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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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EDUCATION

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GENERAL

MOSCOW TV REPORT ON PC APPLICATIONS, PLANS

Moscow TELEVISION SERVICE in Russian 16 Aug 86

[Editorial Report] In its "Vremya" newscast Moscow TV carries a video report introduced by Tatyana Komarova on the growing importance of personal computers, which outlines in general terms how they can increase efficiency and labor productivity; the video shows shots of "Neyron 19.66" personal computers. As an example of how a computer can speed up a research project, a report on a new pharmaceutical compound is given.

Over shots of laboratory scenes the voice-over outlines how there has been a need to find a replacement for narcotics as pain-killing agents because of their undesirable side effects. The reporter goes on to interview one of the discoverers of a new compound, possibly called morfiong, which is a synthesis of morphine and a polymer. Introduced into the organism, it releases minute quantities of the painkiller over a 24-hour period. The interviewee, Professor V.I. Zhorov, points out that the compound does not induce tolerance and that it will be in production this year. The reporter concludes by saying that 15 years have elapsed from the time work first started on the compound to its final stages of production.

Tatyana Komarova reflects on how much time could have been saved on this research with the use of personal computers, and lists some of the factors that as yet hinder their universal introduction and application: the psychological barrier of understanding how convenient they are and their production. This cues into a report from Baku showing a schoolboy testing a 'Sapfir 40n' personal computer designed for schools.

Tatyana Komarova ends by asking V.G. Zakharov, deputy director of the USSR Academy of Sciences Informatics Problems Institute: "Could you please tell us--today there already exists a government program, it has been adopted, the figures are konwn for how many personal computers we have to produce over the 5-Year Plan. What must be done in order for this program to be fulfilled, because, as far as we know, there are serious difficulties at the moment."

Zakharov replies: "Inter-industry complexes have been set up, and that is our main task. But, alongside the obligation to coordinate, the inter-industry

complexes must also be given the right to implement these obligations. It is essential to change planning schedules somewhat--for example, 36 ministries are being used or are participating. It is evident that it is useful to implement planning in terms of problems and not between industries."

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HARDWARE

NEW VIDEO MONITOR IN PRODUCTION

Moscow LENINSKOYE ZNAMYA in Russian 21 Mar 86 p 1

[Article by A. Sokolov under the rubric "Reportage": "Light, Reliable 'Amber'"]

[Text] One of the key directions in the acceleration of scientific-technical progress has been the broad introduction and application of computer technology in all branches of industry and domestic life. It is natural that life has shown an increase in demand for it: it must be reliable, have the necessary operating speed, and it must be easy and comfortable to work with.

It was not so long ago that monitors used for professional as well as personal computers - one of the basic elements for the output of information - evoked criticism among specialists. They were bulky and their freatures were to their foreign counterparts.

But here at the Zaprudnenskiy Electro-vacuum Device plant, output has begun of the new "Elektronika MS 6105" video monitors, designed for wide use as displays for professional and domestic computers for the output of alpha-numeric information, for graphic representations, for the so-called "technical vision." V.A. Ivchenkov, senior technologist of the monitor assembly section of the plant discusses how the new model was put into production:

-The new monitor is substantially different from its predecessor, the ShchTsM 3.548.008. The "Elektronika MS 6105" (its daily name is the "Amber-8" ["Yantar'-8"]) is much more compact, modern in style, and its external appearance is much more elegantly developed. With its technical specifications the "Amber-8" can compete with its best foreign counterparts. In comparison to its predecessor, it has higher reliability, improved display quality, and increased resolution, which is of no small importance: operators who work several hours in front of the monitor will strain their eyes less. I would note that the new model weighs three times less than its predecessor, and the specifications of the cathode ray tube are improved.

The plant has been producing the old monitor for four years. Since May of the past year, without reducing its output, production of the

"Elektronika" began. Several test monitors were made, and production took place on the same shop floors of the plant. The plant specialists had to study many new operations, as, for example, the assembly of the components on the plates. They have received preassembled plates for the old monitor.

-But what has been done that is new, and what else is being planned in the section for improving the quality of manufactured articles and labor productivity? - I asked V.A. Ivchenkov.

-Today we are already conducting electro- and thermo-tests for the early appearance of defects in them. Testing the monitors for work capacity gives the opportunity to obtain the necessary material on the most vulnerable locations in the circuits and assemblies of the new monitor. This in turn allows us to significantly influence the quality of the product. We are planning in the near future to put into operation an automatic machine to solder the plates "by wave," and to form a section for automated purification of the conductors, which increases the efficiency of the labor of the assemblers.

And so, at the plant they have begun with prototypes of the "Elektronika MS 6105." And what are the prospects?

-I should say that of 125 persons working in the section, only 50 workers are occupied in the manufacture of the new monitor. Nevertheless, before the end of the year we are already planning to produce several thousand "Ambers."

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NEW SMALL COMPUTERS INTRODUCED

Moscow EKONOMICHESKAYA GAZETA in Russian No 15, Apr 86 p 17

[Article by P. Asaulchenko: "From the Family of Small Computers"]

[Text] At the amalgamated "Orlov Factory of Control Computers imeni K.N. Rudnev" production began of the first of a series of small computers - the SM-1210. This unit, a small local computer center, is designed for automated systems for the control of technological processes. By the amount of main and total memory and performance (1 million operations per second), it corresponds to the world level for computers of this type.

Yet another new product of the Orlov Machine-Building Enterprise from the family of small computers is the SM-1810. Its desk version is designed for automated work places for engineers and technologists.

In this Five-Year-Plan at the amalgamated plant not only has the product line of the computers produced been updated, but the volume of computers produced has increased significantly, by 1.8 times, without an increase in the number of workers.

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PERSONAL COMPUTERS

Moscow EKONOMICHESKAYA GAZETA in Russian No 21, Apr 86 p 15

[11th installment of article by Professor V.A. Myasnikov, chief of the Main Administration of Computer Technology and Control Systems of the State Committee for Science and Technology [GKNT]]

[Text] In the preceding installments we became familiar with such classes of computers as the ES (general-purpose) and the SM (small control system) computers. Minicomputers are the computers most oriented towards the solution of the user's non-computational tasks. Characteristic traits of this class of computer are its expandability, adaptability and accessibility for interaction with other equipment. Depending on the realm of application, minicomputers permit expansion of their capacity and variation of their configuration within the broadest ranges. Such possibilities of minicomputers have allowed the development of the concept of problem-oriented units (POK's), and present hardware and software for the solution of problems in a specific real of application.

The next stage in the development of the POK was the creation of microcomputers based on microprocessors. The appearance of this class of computers, which are not inferior in their functional possibilities to minicomputers, has formed the basis for the mass utilization of computer technology in control systems at various levels - from a device or separate installation to the creation of automated sections, shops and entire enterprises - and has broadened the product line of POK's. At the same time a reorganization of labor was required for technical engineers, management and other workers whose final and total work product is information.

By analogy to the POK one may say that the personal computer (PC) is a modular programmable unit located at the individual workstation of the specialist, and is distinct in its simplicity of adaptation to the user and the tasks it performs for him. By reconfiguring the computer's hardware and software, the PC facilitates the attainment of a sharp increase in the performance of the labor of technical engineering workers, administrative and management personnel, and an improvement in the quality of decisions made (expert systems). Personal computers also facilitate the intensification of the process of education in universities, tekhnikums and schools.

What can a PC do? I would like to say everything. At any rate, that will be the case in the near future. Having become a reliable aid to the specialist and his daily work, the PC not only edits text, aids in design and construction, which is to say it is an instrument of intellectual labor, but most importantly creates a certain infrastructure on a continually growing data base (and in the future - a knowledge base). The simplicity of the relationship with the PC is ensured not only by its widely accepted and convenient technology, but also by its programmability. Particular attention in the creation of the PC is devoted to the language of communication with the machine. The basic task here consists of creating a language that is understandable to the machine as well as to the non-professional user. The so-called "BASIC" language has attained the widest distribution in personal computers. As experience shows, it can be mastered by the engineer of average qualifications in one week.

Having simple and convenient language capacity and developed input-output capacity, personal computers, when used with ready-made problem-oriented program packages, are easily and quickly adapted to a range of the informational tasks of the non-programming user, and gives him the opportunity to place the computer at his own work station and perform tasks with it.

By integrating automated control systems using separate hardware modules, and transport and storage systems, flexible automated sections and shops - the basis of "unmanned" technology - can be formed. Integration of systems of "automated system equipment - automated systems for control of technological processes - automated design systems - automated systems for scientific research" provides the possibility of rapid reorganization, in order to create and produce new types of manufactured goods. Here, the automated production control system begins to a large degree to perform new functions of a dispatcher, realizing the operational control, planning and regulation of the entire process of production.

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DETECTION OF DEFECTIVE COMPUTERS IN REDUNDANT FAULT-TOLERANT SYSTEM WITH SLIDING RESERVE

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 5, May 86
(manuscript received 13 Mar 85) pp 143-150

[Article by I.V. Shagayev, Moscow]

[Abstract] Problems of the design of fault-tolerant systems and diagnosis algorithms based on the idea of self-testingaand oriented toward the use of standard mini- or micro-computers are discussed. The problem is to construct a procedure for detecting the defective computer in a redundant system of two computers and reconfigure the system so as to allow continued operation in spite of a fault. The system is based on the use of a third or check computer, the memory contents of which are compared with the contents of the other two computers to determine if either of the two working computers has experienced a fault. The methods of diagnosis suggested require no utilization of external storage, and allow the system to be used in real-time processes. Figures 5; references 5: 2 Russian, 3 Western.

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UDC: 62-5:681.3:007

REVIEW OF EQUIVALENT PROBLEMS OF IMPLEMENTATION OF CIRCUITS BASED ON AND-NOT ELEMENTS INDEPENDENTLY OF SPEED

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 2, Mar-Apr 86
(manuscript received 19 Jul 85) pp 159-171

[Article by B.S. Tsirlin, Leningrad]

[Abstract] Previous works have demonstrated the possibility of generating complete speed-independent systems using AND-NOT hardware elements, as well as AND-OR-NOT and OR-NOT elements. The question arises, what subclasses of

circuits, independent of speed, cannot in principle be implemented using any given hardware base? This review analyzes this question for elements of the minimal AND-NOT functional basis. The implementations of hysteresis flip-flops are described. Delays in connecting wires are considered. It is demonstrated that the construction of circuits which are independent of speed using a hardware element base requires production of an operable hysteresis flip-flop, a problem which has not yet been successfully solved for I^2L MOS-structure elements. The construction of circuits insensitive to delays in connectors is important due to the appearance of elements whose operation is so rapid that delays within the elements are comparable to those within connectors. A major result obtained in this work indicates the impossibility of solving this problem for AND-NOT elements by logical methods. Figures 9; references 20 (Russian).

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SOFTWARE

UDC: 681.3.016

HIERARCHICAL TREE-STRUCTURE DATA BASE MANAGEMENT SYSTEM

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 5, May 86
(manuscript received 25 Apr 85) pp 128-134

[Article by A.V. Lashmanov and A.B. Pechkarev, Moscow]

[Abstract] A data base management system (DBMS) is described which is designed to provide simple, clear structures for use at the logical level of description and manipulation of data, simple operation, and a decreased level of dependence on characteristics of the computer environment and operating system, achieved by using a high level programming language and allowing the user to select the volume of main memory required. Data are stored in flat table files and retrieved by modified B-tree techniques. The system, called the VID (abbreviation for Russian words for branched hierarchical data) system, uses a tree-form data structure in which each initial type of record consists of one field, and non-initial record types (second and subsequent in hierarchy) can consist of any number of fields, one of which acts as a unique key. Physical organization of the VID DBMS differs in that the key portion of the first row of a block is entered in a higher level index block, while second and subsequent entries in blocks at any level are stored as records with left justification of compressed keys. VID data management language operators are subroutines intended to be called by languages such as PL/1, FORTRAN or even ASSEMBLER, performing functions such as creation of a new table, opening and closing tables, appending, modifying and deleting data from tables, and deletion of tables. Advantages of the new data base system are said to include little variation in access time with number of rows in a table, unlimited table size, economical consumption of mass storage, and increased resolution of index blocks. References 2 (Russian).

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UDC: 519.95

METHOD OF IDENTIFYING NATURAL LANGUAGE WORDS IN DIALOGUE SYSTEMS

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 2, Mar-Apr 86
(manuscript received 30 Jul 84) pp 205-208

[Article by G.G. Ananiashvili, N.N. Vichinashvili, Z.I. Mundzhishvili and T.L. Khomediki, Tbilisi]

[Abstract] As much as 30% of operating time in dialogue information retrieval systems is involved in dictionary lookup and morphological analysis of user input words. Existing methods of addressing to minimize dictionary lookup time include direct addressing. The authors suggest an algorithm for organizing a dictionary by direct addressing allowing, regardless of the significance and size of the input set of word forms, generation of a function indicating the address of the input words and producing nonrepeating values. The algorithm is based on the mathematical apparatus of Abelian groups, which can be reduced to subdivision of an n-dimensional vector V^n over field GF(2) into nonintersecting neighboring classes with respect to kernel G of a certain homomorphism which is a function of addressing. The generating elements of the neighboring classes are the initial word forms of the dictionary. An example of the operation of the algorithm is presented. The method of identification of words suggested allows organization of a dictionary by the direct accessing principle, eliminating collisions, assuring maximum speed in the word identification stage. The procedure used to construct the addressing function is independent of the size of the dictionary or its contents. The system allows correction of the most probable orthographic errors and solves the synonym problem by storage of erroneous word forms and synonyms in the dictionary. References 6 (Russian).

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ALGORITHM FOR DECOMPOSITION OF THE PROBABILITY GRAPH OF DIALOGUE PROCEDURES

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 2, Mar-Apr 86
(manuscript received 22 May 84) pp 209-213

[Article by V.V. Araksyan, Moscow]

[Abstract] The problem arises in dialogue systems of expanding the model of dialogue procedures to encompass those characteristic for humans. One means of solving this problem is the introduction of probability elements to the dialogue. This article describes a model based on the concept of a probability graph of dialogue procedures. An algorithm is developed to decompose this graph into basic or elementary components important for the process of automation of dialogue information processing procedures in the automated information retrieval system. Figures 8; references 7 (Russian).

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APPLICATIONS

APPLICATION OF COMPUTER-AIDED DESIGN SYSTEM

Moscow EKONOMICHESKAYA GAZETA in Russian No 15, Apr 86 p 17

[9th installment of article by Professor V.A. Myasnikov, chief of the Main Administration of Computer Technology and Control Systems of the State Committee for Science and Technology [GKNT], under the rubric: "School of Computer Literacy": "We work at a Display Terminal"]

[Text] The engineer solves the majority of his problems in an automated design system at an automated workstation. The graphic display terminal, part of the structure of the automated workstation, allows the engineer, with the aid of a keyboard, to call up the information he needs on the display screen. What he sees is a description (sketch) of an analogous construction which has been taken as the basis for future development, computing methods and programs, and initial data for computation (normatives, characteristics of materials, economic indicators, etc.).

The engineer, receiving a graphic representation of the construction (components, assemblies, machines) on the display screen, using a "light pen" and keyboard can change the configuration of the construction, dimensions of sections and sizes of components, perform a rotation of the entire representation and its separate components and change the scale of the sketch and remove separate parts from it.

Recently, thanks to computer programs that perform machine geometry and graphics, it became possible to obtain three-dimensional representations on the display screen. On the screen we can see a component as if it had volume. The representation can be rotated about any axis in order to view the object from all sides.

The graphic display allows rather simple resolution of component problems, such as the relocation of construction objects on an overall plan of a city, arrangement of equipment in factory departments, planning of individual quarters in an apartment building and distribution of devices in an airplane cockpit.

After development of the construction on the display, the engineer receives the sketch on a plotter. The plotter is a drawing table with an automatically-moving sketching assembly. The sketching assembly moves about the paper sheet according to the program loaded into it.

The drawing speed reaches 0.5-1 meter per second, with a precision of a radius of up to 0.1 millimeter. It is possible to obtain lines of varying thickness and color. On the sketch both numeric and text information can be drawn out.

Utilization of the automated workstation for the output of technical documents significantly reduces and even eliminates mistakes in the project. In addition, as the sketches and schematics of the objects are preserved in the memory of the system, adding changes and corrections to the document does not present difficulty.

Application of the CAD [Computer-Aided Design] system has a great effect on the early stages of development, when the principles of the action, structure and basic characteristics of the manufactured article or object are selected. During this time the designer, interacting with a computer-generated mathematical model, creatively analyzes various versions, optimizes them and chooses the best valid version of the project of the technical assignment for preparation of work plans.

Without the CAD system the creation of effective flexible automated production is unthinkable, as the CAD system can automatically, by means of a corresponding subsystem, issue not only the finished documents but can immediately issue control information for work on the machine tooling with numeric program control as well.

The Party and government attach great significane to the development of work in the field of creating CAD systems in industry and construction. In the 12th Five-Year-Plan regular production will be established for technical automated workstations of high, intermediate and low performance based on powerful universal computers and minicomputers, and also of automated workstation terminals for technological work using personal computers.

In December of 1985 at the 41st Special Session of the Soviet for Mutual Economic Aid [SEV] the general agreement of the member-nations of the SEV was affirmed for "multifaceted cooperation in the realm of the creation and introduction of computer-aided design systems (CAD)." Within the confines of this agreement a program for multifaceted cooperation of the member-nations of the SEV was worked out in the realm of the creation and introduction of CAD systems in scientific-research and construction-engineering organizations.

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INTEGRATED AUTOMATED ENTERPRISE MANAGEMENT SYSTEMS

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian Vol 22, No 2, Mar-Apr 86, pp 374-376

[Article by K. P. Glushchenko]

[Text] An All-Union Conference "Integrated Automated Enterprise Management Systems" was held at the Novosibirsk Akademgorodok on 22-24 October 1985. The conference was organized by the Computing Center of the Siberian Department of the USSR Academy of Sciences. Taking part were about 150 representatives of academic and industrial research institutes, VUZes, enterprises and associations from 28 cities of the nation.

In opening the conference, Academician A. S. Alekseyev (Computing Center, Siberian Department, USSR Academy of Sciences) stressed that the April 1985 Plenary Session of the CPSU Central Committee had pointed out the need to overcome the lack of conformity of existing management techniques to new conditions. Automation of a management system should be aimed at solution of this problem. One of the reasons for poor substantiation and discoordination of management decisions, and the imbalance of quotas on all levels of the national economy is the lack of information. This deficiency can be overcome only by using computer technology; but in many cases, computers are being ineffectively used, which is slowing down the improvement of management systems. Often computers do not make decision making easier for management, but rather produce a "glut" of "new" information. Conditions have now been brought about -- modern forms of computer technology, a large detachment of specialists, cumulative experience -- that enable us to overcome these negative tendencies, and to go on to a "second cycle" of management automation characterized by development of high-quality integrated automated management systems (IASU's).

A number of reports were heard in plenary sessions of the conference.

I. M. Bobko, associate member of the RSFSR Academy of Pedagogical Sciences (Computing Center, Siberian Department, USSR Academy of Sciences) analyzed the initial conditions and goals of setting up an automated management system (ASU). One of the reasons for deficiencies in management automation is that massive introduction of ASU's has outstripped the development of theoretical fundamentals; existing management techniques and informational processes have been automated without in-depth analysis of possible methods of improving management.

A serious omission has been the lack of close contact between ASU specialists and theoretical economists, and the fact that solution of organizational and economic problems has lagged behind the handling of informational and technical issues. In setting up an ASU, one must start from principles of socialist economics, and from this viewpoint, careful thought must be given to borrowing the design concepts of mathematical and informational software, and even the hardware accepted in capitalist nations. The main content of development of the ASU must be scientifically sound processes of improving industrial, economic and social relations.

V. V. Titov (Computing Center, Siberian Department, USSR Academy of Sciences) considered questions of optimizing the performance of an industrial enterprise on the basis of a multilevel hierarchical system of simulation and optimization models. The upper level is a model of prospective development and performance of the enterprise; on the next level, a model of formation of the annual plan is used, that consists of two parts: development of the draft of the technical, industrial and financial plan and simulation of its execution, then the model of volumetric calendar planning, and finally, simulation or optimization models of on-line calendar planning. Work on developing and implementing this system of models is being done in the framework of improving the "Sigma" ASU.

V. V. Marusin (Computing Center, Siberian Department, USSR Academy of Sciences) dealt with some of the problems of development of ASU's in the design of information and program software. Among these problems are: ensuring the validity of data and the reliability of systems that are designed for direct interaction between users who are not programmers and computers; organizing software in the form of applied program packages; stages in developing "smart" decision making systems in the automated enterprise management system; design of distributed systems on the logical (user), conceptual and physical levels. The solution of these problems requires developers of automated enterprise management systems to rethink a number of principles that have been considered effective up until now.

A report by V. I. Sukhov ("Kriogenmash" Scientific Production Association, Balashikha) was devoted to experience in realizing an IASU that covers all spheres and areas of management of the activity of the association, and implements planning and management on all stages and phases of work in the cycle of production of cryogenic technical complexes (from research and development to fabrication and shipment). Five directions in this problem area were considered at the conference.

The first was **status and general systems issues of IASU development.** G. I. Algazin and V. V. Marusin (Computing Center, Siberian Department, USSR Academy of Sciences) discussed making coordinated decisions in hierarchical management systems. They proposed a classification of parameters that significantly determine the method of decision making, ensuring coordination of the operation of subdivisions of the enterprise. The generation of a coordination signal is comprised of selecting: a coordination principle (iterative coordination, delegating responsibilities, and so on), a coordination method (modification of constraints or goals), and a technique for implementing the accepted coordination method. The coordination of planning and management decisions under the conditions of the automated enterprise management system was also discussed in a

report by V. I. Aksenova Barnaul Laboratory, Computing Center, Siberian Department, USSR Academy of Sciences).

V. G. Kourov (Shadrinsk Automatic Equipment Plant) talked about an IASU in operation at the plant, including: a higher loop of organizational management and integration among departments, a lower loop of shop management (based on the "Production" job set of the "Sigma" standard ASU), a number of CAD systems ("Technology," "Numerical Preset Control," "Automatic Punch," and others), and an automated technological process control system. Interaction among the systems comprising the IASU is handled via a distributed database; problems requiring expeditious decision making, and also those based on simulation models, operate in the interactive mode. An interesting feature is the presence of elements of automation of the management of IASU development: in accordance with organizational management procedures transcribed in computer storage, a watch is kept on computer transfer of component functions for the purpose of timely relocation or retraining of the persons performing these functions. K. S. Kadyrbayev ("Aktyubrentgen" Production Association) described the model of on-line management of a hierarchical production system in operation in an automated enterprise management system. There are two levels in the model: development of the operating plan of the subdivision (based on optimization) and determination of coordinated team quotas (using simulation methods).

Structuring of management tasks is crucial for synthesis of the functional structure of the IASU. V. S. Mikhaylov and V. A. Sokirko (Kiev Construction Engineering Institute, Kiev Institute of Management of the National Economy) suggested a method for solving this problem that they call the "stage-functional" method. Formation of an "official" job list is based on modules of two kinds: one consisting of tasks of accounting, monitoring and regulation, and the other including jobs of reporting, analysis and planning.

Also heard were reports by A. N. Buinov and S. V. Dubrovskiy (Institute of Natural Sciences, East Siberian Technological Institute, Ulan-Ude) on planning the system of goals of operation of the IASU subsystems, Ye. A. Kalganov and I. A. Lozhevskiy (Siberian Highway Institute, Omsk) on an adaptable model of synthesis of the IASU structure, and others.

The second direction was **methods of developing subsystems in the IASU.** P. Ya. Kalita (Institute of Cybernetics, UkSSR Academy of Sciences) looked at a systems technological complex of production control in accordance with deviations of target parameters. The production system was described by four interrelated groups of planning and accounting parameters: of the production system, of the output of goods, of the quality of items, and of production efficiency. Management consists in establishing goals, coordinating them with the parameters of the production system, and ensuring attainment of the goals. In this context, a control is produced when the actual values of the parameters characterizing goals differ from the planned parameters under the influence of internal causes or external perturbations.

Yu. A. Polyakov, A. I. Klyaus and V. Ye. Petrov presented the results of development of an interactive system for calculations and analysis of variants of five-year and annual plans of an industrial enterprise. This system is a

further development of the complex "Optimization of Production Plans" in the "Sigma" ASU. A. P. Levitskiy, R. V. Dyrchenko, N. I. Karagedova and L. A. Sleptsova (NIIsistem [not further identified], Novosibirsk) talked about an interactive data teleprocessing system incorporated in the "Sales Management" subsystem and aimed at the final user; this system is typified by clear delineation of processes of planning, regulation, accounting and analysis for elementary operations and distinguishing operations performed by the computer system and by managerial workers.

A number of papers dealt with questions of development and operation of automated technological process control systems and CAD systems. For example, G. L. Denishchenko, A. Yu. Gusev, G. N. Svistun and L. N. Kovyryanova (Dnepropetrovsk Affiliate of VNIPI SAU [not further identified] considered the "Plavka" automated technological process control system as part of the IASU of a converter shop; V. I. Sukhov and A. F. Arinin ("Kriogenmash Scientific Production Association) talked about a CAD system for items of cryogenic equipment; A. M. Sukhodolskiy, I. N. Galtsov and Yu. R. Beytyuk (Minsk Radio Engineering Institute) discussed systems for computer-aided design of flexible manufacturing systems for making microelectronics items.

The third direction was **IASU informational software.** A report was given by I. M. Bobko, Ye. N. Granitsa and A. A. Novikov (Computing Center, Siberian Department, USSR Academy of Sciences) discussing a system of data bank utilization by the final users in a computer network. The system has been validated on the base of the collective-user computing center of the Siberian Department of the USSR Academy of Sciences. The authors outlined the initial principles of designing such a system, and analyzed experience in using it.

V. N. Frolov (Physicotechnical Institute, Ural Science Center, Ustinov) showed the possibilities for using the symbolism of linear programming (LP) for improving the confidence and completeness of the informational description in the ASU. To get new information (or improve the accuracy of available information), the inverse LP problem is solved: finding (or more precisely defining) the values of coefficients from the known structure of the model and the variables. Such an approach has been used to determine the technical-economic parameters of the metallurgical industry that are part of the informational base of the ASU.

Also discussed were questions of investigation, development and introduction of the IASU data bank (B. S. Garber, S. G. Dertev -- "Kriogenmash" Scientific Production Association), design of a data bank of an integrated system for controlling a linear flexible computerized manufacturing system (V. M. Porokhnya, M. I. Gonza, A, B. Idrisov -- Pavlodar Industrial Institute), compression of information in large data banks of automated enterprise management systems (A. N. Merkulov, Barnaul Laboratory, Computing Center, Siberian Department, USSR Academy of Sciences), and informational coordination of the job complexes "Production" and "Technological Preparation of Production" in the "Sigma" ASU for the purpose of automating the preparation of initial data (V. T. Pinchuk, I. L. Kabb).

The fourth direction was **development of optimization and simulation models in the IASU.** Yu. P. Svirin, M. P. Revotyuk, S. N. Myasnikov and A. B. Dolgiy

(Minsk Radio Engineering Institute) talked about developing real-time simulation models of program-controlled complexes. The purpose of such models is comprehensive debugging of the IASU, development of alternative organizational and engineering design features, instruction of personnel and so on. Petri nets that describe parallel operation of interacting elements were used as the modeling apparatus.

The task of distributing the annual production program by plan periods is the linking job between technical-economic and calendar planning. S. V. Kotlik and Yu. B. Maksimov (Kharkov Institute of Radio Electronics) proposed an approach to solution of this problem in an optimization formulation based on a modified method of descent by coordinates in which the variables to be changed are selected by certain heuristic rules.

L. F. Pavlenko (Leningrad) outlined the results of development of a job complex for optimizing the list of metallic materials in production of articles within the automated enterprise management system. The use of this complex, which takes information about the type size series of materials and substitute materials as initial data, has enabled standardization of the list of materials and reduced the inventory of metal in the enterprise.

An examination was made of a probabilistic model of operation of the storeroom (warehouse) of a completely automated section of an enterprise (A. K. Sulimova -- Kazan Aviation Institute), inventory management optimization models in automated systems for managing export of equipment (S. S. Genba -- Computing Center, Siberian Department, USSR Academy of Sciences) and so on.

The fifth direction was **development of general principles of designing applied program packages (PPP's) in the automated enterprise management system.** After analyzing the specifics of enterprise management systems, S. L. Shirokova (Barnaul Laboratory, Computing Center, Siberian Department, USSR Academy of Sciences) suggested the following requirements for PPP's of automated enterprise management systems: they should be conducive to the most effective organization of the computational process and methods of access to data, should have well developed mechanisms of adaptation, be designed as a set of packages, provide effective aids for ensuring confidence of data, maximize satisfaction of the needs of the final users (with respect to functions performed, data makeup and formats, and computer accessing language). The principles of formation of the centralized fund of PPP's for automated enterprise management systems that are required for going on to produce systems software mainly (ideally -- completely) from off-the-shelf "modules" were discussed by K. P. Glushchenko (NIIsistem).

K. A. Zubovich (Belorussian State University, Minsk) noted the advisability of designing PPP's based on a functional programming system, which not only rationalizes the process of development, but also simplifies the accompaniment and use of the package. The development of organizational integration in the IASU is possible by developing automated work stations for management personnel. T. V. Pisareva and G. I. Marchenko (Tomsk Institute of Automated Control Systems and Radio Electronics) investigated the design of a crucial component of the automated work station for management personnel -- the user interface that does

the work of forming, interpreting and executing the request of the administrative worker.

The recommendations passed by the conference note the insufficiency of procedural development of problems of IASU design, and point out the necessity of intensifying this development; the question of coordinating work in the IASU field is formulated. Main directions are suggested for raising the scientific and technical level of IASU's: using modern database management systems that are oriented toward the final user; inclusion of optimization and simulation models; expansion of the use of PPP's; computer networking with flexible architecture and software compatibility.

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PRINCIPLES OF ORGANIZING EXPERT SYSTEMS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 6, Jun 86 pp 33-34

[Article by V. L. Belousov, candidate of technical sciences]

[Text] In the Comprehensive Program for Scientific and Technical Progress of CEMA Member Nations up to the Year 2000, one of the major goals is to develop improved aids for man-machine communication for use in handling especially complicated scientific jobs, management of the economy, and development of knowledge bases.

In the late seventies to early eighties, a new and independent class of intellectual systems -- expert systems or consultant systems -- came into existence. Expert systems were conceived and began their development in branches of science with mathematically weak formalization (such as medicine, biology, chemistry, and other natural and social sciences). The systems were supposed to meet the needs of final users, primarily scientists and specialists in the aforementioned branches of science for a concentrated knowledge base on specific subject areas necessary for scientific research and practical work. Such systems opened up the possibility for direct computer access to final users unsophisticated in programming. Heretofore, the specialist wishing to do jobs involving the use of computers had to learn their languages. Conversely, in expert systems the computer "learns" the language of the person with whom it is to work. Consequently, capabilities are opened up to practically every specialist for access to the latest advances in the field of knowledge of interest to him, and this will certainly have a decided impact on improving the effectiveness of scientific research, realization of applied tasks and so on.

At present, there is still no precise definition of expert systems. In general form they can be represented as application-specific intellectual systems that realize all modes ("client," "pupil," "teacher") of the user's work, and have subsystems of knowledge explanation and accumulation.

In the "client" mode, all fundamental decisions are made by the user, and the expert system acts only as a consultant that provides data needed for solving a problem, sometimes telling where the data came from.

In the "pupil" mode, the information communicated to the user by the expert system structures his work on solving a problem in a certain way. When there are difficulties, the system suggests information to the user that may be of assistance in the given specific case. Moreover, when a certain path to solution of a problem has been selected, the system carries out calculations. In essence, in the "pupil" mode, the expert system acts on the one hand as a science library, and on the other, as a methodologist and teacher.

In the "teacher" mode, the user enriches the system with knowledge about a given subject area, methods of formulating and handling the tasks accessible to it. However, in this case, two fundamentally different situations are possible: in the first -- the knowledge is added to the system by programming specialists, and in the second -- by the subject area specialist himself.

Realization and use of an expert system presumes active interaction between people (experts, engineers, interpreters, users) and system components.

Let us consider their goals and tasks in general form. As a rule, the system comprises experts, interpreter-engineer, verifier, user, and also the field of application, the hardware and software of the expert system itself.

The expert is a specialist in a given subject area; his knowledge is input to the expert system, and then used for expertise.

The expert may not know all details of a program, and therefore inputting his knowledge into the system as a rule requires the assistance of a programmer (interpreter-engineer) who is versed in the area of knowledge of the given expert system and acquainted with the structure of the program. Sometimes, the expert may set up his own program for application of his knowledge, but experience has shown that in most actually existing systems, the development of methods of representing knowledge and methods of solving problems should be the province of a specializing programmer. All this dictates the requirements for developing an effective system.

During operation of the expert system, the need arises for changes, amendments and improvements of the knowledge base, and errors often occur that can be detected only by experts. Consequently, feedback is required between the expert and the program; this is provided by the verifier through presentation of the output data of the system for experts in a specific subject area.

In the course of his work, the user transmits the results of operation of the expert system to the field of application of this system. Errors may also show up on this stage, as expert systems are designed for people who do not have exhaustive knowledge in the given subject area. From the field of application, the user may get information about the consequences of his actions or recommendations produced by using the expert system. In this way, the efficacy and advisability of using the expert system is verified, and practical feedback is provided between system and user, which is a mandatory and characteristic condition for systems of this class.

The following modules are the technical structural base of the expert system:

a knowledge base and closely related base for detecting contradictions;

a module for organizing solution of the problem that includes, among other things, explanatory functions;

interactive processors oriented toward the developer and final users.

The knowledge base contains all information necessary for operation of all components of the expert system, such as that required for response of the module for organizing solution of the problem to questions posed as an expert, i. e., output of information on a given area of knowledge, and the method of applying this knowledge to a certain class of problems. The knowledge base also contains what is called declarative knowledge that comes to the system from experts, and includes facts, axioms or rules relating to these facts. This knowledge is represented in the form of relations, which facilitates the user's understanding of problems and intervention into the solution process.

The knowledge base also contains knowledge relating to information processing procedures, and methods of logical deduction. They describe the sequence of actions that must be performed to get a certain result.

The module for organizing solution of the problem handles jobs of user requests and contains knowledge about the method of judgment (i. e., strategy and heuristics) that enables solution of the problem.

In addition to modules of solutions of specific problems, the resolving module frequently contains planner programs and programs of logical conclusion (or a conclusion mechanism).

Another part of this module, the explanatory subsystem, explains the solutions that have been generated, and makes them comprehensible to the user, i. e., they inform the user about the underpinnings for a given computer solution. The presence of this subsystem is typical of all heuristic systems.

The interactive processors act as an interface that provides communication between man and computer, and that includes a user natural-language (NL) interface through which data are perceived and results, explanations and requests are output. The user interacts with the system either via a dialog on the NL subset, or through a functionally oriented display. When using the NL, the types of questions and sentences may be sharply restricted; however, the non-specialist in programming should then have no trouble in understanding everything that the system communicates to him or requires from him.

To provide for a dialog between user and computer, in some systems there are special program packages that are part of a more general smart interface that provides a basis for development of new informational technology. Its essence is that final users can use computers as reference-consultative systems for getting new results and constructing new theories in their own subject area, and can do designing, planning, administrative and scientific jobs regardless of the complexity of the mathematical models of these tasks. Moreover, the new informational technology is the capability of interaction between final users through

computer networks in the process of solving general problems in management, planning, design and research. And finally, the third aspect of the new informational technology is paperless informatics, i. e., the possibility of emancipation from the expenditure of enormous amounts of paper.

Capabilities of this kind are also offered by the dialog processor or the so-called module of acquisition of knowledge (aid for accumulation of knowledge) for operation with an interpreter-engineer; by using the processor, the expert inputs his own knowledge on a specific area to the knowledge base, creates it and updates it. Often in this context the knowledge base of the expert system is formed by the final user in his own professional language.

Thus, expert systems differ from other systems in:

explicit and consistently implemented orientation toward the user far from the programming, and also the trend toward speaking to the specialist in his own accustomed language;

comprehensibility, i. e., a property that reflects the point of interaction between the system and the user and is an irremovable part of the system. This property does not mean that the expert system must be a psychological model of a human expert, but presumes that all messages of the system are to be perceived by the user in a natural way. Expert systems are typified by: an interactive mode; a dialog on a natural language subset; the capability of "explaining and justifying" its actions; accounting for different levels of users; a large volume of the knowledge base, which presumes the use of efficient mechanisms of accumulation, verifying for absence of contradictions, and correction of the knowledge base during service. Moreover, the expert system must update uncertain, incomplete and inexact knowledge that as a rule is encountered in actual problems.

Expert systems open up new capabilities over traditional methods of handling various problems of collecting and processing information:

they give the capability of using computers to solve problems that cannot be effectively solved by traditional methods;

they are readily comprehensible for final users who are not programmers. The architecture of the knowledge base allows continual development of the system, i. e., it provides explanations that confirm definite conclusions;

expert systems considerably expand human capabilities in a rapidly changing informational environment.

It can be assumed that the use of systems of this class will have a decisive impact on raising the efficiency of automated control systems, CAD systems and the like. For example, according to the present concept, the CAD system supports computer-aided design of some structural component of a part, subassembly, or item as a whole out of a system of components that are available in a data bank, does the necessary calculations, provides views in three dimensions, and so on. However, all manipulations in the process of designing from the

computer-aided work station are carried out by the designer himself. In doing this work, he relies mainly on his own experience and knowledge; consequently the technical level of the newly designed item actually depends on the skill of the specific designer.

On the other hand, if the designing is done with the aid of an expert system, it will suffice for the designer merely to formulate the requirements for the new design, and the expert system, utilizing the knowledge base in the given subject area, will select a design that will ensure a prescribed technical level, and will provide the necessary explanations for this selection.

Thus, in performing work one can use the collective experience of specialists of a higher class, and thereby ensure high quality of the design, producing goods with high characteristics.

Under such conditions, the role of the designer changes appreciably: ultimately he becomes the user and the expert of the system at the same time as he uses the system in different modes ("client," "pupil," "teacher"). Obviously there should be sector-wide and intersectoral networks of expert systems for effective exchange of knowledge in each subject area, for example in design, and in development of new technology.

Implementation of the program of creating expert systems requires not only new computer equipment and the corresponding software, but also new approaches to organizing the creative process of each specialist in the national economy of our country.

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IMPROVEMENT OF AUTOMATED INFORMATION PROCESSING

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 6, Jun 86 pp 7-9, 33-34

[Article by A.A. Tyapicheva, engineer-economist]

[Text] An analysis of jobs to be done in on-line control of basic production in such enterprises as VAZ [Volga automobile plant], AZLK [Moscow automobile plant imeni Leninskiy Komsomol] and GAZ [Gorkiy automobile plant] has shown that they take up as much as 60 percent. Of course, this makes it necessary to pay particular attention to the informational, programming, and technological support of the complex system for on-line control of basic production. Practice shows that there are some appreciable deficiencies in this matter: there is no large-scale automation of calculations for one-line control (the principle of integration is only partly reflected), the thrust is toward "paper" technology of data processing and a considerable level of exchange of on-line information directly between supervisors without the use of computer equipment, the degree of automation of jobs in on-line regulation of basic production continues to remain low.

Experience in introducing automation of data processing in on-line control of basic production in machine-building enterprises confirms the necessity of a systems approach to improving automation of on-line control based on the principle of integration. This problem can be solved by using an integral data processing system (ISOD): integrated processing procedures, technological processes of data analysis, and the information itself.

Integration is based on the principle of uniformity of the functional loops of data processing and "intimacy" of the relation among the tasks of different loops in on-line control of basic production. This should be understood as logical interaction of information processing as it relates to functions of control (on-line planning, accounting, analysis and regulation), to the level of control (section, shop, enterprise), and to the time aspect (real time, shift, day, five-day period, ten-day period). These criteria enable us to unify the jobs of various loops of the automated system of on-line control of basic production when these jobs realize basic functions of one type, i. e., to integrate jobs vertically into blocks, and horizontally -- in the form of the interconnection of jobs between the blocks.

Different numbers of block types are distinguished, depending on the method of on-line regulation. In the first method, after the actual status of the production process has been verified, an optimum correcting plan is compiled that puts the process into the status that had been preplanned for the instant of completion of the planning period. In the second method, following the control check, the production process is brought into line with the originally compiled plan in a minimum time. This is essentially regulation by deviations.

For all time loops of on-line management except intrashift (real time), it is advisable to group jobs into three blocks: accounting, analysis and planning; the latter implements on-line regulation that reflects the first approach. The intrashift loop presumes an additional fourth type of job block: a block of on-line regulation that reflects regulation by deviation, i. e., on-line regulation by the second method.

Grouping of jobs into blocks integrates the vertical flows of information among the levels of on-line control, enabling a reduction in the duplication of information used for different jobs of one block by plotting graphs of the interconnection between indices within the limits of a block, and doing away with repetitions in computations (integration of calculations) by standardizing computational procedures.

Experience with work in this direction in the VAZ, AZLK and GAZ plants shows that there is insignificant vertical integration of information flows, and confirms the necessity of improving automated processing of information in on-line control of basic production.

The nature of the relations among jobs enables integration of their various levels under condition of a short working period of the data processing loops corresponding to these levels. In this context, the tasks of loops of higher levels are joined with the analogous tasks of lower levels, approaching the original source of information.

Jobs within blocks are joined by vertical ties, and between blocks -- by horizontal ties that form data processing loops. This gives rise to the problem of proper design of the data processing loops, i. e., retention of horizontal ties between blocks in an integrated system of on-line control of basic production. The problem can be solved by strictly adhering to correspondence of levels of the blocks of accounting, planning, analysis and regulation. Horizontal integration of tasks gives the capability of looking at the entire aggregate around the data processing loops of levels of on-line control in a time frame, and improving the standardization of data processing procedures.

Besides, horizontal integration enables decomposition of data sets by levels of control, thereby providing supervisors with the data needed for on-line control.

The vertical and horizontal block integrations of jobs implement the main principle of the ISOD -- one-time input of information into the system, which presumes unification of sources of information, recorders and data input facilities, as well as communication channels in the case of automated data processing in on-line control of basic production. Implementation of the basic principle

of the ISOD also finds its reflection in organization of a database for on-line control, and gives a number of important advantages: minimum redundancy, minimum expenditures, integrity, physical and logical independence, compatibility and high productivity.

However, practical service experience with a subsystem for on-line control of basic production shows a lack of horizontal integration of jobs on a certain level of on-line control that correspond to on-line control loops in a specific time period. For example, AZLK has no set of on-line analysis tasks such as "Checking the Course of Shipment of Items"; "Checking Fabrication of Items in Blanking Shops"; "Determination of Shortage by Complexes"; "Determination of Shortage for the Plant" and so on.

Much greater advances have been made at VAZ, where horizontal integration of jobs on the level of sections and shops is nearly complete in time intervals of a week, a day, and a shift.

The weakest link at this enterprise is the intrashift data processing loop, although it should be noted that this loop is closed for assembly production. At VAZ, the intrashift data processing loop for assembly production is represented by jobs of all types of blocks: on-line planning, accounting, analysis and regulation. On-line planning comprises jobs of organizing shift quota schedules for the section and the shop. The block of on-line analysis is realized by nine jobs, yielding real-time data about deviations during assembly.

The on-line regulation block is typified by the task that implements preparation of the on-line decision "Priority Packing of Vehicles." The accounting block is represented by seven tasks that are done in real time; a basic flaw is the very limited number of tasks that represent the block of on-line regulation and that reflect preparation of on-line decisions, and also that the closed loop extends only to assembly production.

In automating information processing with respect to internal on-line control in other subdivisions, the main thrust should be toward immediacy of intrashift on-line accounting and analysis. Experience in using applied program packages (PPP's) shows that there are packages corresponding to the given requirements: the PPP "Production Accounting" that is used in the software environment of the ISUP [integrated quality control system] program package set, and the PPP "Interactive Software System for On-Line Control of Production and Warehousing" (ASU-SM-Satellit [not further identified]). An advantage of this latter package is that the program package can be used in a multilevel hierarchical automated enterprise management system, whereas the PPP "Production Accounting" assumes a centralized form of data gathering and processing.

It should be noted that the centralized form of data gathering and processing does not meet the requirements of the integrated approach to automation of data processing in on-line control of basic production. The integration of technological processes presumes that the points of collection and initial processing of primary information have been brought as close as possible to the place of origination, and that transmitted information has been filtered for use in handling jobs on a higher level of control. Such a system of collecting and

processing information reduces the volumes of the information flows that circulate among levels of on-line control, reduces the bodies of data in databases, and thereby reduce expenditures on input, storage and processing.

The autonomously distributed form of information gathering and processing corresponds most completely to the requirements of integrating technological procedures of data processing and immediacy of obtaining information needed by supervisors. Distribution of databases among processing centers of the lower level of an autonomously distributed data gathering and processing system subdivides their volumes, thereby facilitating access to the data stored in them. Moreover, there is a reduction in the time of accessing information to be processed, which increases the immediacy of distributed data processing.

Analysis of forms of data gathering and processing used in machine-building enterprises (VAZ, AZLK and GAZ) confirms that the higher level of integration of jobs in on-line control of basic production corresponds to at least a partial form of the system of autonomously distributed data processing.

For example, at the VAZ plant there is an automated system for on-line control of assembly production that has a considerable degree of integration and uses an autonomously distributed system of data gathering and processing. Therefore, orientation toward comprehensive integration presumes the use of an autonomously distributed system of data gathering and processing based on existing mini- and microcomputers. This applies in particular to automation of intrashift data processing loops for on-line control that introduce more stringent deadlines for supervisors to get information for on-line control.

Automation of data processing in accordance with the intrashift on-line control loop is closed by the block of on-line regulation jobs whose basic essence reduces to preparation of on-line decisions on intrashift redistribution of resources. The main problem that has to be solved for this purpose is setting apart a set of tasks for implementing the block of on-line intrashift regulation. Informational and conceptual correspondence of the on-line regulation block and the decision making process gives an objective evaluation to the tasks that are being set forth, and the following are suggested as criteria for defining them: stage of the decision making process; systematic use of information obtained as a result of implementing the task for preparing on-line decisions; use of certain models for getting information and attaining its quality characteristics; obtaining information characterized by common content.

Based on the aforementioned criteria, we can distinguish the following set of tasks that realize the block of on-line intrashift regulation:

1. "Engineering of Situations" that assume qualitative ("recognitional") analysis of disturbances, and construction of situations that isolate the effects (causes) for perturbations;

2. "Analysis of Situations" that essentially reduce to quantitative analysis of situations for determining the necessity of preparing on-line intrashift decisions;

3. "Formation of Decision Set" that implement generation of a possible set of on-line decisions for resolving a situation that has arisen;

4. "Analysis of On-Line Intrashift Administrative Decisions" that enable analysis of the presence of conditions allowing practical implementation of on-line decisions;

5. "Evaluation of On-Line Intrashift Administrative Decisions" that are aimed at choosing from among the set of on-line decisions the most effective one based on evaluating outcomes of the decisions.

A prerequisite for practical handling of jobs is the availability of a typical set of situations tied in with a certain level of on-line control, and a typical set of administrative decisions on redistributing available resources; the feasibility of establishing a fixed relation between the typical situations and the typical administrative decisions; the possibility of constructing mathematical models for analysis of situations, on-line decisions, and their evaluation.

The necessity of bringing the level of on-line control as close as possible to production and of reducing the duplication of administrative actions originating on different levels requires filtration of information about situations and problems as it is transmitted to higher levels. Therefore, information about deviations that arise and their consequences goes to a higher level (and back) first of all when the lower level of control is not in a position to solve the problem, and secondly, if it is not delegated to prepare the necessary on-line decisions. This allows information to be transmitted by levels selectively, without overloading them with excess information; the information flow for higher levels is formed only from the deviations and consequences that cannot be eliminated on a preceding level.

Filtration of information as it is transmitted to the next level requires assignment of base typical situations to each level of on-line control, and establishment of rules for constructing them. This allows them to be "recognized" when specific situations arise during production, and also reveals the informational relations among the levels of on-line control, limiting them solely to those actually necessary in the form of informational interconnections of jobs of the on-line regulation block. In this way, vertical integration finds reflection in jobs of the on-line regulation block.

The horizontal informational interconnections within the on-line regulation block allow standardization and subdivision of the data processing procedures in this block, thereby enhancing the efficacy of computational procedures based on using models of different kinds.

The implementation of tasks 2, 4 and 5 requires construction of mathematical models of analysis of situations, analysis of on-line decisions and their evaluation, and for tasks 1 and 3 it is necessary to construct semantic (conceptual) models that reflect the intensional interrelations of perturbations and effects (causes) of their onset. Moreover, the set of on-line decisions must accord with the situations that they resolve. In constructing semantic models, the problem is to single out a complete set of perturbations on each level of

on-line control that are fixed in the production process. As shown by research, the development of mathematical models must be based on a heuristic approach, as the realization of classical models of mathematical programming for these purposes with the use of present-day equipment is ineffective when there are time limitations on getting the result. The feasibility of a heuristic approach can be explained by the existence of a limited number of administrative situations and on-line decisions to be evaluated, as well as by a well developed theory of independent choice that determines the passage from local estimates of individual consequences in situations and solutions to compromise multiple-aspect evaluation. The problem is in constructing local estimates and combining them into a resultant evaluation by using a rule for determining the latter from the theory of independent choice.

The design of the block of on-line regulation that closes automation with respect to the loop of on-line intrashift control, and allowance for the principle of comprehensive total integration enable us to develop a complex system for automation of information processing in on-line control of basic production of machine-building enterprises that is closed in the section of on-line control loops and utilizes the advantages of ISOD's.

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VARIOUS NEW FACILITIES DESCRIBED

Leningrad LENINGRADSKAYA PANORAMA in Russian No 2, Feb 86 p 40

[Article under the "LP Diary" rubric]

[Text] At the "Arkhitektor" Creative House in Zelenogorsk there are often regional, republic, and sometimes even All-Union seminars and symposia for architects. At the same time, this is a health institution, where one can have a good rest at any time.

The existing complex of buidlings is intended for 64 people and in the summer an additional 40 people, but this is clearly insufficient. Therefore it has been decided to build several other buildings on an adjacent lot. The design received high approval by the Leningrad Civil Construction Council. The designers are specialists at Lenin Zonal Scientific-Research Institute for Standard and Experimental Design of Residential and Public Buildings L.V. Dobronitskaya, M.V. Pokshishevskaya, architects; I.N. Filatov, Z.I. Lomonosenik, and N.I. Mazurenko, engineers; Ye.D. Volraikh, architect, participated.

Preserving the site's present architectue and landscape, the designers provide clearly formulated zones: dormitory club and sports areas, quite areas, parks and other areas.

The first stage will be the construction of a dormitory for 84 people and a spacious dining room. In the next stage cottages will be built. Then the Creative House will accommodate 220 people.

The designers gave special attention to creating good conditions for architects' professional work. A special "creative center" will be built. It will have a well equipped design room, exhibit hall and library. It has also been decided to build a club-sports building with a swimming pool.

The architectural appearance of the new building will have the same character as the present dormitory -- pitched roofs and wooden trim.

HANDICRAFT SHOP FROM MIDDLE OF PAST CENTURY

Three new exhibits -- a blacksmith's shop, a stable and a fire tower, opened at the Stationmaster's House Museum. There are more than 250 times from daily life in the past century. These include a forge and anvil from the 19th century, forge tools and horseshoe making tools. In the stable there are harnesses, both for every day and holiday use, made especially for ceremonial parades. There are also yokes, shaft bows and various bells. In another exhibit one's attention is turned to rare photographs from the end of the last century, which shows members of the Gatchina Fire Guard in their outfits and with fire fighting equipment. Almost all the items in the exhibits were collected by scientific associates of the museum and a search expedition of the Association of Museums in Leningrad Oblast.

AUTOMATED DESIGN SYSTEM AT LENINGRAD AVIATION INSTITUTE

An educational-research system for automated design went into operation at the Leningrad Institute for Aviation Instrument Building. With its help, future engineers will be able to improve the standards of their course and diploma work and, directly at institute laboratories, design servomechanisms, a most widespread modern device.

The SAPR's [System for automated design] introduction in the educational process is a major stage in the institute's work to attract students to the operation of computers.

TAKING CUSTOMERS' REQUESTS INTO CONSIDERATION

More than 50 types of mass consumption goods are being produced at the Leather Goods Association imeni A. Bebel. A program for expanding assortments and improving the quality of goods which is already being realized here, is intended to master the production of new models of fur gloves and mittens and of expensive purses and castor equipped luggage. The introduction of technology for foil stamping makes many objects even more attractive. Greater attention is being given to the selection of accessories. This is being done to increase the use value of these goods.

PETROKREPOST BEING TRANSFORMED

The city of Petrokrepost is growing and being improved. Recently workers and employees at the Nevskiy Shipbuilding and Repair Yards celebrated a new 174 unit apartment building, built on the banks of Malonevskiy Canal. A building on the banks of Staroladozhskiy Canal is also being prepared for occupancy. The city's citizens will obtain keys to an additional 119 apartments.

The Ladoga Department Store and the Neva Grocery Store are unrecognizable after major repairs. A new ferroconcrete bridge has been built across Staroladozhskiy Canal. At workers' request, electric lighting on several streets has been rebuilt.

Much is being done in Petrokrepost with the active participation of local shipbuilders. For example, the Yard has assumed the functions of a contractor

in the construction of a citywide boiler which will operate on natural gas. This will make it possible over the long term to eliminate 17 low capacity and inefficient boilers and to considerably reduce air pollution.

NEW MUSEUM PAVILION

The Chinese Kitchen [Kitayskaya kukhnya] is the name of a new pavilion opened after restoration at the State Art-Architecture Palace-Park Museum-Preserve in the city of Lomonosov. This structure, a miniature compared to other old buildings, is on the pond shore in the Upper Park.

The Chinese Kitchen was built in 1985-1853 by the architect L. Bonshedt on the site of the former Frelinskiy House. The pavilion is interesting primarily because it is in a style similar to a famous Chinese palace built 100 years earlier from a design by the well known artist A. Rinaldi.

The site's initial layout was revealed during the restoration. The site, which occupies about 100 square meters, now holds an exhibit "Decorative and Applied Art in the 18th and 19th Centuries. This exhibit, the first in the Lomonosov Complex, will be open for an entire year. Visitors have already seen a collection of porcelains and bronzes, marble sculpture and items made from nephrite and ivory.

11574
CSO: 1863/336

UDC: 519.95:415.5

A DIAGNOSTIC EXPERT SYSTEM

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 2, Mar-Apr 86
(manuscript received 12 Nov 85) pp 119-128

[Article by V.V. Baidun and Z.B. Rakhmanova, Moscow-Baku]

[Abstract] The principles used as the basis for software implementation of an expert medical diagnostic system called LEDI-Z are outlined. The system is designed to act as a consultant to the intensive care physician. The basic model is a system of frames showing medical characteristics, pathologic states or complex syndromes, treatments or case histories. The frames are interrelated by a network of associative connections showing possible causes of patient states and prognoses. The language used in developing the system is described and samples of frame-generating programs in the language are presented. The user interface involves a query language based on pattern comparison. The system is presently being converted to utilize a menu-type dialogue interface to allow use by nonprogrammers. The system can operate in student mode, in which new knowledge is accumulated by the system under the direction of the physician instructor. References 10 (Russian).

6508/9835
CSO: 1863/381

UDC: 621.3-523.8:658.3

IMPROVEMENT OF PERSONNEL ADMINISTRATION BY THE USE OF COMPUTERS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 7,
Jul 86 pp 36-39

[Article by Candidate of Economic Sciences S.G. Akhmetova, L.V. Nevskaya and Engineer N.V. Subbotina]

[Abstract] The machine building plant imeni V.I. Lenin in Perm utilizes an automated management subsystem for personnel administration. The system

produces weekly reports which can be used to analyze the frequency and content of disruptions of labor discipline as well as personnel turnover, including frequency of departure of workers, present and past, and reasons for termination of employment. A quarterly report on turnover allows personnel managers to study the structure of employee turnover due to problems with housing, commuting distance, birth of children, wage dissatisfaction, change of profession and other factors. Samples of the new report forms allowing this deeper analysis are presented.

6508/9835
CSO: 1863/384

UDC: 621:65.011.56:Δ65.01:3-523.8

DIALOGUE SYSTEM FOR PROCESSING PRICE INFORMATION ON PERSONAL COMPUTERS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 7, Jul 86 pp 34-36

[Article by Candidate of Technical Sciences V.S. Konstantinov and Engineer A.V. Dolgopolov]

[Abstract] The use of personal computers to develop price data on agricultural products is very promising, allowing interactive computation at very low cost. One such system, the "Nabor" dialogue system, is described. The software consists of control and data file manipulation programs supporting computation of prices based on product costs, delivery costs and profit margins, and also allows "what if" calculations, showing the effect on profitability of variations in costs and sale prices. All information is stored on magnetic disks, and the programs support random access files to improve speed of operation. A flow chart of the operation of the system is presented, plus text descriptions of the processes of data input, editing, computation and output. The Nabor system is now in use in the RSFSR State Commission on pricing for computation of agricultural product prices.

6508/9835
CSO: 1863/384

UDC: 65.011.56:658.78

EFFECTIVENESS FACTORS OF REAL TIME AUTOMATIC CONTROL SYSTEMS IN WAREHOUSE COMPLEXES

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 7, Jul 86 pp 31-33

[Article by Engineer I.V. Klyuev and Candidate of Technical Sciences R.K. Kuramshin]

[Abstract] A method is suggested for estimating effectiveness factors to rate a real-time ASU for a warehouse complex, based on analysis of the time characteristics of technological processes, determined by timely production of control information. Equations are derived for determining the savings of warehousing costs attributable to the automatic control system as a function of the wages of paid warehouse workers and the cost of buildings and equipment.

6508/9835
CSO: 1863/384

AUTOMATED MANAGEMENT SYSTEM FOR CONSTRUCTION

Baku NARODNOYE KHOZYAYSTVO AZERBAYDZHANA in Russian No 5, May 86 pp 47-49

[Article by T.M. Mardanov, Computer Center, Main Administration for Construction, Baku]

[Abstract] The author's administration supervises 3 large residential construction combines, all of which perform massive construction of residential buildings using standard plans based on reinforced concrete products and structures manufactured by the combine at several production facilities. The computer center has undertaken systematic development and expansion of an automated management system for the process of housing construction in Baku. The various subsystems have now been created, successfully used and have become a component part of the daily process of administering the second of the three combines. The system always contains the present status of each construction project, and generates information each day concerning the course of construction of all projects. The system also performs monthly accounting. Terminals connected to the system can call up on their screens any of the tabular displays showing the status of any project in the system. The system uses an ES-1022 computer.

6508/9835
CSO: 1863/366

THEORY OF COMPUTATION

UDC: 619.68:519.63

USE OF SYMBOL CONVERSIONS IN COMPUTERS FOR THE STUDY OF APPROXIMATIONS IN THE STABILITY OF DIFFERENCE SYSTEMS

Moscow ZHURNAL VYCHISLITELNOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 26, No 4, 1986 (manuscript received 13 Aug 84; revised version 6 Mar 85) pp 586-600

[Article by S.I. Mazurik and V.P. Shapeyev, Novosibirsk]

[Abstract] A study is made of the use of computers in the investigation of approximation and the stability of difference systems for systems of differential equations with many independent variables. In contrast to previous works, this article studies the implementation on a computer of the process of investigating the approximation of difference circuits for both one and for a system of differential equations which may be heterogeneous, may have variable coefficients and may be quasilinear. As concerns analysis of the stability of difference systems, the present article studies the use of computers for the Fourier method, for which an algorithm is presented. The implementations of algorithms analyzed in this article were performed using a system of software written to run under the DUBNA monitor system on a BESM-6 computer in the language REFAL, which is designed for symbol conversions. The sequence of operations performed by the programs in the system which implements the Fourier method is listed. Examples of operation of the programs are presented. The program system presented in this article can be used to study approximations and stability in a rather broad class of difference systems. References 25: 18 Russian, 7 Western.

6508/9835
CSO: 1863/354

UDC: 618.5:68.142.65

ORGANIZATION OF COMPUTATIONS ALLOWING OPTIMAL UTILIZATION OF STACK MEMORY

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 2, Mar-Apr 86
(manuscript received 30 Jul 85) pp 199-205

[Article by G.S. Levitin, Kharkov]

[Abstract] Algorithms are suggested to optimize the schedule of performance of operators (routines) to minimize the total number of stack pushes and pops and maximize utilization of the stack during the computational process. It is assumed that nothing other than the order in which modules are run affects the frequency and depth of filing of the stack, and that a schedule which allows information pushed onto the stack to remain in place for the maximum time as intermediate routines are run before it is popped off the stack is the most desirable schedule from the standpoint of stack operations. Figures 4; references 3 (Russian).

6508/9835
CSO: 1863/381

UDC: 62-507

AUTOMATON MODELS AND METHODS OF INVESTIGATING REGULAR QUEUING SYSTEMS

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 2, Mar-Apr 86
(manuscript recieved 22 Jan 84) pp 186-195

[Article by V.I. Levin, Penza]

[Abstract] Using a very general system as an example, it is demonstrated that regular queuing systems can be successfully modelled and studied analytically by means of the dynamic theory of automata developed earlier by the same author. The nature of this theory is discussed. A mathematical model of the system is developed and the operating characteristics of the system are computed. This approach can be extended to more complex regular systems with nonuniform flows of requests and services. The approach presented is considered a further development of the method of probability-automatic modelling of discrete systems, allowing both modelling and analytic study of systems. References 3 (Russian).

6508/9835
CSO: 1863/381

UDC: 62-52

A HOMOGENEOUS FAULT-RESISTANT STRUCTURE

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 2, Mar-Apr 86
(manuscript received 17 Jul 84) pp 172-179

[Article by A.Kh. Giorgadze and P.B. Mandzhgaladze, Tbilisi]

[Abstract] An algorithm is suggested which can be used to construct a 2-dimensional homogeneous structure for any preassigned 2-dimensional homogeneous structure functioning without failures, the cells of which can experience failures, and which models the behavior of the first homogeneous structure without failures if the distribution of failures on the plane of cells of the modelling homogeneous structure satisfies the condition that in any 3 X 3 square of cells failure occurs in no more than one cell per cycle. Fault tolerance to these 3-separated failures is achieved by coding cell states of the homogeneous system described by the states of four cells of the modelling system and introduction of one new state such that the vicinity of the modelling system is greater than the vicinity of the modelled system by a maximum of a factor of 9. Figures 6; references 4: 3 Russian, 1 Western.

6508/9835
CSO: 1863/381

UDC: 621.39

ENTROPY APPROACH TO ESTIMATING QUALITY OF AUTOMATIC REGULATION SYSTEMS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 287 No 4, 1986
(manuscript received 5 Aug 85) pp 799-801

[Article by Corresponding Member of the USSR Academy of Sciences
V.V. Petrov and V.I. Sobolev, Moscow Aviation Institute imeni S. Ordzhonikidze]

[Abstract] Previous works developed information methods for analysis and synthesis of dynamic systems. The present article studies a generalized plan of a linear automatic regulation system. Equations presented in the article calculate the loss of entropy of the system, which can serve as a criterion for estimating the dynamic quality of the regulation system in response to random perturbations. This is known as the entropy criterion, which can be used to evaluate the regulation system. This criterion expands the aspects of analysis and synthesis of regulation of systems available to the designer. Figures 2; references 5 (Russian).

6508/9835
CSO: 1863/345

UDC: 517.9:538.1

ASYMPTOTIC SOLUTIONS IN UNIAXIAL MAGNETIC BUBBLE FILM

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 287, No 4, 1986
(manuscript received 14 Oct 85) pp 821-826

[Article by Academician V.P. Maslov and V.M. Chetverikov, Moscow Institute of Electronic Machine Building]

[Abstract] An asymptotic estimate is obtained of the solution of a system of simultaneous Landau-Livschitz equations corresponding to magnetic bubbles such as those used on computer memory systems as epsilon approaches 0. References 8: 7 Russian, 1 Western.

6508/9835
CSO: 1863/345

UDC: 519.7

STATISTICAL PROPERTIES OF MAJORITY VOTE DECISION MAKING IN CLASSIFICATION PROBLEMS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 287, No 2, 1986
(manuscript received 2 Apr 85) pp 320-322

[Article by Yu.A. Zuev, Computer Center, USSR Academy of Sciences, Moscow]

[Abstract] Classification in this article is treated as the act of placing an object in one of two classes, one of which is the correct class for the object. The classifiers may be experts, hardware devices or pattern recognition algorithms. In the case of statistically independent classifiers, the reliability of a classification committee approaches one as the number of members approaches infinity as a result of the action of the law of large numbers. This article studies the reliability of such a committee with a finite number of members, estimates the rate of convergence of this reliability toward one and analyzes models in which the classifiers are not independent. References 3: 1 Russian, 2 Western.

6508/9835
CSO: 1863/345

UDC: 519.67

MACHINE ALGORITHMS FOR CHOOSING EMPIRICAL FORMULAS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 5, May 86
(manuscript received 31 May 85) pp 151-161

[Article by M.A. Konovalov and Ye.A. Legovich, Moscow]

[Abstract] A machine algorithm is known for the selection of empirical formulas to approximate measured functions. However, the set of empirical functions which the algorithms suggests is fixed and does not extend beyond the set used in manual methods. If a broader class of functional transforms is used in combination with exponentiation to an arbitrary power, a rather broad spectrum of empirical functions can be derived. The search for numerical values of the exponents in this case can be performed by multi-parameter optimization. This requires the use of computers with extensive software, including numerical methods of computational mathematics. The use of these machine algorithms for selection of empirical functions can increase the effectiveness of the process of selection, allowing the researcher to spend time on creative search for and selection of optimal solutions, with routine computational processes transferred entirely to the computer. This article discusses the generation ofaa general approach to problems of selection of empirical functions based on this technique and presents a general computer algorithm for the process. Figures 5; references 6 (Russian).

6508/9835
CSO: 1863/378

NETWORKS

UDC: 621.394.74

LOCAL-AREA NETWORK WITH STACK MULTIPLE ACCESS ALGORITHM

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 22, No 2, 1986
(manuscript received 18 Jul 84) pp 49-58

[Article by B.S. Tsybakov and S.P. Fedortsov]

[Abstract] A study is made of a local-area network using a stack multiple access algorithm suggested in a previous work by the same authors. The stack algorithm is distinguished by its high transmission speed, requiring each workstation to track channel status only from the moment a packet is ready to trasmit up to the moment when successful transmission is started. The stack algorithm from the previous article is extended to the case in which stations test the channel. It is shown that the maximum packet transmission speed approaches 1 as the channel test time decreases or as the packet size increases. Figures 2; references 7: 4 Russian, 3 Western.

6508/9835
CSO: 1863/365

UDC: 621.394.74:519.2

QUEUING NETWORK WITH REGENERATING TRAJECTORIES

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 22, No 2, 1986
(manuscript received 24 Nov 83) pp 59-68

[Article by A.L. Tolmachev]

[Abstract] It is usually assumed that the path of a request in a queuing network among network nodes is the trajectory of a Markov chain over the set of nodes. A more recent alternative approach assumes that the path of a request is fixed and finite. This article demonstrates that this second approach can be naturally extended to describe the complex behavior of requests in a queuing network. It is generally interesting to analyze arbitrarily connected difficulties of servicing a request in each stage of

its path through the network. This article solves this problem for arbitrary nodes with servicing disciplines from the class of disciplines studied by Kelly. It is found that to calculate the marginal probabilities of network states, the traditional assumption of independence of difficulties in servicing requests in various stages of their paths through the network is not necessary. References 12: 4 Russian, 8 Western.

6508/9835
CSO: 1863/365

EDUCATION

COMPUTERS IN AZERBAYDZAN SCHOOLS

Baku TASS in English 11 Jul 86

[Text] Personal computers are being introduced at secondary schools of Azerbaydzan, a Caucasian republic, in line with the decisions of the CPSU's 27th Congress. Without leaving his place a teacher can now control the learning process of every schoolboy or girl and give them the information they may need. The prototypes of the school computers developed by scientists from Moscow and Baku have been tested successfully. The new computers are easy to operate and can be used even at kindergartens, according to scientists.

/9835
CSO: 1863/11-B

MOSCOW TV SHOWS CLASSROOM COMPUTER USE

Moscow TELEVISION SERVICE in Russian at 1430 gmt on 14 Aug 86

[Editorial Report] In its "Vremya" newscast a video report from Moscow on preparations for the coming school year shows new school buildings in new housing developments. The video cuts to a computer classroom containing about 16 terminals. The camera moves on to the correspondent talking to the teacher in the main computer room, showing a man changing a tape in the machine. The video pans around the classroom again showing the main computer marked SM 1407 in Cyrillic. The man is shown using a cyrillic keyboard on the VDT 52100 Videoton terminal. Next a close-up of the screen is shown revealing the basic command symbols for calling up the menu, printing, loading a program and running a program, including reference to a control key that is in both Russian and English. The camera then moves on to a wall poster explaining the structure of the computer course, which includes the fundamentals of Pascal. The video ends with a pan shot of the classroom.

/9835
CSO: 1863/28-F

COMPUTER TEXTBOOK TRANSLATED INTO UZBEK

Tashkent YOSH LENINCHI in Uzbek 6 Feb 86, p 4

[Article by R. Karimov, "New Textbook for Schools"]

[Excerpt] It must also be noted that a shortage is still being felt of educational materials on computer technology and programming. Nor can it be said that the situation is better than this in the creation of educational materials in Uzbek. Recently Oqituvchi Publishers issued the first part of the manual "Informatika va hisoblash tekhnikasiasoslari" (Fundamentals of Informatics and Computer Technology) (collectively authored under the direction of Academician A.P. Yershov) in Uzbek. It is intended for secondary educational institutions.

One can only welcome the publication of the above-mentioned experimental manual in Uzbek at a time when the study of higher level algorithmic languages is taking on a mass character.

The manual consists of two sections: In the first section are algorithms and algorithmic languages. It is devoted to solving algorithms with calculations and creation of auxiliary algorithms. Here there is a discussion of the role and capabilities of computerized information processing, computers, and EVM [electronic calculating machines]. There is a simplified explanation of the physical fundamentals of EVM operation and the main characteristics of EVM's. Questions and exercises follow every sub-section in order to reinforce theoretical knowledge.

The second section is devoted to creating algorithms for solving problems, e.g., the solution steps using EVM are explained, as well as the creation of algorithms of working with table quantities and the creation of algorithms to solve mathematics and physics course problems. Appendices are provided at the end of the section. These appendices provide information on work with calculators and the algorithm library.

The manual was translated into Uzbek by teachers of Tashkent Polytechnic Institute Faculty of Automated Control Systems U. Mannonov, Y. Muhitdinov, and Sh. Nuritdinov.

Now the publisher is preparing a methodological manual for the book. The methodological manual consists of 2 chapters. The first chapter is devoted to

questions of introducing the course "Fundamentals of Informatics and Computer Technology." It gives general methodological directions on the course content and instruction. The second chapter gives recommendations. It explains algorithms and their characteristics, algorithmic language, and creation of auxiliary algorithms. The stages of problem solving using EVM are given. An approximate plan is given in the appendix for executing algorithms with the help of calculators and teaching the new course.

It is worth noting that the translators used EVM in preparing this manual. Of course it is hard to say that a machine is the equivalent of human consciousness, but it can fulfill tasks which are assigned to it.

Because the manual is one of the first texts issued in Uzbek, it contains some shortcomings. Nevertheless, there is no doubt that it will become a most necessary instructional and work manual for many people.

/9835
CSO: 1836/0873

IMPORTANCE OF COMPUTER LITERACY STRESSED

Ashkhabad MUGALLYMLAR GAZETI in Turkmen 11 Apr 86 p 2

[Editorial Report] Ashkhabad MUGALLYMLAR GAZETI in Turkmen 11 April 1986 carries on page 2 an 800 word article by M. Khanov, a teacher at the Turkmen State University, on various ways in which the new secondary school course in data processing and computer science is to be taught. In the 9th grade the course is taught one hour a week, yielding a total of 34 hours in the school year. In the 10th grade there are two variants: one hour or two hours a week. He points out that "the theoretical materials in both variants are the same; the practical parts differ only in content and scope". Stressing the need for widespread computer literacy, he notes that "people have to work with computers in their daily life and they must learn to 'think' along with computers".

/9835
CSO: 1863/69-P

TEACHER REVIEWS INTRODUCTION OF COMPUTERS INTO SCHOOLS

Moscow SOVETSKAYA ROSSIYA in Russian 24 Apr 86 p 2

[Interview with Nina Aleksandrovna Sadovskaya, scientific associate, Novosibirsk State University, by T. Kravtsova, date and place not specified: "The Computer Against Sceptics"]

[Text] "Universal computer literacy", "the second electronic literacy", "an intellectual revolution", what sort of epithets scientists and journalists won't think of to describe the invasion of educational computers into our lives. "The foundations of information science and computer technology" is a first and real step by public education towards the computerization of the schools. What kind of difficulties do teachers and scientists run into in teaching the new subject? We asked this question to Nina Aleksandrovna Sadovskaya, a scientific associate at Novosibirsk State University, who for more than 10 years has been doing teaching and practical work in a computer class at the 130th Novosibirsk School. At a recently completed All-Union Exhibition "Electronic Computer Technology and Public Education", the work of Nina Aleksandrovna and her colleagues, pedagogues and scientists at the Siberian Department of the USSR Academy of Sciences, was given 15 awards from the VDNKh, and Sadovskaya herself was awarded a gold medal.

[Question] Nina Aleksandrova, you often meet with practical teachers, and are constantly "inside" of problems in school computerization. In your view, which of them requires the quickest solution?

[Answer] Taking teachers as a whole, I still meet with some scepticism regarding the computerization of teaching [obucheniye]. If this scepticism is not overcome, what sense is there in solving the remaining question. Very often even teachers themselves cannot answer why computerization is needed at all. They are put in a position of implementing it, but cannot explain why it is needed. As you know, this is a very important problem for the state, and it is no accident that during the 12th Five-Year Plan it is one of the ten top questions.

In addition, the computer is an intensifier of human intellectual activity, while grade school education is the formation of society's intellectual potential. This means that by using computers in the school we thereby influence the intellectual potential of society as a whole. This is one of the reasons why computers have "dropped out" of VUZ's into grade schools.

Unfortunately, people more frequently write and speak about giving computers to learners but forget about teachers. The practical teacher often does not feel a personal requirement for a computer and therefore does not know what it can give him in work. It is necessary to propagandize not simply the machine's potentials, but its potentials in the specific activities of a specific teacher.

[Question] What is the most important manifestation of the computer's influence upon pupils?

[Answer] While in an ordinary grade school course, a learner, with the help of the laws of physics and mathematics, gets accustomed to calculating, finding and, in the best case, to proving something, in a computer class this function is performed by a computer. The logical question then is: What remains for the learner to do? There is a shift in emphasis, from an implementer he is transformed into a creater. He learns to run the computer, that is, to become master of the situation. This has a general influence upon changes in his thinking.

[Question] What changes in the teacher's work?

[Anwer] The computer is a means between teacher and learner. It organizes teaching appropriate to physiological and psychological individuality. For example, in traditional teaching, all learners need to "move" at one pace, independently of their capabilities, inclination and physiology. The computer finally makes it possible for the teacher to actually work with each pupil individually! In some of our experimental work the teaching pace varies 3-5 fold, while some young people "moved forward" 10 fold faster. Under ordinary conditions could a teacher really manage everybody? Of course not. True, according to our observations, the optimal size of a computer class should not exceed 12-15.

[Question] Doesn't this diminish the role of the teacher 's personality in the class?

[Answer] On the contrary, personality becomes even more important than in traditional teaching . Here, evidently, the principle formulated by Norbert Wiener "A machine has machinelike qualities, but a human is not a machine." In other words, a learner, satiated by communication with a metal partner, turns to the teacher for his human qualities. Among the most important of these are the teacher's organizational capabilities, and a knowledge of child psychology and physiology. A teacher should should be engaged in the main task: teaching and work with the child's personality.

[Question] Can you now say how long it will take before the computer in the school becomes as ordinary as, for example, the television in the house?

[Answer] In spite of technical difficulties, computers are appearing in schools much faster than we can imagine. The matter lies only with industry. At present there are two approaches to the computerization of teaching. One is organizing pupils' desks to be based upon computers. The other is teaching through terminals. This is the approach we took 10 years ago. What does this mean? There are no computers in the class. There are screens and teletypes which are linked to a computer in the computer center at the Siberian Department of the USSR Academy of Sciences.

What are the positive aspects of this approach? First of all, the terminal equipment costs considerably less than do personal computers. This is not a minor factor for grade school education needs. Secondly, every 2-3 years there are changes in computer technology. If we install personal computers in schools, there is a risk of teaching childern on obsolete equipment. Terminal equipment is longer lived: Today we are teaching children on the same terminals as 5-10 years ago and they will serve us much longer. All computer modifications concern only the computer center. We periodically learn about this, hook up to it and use its new potentials.

Thirdly, breakdowns in terminal equipment in our office are straightened out by electronics engineers whom we call through a collective use dispatcher service. Finally, the collective use system is a concentration of progressive pedagogical information and can potentially be copied by any school in the country. This removes one of the most acute problems in modern education -- that of "capital city" and remote schools.

[Question] What does the experiment at your school show. How effectively is electronic computer technology used in education?

[Answer] Every year our graduates enter Novosibirsk State University [NGU]. NGU has analyzed the success rate of students, starting with entrance examinations, right up to the 4th and 5th years. It has been shown that the best results are consistently attained by our students, the majority of whom attended computer classes.

I also want to add that our observations show that at least 80 percent of all our graduates select a profession directly related to computers. True, very often, especially in recent years, they enter a specialization not traditional for computers, for example, medicine and teaching. However, entering these higher educational institutions, they already see the intelligent uses of computers which will be required of them in their future profession.

[Question] Well, what is to be done if schools are still not equipped with computers or terminals?

[Answer] Learn, both teachers and childern should learn. It isn't strange if in some places this must be done by the non-machine method. We have passed this period, but it helped us rapidly move on to the next stage -- practical work on machines. In addition, here in Akademogorodok a three year

correspondence course was presented on the pages of the journal, KVANT under the leadership of Academicians A. Yershov and the teacher G. Zvenigorodskiy. This experiment showed that programming can be taught even by correspondence and that with a good methodology one can inculcate solid habits and a good style, in young people who do not have a computer nearby. There is another form of correspondence work -- organizing, perhaps on vacations -- practical exercises, following the example of the All-Union Summer School for Young Programmers here in Nobosibirsk.

Thus, schools are making the first steps in the difficult path of computerization. Many problems have still not been solved. However, if experience acquired is skillfully used they can be solved. And they must be -- there is no other way out.

11574
CSO: 1863/336

ARE SCHOOL COMPUTERS NECESSARY?

Moscow KOMSOMOLSKAYA PRAVDA in Russian 28 Mar 86 pp 1-2

[Article Yu. Danilin and S. Kushnerev under the "Direct Line" Rubric: "Why You Need a Computer"]

[Text] This is Igor Smykov, a correspondent student, speaking.

Hello Igor, I am listening.

"Won't a total replacement with computers lead to children forgetting how to count."

No, they won't forget. Pupils in computer classes are much better at verbal counting, quicker in learning multiplication tables and even at conjugating verbs... This is not the result of cramming, but is due to computer games.

Allo, 257-23-49. Answer, Grozniy...Andrey Petrovich. You are talking to Polezhai, chief of the Automation Department at the Repair-Machine Shop. My question: Within what time and with how much resources do you presume to computerize the schools?

I understand your question comrade Polezhay. I should tell you that full computerization is a practically endless process. I would delineate the following stages: offering information science cources in the 9th and 10th grades so that about half of class time is directly on machines; switching this course to 7th and 8th grades and making practical use of knowledge about information science in upper classes; teaching computer literacy in the 5th grade of eleven year schools and, finally, communication with computers even in kindergarten and at home it is now difficult to predict the timeframe for computerization. The first stage should apparently be realized in 1991-1992.

How will school computer servicing problems be solved?

It is an acute problem. Government decisions entrust the servicing of school computers to TsSU territorial organs. Possibly the creation of the State Committee for Computer Technology will make some changes in this question...

Andrey Petrovich, you are speaking with Gubanov, an engineer from Kharkov. We

work on microcomputers similar to the American SDK-85, but do not know if it is suitable for school. How can we learn what machines schools need today?

This is a purely technical question. I would advise you to turn to the USSR Academy of Sciences' Moscow Institute for Problems of Information Science. Its collective is participating in working out technical requirements for school computers, and the appropriate specialists are there.

Allo, the Affiliate of MISIS [Moscow Institute for Steel and Alloys] in the city of Electrostal is concerned. What equipment will replace Agats at schools?

A mass produced school computer will replace the Agat . I don't know exactly what it will be called. It will be a machine with features permitting it to easily be linked to networks. Such machines will begin to be produced on a more or less mass scale next year.

Lvov on the line. Irina Ivanova Sheriy, engineer. Andrey Petrovich, how do you think the "second literacy" should be based upon the first; programming languages based upon Russian?

Unconditionally! This is my unwavering opinion. We will communicate with machines in our native language.

Greetings from department head at the Orel Pedinstitute, Khopayev. When will an information science textbook for 10th graders appear?

The text is already at the typesetters. By summer it will be printed in a full edition, and, I hope, the first 300,000 copies will go to the June courses for retraining teachers. The text contains data on two programming languages "RAPIR " and "BASIC". Selection remains to the teacher. Incidentally, is was recently asked about programming in Russian, well, the first of these languages is our native one.

Moscow, do you hear me? This is Voronova, a teacher from Urgench. I want to report that many 9th graders have still not received information science textbooks.

I think that it is a crime not to have received this textbook in the birthplace of al-Khwarizmi. A sufficient number of them were printed back during last July. Now, of course, we cannot answer who is guilty in your case, but, using the "Direct Line" we will turn our inquiry to the republic and USSR Ministries of Education. I only hope that nothing similar will happen again.

Aleksandr Chenysov, a 10th grader, is speaking. I am calling from Irkutsk. What are the possible forms for organizing the work of pupil-programmers? Is it necessary to create a special scientific-popular journal on information science and programming, similar to KVANT?

These are good questions, Sasha. I answer, based upon experience in organizing the productive labor of pupils in Novosibirsk. The most natural form is an

interschool UPK [Training-production combine]. Professional programming is easy there. We are convinced that even after a half year there, students can dedicate further time to developing real programs ordered by nearby institutions, above all the school itself. This brings into the orbit of information sciences teachers of other subjects and pupils from lower classes. As far as another journal is concerned, this is hardly a pressing matter. This year a basic journal INFORMATIKA I OBRAZIVANIYE will appear, edited by academician A. Melnikov. There are also KVANT, and magazines such as ZNANIYE -- SILA, YUNOM TEKHNIKE, TEKHNIKA -- MOLODEZHI, which have sections on information science and programming.

Allo, Andrey Petrovich, how do you do. This is Svetlana Dudkina from Moscow.

Ho do you do, Svetlana!

Andrey Petrovich, why are the "Foundations of Information Science" introduced only in the 9th grade? What about present 10th graders, how will it be for them. For example, I want to enter a VUZ in this speciality, but have no practical experience.

I understand your grievance. However, here I cannot help. This subject is coming to life before your eyes. It began in the 9th grade because one year is not sufficient to attain computer literacy. It would be too difficult to begin simultaneously in the 9th and 10th grades. Are you from Moscow? I strongly advise you to go through a Komsomol raykom to get in contact with two well known Moscow Clubs "Komputer" and "Interfeys" One of them is in Polyanka and the other in the Arbat. For a few months you could mingle "among specialists" and, most importantly, work with machines. Fight your way in -- the clubs are open to all. I wish you success Svetlana!

How do you do. This is Andrey Pechenkin, a worker from Chelyabinsk. I am concerned. I want to learn if (and where) it is now possible to obtain applied programs for home computers?

Do you already have a personal computer?

I do. I put it together myself. Now, with its help, I want to learn how to use it and teach my son. It would be good to get some educational programs and electronic game programs.

Excellent! Unfortunately, there are now no such "public" ["kazennyy"] I would call them, possibilities. My advice, more actively get acquainted with organizations where there are personal computers and applied programs, and subscribe to the journal MIKROPROTSESSORNYY SREDSTVA I SYSTEMY.

Andrey Petrovich, you are talking with Roman Galyas. I am a 9th grader in School No. 75 in Volgograd. Don't you think that it is unadvisable to introduce computers in this grade. Is it worth it to initially train and then have to begin again later? The teachers themselves are only learning it...

You see, Roman, the first step is necessary. It is important that everyone do this together, soon. Only in this way can the matter be moved from a dead

stop. For almost 30 years now we have been engaged in questions of programming and using computers in schools. Although you tell somebody about something, they may not believe it. This is why, in my opinion, a correct decision was made: Information science courses were introduced in all schools at the same time. Thanks to this everything was put into motion. Of course, at many schools there are still no computers or well prepared teachers. However, right now there is a situation of impatient expectation. This forces industry and students to move faster...

This is Andrey Nikolayevich Smykov, an 8th grader from Ustinov. Can you say why our Soviet computers are of poorer quality than foreign ones? What is being done to liquidate this lagging?

The main reason is that our computers have still not been put "on the shelf". Under individual [shtuchnoye] production conditions, a comparatively inexpensive computer can initially only be produced by relaxing specifications. This in itself is disgraceful and cannot continue long. It must be said that a school makes very large demands upon computer quality. In education computers can only be realistically used under repair free operating conditions. If a machine breaks down it cannot be repaired on the spot but must be replaced by a new one. What is being done here? Technical conditions for school computer production are being toughened up, and, the main thing, there is very serious work under way on organizing mass production of computer equipment, as was mentioned in the 27th CPSU Congress.

Allow me to introduce myself: This is Oleg Shamshura, graduate student. Don't you think that personal computers in school are not the proper way, and that the solution should be to set up terminals in classes?

I must say that in experimental conditions one can work in one or the other mode. However, techno-economic analysis shows that the cost of a personal computer practically coincides with that of a terminal for a large machine. On the other hand, when computing capacity is, roughly speaking, distributed to parties, it turns out to be more reliable.

Andrey Petrovich, can you say who in our country is engaged in the development of educational programs for schools? You are talking to Leonid Dmitriyevich Ivonin, dean of the Physics-Mathematics Department at the Kurgan Pedinstitute.

I can answer. Educational programs are being developed throughout the entire Soviet Union -- in any collective having computers and people with initiative. However, the USSR Ministry of Education and the USSR APN [Academy of Pedagogical Sciences] are organizing collection points for such programs, which will approve and distribute them. In particular, this is one of the basic tasks of the the APN's Institute for Information Science and Computer Technology, which has been set up in Novosibirsk. I think that centralized collection and copying of educational programs is beginning this year. As a neighbor, I advise you, Leonid Dmitriyevich, to make direct contacts with the new institute.

Moscow, Moscow! Gomel is calling. Nikolay Petrovich Skalyuk, Gorono [Urban department of public education] inspector is on the phone. Tell me, don't

algorithmic language specially created for educational purposes turn out to be "dead" languages? After completing school, pupils practically never encounter them.

Any question concerning the future can only be answered provisionally. However, if teachers properly and skillfully do their work, then this educational language will not remain dead. If yesterday's pupil becomes a programmer, then he can easily get accustomed to writing the algorithms he compiles in a language he knows. Then in the future, based upon this notation he can convert it into a program for any specific machine in any programming language.

Andrey Petrovich, how do you do. You are talking with Yan Portnoy, a student at school No. 21 in Kishinev, a council member of Viitorul, the science student society. My question, what is Komsomol committees' role in computerization?

Hello, Yan. As far as the school Komsomol is concerned, I will make it precise: You must use circles and evening exercises primarily to help all young people who so desire to get acquainted with computers. Senior students are obligated to supervise such circles. It is very important that together with each 9th or 10th grader, there be a group of younger students [stayka malyshey], whom the older students could, with the full authority of their knowledge, get acquainted with this important matter.

This is Vera Semenovna Shpak, a senior engineer-programmer in Chaikovskiy, Perm Oblast. Will a faculty for training programmers be opened in any VUZ this year or next?

A good question, Vera Semenovna. It must be said that we already have several departments [otdeleniye], if not faculties, which are preparing programmers. True, these are still in "applied mathematics". It is a very urgent problem. I think that this question will be solved within the framework of the forthcoming restructuring of higher schools.

Andrey Petrovich, Kiev is concerned. We at the State University Biology Faculty are worried: Is it necessary, right after the general educational schools, to introduce information science as a required course at higher educational institutions? How, with minimal outlays, can it quickly make up for the teacher shortage?

I think that information science in schools will lead to similar courses within the framework of VUZ general educational courses. Elements of this are already given in most VUZ's. As far as sources of cadre are concerned, this involves pedinstitutes, and a wide range universities and technical VUZ's. The top priority measures are quite obvious: Graduates from mathematics and physics faculties should be given 200-300 hours of additional training. This path is somewhat hasty, but fast. This is how information science teachers will be trained during this and the next academic years.

Andrey Petrovich, Natalya Nikolayevna Nazarova, a teacher, has turned to you. We are deeply experiencing everything that is taking place in our school. The

reform has begun. How can we get along without the unique discoveries made by gifted pedagogue innovators? For example, V. F. Shatalov, attempted to introduce his system in 1956. Now there is a new experiment in School No. 5 in Donetsk. I very much want this to be the last experiment and Shatalov's methodology to become the property of all teachers.

Natalya Nikolayevna, I share your feelings on this subject. I want to tell you that now, within the framework of the school reform and the program for getting schools acquainted with scientific and technical progress, this very important matter has begun. The USSR Academy of Sciences took the initiative to organize a broad and, as is now said, temporary collective, which combines the efforts of students, programmers, medical specialists, psychologists and other specialists having some relation to education. It is conducting global research and experiments on the construction of education and training systems meeting today's and tomorrow's requirements. One feature of this collective, which is headed by USSR Academy of Sciences Vice President Velikhov and which is based upon the Academy's Institute for Problems of Cybernetics and the Scientific Council on Problems of Cybernetics is its joint work with progressive teachers and the use of experience so as not to make this huge project a partial exercise by one or two enthusiasts. I am very much counting on this new collective, which is now being formed and beginning its work, not to ignore some of those notable computerization experiments which we made in schools and which have been conducted in Bulgaria, for example, for six years. I know exactly that this temporary collective will very attentively study, in particular, Shatalov's and Shchetinin's work results.

Yershov at the telephone. Greetings Gulyaeva! I agree with you that computers open up completely new horizons for musical creativity. For example, modern music by synthesizers would simply be impossible without computers. The computer has also substantially expanded the potentials of musical education, especially in teaching composition and solfeggio. I'll give you the address of a Novosibirsk collective which is interested in this problem. Write to 630090, Novosibirsk, Computer Center SO AN USSR, Yu. A. Pervin..

"Direct Line?" You are talking to Vladimir Leonidovich Zaldiger from Ufa, programming sector chief. I and my son dream about purchasing a personal computer.

There is now only one model personal computer, the BK-0010, for sale. One can get acquainted with its specifications in the journal MIKROPROTSESSORNYY SREDSTVA I SYSTEMY and also in Electronika company stores. I think that in a few years other personal computers will be for sale.

Andrey Petrovich, I have another suggestion. The journal you mentioned recently described the Irisha microcomputer developed by the Chemistry Faculty at MGU [Moscow State University]. It would not have been bad if the article had closed with the words: "The necessary peripherals can be acquired at the address..."

I agree completely. Unfortunately, this question has no instant solution. I think that even in the 12th Five-Year Plan sets of microprocessor equipment and integrated circuits will be sold on a mass basis for avocational

purposes. In any case, the producing ministries are very interested in this. It only remains to find reliable trade and economic channels as quickly as possible.

At this time Ye. V. Blokhina from Panevezhis and L. S. Aleynikov from Minsk were on the line. They asked the following questions: What are the prospects for the production of personal computers in our country? Did Andrey Petrovich find the algorithm and program fund's work to be satisfactory? Didn't he think it was harmful to transfer so many computers to schools. Wouldn't this expose the flank of the scientific front?

Greetings Yelena Vladimirovna and Leonid Sergeyevich. I will answer your questions in order. This means Panevezhis: The first question is on prospects for the development of personal computers. A very important government decree was passed which sets, in the hundreds of thousands, the total number of personal computers produced in the 12th Five-Year Plan. In a world context this is not so grandiose, however, for us it it truly a gigantic step. We must do about as much as we did 15 years ago when we built the VAZ [Volga Automobile Plant]. Now it is necessary to built a "computer VAZ", and this is not easy. However, there is hope that in the 12th Five-Year Plan this will find its initial solution. Incidentally, I should say that the city of Panevezhis can help in this matter, having organized the production of disk drives for personal and school computers.

I now answer Leonid Sergeyevich. The algorithm and program fund situation is unsatisfactory, even though the Belorussian Republic Fund is, in my view, working well. If all the others would only reach its level, then this matter would be substantially advanced.

Alas, today many programs are escaping the fund. Economic stimulation measures were insufficient to entice developers to improve their programs so they could be copied and distributed. I hope that this will be corrected within the framework of the economic mechanism's overall restructuring.

Your second question: Do I consider it harmful to transfer computers to schools? I should immediately state that in no way do I so consider it! I am absolutely convinced that the use of computers at schools to influence creative activities is the most effective use of computer technology.

Telegram:

ANDREY PETROVICH! THE DIFFICULTY OF SELECTING INFORMATION IN SCIENCE!!! WHEN WILL A GLOBAL ELECTRONIC INFORMATOR [Information system] BE CREATED?

Student STEPANENKO

Moscow

A. P. Yershov: I think that it will be 15 years before computer technology and communications systems are sufficiently developed and a large share of urgent information is entered immediately into machine media and not only on paper. However, even now we have a number of large data banks used by scientists and designers. It is not far off before there are systems open to anybody

interested, like public libraries, from which data can be requested from a home terminal or workplace. This problem touches upon many technical, organizational and legal questions. However, I assume that it will be solved by the turn of the century.

Andrey Petrovich, how do you view the use of computers in Komsomol work? Aleksandr Rybnikov, department chief at the Ulyanovsk VLKSM Obkom, is asking.

I think that the main task for Komsomol committees at enterprises or raykoms is the organization of extracurricular club work on information science, using classrooms and equipment at enterprises.

Andrey Petrovich, it is already half past three. The last question --- from KOMSOMOLSKAYA PRAVDA. We would not have had so many calls today, had our readers had wide access to the journal MIKROPROTSESSORNYY SREDSTVA I SYSTEMY. How does one get acquainted with it?

In the future the answer will be elementary. Go to the nearest post office and subscribe to this journal for the next quarter. Subscriptions are not restricted. Incidentally, its readership is growing quite well. It started 2 years ago with 800 subscribers and, at its own risk, published 5,000 copies. Last year we had 21,000 subscribers, and this year 53,000. We recommend that you hurry and enlist in this rapidly growing army. You can, of course, get acquainted with past issues in the library. My only request, just don't keep it forever.

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COMPUTER EDUCATION IN LENINGRAD GRADE SCHOOLS SURVEYED

Leningrad LENINGRADSKAYA PANORAMA in Russian No 2, Feb 86 pp 14-15

[Article by V. I. Kruchina-Bogdanov: "The Computer Goes to School"]

[Text] When the first electronic computer appeared, a commission of authoritative experts in the United States of America concluded that 50 such machines would be sufficient to meet the entire world population's needs. The laughability of such a hasty assertion is now obvious.

By 1980 there were at at least 250 million microprocessor units and systems, and the need for them is growing. Specialists calculate that by 2000 their number will increase to about 10 billion!

This puts special urgency on the immediate elimination of computer illiteracy and the introduction of universal education in the electronic languages for human-machine communication. Above all, it is the public educational system which must respond to this call of the times.

Within the framework of the reform in general educational and professional schools, this year a required course "Fundamentals of Information Science and Electronic Computer Technology" is being introduced to senior classes Its purpose is for them to master the ABC's of programming, the skills of writing very simple algorithms for solving specific academic or applied problems, and to acquaint them with computer technology and the rules for communicating with "intelligent machines" so that they can have substantiative dialogues on selected subjects.

At one of its recent meetings, the Lensovet Ispolkom examined computerization in our city's secondary schools and measures to accelerate this process. The existing situation, positive experience and still unsolved problems were explained by Yelena Vsevolodovna Petukhova, head at the Main Administration for Public Education, department involved in questions of professional orientation for students and the introduction of computers in the educational system.

She reported, "The introduction of the new program of studies did not take us unawares." It could be said that its foundations were laid by the first

experiments which ten specialized schools have had over a number of years in the preferential, i.e. more thorough, teaching of physics and mathematics. The most serious attention was also given to information science and computer technology.

In subsequent discussions, in which Boris Samsonovich Medvedev, methodologist at the Institute for Improving Teachers Qualifications, and a computer engineer participated, it was revealed that the first basic difficulty along this path is the lack of enough prepared teachers. As this not only involves the acquisition of elementary practical skills in dealing with computers (quite important in itself), but also poses the broader task of pupils becoming acquainted with fudamentally new methods of thinking, the RSFSR Ministry of Education recommends placing primary emphasis the retraining of general educational school teachers.

Last summer about 400 teachers of mathematics and physics to senior classes underwent such retraining in our city. The exercises were a 144 hour program, almost double the 78 hour one proposed by the RSFSR Ministry of Education. Twelve leading academic and sectorial scientific research institutes in Leningrad participated in developing it.

The teachers prepared abstracts, compiled algorithms and programs for practical use on computers and gave reports. Most of the experienced teachers successfully handled the tasks presented them.

In order to assure an incoming flow of young specialists, this year another specialization was introduced at the Physics and Mathematics Departments of the Leningrad Pedagogical Institute imeni A. I. Herzen. Students in all other fields, including the humanities, are also getting acquainted with the basics of information science and computer technology.

Assuring the full computerization of grade school education requires more than training just the teachers in information science. With the basic help of specialists from the Herzen Institute, an accelerated course has been conducted for about 200 officials at special physics and mathematics schools, public education inspectors and associates and methodologists at the Institute for Improving Teachers' Qualifications.

Every Thursday at the House for Technical Propaganda there are now regular lectures, seminars, exchanges of experience, scholars give methodological recommendations on overcoming "computer illiteracy" and attaining "universal electronic education". Up to 300 people attend lessons in the auditorium. Leningrad's mass communications organs, especially those for young people, are also involved in this important matter.

The other substantial difficulty in the computerization of general educational schools is the supply of the needed electronic equipment. Solutions to this and related questions require considerable effort, time, and materials. It is sufficient to note that to completely train those so desiring it, each school should have at least one 20 student classroom with the minimal set of microprocessor equipment: keyboard, screen, memory and printer. To this one must add more complex teaching equipment. One complete set of such equipment

now costs approximately 250,000 rubles. It isn't difficult to imagine how much it will cost to completly computerize just our city alone, where there are more than 300 such schools.

However, the situation is not so much one of money. Our country, the first in the world to begin the faculty training of pupils in programming, has still not begun the series production of educational computers. Moreover, up until recently, individual groups of enthusiasts, full of initiative, undertook the development of experimental models at their own risk. A centralized approach to a school network of first generation personal computers intended specially for educational purposes only began in the first quarter of 1985. This was DVK [Dialogue computer set] and AGAT equipment. It has already been taken out of production.

The levels of equipment availability at Leningrad schools, which have traditionally high scientific-production potentials, somewhat exceed the national average. About one-third of the schools have various types of equipment for the first steps towards computerization. Understandably, there are not always full sets of equipment with screens, although there are some.

One of the first items on the RSFSR Ministry of Education's general list of budget allocations was 10 sets of AGAT personal computers for School No. 356 in Moskovskiy Rayon. These are not completely perfected machines. Four sets of imported machines with screens have arrived in our city. They are being used in Frunzenskiy and Leninskiy rayons.

However, the main route for computers to get to schools is patronage by enterprises which either produce electronic equipment or have enough so that, in accordance with the law on school reform, they can give the needed equipment to the schools they patronize. For example, the Svetlana, Pozitron, Kirovskiy Zavod, Zavod imeni M. I. Kalinin, the Polytechnic and Technological Institute, Leningrad State University, LETI [Leningrad Electrical Engineering Institute], LITMO [Leningrad Institute for Precision Mechanics and Optics], and the Shipbuilding Institute helped create good conditions for overcoming computer illiteracy at the schools they patronize. They did not pursue the egotistical goal of obtaining narrowly specialized personnel. They kept in view the broader perspective of general scientific-technical progress.

The Leningrad Obkom Buro of the CPSU approved the patronage work of VUZ's, production enterprises and scientific-research institutions on school computerization, an important general state matter. Head organizations responsible for this work have been selected for each administrative region.

However, it must be admitted that it would be inadvisable and unprofitable to set up a computer class or center at each school. They would remain chronically underutilized. After all, today only 9th graders are studying information science. During the academic year they will become acquainted with the subject and master the technique of writing algorithms for programmming various processes. Study will continue next year. Tenth graders will begin lessons this academic year.

Ninth graders study the new subject once a week, while next year 10th graders will have twice weekly classes, differing by name, but in essentials close to programming languages. Thus, expensive equipment will not work more than 1-2 hours weekly. Economically, this is clearly unjustified.

It is much more rational to set up combined computerization centers in large cities. As a matter of fact, UPK [Training-production combines] have been operating for more than a year. With regards to the tasks of eliminating computer illiteracy, the following UPK might be included among the best: Vyborgskiy, Moskovskiy, Petrodvortsoviy, Kirovskiy, and Krasnogvardeyskiy. Smaller bases for "universal electronics education" are being set up inn Kolpinskiy, Pushkinskiy, Vasileostrovskiy, Petrogradskiy and Oktyabrskiy rayons.

However, in addition to these it is also necessary to have a general city center for school information science which would train teachers from all sorts of specialities. It could also simultaneously become a laboratory for developing the growing generation's creative initiative in using the very rich possibilities of contemporary science and technology. Young people's attraction to this civic and social self-expression is vividly manifested in our traditional conferences on school information science. These are attended by teachers, engineers-specialists and scholars from our and other cities and republics.

The fifth such conference is to be held this Spring. In 1985 there were more than 700 participants, including 400 pupils. Of the 149 reports read, 89 were by secondary school pupils, including 78 from Leningrad. The venerable academicians and scholars sitting on the presidum testified to the full professionalism of the reports from pupils who had not yet received their school graduation certificates.

A general city center for information science would give inestimable scientific-methodological help not only in teaching pupils, but also teachers of all fields and could become an experimental base for finding the most improved methods for a general mastery of computer literacy. It could provide diverse cybernetic games and electronics communication skills not only to senior classes, but to children of all ages. Experience shows that learning a machine language is more successful the younger one starts. This is shown by extracurricular faculties and circles in many Leningrad schools which are held by school graduates and their parents on a social basis.

In short, computerization needs a home suitable for this. By their common efforts, industrial associations and scientific organizations in the city could solve the substantial financial and personnel problems. I hope that in the forthcoming 12th Five-Year Plan problems in teaching information science and the basics of managing this complex technology will make scientific and technical progress towards a solution appropriate to modern demands and the general educational reform. This is an urgent demand of the time.

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EXHIBITIONS

"COMMUNICATION-86" EXHIBITION HELD IN MOSCOW

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 30 May 86 p 1

[Unattributed interview with E. Pervyshin, USSR Minister of Communication Equipment Industry]

[Text] On May 27th in the Moscow complex at Krasnopresnenskaya naberezhnaya the international specialized exhibition "communication-86" ["Svyaz'-86"] was opened. More than 350 firms, enterprises and organizations from 25 nations are taking part in it. As it stands, the latest achievements in the sphere of technical transmission, receiving and processing of various types of information are presented. That is what the Minister of the Communication Equipment Industry, E. Pervyshin, president of the organizational committee of the exhibition, will discuss with us.

-Firms and organizations from many nations have expressed interest in this third (the others were in 1975 and 1981) international review of systems and means of communication held in the USSR. As far as the Soviet Union is concerned, for us "Communication-86" is the first large international exhibition held after the 27th congress of the CPSU. In the program for the acceleration of economic and social development of our society specified by the congress for the period until the year 2000, radioelectronics, means of transmission and processing of information are some of the most important priorities of scientific-technical progress.

The development of the radioelectronic branches of industry proceeds at a tempo ahead of its schedule in our country. And for these branches participation at such a representative international review will serve as an original report of what has been done in the last Five-Year-Plan. However, what has been achieved should be evaluated not by yesterday's standards but in light of the tasks set forth by the party congress. We speak here of the qualitative lifting of our economy to a new level. Therefore, at the Soviet exposition first and foremost were reflected the achievements and developments summoned to facilitate the strengthening of the national economy.

The applications of means of transmission and information processing are in fact far from exhausted by communication, radio and television. They have penetrated literally into all spheres of human endeavor: into industry, agriculture, transport, scientific research, medicine, into the

realm of people's relaxation and domestic life. Today, modern broadcast and information processing technology is universal, a source for qualitative transformations in all realms.

In evaluating the displays of the exposition there are also other significant items. Take only increased scientific capacity. In order to remain in stride with the times in planning scientific research, it is necessary today to simultaneously forecast the results and prepare the technological basis for realization of the expected discoveries. Only in this manner is it possible to register the necessary tempo of technological progress and ensure the acceleration of development of the radioelectronic branches of industry.

Another most important characteristic of our exhibits is the broad utilization of built-in microprocessors and microcomputers. This has fundamentally changed the characteristics of consumer products, broadened their possibilities, increased their reliability and reduced their energy consumption. Equipping electronic devices with microcomputers has revealed ways of sharply increasing productivity through information processing. The contemporary microcomputer has adopted functions which a single operator does not have the capacity to perform himself. Equipping apparatus with computer technology has allowed the beginning of complex automatization of the functions of processing and broadcasting information on regional as well as all-union scales, in particular within the confines of the Unified Automated System of Communications for the Country [YeASS].

Today this network is gigantic. And the hardware complex, designed for transmission of all types of information covering the scale of the entire country, is being continually developed and completed. On the YeASS channels telephone and telegraph communication, television and radio programs, newspaper dispatches, telemetric data and information for computers are broadcast. The distinctly coordinated work of communication channels on earth and in space allow the solution of the problem of sending information to entities located on a territory equalling one sixth of the earth's surface. Without a powerful system of space communication this would be neither economically nor technically feasible.

In the Soviet section of the exposition modern digital methods for processing and transmitting information are widely represented. This includes apparatus for condensation, systems for television and radio reporting, and domestic radioelectronic technology. In the stands the results are displayed from research and practical development related to the creation and introduction of light-conducting communications systems, which have an increased throughput capacity, insensitivity to electromagnetic interference, and are distinguished by their light weight.

At the "Communication-86" exhibition other nations demonstrate their own achievements. Their participation in this large review allows even broader development of contacts and the exchange of scientific-technical information. We attach a great deal of significance to such interaction. Particularly close cooperation has formed between the nations of the Council for Mutual Economic Aid [SEV]. It has received a powerful impulse in December of the past year after it adopted the "Complex Program for Scientific-Technical

Progress of the Member-Nations of the SEV through the year 2000." One of the five provisions of the program is the "Electronification of Agriculture." The work on this most important theme was reflected in the expositions of our country and of other brother nations.

The Soviet Union is actively strengthening its scientific and economic trading partnership with the developing nations, with many Western states and Japan. We are participating in various international organizations, whose activity serves the development of telecommunications on the international scale. Here, we would suggest that the advantage of such cooperation can far from always can be expressed in categories having purely commercial benefit. There are many problems in the world which require the unification of the forces of many governments. Among this is ensuring reliable communication on the ocean, the preservation of human life in extreme conditions, as for example in natural disasters and catastrophies. Much is being done, with the inclusion of Soviet specialists, in solving problems of this nature.

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