to design specialized dialogue in the "RUKOVODITEL" [manager] mode. In the last stage of such a dialogue it is possible to input one of the operating instructions with catalogs or pieces of reference information.

The instruction KONETs makes it possible to conclude work at the given level and work with the TSSKP as a whole.

A special operating mode for an interactive program for processing user instructions (TSDP), RUKOVODITEL, during which the user used a limited set of instructions and inputs them with the help of programmed function keys or a photoselector, is provided to make the operation of the controlling structure easier. In this mode the user has access to any information.

The user's scenario dialogue is designed by the system administrator and makes it possible to implement the hierarchical retrieval of necessary information. The operation begins with the input of a special task code from a specified workstation. After this, a list of subjects is output onto the screen of an alphanumeric display. The necessary subject is selected either by a photoselector or with the help of a programmed function key. The subject selected may contain an additional list of subjects, each of which can in turn consist of several subjects. Selecting the next subject, the user implements a hierarchical retrieval of the necessary information. The depth of the retrieval may be arbitrary. In the next stage of the retrieval, it becomes possible for the user to examine the necessary piece of reference information. The examination of the piece of reference information is carried out by paging through the pages foward and backward. After the examination of the piece of reference information is concluded,the user exits to the first list of subjects of the highest level of the hierarchy.

Functions involved in demarcating access to lists and catalogs for different categories of users and different operating modes are executed in a TSSKP. The source data are tables demarcating access that are created for each piece of reference information and each catalog. The demarcation of access is accomplished by checking the user's authority by comparing his or her identifier and the table demarcating access to the references/catalogs of the instruction code entered. The user's identifier is entered in a field with increased brightness. The user who created the piece of reference information or catalog is responsible for preparing the table demarcating access. In the absence of an access demarcation table the user is permitted to execute any instructions for the given catalog or piece of reference information.

When working in a catalog- or piece of reference information-reading mode, the user is unable to obtain information from the access demarcation table and the attributes of the piece of reference information and catalog that would permit him to avoid checking for access demarcation. This information is only accessible in a piece of reference information/catalog-updating mode after the

user is given access to this type of oepration.

The access demarcation table is registered in the piece of reference information/catalog-updating mode and contains information with the following structure:

,IDENTIFIKATOR-F,.......,IDENTIFIKATOR-F,

where IDENTIFIKATOR is the user's identifier, which consists of a line 1 to 20 characters in length, and F is the flag of the accessible instruction codes for the given identifier, which takes the values K for all instruction codes and Ch for instruction codes that do not modify the piece of reference information/catalog.

When working with a TSSKP, it is possible to use means of demarcating access (protection) for instructions and task codes (transactions). Two types of protection are possible, password and terminal. When password protection is used, instructions and task codes are processed when a correctly specified password is entered together with an instruction or task code. When terminal production is used, protected instructions and task codes may only be entered from specified logical terminals.

The complex use of means for protecting TSSKP and the OKA system and the implementation of organizational measures when creating a computing process provides reliable demarcation of access during work with catalogs and references.

Using TSSKP in systems of different design makes it possible to automate the information and reference information functions of designers and planners and provides the possibility of evolutional development from centralized to distributed information processing.

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USING MACHINE-ORIENTED MASTER DOCUMENT FOR DESIGN DOCUMENT FOR PURPOSES OF INTRODUCING SCIENTIFIC-ENGINEERING ACHIEVEMENTS

[Article by S.N. Konoplev from the Moscow Urban Territorial Center of Scientific Information and Propaganda]

[Text] The task of introducing scientific-engineering achievements into production is of primary importance in the country's economy at the present time.

There have been a number of scientific-engineering achievements in the field of nonstandardized equipment for enterprises being built or redesigned.

Above all, this equipment includes equipment that has been provided for in approved engineering (technical manufacturing) plans and estimates for major construction and that has been manufactured pursuant to occasional (single) orders by associations, enterprises, or construction and assembly organizations based on ordered specifications and sketches of design-engineering organizations and that is not repeated, but only used by virtue of special engineering decisions in a plan [1].

The main stages of the technology for organizing the introduction of such scientific-engineering achievements are as follows:

> obtaining reference awareness information about existing developments meeting the information need,
> obtaining design documentation for the development of interest,
> manufacturing products based on the documentation obtained by internal efforts for placing an order with another organization.

If the first stage of the technology is sufficiently developed (there are branch and interbranch systems of scientific-engineering information that provide users with reference awareness information in both traditional and automated modes), then the second and third stages have been researched and developed to a much lesser degree.

Improving operations in the second stage depends on the speed of obtaining design documents for "circulating" innovations.

More than 100 interbranch territorial scientific-engineering information [NTI] organs, which have been united into the All-Union System for Providing Enterprises and Organizations With Design and Production Documentation for Nonstandardized Equipment, are working on the problems of compiling and disseminating design documentation in the State System of Scientific-Engineering Information [GSNTI].

At present, up to 10 million pages of design documentation with the AI format have been disseminated. Creating a system to provide design documentation has made it possible to significantly improve the state of operations on the first two stages because it has become possible for the user to select the developments of interest to him or her from reference awareness information and to obtain the necessary set of working documentation.

In accordance with the order that has been established in the country, all enterprises and organizations are obliged to send information charts for the innovations they have developed to the interbranch territorial NTI organs (republicwide institutes of scientific-engineering information [RINTI] and territorial centers of scientific-engineering information [TsNTI]). After analyzing these charts, the specialists at the TsNTI select the innovations for which they need to obtain a complete set of design documentation, proceeding from the degree of innovation, economic and social impact, and possibility of using it at other enterprises.

The design documentation is selected, stored, and disseminated in sets. A technical description of the design is included into the set that is deposited in the fund of the interbranch territorial organ of scientific-engineering information together with a set of working sketches and other documents. It includes the following data:

> name of the enterprise at which the given design was developed,
>   manufactured, and introduced and the quarter and year of introduction;
> purpose and area of application of the design;
> description of the design and its operating principle;
> specifications;
> impact from its introduction;
> existing flaws in operation (environmental pollution, noise, etc.).

Information about design documents for engineering innovations is delivered to the user by traditional methods or by use of the Republicwide Automated System for the Retrieval and Dissemination of Information in the RSFSR and Other Automated Systems in the Union Republics [RASPRI-1].

The traditional methods include publication of information letters about design documentation and reports based on these that have been prepared on cards of the All-Union Card Catalog of the Tracing Holder, which consists of three series, industry, construction, and agriculture.

Provision of information about design documentation through the RASPRI-1 is accomplished on the basis of a data base about advanced production. The centralized production of this data base is accomplished manually by the

Volgograd TsNTI. Reference awareness information is delivered to the reader in both a question-and-answer mode and a mode of selective dissemination of information.

Design documentation sent to the address of enterprises and organizations of the RINTI and TsNTI is a question-and-answer mode based on reference awareness information.

It was necessary to develop a unified form for a machine-oriented document formed at the RINTI and TsNTI in order to determine the requirements for reference awareness information about design documentation providing for precision of the documentation request and also to eliminate duplication when preparing it for entry into a data base on advanced production experience and the All-Union Card File of Drawing Repositories. Thus, the document is a machine-oriented master document for the design document established by the GSNTI and made effective beginning 1 Jan 1984 [2].

The master document includes the following main requirements:

Universal Decimal Code [UDC];

size of set of design documentation in sheets of AI format;

cost of set of design documentation;

name of design (the name existing on the set and general sketch is
   assigned);

number of the set of design documentation (it consists of three groups of
   digits that are separated from one another by dashes, with the last
   two digits indicating the year in which the set was deposited in the
   fund of the RINTI and NTI and a three-digit ordinal number of the set
   and ordinal index of the interbranch territorial organ of NTI in
   accordance with the Classification System of Organs of NTI, which was
   established by the Administration of Scientific-Engineering
   Information and Propaganda of the GSNTI on 2 Mar 1982);

information about the presence of an authorship certificate for the
   design described and its demonstration at an exhibition;

information about the organization and developer and about the enterprise
   at which the given design was introduced;

data about the nature of the innovation, including whether the design has
   analogues among existing designs, has an analogous design but better
   indicators, is completely analogous to an existing design, or is a
   small-sized more efficient proposal;

information about publications on the design deposited in the fund of the
   RINTI and TsNTI (information sheets, posters, journals, card files,
   etc.)

information about the associates of the RINTI and TsNTI who selected the
set of design documentation and deposited in the fund;

cost of developing the set of design documentation and data with the
annual economic effect.

Using a machine-oriented master document for a design document makes it
possible to significantly reduce the times of introducing scientific-
engineering achievements and economize monetary resources by eliminating
duplicate developments.

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EXPERIENCE OF INTRODUCTION AND MANAGEMENT OF CLASSIFICATION SYSTEMS IN USSR MINISTRY OF POWER AND ELECTRIFICATION

[Article by S.I. Alekseyeva, I.D. Dzhura, and L.M. Postnova from the Soyuztekhenergo]

[Text] The introduction of the All-Union Classification System for Enterprises and Organizations [OKPO] at the USSR Ministry of Power and Electrification [Minenergo SSSR] made it possible to provide users with classification system codes for all levels of management.

The all-union identification codes of the System of Designations of Objects of the Terrritorial Administrative Division of the Union of the USSR, Union Republics, and Other Population Centers [SOATO], the All-Union Classification System of the Branches of the Economy [OKONKh], the OKPO, and others are used in all forms of planning documents, statistical and accounting reports, material and technical supply, and product lists when processing information using modern computer techology.

Introduction of the OKPO is of great importance under conditions of the creation and functioning of an automated control system [ASU] because, as objects of the classification system, enterprises and organizations are the main links in the area of planning, accounting, and administration. In other words, they are the sources and, at the same time, the users of the information.

Two classification systems operate in the Minenergo, a branch system and the branch section of the OKPO.

The branch classification system is used for internal tasks of the branch at all management levels. The branch section of the all-union classification system is used at the interbranch level of management.

Because of the complexity of the Minenergo, a unified file of the branch classification system and the branch section of the all-union classification system (KPO-2) was developed for convenience in using the branch and all-union classification system codes. The KPO-2 consists of code designations and names of objects.

Structurally, it may be represented in five blocks.

Blocks 1 and 3 reflect the content and structure of the branch classification system (code of object, control number, name of object).

Blocks 2, 4, and 5 correspond to the branch section of the OKPO (code of object, control number, name of object, and codes according to the SOATO and OKONKh correlated with the given object).

The size of the classified set is 7.1 x 10,000 objects.

The branch part of the classification system reflects the existing structure of the Minenergo.

```
                                          XX       XX       XX      X
                                           |        |        |      |
Main administration, all-union             |        |        |      |
production associations, etc.              |        |        |      |
_____       |        |        |      |
                                           |        |        |      |
Trusts, production associations,           |        |        |      |
management of construction (based          |        |        |      |
on the legal rights of trusts) of          |        |        |      |
the power generation system                |        |        |      |
_____   |        |        |      |
                                                    |        |      |
Enterprises                                         |        |      |
_____    |        |      |
                                                             |      |
Control number                                               |      |
_____ |      |
```

Such a structure of the classification system makes it possible to implement the on-line retrieval and servicing of users of the management system. The management system of the classification system in the branch has the following three levels:

Level 1, the main organization with respect to managing the classification system in the branch, implements the creation, introduction, and management of the classification system as well as further improvement of the management system and organizes the steady service of leading (base) organizations and the users attached to them with information concerning the classification system;

Level 2, the leading (base) organization, provides services to users attached to it relating to the OKPO and KPO-2;

Level 3, the users of the management system, are the users of the classification system.

Orders as well as directive materials related to changes in the organizational structure of the Minenergo are the source of changes in the classification system.

To make changes in the branch part of the all-union classification system, the head organization fills out a standard form, a notice, and sends it to the Main Computer Center of the Central Statistical Administration of the USSR [GVTs TsSU SSSR] together with copies of the orders or directive materials.

The management system that is operational in the Minenergo makes it possible to to provide users with steady information in a timely manner.

An automated system for managing the classification system on a minicomputer (type SM-1600) and computer (not lower than the YeS-1033) is currently being developed in the head organization of the branch.

The automated management system makes it possible to implement the on-line retrieval and storage of information about changes in the classification system on magnetic carriers as well as to provide users of the classification system with information in a timely manner.

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AUTOMATED SYSTEM FOR MAINTAINING ALL-UNION CLASSIFICATION SYSTEMS IN MINISTRY OF TRACTOR AND AGRICULTURAL MACHINE BUILDING

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 8, Aug 86 pp 20-22

[Article by V.M. Solovyev and V.Ye. Marmazinskiy from the Tula department of the Main Special Design and Production Bureau]

[Text] The Ministry of Tractor and Agricultural Machine Building [Minselkhozmash] has placed the second stage of a branch automated system for managing the all-union classification systems of technical and economic information (OASVOK-2) into industrial operation. The following were included in it:

     class 47 A-OKP (branch department with a size of not more than 30,000
         positions),
     class 47 I-OKP of the CEMA (branch department),
     All-Union Classification System of Enterprises and Organizations [OKPO]
         (branch department),
     class 467 A-OKP (product list used in the branch),
     K-OKP (Higher classification groupings of the All-Union Classification
         System of Industrial and Agricultural Information [VKG OKP]).

In comparison with the first phase, a number of functions expanding the capabilities for retrievel of information with resepct to class 47 A-OKP have been implemented in the OASVOK-2.

Depending on the use of the All-Union Classification System of Technical and Economic Indicators [OK TEI] in the branch for each of the classes, a different approach was used for each during the creation of its automated management system. Thus, special software and individual data bases using the YeS 6.1 operating system and YeS-1045 computer were created for the automated management systems for classes A-OKP and I-OKP CEMA. The automated management system for the OKPO and class 46 A-OKP were constructed on the basis of a branch management information system (the ASU-Selkhozmash).

Standard requests from users of the OASVOK-2 are shaped in the form of a letter or on forms that have been established by the State Committee for Standards [Gosstandart] in policies concerning management of the OK TEI, OKP, and OKP CEMA. The request is transferred to special forms in order to enter

the information into the computer at the Tula department of the Main Special Design and Production Bureau Automated Control System [GSKTB ASU].

Execution of tasks by the OASVOK-2 in response to typical requests makes it possible to obtain the following documents:

  notices of changes in the standard of class 47 A-OKP in the form of hard copy (changed pages), which are sent to the GNITsVOK [not further defined] of the Gosstandart;

  printouts for visual retrieval of codes of class 47 A-OPK based on index marks or identification flags;

  printouts for visual retrieval of objects of the OKPO according to their location and name.

The practical use of the individual automated management systems or their tasks has been accomplished in proportion to their development for making the OASVOK-2 operational. When necessary, additional tasks that were not stipulated in the technical assignment for the OASVOK-2 have been developed. Thus, when the OASVOK-2 was being designed, the requirements of the Gosstandart made it necessary to create a standard for class 47 A-OKP in hard copy and on a machine carrier and send it to the GNITsVOK. Two special tasks were developed that provided for converting information from the classification system that had been previously created in the branch to the respective forms of the standard in the form of hard copy and a communicative format.

To increase the quality of the information sent on magnetic tapes, an off-line program for checking information based on the OK TEI was developed under the methodological supervision of the GNITsVOK in the head organization with respect to the OK TEI, the Tula department of the GSKTB ASU.

When the OASVOK-2 was being developed, most of the attention was placed on expanding the functional capabilities of the system when managing class 47 A-OKP.

The following functions are implemented in the automated management system:

  creation of a file for the classification system (main file),
  file correction,
  output of information (printouts) in a batch processing mode based on standard requests.

Standard requests are intended to output the following:

  individual positions of the classification system based on code, index mark, or identification flag;

  groups of positions of the classification system based on the range of codes;

  all positions of the classification system with sorting by codes, identification marks, or identification flag.

31

It is proposed that the OASVOK-2 be improved in the following directions:

make it possible to have bilateral information exchange on magnetic tapes
according to the OK TEI in a communicative format, and above all for
class 47 A-OKP, between the Tula department of the GSKTB ASU and
GNITsVOK;

eliminate the double (for the automated system of managing the OK TEI and
OASVOK) preparation of changes based on class 47 A-OKP on machine
carriers;

expand the number of automated functions;

increase the quality of information about changes in class 47 A-OKP that
is sent to the GNITsVOK by additional program checking (compared with
the offline check program that has been assimilated);

improve the time characteristics of the operation of individual programs
to reduce the time spent on information processing.

This will make it possible to increase labor productivity when managing a
large-size classification systems.

Operations to increase the system will be carried out on the basis of new
standard decisions at the all-union level that have been made by the GNITsVOK
and that take the introduction of personal computers into account.

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EXPERIENCE OF CREATION OF REPUBLIC AUTOMATED SYSTEM FOR MANAGEMENT OF ALL-UNION CLASSIFICATION SYSTEMS OF TECHNICAL AND ECONOMIC INFORMATION IN ESTONIAN SSR

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 8, Aug 86 pp 22-24

[Article by Candidates of Economic Sciences Kh. P. Kaps and I. A. Kyumnik from the Computer Center of the Gosplan of the Estonian SSR]

[Text] The Estonian SSR has more than 20 management systems for the All-Union Classification System of Technical and Economic Indicators [OK TEI]. Almost all of them are narrow-sector systems at the union republic level.

The second stage of the Estonian Republic Automated System for Management of the All-Union Classification Systems of Technical and Economic Information [RASVOK TEI] was placed into industrial operation in November 1985. The system is used to manage the following:

>   All-Union Classification System [OK] and Republic Classification System
>   [RK];
>   All-Union Classification System of Enterprises and Organizations [OKPO]
>   in the ESSR Gosplan, interdepartmental organizations, and planning
>   commissions of the ispolkoms;
>   Republic Automated All-Union Classification System of Industrial and
>   Agricultural Products [RA-OKP] for the entire ESSR.

The system's main organization, the Computer Center of the ESSR Gosplan, monitors management of the OK TEI and Unified System of Documentation [USD] in all organs, departments, organizations, and enterprises in the boundaries of the republic. The given system, which is a part of the republicwide part of the automated system for managing the OK TEI, is based on the OKA data base management system in a batch processing mode. Teleaccess is used for forming input data sets.

Compared with the first phase, the system has a new data base structure, which makes it possible to reflect the structure of each OK TEI and its internal and external connections. It has also become possible to have unlimited input into the data base of the new OK TEI.

Together with the ESSR Planning Institute, the Computer Center of the ESSR Gosplan has input most of the OK TEI that are necessary to the republic into a computer. Their total volume is 5.4 Mbytes. A data base was thereby created for coding state administrative organs, duties, settlements, regions, organizations, enterprises, the product list of the republic's production, and other objects.

The RASVOK TEI mainly provides services to the Planning Institute, ministries and departments that are subordinate to the republic, and departments of the ESSR Gosplan. In 1985 (beginning in the fourth quarter), a number of republic societies involved in production, the rayon ispolkom of the capital of the republic, many computer centers of ministries subordinate to the union and republic, and some union institutions and enterprises concluded economic contracts with the Computer Center. The number of contract users of the RASVOK TEI grew fourfold compared with 1984.

The main contract services were informing users about OK TEI being issued, draw up orders to acquire them, provide the RK TEI developed by the Computer Center, and provide consultative services on plants for RK TEI, etc. In individual cases, the computer centers provided additional services to users. For example, the Computer Center provided the Computer Center of the ESSR Ministry of Local Industry with two voluminous printouts of the OKPO regarding the RSFSR. New users were acquainted with the structure and content of the OK TEI. Moreover, their interests were identified together with more suitable forms and service procedures.

Information was exchanged between the RASVOK TEI and system users by obtaining printouts of the classification systems, their sections, and different samples of changes in the classification system. In the printouts all positions have a standard order of blocks and, where possible, are printed in alphabetical order. A composite code is presented in the code block in multidimensional OK TEI.

At the present time, users of the RASVOK TEI do not generally have independent structural units with respect to classification and coding, which causes certain difficulties in using the OK TEI. The staff members of the Computer Center provided consultations on location for system users in order to provide instructive and methodological assistance in using the OK TEI.

Work has begun on translating the OK TEI into the UNIBAD data base management system for purposes of centralized management of the OK TEI in the republic economy of the ESSR. Computer technology is being updated. In managing the OK TEI, the Computer Center of the ESSR Gosplan has close contacts with the collective-use Computer Center of the Central Statistical Administration of the ESSR [VTsK TsSU ESSR], the Computer Center of the Estonian Republicwide Center of Standardization and Metrology, the republic administration of the Gosstandart, and the RIVTs [not further identified] of the ESSR Ministry of Communications. In the future the development of a republicwide network of computer centers will necessitate realizing the capability of a network for data transmission and distribution of data banks.

Interaction of the RASVOK TEI with an automated system for managing the OK TEI has been implemented on the level of paper carriers. In the context of the further development of an automated system for managing the OK TEI, the Computer Center must orient its information service regarding the OK TEI toward network technology. This assumes obtaining the necessary instructional materials and OK TEI on magnetic tapes. In addition, as the head organization with respect to the OK TEI and USD, the Computer Center must obtain print editions of the OK TEI through on-line circulation.

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COMPUTERIZED PRIMER

Moscow LENINSKOYE ZNAMYA in Russian 25 Oct 86 p 3

[Article by Angel Andreyevski: "A Computerized Primer"]

[Text] A meeting to hear reports and elect officials is to be held today for the Moscow Oblast Branch of the Soviet-Bulgarian Friendship Society. With each passing year, mutual cooperation and the exchange of experiences between the capital regions of our fraternal countries continue to expand. Published material prepared with the cooperation of the Sophia Press agency tells of the interesting experience of creating an automated system for collecting and processing agro-meteorological information, which operates in the Sredets agro-industrial complex in the Sophia district.

There is a small, well-maintained building near the village of Chepintsy in the Sophia district. A sign on the building says: Experimental automated system for collecting and processing agro-meteorological information for harvest control at the Sredets agro-industrial complex. What does it mean?

The rapid spread of scientific and technical progress in all walks of life has made it almost impossible for a single specialist or even a single institute to solve complex computer problems. Therefore, programming collectives are being created in many sectors of the national economy, thereby carrying out the decisions of the 13th Bulgarian Communist Party Congress. One such collective, consisting of representatives from a number of institutes (the Institute for Soil Science and Harvest Programming im. N. Pushkarov, the Institute for Plant Conservation in Kostinbrod, the Bulgarian Academy of Sciences Institute of Cybernetics and Robotics, the Institute for Instrument Building, and the Institute of Radio Engineering and Technology) has developed a system for harvest control by means of the automated collection and computerized processing of agro-meteorological information. This is done by using specially created sensors mounted on a platform next to the station. The sensors measure the air's temperature at a distance of 1-3 meters from the earth's surface, soil temperature to a depth of 5, 15, 40, and 80 centimeters, soil moisture content to a depth of 20, 40, and 70 centimeters, humidity, wind speed, precipitation, solar radiation, etc.

The sensors are connected to a personal computer, to which the agro-meteorological information is channeled and processed, giving a picture of the regions's microclimate and soil conditions.

Ivan Karaleyev, candidate of the technical sciences and section manager at the Institute of Radio Engineering and Technology, says:

"We have created a radio program that manages the transmission of information from the sensors to the computer, including sensors located on a platform near the village of Lozen, i.e., 20 kilometers from the station.

"With certain combinations of data that describe the meteorological situation which are juxtaposed with additional specific indicators, it is possible to forecast the probable advent of disease or pests during critical periods of grain plant development. By means of this automated system, it has become possible to process a large amount of analytical data on the computer, which produces a solution -- should necessary action be taken immediately, or should we wait.

"The information system for the status of acreage under cultivation is very important for harvest control, and is based on soil, climatic, agro-engineering, agro-chemical, and operational production characteristics of each territorial unit of the Sredets agro-industrial complex. In this way, it has become possible to observe crop development under different soil and climatic conditions. All of the information is located in five computer files, which serve as a computerized primer for the agronomist, helping in the struggle for fruitful harvests."

We took the opportunity to ask programmer Mariana Azhambazov to "query" the computer about new weather data. She pressed some keys, and the inscription "Soil temperature at the depth of 5 centimeters is 28 degrees, 15 centimeters -- 22 degrees, 40 centimeters -- 20 degrees" appeared on the screen.

The authors of this for-now experimental automated system for harvest control through agro-meteorological information collection and processing believe that the time is not far off when similar stations will operate all over the country.

12713
CSO: 1863/136

MATHEMATICAL MODEL OF EVOLUTION OF DEMOGRAPHIC BEHAVIOR. I. THE BASIC MODEL. NATURAL SECTION OF BEHAVIOR

[Article by A.Yu. Buzin and I.G. Pospelov, Moscow]

[Abstract] Models describing social phenomena are frequently based on Darwinian concepts involving optimality of behavior, but the criteria used for optimality are sometimes unfounded. This article studies self-reproducing systems described by the value of a characteristic π from a certain set Π. Each system can die or reproduce, the processes depending on the value of π. These birth and death processes change the distribution of the numbers of systems having each characteristic. It is possible to arrive at a state in which all remaining systems have the same characteristic π^*. The asymptotic properties of the demographic processes are thus used as the basis for the study, the results of which are illustrated by numerical examples. The model is stated to be suitable for demographic studies in primitive human communities. Figures 2; references 16: 15 Russian, 1 Western.

PRODUCTION-TRANSPORT PROBLEM OF OPTIMAL PLACEMENT OF ENTERPRISES CONSIDERING THE SEQUENCE OF THEIR CREATION

[Article by N.D. Astokhov, Moscow]

[Abstract] A study is made of the problem of finding the minimum of the goal function in the set of all possible ordered subsets of a finite set, in which the goal function is the sum of a known form of super modular function, the value of which is independent of the sequence of the elements in the subset, and a function defined in an ordered subset. This is utilized to develop a

combinatorial algorithm with a system of running through versions and rejection rules similar to that used in successive computation algorithms. References 5: Russian.

OPTIMAL CONTROL IN DEVELOPING MULTICRITERION PRODUCTION SYSTEMS

[Article by B.A. Vlasyuk, Moscow]

[Abstract] In previous studies, the structure of control in economic systems was studied from the standpoint of optimal distribution of resources. The present article, a continuation of the earlier works, analyzes the same problem from the point of view of optimal functioning of a system of manufacturing facilities. An input-output dynamic model of the manufacturing element is constructed in the form of a problem of optimal control based on combining the ideas of production functions with the idea of active behavior and simultaneous consideration of production and financial flows. By connecting several such models with input-output connections, a model of the production system is generated which is similar to a multiple-branch model with nonlinear production functions and linear interbranch balance equations, yet is an active system. Algebraic equations are introduced for determination of the stable exponential development mode of such a system. Figures 4; references 7: Russian.

QUASI-ORDER DESIGN PROCEDURE IN A SET OF MULTICRITERION ALTERNATIVES BASED ON RELIABLE INFORMATION OF PREFERENCES OF THE PERSON MAKING THE DECISION

[Article by L.S. Gnedenko, O.I. Larichev, Ye.M. Moshkovich and Ye.M. Furems, Moscow]

[Abstract] A new method is suggested for quasi-order design, utilizing correct procedures for producing information on the preferences of the decision maker, including a special procedure for determining and eliminating contradictions in the information obtained from the decision maker. The method of transition

from information on preferences of the decision maker to a decision rule in which independence of criteria is tested and the transitive nature of the binary preference relationship is utilized is new. The quasi-order is constructed directly from information obtained from the decision maker reflecting his preference in meaningful concepts without transition to any quantitative estimates, thus attempting a concrete foundation for the first and second stages of the quasi-order construction method in a set of multicriterion alternatives. The procedure for quasi-order construction in the set of estimate vectors is a set of algorithms implementing a dialogue between the decision maker and the computer. It is based on descriptive studies in the area of decision making, defining the type of information which can be reliably obtained from a decision maker. The procedure is closed, including a test for consistency and elimination of contradictions in the information on the preferences of the decision maker. It is distinguished by correctness of processing of the information obtained from the decision maker in order to construct a binary relationship based on its properties of transitiveness and independence of preference criteria. References 24: 18 Russian, 6 Western.

DIGITAL SYSTEM FOR COLLECTION AND PREPROCESSING OF HYDROPHYSICAL INFORMATION

[Article by V.A. Belomestinkh, V.N. Byukhin, A.N. Kasperovich, Yu.A. Popov, V.G. Sutyatin and Yu.V. Shalaginov, Novosibirsk]

[Abstract] A flexible, computer controlled, miniature system for collection and preprocessing of hydrophysical information is described, based on a digital method of processing data using the latest microcircuits. The system contains two specialized processors: a data preparation processor which performs parallel computation of spatial characteristics of signals and a special preprocessor, which heterodynes and filters signals with simultaneous reduction in the data stream transmitted to the computer system for subsequent analysis. The basic modules of the system are described in detail. An operating model of the digital data collection and preprocessing system for hydrophysical experiments has been built, and has shown good technical characteristics and demonstrated the possibility of software setting of parameters in a small, light-weight device. Figures 3; references 3: Russian.

SOFTWARE IMPLEMENTATION OF A LEARNING CLASSIFIER OF TWO-DIMENSIONAL FIELDS IN
A DIGITAL INFORMATION PROCESSING SYSTEM

[Article by G.I. Peretyagin, Novosibirsk]

[Abstract] A study is made of algorithms and programs for texture analysis and
classification of two-dimensional fields in a digital image processing system.
The main purpose of the software is comprehensive investigation of image
subsets to isolate texture characteristics allowing most effective classifica-
tion of data base on remote earth surface sensing. The algorithms are intended
to operate with the software of an image processing system containing a set of
standard OS-10 monitors of the YeS 1010 computer, plus programs allowing
efficient magnetic disk file access. The software described has been used to
classify types of ice fields and determine regression variation of productivity
of forests as a function of texture characteristics in aerial photographs.
Figures 4, references 13: 12 Russian, 1 Western.

USE OF ASYMPTOTIC EXPANSIONS TO ESTIMATE DISTRIBUTIONS OF NON-GAUSSIAN
STOCHASTIC PROCESSES (2. RESULTS OF MATHEMATICAL MODELING)

[Article by Y.Y. Baltrunas, V.Yu. Rudzkene and D.V. Cheponite, Institute of
Physical and Technical Problems of Power Engineering, Lithuanian Academy of
Sciences]

[Abstract] Results are presented from mathematical modeling of estimation of
the accuracy and properties of approximation of the empirical distribution
function F_N (x) of stochastic processes by a certain function G(x) by the use
of an asymptotic expansion. The approximation of $F_N(x)$ by the γ distribution
was also used to compare the results of approximation of the function by the
expansion. The purpose of the work was to determine the effectiveness of
practical application of the asymptotic expansion and γ distribution in
approximation of the distribution function. The statistical analysis shows
that the quality of the approximation can be characterized by a coefficient
K_1 and the form of the distribution $F_N(x)$. When the distribution is near
normal, the value of K_1 is one the order of 1-10. When $F_N(x)$ differs signi-
ficantly from normal, approximation of $F_N(x)$ by the asymptotic expansion is
senseless. If $F_N(x)$ is log normal or nearly so, a more accurate approximation
is provided by the γ distribution. Figures 4; references 5: 4 Russian,
1 Eastern European.

COMBINED CONTROL SYSTEMS IN ONE QUALITY DYNAMICS PROBLEM

[Article by V.A. Gelovani, Yu.F. Pronozin and V.I. Rabover, All-Union Scientific Research Institute of Systems Research, Moscow]

[Abstract] The problem discussed in this article adjoins the general problem of decreasing the dimensionality (aggregation) of dynamic systems, but is related to tracking of the quality properties of trajectories in phase space. References 6: 5 Russian, 1 Western.

ADAPTIVE CONTROL OF FINITE AUTOMATA WITH UNOBSERVABLE STATES

[Article by M.G. Konovalov, Computer Center, USSR Academy of Sciences, Moscow]

[Abstract] If A is a finite probability initial moore automaton $A = \{X, Y, Z, \Pi, M, p\}$, where X, Y and Z are finite sets of states, inputs and outputs, and Z is a set of numbers from the interval (0, 1); $\Pi = \{\Pi(y), y\epsilon Y$ is the transition function, i.e., the set of matrices of the probability of transitions of the states; $M = \{\mu(x), x\epsilon X\}$ is the output function, i.e., the set of distributions in Z; p is the initial distribution (in X), this article studies automaton A as an object of control. The inputs are interpreted as controls which can be selected, while the outputs are interpreted as the gains achieved. References 1: Russian.

This article introduces the concept of P-operators approximating the initial operators and suggests approximate computation algorithms for systems analysis. It is shown that the use of information on structure is useful in the solution of systems of equations describing behavior as a function of input and output. Models of dynamic systems are analyzed and questions of accuracy discussed. Looking upon structure as a dynamic system helps to construct structured-design algorithms and aids in the investigation of accuracy in response to changes in operator modules. Figures 6; references 13: Russian.

THEORY OF FUNCTIONAL DIAGNOSIS OF DISCRETE DYNAMIC SYSTEMS

[Article by V.V. Danilov and A.N. Zhirabok, Leningrad-Vladivostok]

[Abstract] The theory of functional diagnosis of linear dynamic systems and finite automata cannot always be applied in practice. A method for solving functional diagnosis problems in nonlinear systems, based on analytic definition of the systems, which would allow direct description of the controlling system, is required. In this connection, expandable discrete dynamic systems, intermediate between linear and nonlinear systems, are of interest for this case. This article develops the principles of the theory and produces an algorithm for synthesis of such a controlling system. An example of functional diagnosis of an expandable discrete dynamic system is presented. The method can also be applied to arbitrary discrete dynamic systems which are not necessarily expandable. Figures 5; references 6: Russian.

DESIGN OF LINGUISTIC DEVICES BASED ON FUZZY LOGIC

[Article by V.D. Baronets, Gorkiy]

[Abstract] This article studies the following problem: A system of fuzzy logic functions $\{\tilde{f}_1 (\tilde{x}_1, \ldots, \tilde{x}_n), \ldots, \tilde{f}_m (\tilde{x}_1, \ldots, \tilde{x}_n), \tilde{x}_i, \tilde{f}_j \in \{0, \ldots, 1\}$, $i=\overline{1,n}$, $j=\overline{1,m}$ is defined, the area of forbidden values $\{\alpha_p, \ldots, \alpha_s\}$ of the system is known and the primary areas of change $\{\alpha_r, \ldots, \alpha_t\}$ of variables

x_i are established. Find the new change areas $\{\alpha_r,, ..., \alpha_t,$ of variables x_i and the area of definition $\{\alpha_p, ..., \alpha_8'\}$ of the system. A constructive procedure for solving the problem is presented, consisting of successive reduction of each function $\tilde{f}_j$ of the system to a function of two variables $\tilde{f}(\tilde{x}_1, \tilde{x}_2)$ with definition in each stage of the area of change of the new variable, allowing construction of a matrix of values of the fuzzy logic functions which can be used to find the desired areas. Figures 4; references 5: 4 Russian, 1 Western.

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DIGITAL INTERPOLATORS OF CURVED TRAJECTORIES

[Article by N.S. Anishin, Krasnodar]

[Abstract] A method is suggested for constructing integer algorithms for digital interpolation or generation of curved function trajectories of arbitrary form. The algorithm is constructed by the method of estimating functions, starting with an optimal digital linear interpolation algorithm, which is applied repeatedly to the current tangent to the interpolated curve, with periodic refinement of the parameters of the line. The method is recommended for either hardware or software implementation. Proper selection of scaling factors can assure achievement of the required speed and accuracy. References 10: 6 Russian, 4 Western.

6508/13046
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ACTIVE IDENTIFICATION WITH ADAPTIVE CONTROL

[Article by A.M. Talalay, Moscow]

[Abstract] A recurrent procedure is presented for refining the parameters of the model of an object in which experimental plans are used. The article analyzes not the sequential feeding of special actions to the inputs of the object, but rather simultaneous changes of all input actions according to the experimental plan. The algorithm suggested is compared with the single-step algorithm of Kachmazh. The article therefore compares the best of the

single-step adaptation methods to the best of the multistep methods, based on the instantaneous method of least squares with a sliding window.
References 8: Russian.

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USE OF SEQUENCES OF SIGNALS IN CONSTRUCTION OF TESTS FOR NETWORKS OF AUTOMATA. II. NETWORKS WITHOUT FEEDBACK

[Article by A.G. Birger and Ye.T. Gurvich, Moscow]

[Abstract] A study is made of discrete devices, networks of arbitrary asynchronous single-output automata. The approach suggested in a previous work is extended to all networks, discussing only networks without feedback loops. The problem of constructing a test for a set of identical constant defects in external and internal poles of the network is solved. The study is limited to defects at the outputs of the network elements, since any other defect is equivalent to a defect at the output of an equivalent single-input repeater element. The algorithm developed illustrates the capabilities of using the generalized asynchronous sequence calculus developed in the previous study, which guarantees construction of a test if one exists. The method is an extension of the structure approach suggested previously. References 6: 3 Russian, 3 Western.

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ANALYTIC MODEL OF RANDOM MULTIPLE ACCESS TO A LOCAL AREA NETWORK

[Article by G.P. Basharin and V.A. Yefimushkin, Moscow]

[Abstract] Wideband local area networks providing random multiple access of work stations to the network by the ALOHA, carrier-sense multiple access/ collision detection and other methods are studied. An analytic model of such a LAN with a finite number of work stations and general cycled random multiple access protocol is suggested. An example is presented, illustrating the applicability of the model for the investigation of functional characteristics of LAN's of this type. Analytic stages include formalization of possible channel states, description of LAN structure parameters, production of nonzero vectors and matrices for the assigned structure and load parameters, and solution of a system of equilibrium equations. The model can be used to describe LAN's with deterministic multiple access token-type protocols, simplifying comparison of the probability and time characteristics of LAN's with different multiple-access protocols. Figures 5; references 18: 10 Russian, 8 Western.

6508/13046
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ESTIMATING INFORMATION RELIABILITY IN SMALL LOCAL AREA NETWORKS

[Article by V.S. Podlazov and P.Ya. Yalkapov, Moscow]

[Abstract] A study is presented of the error statistics in small local area computer networks. The reliability of information transmitted is estimated, and methods of information protection are discussed. Simple modular codes utilizing alternation methods are suggested to improve transmission reliability. The codes suggested satisfy the CCITT requrments only for independent errors

with bit distortion probability not over 10^{-6}. In combination with echo monitoring, information reliability is assured for bit distortion probability 10^{-6}. Figures 2, references 10: 7 Russian, 3 Western.

6508/13046
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COURSE ON COMPUTATIONAL MATHEMATICS AND COMPUTER TECHNOLOGY IN THE CHEMICAL ENGINEERING VUZ

[Article by A. I. Boyarinov, doctor of technical sciences and head of the computer technology department at the Moscow Institute of ChemicalEngineering im. D. I. Mendeleyev: "A Course on Computational Mathematics and Computer Technology in the Chemical Engineering VUZ"; first paragraph in italics in source]

[Text] A. I. Boyarinov is a doctor of technical sciences and the head of the computer technology department of the Moscow Institute of ChemicalEngineering im. D. I. Mendeleyev. The areas of scientific interest are: mathematical modeling and optimization of chemical-technological processes and application of computer technology in the learning process.

At present, a qualitative re-armament of practically all the areas of human endeavor is taking place because of the ubiquitous spread of computer technology. This phenomenon is accompanied by fundamental changes in existing technology, a quicker pace of scientific development, and what is no less important, the formation of a new kind of thinking on the part of today's engineers, scientific workers, and managers of production and science. Any delay in the mastering and use of computer technology in the national economy can lead to catastrophic growth with far-reaching negative consequences. In this regard, a special responsibility has been placed on the higher educational system for the training of scientific and engineering personnel that know how to use computers in the national economy. No engineer or scientific worker, having graduated from an institute of higher learning or university, can be considered a fully qualified specialist if he does not at least possess the knowledge and skills needed to use computers in his area of specialization. The introduction of the "Fundamentals of Informatics and Computers" course in the middle schools is without a doubt an important step in the propagation of general computer literacy. In turn, the schools of higher learning need to concentrate their efforts on addressing problems concerned with the implementation of higher-level computer training for their students.

How and what should future engineers and scientific workers be taught in the area of computers, in the institute of higher learning? There is hardly any one answer to these questions. Naturally, the future specialist in the development of computer facilities and the engineer-chemist-technologist have to receive computer training to a different extent and with a different orientation, just as their chemical engineering training has to be different.

The industry that produces computer hardware is now growing at a furious pace. Compared with the first one-of-a-kind models of the 1940s and 1950s, the efficiency of today's computers has grown by a factor of hundreds of thousands. Thanks to achievements in the technology of microelectronics, computer dimensions have decreased dramatically, their power requirements have been reduced, and the costs of computer storage for a unit of information and for a single operation have decreased by more than a million-fold! Today's machines include large and medium-size computers, small (mini-computers), and very small (micro-computers), as well as a wide range of microprocessor modules that make it possible to produce computer systems with the necessary functional capabilities.

Everywhere where there is a need to implement routine operations -- computations, the performance of a given sequence of actions, the generation of a reaction to a particular situation -- microprocessor-based computer systems that are distinguished by their relatively inexpensive cost and highly functional capabilities may be used effectively. The range of their use is practically unlimited. This includes the processing of measurements from various instruments (chromatographs, mass spectrometers, etc.), automated process control using the continous analysis of parameters, programmable changes to the operating modes of a variety of equipment, and many others.

A new direction in computer production, the personal computer, has recently undergone rapid development. The main components of this computer are the microprocessor and hardware for the input, output, storage, and transmission of information. The personal computer is at the complete disposal of its user, and can exchange information with other personal computers or with more powerful computers, if the user so desires. As a matter of fact, the personal computer can play the role of a terminal while maintaining its own computational resources. In so doing, most of its tasks are performed directly on the personal computer, and communication is established with the mainframe only if it becomes necessary to perform complex computations.

A significant advantage of the personal computer is its ability to operate independently of other users. A mainframe computer usually serves a network of terminal devices in a time-sharing mode. In so doing, a period of time is apportioned to each terminal, during which the computer serves that terminal. As more users work simultaneously in the terminal network, the less attention is paid to each of them, the longer the response time, and the less efficient is work conducted on the terminal.

What does it take to communicate with a computer? What does a specialist need to know and do in order to say that he is capable of using a computer in his work? There are several levels of skill involved with using a computer, according to which several types of specialists can be identified.

The systems programmer knows about and knows how to use the computer in order to create and refine operating systems, and makes possible the easy and efficient use of its resources.

The application programmer knows about and knows how to use the computer as a programmable computational system in order to create new application programs and packages that make it possible to solve various standard data processing problems by using specific computational algorithms.

The user knows about and knows how to use application programs and packages included in the computer's software in order to solve the problems that confront him.

We have left out computer hardware specialists, as well as computer operators who know a language for communicating with the computer but are primarily intermediaries in communicating with the computer for the above-mentioned groups of specialists.

Systems and application programmers are those specialists that create computer software and to a significant extent make easier the dialog with the computer for the most numerous group of specialists, the users. Programming is a special profession. In principle, a programmer may work for a user who gives him a specific task, while the programmer translates this task into a language that the computer understands, selecting and, if necessary, developing an appropriate algorithm for performing the task. This is the way it was in the dawn of the computer age. But as computer resources and automated programming have been refined, a significant part of the functions that were previously performed only by programmers have become available to users, as well.

It is obvious that the training of systems and application programmers has to answer a particular need: the creation of computer software, which is the basis of their profession. A user-oriented approach to computers should predominate in the engineering training of other professions that are not directly oriented toward the creation of computer hardware and software.

A user-oriented approach presupposes the availability of a computer equipped with sufficiently powerful software, at least in the area that the user needs in his everyday activities. In so doing, the user has to know how to correctly formulate his problem and use the appropriate program available in the collection of application program packages in the computer's software. However, in practice engineers deal with a variety of problems for which there are not enough of these packages. Therefore, a knowledgeable user has to not only know how to use an off-the-shelf program from an available package, but also know how to tailor some of the standard programs or even write his own program in order to solve his problem.

Communication between the user and the computer, if it occurs without the intermediary-operator, requires certain terminal operation skills. Here, communication with the computer takes place in the language of its operating system and makes it possible to call into execution various programs, enter input data, derive results, or create, modify, and execute one's own programs.

Unfortunately, the computer operating systems that are in use and being produced by industry differ significantly from one another and, in addition, are constantly being modified in the course of their development. The number of modifications of particular operating systems, called versions, can number in the tens.

The situation is somewhat better for high-level programming languages, although they are presently several hundred in number and still growing. At the same time, a relatively small number of programming languages has stabilized, and as a rule is included in the software of any computer. FORTRAN, ALGOL, COBOL, Pascal, PL/I, BASIC, and a few others belong to this group of languages.

In order to work directly on a computer terminal, it is necessary to know a particular set of instructions (commands) that are executable by the operating system. It does not make sense for the engineer-user to learn the commands of a number of operating systems. It is sufficient to have a general understanding of the use of possible commands and select those that are necessary for work when becoming familiar with a particular computer.

Today's high-level programming languages as a rule include a rather large selection of available operators (instructions) that make it possible to write various computational algorithms. Learning any of these languages in its entirety is still no simple task. At the same time, a substantially smaller number of operators contained in a particular programming language -- no more than 10-20 -- is usually sufficient to write the majority of user programs. As a rule, these essential operators, with subtle distinctions, appear in any programming language (with the possible exception of special problem-oriented languages), while the other language operators help to more effectively organize complex programs, making it possible to more efficiently utilize computer resources. Therefore, the majority of users does not need to make a special effort to learn programming languages. In everyday practice, it is enough to know only a few basic programming language operators for the available computer.

However, some degree of computer programming knowledge and the possession of elementary computer skills to some extent characterizes a user's computer literacy. A rather high level of mathematical training is also one of its most important characteristics. For example, it is possible to work with a computer system, using a financial system device or the "Sirena" airline ticketing system device, but not be computer-literate. At the same time, in solving problems that arise in the course of work by means of a pocket calculator, even without availing oneself of the services of a more or less powerful computer, it is possible to substantially increase this literacy.

A distinguishing characteristic of a computer-literate specialist is a particular style of thinking that is used in solving specific problems. In so doing, the mathematical formulation of a problem and the construction of a mathematical model play a significant role, which make it possible to abstract oneself from insignificant details, such as computations dictated by the problem's complexity, and concentrate one's attention on the primary and most significant interrelationships and mechanisms. In so doing, the need to use a

computer naturally arises from the nature of the problem, and its successful use is ensured by the mathematical correctness of the mathematical model that has been constructed.

An engineer, researcher, or scientific worker is only computer-literate when he defines and independently formulates a problem in his work that must logically be solved by using the computer. This occurs when problems that arise are thought out in depth, when there is a sufficient level of formalized thinking, and when there is the appropriate mathematical training.

A very important feature of the dialog between the researcher and the computer should be noted: positive feedback in the process of this dialog. This is dependent on the fact that, in solving a problem on the computer, its conditions and the sequence of computational operations that lead to the sought-after results must be stringently formulated. All of this forces the researcher to delve deeply into the essence of the problem and sometimes even completely rethink the initial problem statement after deriving its results. In so doing, the computer with its high computation speed not only helps to quicken the pace of scientific research, but also improves its quality.

At the Moscow Chemical Engineering Institute im. D. I. Medeleyev, the teaching of computer literacy for future engineers-chemists-technicians begins in the first semester of the first year. In the initial learning stage, the main emphasis is on the development of the student's skills in directly communicating with the computer. Starting with their very first classes, the students have the opportunity to work independently at the terminal of a personal microcomputer. They master the basic techniques of working with the computer: writing a program, debugging it, running the program, and data i/o. In the very first class, students become familiar with the simplist forms of organizing data i/o, program and execute computations in terms of formulas, and write programs that generate tables of values for given functions. The theoretical training of students in the area of computational mathematics by means of a lecture course is conducted in parallel with laboratory work. Lecture material is reinforced in seminars, where the students examine the methods being studied in terms of their computer implementation.

Experience has shown that it is not necessary to systematically teach a programming language in a special course if a computer is available with sufficiently developed interactive capabilities, making it possible to input a program in interactive mode, i.e., with the capacity to issue error messages immediately after entering an operator. Familiarity with the main operators of a language occurs as computational methods are learned and the programs being written become more complex. The software developed at the institute for the "Elektronika DZ-28" microcomputer, including an operating system with compiler for source programs written in high-level languages, satisfies these conditions. A system for diagnosing errors in inputted programs is constructed in such a way that the computer will not accept an operator that has been entered if it contains an error or if it does not correspond to a specific syntactical construction. The inputting of a source program can only continue after entering the correct operator. In this way, programming syntax is directly learned in interactive mode, while entering a program, which

greatly hastens and simplifies the learning of skills for communicating with the computer.

The creation of conditions that make it easier to come in contact with the computer make it possible to pay more attention to one of the most important components of computer literacy: the ability to develop computational algorithms. Training is conducted with examples from the lecture course and is augmented with the actual checking of programs developed in the laboratory.

Students can use computer work skills attained in the first year and knowledge of fundamental computational methods in the laboratories of general and specialized departments, in carrying out their laboratory and course assignments. A deeper familiarity with algorithm-creating methods and various aspects of computerized applications in engineering work occurs in studying the subject of "Computer Applications in Chemical Technology," which is addressed in the fourth and fifth years and is augmented with a series of laboratory projects and course work. Here, students also obtain skills used in communicating with the SM-4 minicomputer, become familiar with the operating system of this machine type, and program problems in the FORTRAN-4 language. Along with general computer application questions in chemical engineering design and control, a number of standard problems are also examined (computing and modelling chemical engineering processes; data processing and estimating mathematical model parameters; optimization, etc.). Much attention is paid to an important point: the evaluation of computer-derived results, as well as the use of the computer as a tool for studying the properties of chemical engineering entities (the modelling of static and dynamic equipment characteristics).

Course work consists of solving a specific research problem in an area close to the student's future specialization, such as the processing of a particular quantity of experimental data in order to find certain kinetic constants in the chemical process and the subsequent design of equipment, using a given economic criterion. In solving the given problem, the student usually uses special application program packages, which makes it possible to spend more time on problem formulation, without being distracted by the plethora of questions related to detailed programming.

General and, in particular, specialized academic departments have to play an important role in training the engineer-chemist-technician to attain a sufficient level of computer literacy. In those departments where working on the computer has become the norm for the majority of instructors and their colleagues, students have a great opportunity to reinforce the knowledge they have obtained in studying the subjects "Computational Mathematics and Computers" and "The Application of Computers in Chemical Engineering." Experience has shown that the graduates of these departments leave the institute ready to deal with various unexpected situations that may arise in implementing computer facilities in various branches of the national economy.

As comrade M. S. Gorbachev noted in his report on the questions of hastening scientific and technical progress, at the June (1985) meeting of the Central Committee of the USSR Communist Party, "...the catalyst of progress is microelectronics, computer technology, instrument building, and the entire

informatics industry. They require a faster pace of development. Of course, much depends not only on the increased production of computers, but also on their skillful use in the national economy."

12713
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